

Efficiency Canada Energy Poverty Data Map: User Guide

Abhilash Kantamneni



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Les points de vue, les analyses, les interprétations et les recommandations exprimés dans la présente étude sont ceux de l'auteur ou des auteurs et ne reflètent pas nécessairement les opinions de la SCHL. La contribution financière de la SCHL au présent rapport ne constitue pas une approbation de son contenu.

About the author

Abhilash Kantamneni is the Director of Action Research at Efficiency Canada specializing in energy poverty and low-income energy efficiency. He has a Master of Science in Physics and Computer Science from Michigan Tech and a Bachelor of Engineering in Electrical Engineering from Anna University. Before joining Efficiency Canada, he worked with communities across the U.S. and Canada to achieve local priorities, including improved housing, increased good jobs, and reduced poverty.

About Efficiency Canada

Efficiency Canada is the national voice for an energy-efficient economy. Our mission is to create a sustainable environment and better life for all Canadians by making our country a global leader in energy efficiency policy, technology, and jobs. Efficiency Canada is housed at Carleton University's Sustainable Energy Research Centre, which is located on the traditional unceded territories of the Algonquin nation. The views expressed, as well as any errors or omissions, are the sole responsibility of the author.

About Create Climate Equity

Create Climate Equity is a not-for-profit that advocates for energy and climate policies and programs that are equitable, just, and effective for all. It achieves this through the delivery of energy efficiency programs and the incubation of innovative energy research and projects.



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Summary

Improving energy efficiency benefits all Canadians, and those experiencing energy poverty and other vulnerabilities benefit the most from efficiency improvements.

This user guide introduces an interactive map designed to visualize energy poverty and vulnerability across different parts of Canada at various geographic scales, outlines how energy poverty and vulnerability are linked to negative housing and health outcomes, and presents a use case for how this mapping tool can be used to better understand how energy poverty and vulnerability show up in a specific province or city. Additional downloadable resources are also specified.

Introduction

This user guide introduces an interactive map designed to visualize energy poverty and vulnerability across different parts of Canada at different geographic scales. The map highlights key indicators such as energy poverty, energy costs, and relevant sociodemographic indicators. Users can navigate through various layers and data points to understand the nature and context of energy poverty faced by communities, enabling policymakers, researchers, and the public to identify critical areas for intervention and support. Select indicators are mapped visually, more comprehensive indicators are available for data download.

This interactive map is complemented by additional data and resources that are available for download. See Resources section.

Context and background

Energy poverty and housing vulnerability are critical issues affecting many Canadians. The lack of access to affordable, reliable, and modern energy services coupled with inadequate housing conditions can have severe consequences for individuals, families,

and communities across the country. Improving energy efficiency will benefit these Canadians.

This project aims to map out how energy poverty compounds existing vulnerabilities for Canadians, including housing and health while building capacity among key stakeholders to act on eliminating energy poverty. We expect the outcomes of this mapping project to lead toward more sophisticated and targeted energy efficiency policies and programs to alleviate energy poverty and associated vulnerabilities to health and housing.

Energy poverty, while a major concern, is not officially or uniformly defined in Canada. While there is significant international literature and emerging Canadian literature on energy poverty and its impacts, the links between energy poverty and housing vulnerability are not well understood in the Canadian context. Understanding how energy poverty and housing vulnerability interact can help diagnose the drivers, risks and outcomes of the co-occurring problems, coordinate policy responses, and direct resources toward alleviating their negative impacts for all Canadians.

Defining energy poverty

Energy poverty as a vulnerability

Drawing on Efficiency Canada's comprehensive literature review of international and Canadian research on energy insecurity, health inequality and housing vulnerability, energy poverty is defined as the vulnerability to future housing-related harms, amplified by energy-related risk factors and conditioned by a household's inability to respond adequately.

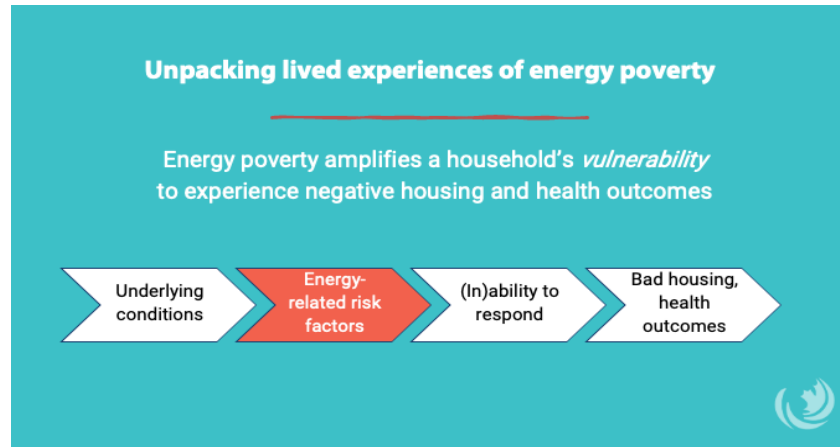


Figure 1: Conceptual framework of energy poverty as risk factors that amplify vulnerability to future housing-related harms.

Underlying vulnerabilities:

An individual or household's underlying vulnerabilities are grouped into themes commonly regarded as determinants of energy poverty, and households may be experiencing any combination of these underlying factors in overlapping and intersectional ways. Examples of underlying conditions include:

- **Affordability:** low incomes, single-earner households, precarious employment, fixed incomes, unstable incomes, cash-flow problems, high household debt, low-disposable incomes etc.
- **Poor housing conditions:** old leaky homes, inefficient heating, poor building envelope, housing needing repairs, lack of access to passive or active cooling, precarious housing, high shelter costs, inadequate housing, unsuitable housing, overcrowding, poor ventilation, dampness and mould issues, structural damages, etc.
- **Systemic marginalization:** exclusion from policies (e.g., renters or those who live in multi-unit buildings are not included in most Canadian energy-efficiency initiatives), challenges navigating complex systems of support (e.g., newcomers who may face barriers learning about no-cost energy efficiency upgrades marketed in English or French), exclusion errors (e.g., households that self-ration

energy use may not show up in common measures of energy poverty such as high energy cost burdens), etc.

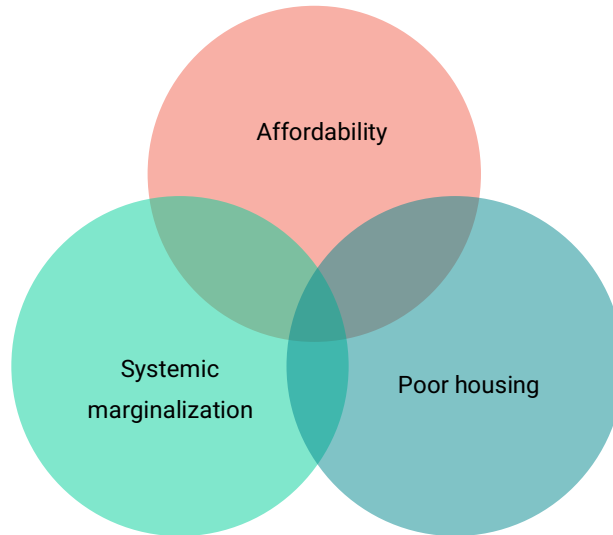


Figure 2: An intersectional look at underlying factors of energy poverty.

Indicators used in mapping tool:

1. Systemically marginalization:

- a. **Seniors:** Individuals >65 years of age.
- b. **Newcomers:** Immigrant individuals who moved to Canada in the last ten years (between 2010-2021).
- c. **Single-parents:** Families containing only one parent with his or her child(ren).
- d. **Individuals that speak neither official language:** Individuals who are not familiar with either official language (French or English).

2. Housing conditions:

- a. **Renters:** Individuals renting their dwelling.
- b. **Housing needing major repairs:** Households living in dwellings requiring major repairs.

3. Affordability:

- a. **Households in low income based on LIM-AT:** Households whose after-tax income falls below the Low-Income Measure, an important measure of poverty in Canada.
- b. **Households with unaffordable shelter costs:** Households that spend more than 30 per cent of their income on housing costs.

Energy-related risk factors:

Examples of energy-related risk factors could include, but are not limited to; high energy bills (chronic or acute, e.g., a single large energy bill), disproportionate energy costs relative to income or housing costs, high energy cost burdens, utility arrears, utility disconnections, disqualification from participation in energy efficiency programs for administrative reasons, using unregulated fuels for heating that require up-front payment, such as propane or heating oil, heating/cooling system malfunction requiring emergency replacement, and so on.

Indicators in the mapping tool and data download:

1. **Energy income-cost burdens:** People who pay a disproportionate portion of their income on energy bills. The median household in Canada pays two per cent of their after-tax income on energy bills (2021 Census custom data). Households paying six per cent, 10 per cent and 15 per cent of their after-tax incomes on energy bills are considered¹ to be high energy burdens, extreme energy burdens and severe energy burdens respectively (three times, five times and seven and a half times).

Improving energy efficiency for these households will put more income in their pockets and make other life essentials more affordable.

2. **Energy housing-cost burdens:** People who pay a disproportionate portion of their shelter costs (costs of housing, including rent/mortgage, property taxes, water,

¹ See Limitations section for a discussion on how these thresholds were chosen.

and utility bills) on energy costs. In median households in Canada, energy costs account for 14 per cent of overall shelter (housing) costs. Therefore, households spending more than two times the median (30 per cent) of housing costs on energy alone are regarded to be at risk of energy poverty, and about three times the median (40 per cent) of housing costs on energy alone are at risk of extreme energy poverty.

Improving energy efficiency for these households will make their housing more affordable.

Inability to respond adequately:

Examples of the inability of a household to respond adequately could include but are not limited to lack of access to cooling during extreme heat events, inability to prioritize energy efficiency upgrades due to other competing priorities, living in housing situations that preclude the ability to undertake comprehensive energy upgrades, such as renting or living in multi-unit buildings, unable to make time for housing upgrades due to caregiving responsibilities, unable to access qualified installers to upgrade to more efficient heating systems or improve building envelope due to rural and remote locations, and so on.

Housing and health-related harms:

Examples of housing and health-related harms could include but are not limited to housing insecurity, housing vulnerability, unaffordable housing, unsuitable housing, eviction, foreclosure, poor cardiovascular health, respiratory illness, poor mental health, social isolation, risk of mortality due to extreme weather events, loss of dignity, emotional distress, unhealthy means of coping, etc.

Understanding lived experiences with energy poverty:
who and how

As described above, energy poverty can be best understood as the circumstances where underlying vulnerabilities to housing and health outcomes are exacerbated by energy-related risks and conditioned by a household's inability to respond adequately, leading to adverse outcomes for their health and housing situations. Since energy poverty is experienced largely behind closed doors, each household's experiences may be unique.

However, by illustrating multiple specific examples under each category of underlying conditions, risk factors, inability to respond adequately and impacts future harms, we can construct archetypes or 'user profiles' that better reflect the heterogeneity of lived experiences with energy poverty. The table below illustrates this methodology with a few examples. Each row should be read as a causal link between underlying social vulnerabilities amplified by energy-related risk factors and leading to future housing-related harms. In-depth profiles of vulnerability to energy poverty in the Canadian context are accessible in [Efficiency Canada's Archetypes Report](#).

Underlying conditions	Energy-related risk factors	Inability to respond adequately	Housing-related negative outcomes	
Affordability	Precarious employment in the gig economy.	A single large energy bill.	Missing a utility bill payment due to cash-flow issues or variability in month-to-month income.	Missing a utility bill as a renter can be grounds for eviction in many Canadian provinces.
	Low disposable income after non-discretionary costs (e.g., childcare).	Chronic high energy bills.	Cannot afford upfront costs to finance energy efficiency upgrades.	Unaffordable housing, as energy bills are a large component of the total cost of housing.
	Low incomes.	Chronic high energy bills.	Families may turn down thermostats and underheat homes in winter to save energy costs, which could cause moisture, dampness, and mould in walls.	Inadequate housing and respiratory illnesses.
	Low incomes.	Chronic high energy bills.	Households may turn down the thermostat in the house and crowd around a space heater in one room to reduce energy costs.	Unsuitable housing and overcrowding.

Unfavourable housing conditions	Low incomes and high household debt.	Arrears on energy bills.	Going further into debt to catch up with mounting utility arrears could lead to missing rent or mortgage payments.	Eviction or foreclosure.
	Poor insulation and building envelope.	Inefficient heating systems.	Households might live in a condo or rent an apartment, and they cannot unilaterally upgrade the heating system or building envelope.	Unaffordable housing due to high energy bills.
	Leaky, drafty homes.		Lack of qualified installers and skilled technicians to upgrade to a more efficient and low-carbon heating system.	Unaffordable housing due to high energy bills.
	Poor ventilation.		Lack of proper ventilation causes moisture, dampness, and mould in walls.	Inadequate housing.
Systemic marginalization	Housing needs major repairs or mold remediation.	Disqualification from energy efficiency programs.	Unable to reduce energy use at home in productive ways, resorting to self-rationing.	Unaffordable housing and/or poor health due to energy rationing.
	Seniors living alone.	Lack of access to passive heating or cooling.	Unable to stay cool by installing AC or accessing cooling rooms during extreme heat events.	Mortality during extreme weather events.

Single person households.	Energy efficiency programs requiring multiple house visits.	Unable to schedule availability for pre-retrofit audit, retrofits and post-audit verification.	High energy bills lead to unaffordable and uncomfortable homes.
Single parent households.	Inadequate heating, cooling and/or ventilation.	Less willing to grant entry to third-party contractors to install corrective measures.	High energy and housing costs, uncomfortable homes, and poor childhood health as single-parent families typically spend a greater amount of time indoors.
Newcomers to Canada.	Old and inefficient heating systems.	Energy efficiency is not on the list of priorities.	High energy bills lead to unaffordable and uncomfortable homes.
Households that do not speak English or French at home.	High energy bills.	May not receive information about available low-income programs and may have a lack of trust in government programs.	High energy bills lead to unaffordable and uncomfortable homes.
Rural homeowners with fixed-income.	Use propane/oil for heat that requires an upfront payment.	May not be able to afford upfront payment for bulk purchasing fuels.	Excess winter deaths.

Table 1: Select archetypes of lived experiences with energy poverty.

A few cautionary notes on Table 1: Firstly, the factors enumerated and the causal mechanisms traced are merely illustrative and are not meant to be exhaustive. Secondly, these factors are not mutually exclusive but may overlap and co-produce each other. For instance, inadequate heating and ventilation can both be an energy-related risk factor, but also a consequence of poor built environment and housing conditions.

Using the mapping tool and data downloads



Figure 3: Screenshot view of interactive data map and dashboard for understanding energy poverty, available for public access at <https://www.energycanada.org/energy-poverty-in-canada/>

Example use case: Number of households experiencing energy poverty in Ontario

The interactive map can be used to understand how many households experience energy poverty in your area of interest. The map shows the percentage of households experiencing one of the energy poverty risk factors: energy cost burdens by income or energy cost burdens as a share of housing costs. These households are at the greatest

risk of energy poverty due to spending a disproportionate portion of their income (>six per cent) or a disproportionate portion of their housing costs (>30 per cent) on energy costs. Improving energy efficiency can make life and housing more affordable for these families.

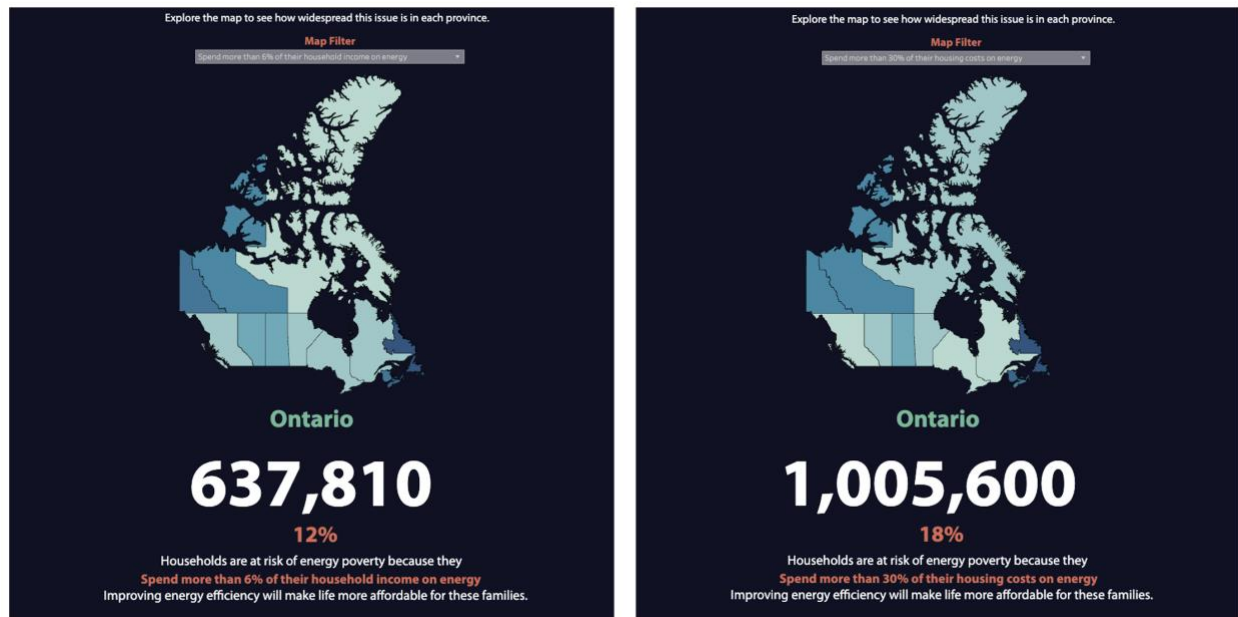


Figure 4: This example highlights two different ways of exploring households at greatest risk of experiencing energy poverty in Ontario.

The interactive infographic also shows the number of individuals or households from select demographics in that area experiencing underlying vulnerabilities with respect to poor housing and health. By one measure, 637,810 households (12 per cent of all households) are at the greatest risk because they spend a significant portion of their household income (>six per cent) on energy costs. Selecting another measure on the interactive map shows us that 1,005,600 (18 per cent) households may be at risk of experiencing energy poverty because they spend a significant portion of their housing costs on energy. While energy poverty exacerbates these vulnerabilities, the numbers shown here reflect the total number of individuals or households from those demographics and not a cross-section of those experiencing high energy cost burdens. Improving energy efficiency for these households reduces their vulnerability to poor health and housing outcomes.



Figure 5: This portion of the interactive dashboard shows the percentage of population in Ontario that corresponds to each group that has an elevated vulnerability to experiencing negative outcomes due to energy poverty.

To summarize, energy efficiency benefits every Canadian. Advancing energy efficiency makes life more affordable for everyone, improving health and housing outcomes for all, especially vulnerable Canadians experiencing high energy cost burdens. Recommendations for policies to target those most in need are available in [Efficiency Canada’s Efficiency+ Report](#).

In addition to the demographic and energy use indicators displayed on the map, more indicators are available for download on our [energy poverty hub](#).

Limitations

Choice of thresholds for energy cost burdens

Canada has no official definition of energy poverty. The United Kingdom, one of the first nations to develop an official national measure of energy poverty as early as 1991, initially measured energy poverty as twice the median household's energy expenditure, which was five per cent at the time, setting the threshold at 10 per cent.²

Dr. Maryam Rezaei's PhD thesis³ in 2016 was the first to advance a measure of energy poverty in the Canadian context. Following the first UK model, her thesis established 'twice the median household energy expenditure' as the measure of energy poverty. At the time of her study, this expenditure was three per cent, establishing a six per cent threshold for energy poverty in Canada based on the 2011 Survey of Household Spending data.

This six per cent threshold has since gained wide recognition among practitioners in Canada and is used as the basis for identifying energy-poor households in many places, from national research reports⁴ to data mapping tools⁵ and media stories⁶ on energy poverty. Conversely, the reports from the Canadian federal government have, on occasion, used the 10 per cent threshold.⁷ Therefore, both the six per cent and 10 per

² See full history of how the measure of energy poverty evolved in UK here: Liddell, Christine, et al.

"Measuring and monitoring fuel poverty in the UK: National and regional perspectives." *Energy policy* 49 (2012): 27-32.

³ Rezaei, M. (2017). Power to the people : thinking (and rethinking) energy poverty in British Columbia, Canada (T). University of British Columbia. Retrieved from <https://open.library.ubc.ca/collections/ubctheses/24/items/1.0351974>.

⁴ Gaede, J., Haley, B., Abboud, M., Nasser, M., 2021. The 2021 Provincial Energy Efficiency Scorecard. Efficiency Canada, Carleton University, Ottawa, ON. <https://www.scorecard.energycanada.org/>.

⁵ Energy Poverty and Equity Explorer Tool uses six per cent as the threshold for energy poverty, based on 2016 Census data. <https://energypoverty.ca/>.

⁶ "About 1 in 3 Islanders Live in 'energy Poverty.' What Does That Mean?" 2024. *CBC*. <https://www.cbc.ca/player/play/video/1.7123396>.

⁷ Statistics Canada. 2024. "Estimation of Energy Poverty Rates Using the 2021 Census of Population." <https://www150.statcan.gc.ca/n1/pub/46-28-0001/2024001/article/00001-eng.htm>.

cent thresholds have historical significance and are commonly referenced in policy discussions.

Currently, based on the latest data from 2021 Statistics Canada Census, the median household energy expenditure in Canada is two per cent, meaning the six per cent threshold now represents three times the median. However, to keep consistent with the current state of practice, practitioners' familiarity of stakeholders with the six per cent indicator and to avoid disrupting ongoing initiatives, our work continues to use the six per cent thresholds, despite currently being three times the median expenditure.

Regarding energy cost burdens as a function of housing costs, the median household expenditure was found to be 14 per cent. In the absence of alternative definitions, a 30 per cent threshold was established to identify households at risk of energy poverty based on the portion of income spent on housing costs, adhering to the historical precedent of two times the median household expenditure.

This situation highlights the limitations of using fixed thresholds to indicate energy poverty.

Households missing from energy poverty data

Ratio-based indicators also have limitations. Some households may not be included in the dataset due to how these measures are calculated. The ratio of annual energy bills to household income determines energy cost burdens. Households that self-ration energy use because they cannot afford to pay their bills are also not reflected in this dataset. Households that do not pay their energy bills or do not report an income are not represented in the dataset. This can lead to anomalies, such as in Nunavut, where over 80 per cent of households are renters and utilities may be included in their rent, resulting in energy bills not being reported separately. Our low percentage number for

Nunavut is consistent with other calculations⁸ using a 10 per cent threshold that also shows a low percentage number for Nunavut.

⁸ Statistics Canada. 2024. "Estimation of Energy Poverty Rates Using the 2021 Census of Population." <https://www150.statcan.gc.ca/n1/pub/46-28-0001/2024001/article/00001-eng.htm>.

Resources

Literature review of energy poverty – what it is, how to measure it, and how it shows up in the Canadian context.

Archetypes or user profiles of lived experiences with energy poverty in the Canadian context.

Recommendations on policy and programs for energy efficiency programs for vulnerable communities, along with database of promising practices on energy efficiency programs for vulnerable communities.

Energy poverty map.

Efficiency For All report.

Energy Efficiency in Rental Housing report.