

Map the System 2023

# Places We Live: Saving Up Valuable Energy

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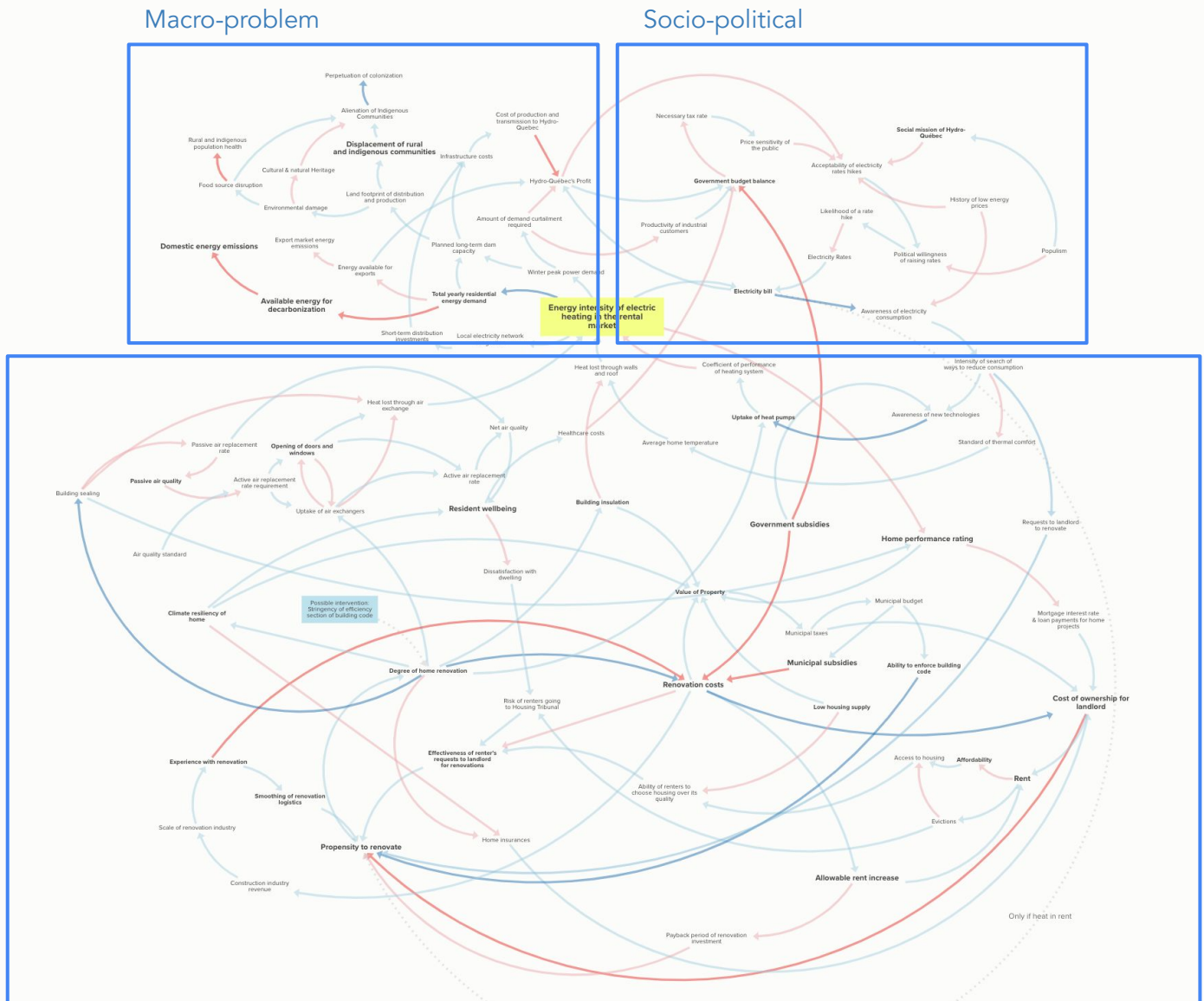
# OVERVIEW

“There is no pathway for Canada to achieve its greenhouse gas emission targets that does not include deep and widespread energy efficiency improvements to the residential and commercial building stock”

(Haley & Torrie, 2021).

The residential building stock in Canada is energy intensive and in poor condition, limiting the country’s ability to decarbonize its overall economy and negatively impacting the lives of renters. Efficiency Canada (Haley & Torrie, 2021) estimates that retrofitting Canada’s entire building stock could free up 50 TWh of clean energy, the equivalent of 10 million of EVs on the road—displacing enough CO<sub>2</sub> to meet 20% of the federal greenhouse gas emissions reduction target for 2030. However, in Montreal, where almost half the Quebec population resides, measures, strategies, and incentives targeting the rental market are insufficient.

# System 1. Energy intensity of electric heating in residential dwellings in Montreal.



Technical drivers and financial/legal ramifications

View the system here:  
<https://embed.kumu.io/0fdb3bfd78afb84ec6743930b732381>

# POSITIONALITY & METHOD

## Positionality

Julien (he/him) is a Master's student in Engineering and Louise (she/her) is a Bachelor's student in Economics and Environment. We are Francophone Montrealers from white-settler families.

We have both lived in subpar rental housing, with poor insulation and dubious salubrity, forced to pay disproportionate bills and rents.

We both grew up with Hydro-Quebec and its mythos—it supplies low-cost and clean electricity that supports our French Quebecer prosperity. The myth minimizes colonial history: hydro-projects often lead to land expropriation, environmental damage, and impacts to living conditions for Indigenous communities. Despite attempts at reconciliation, increasing electricity demand overrides these concerns: the recent four-dam complex La Romaine involved repressing ancestral rights and disregarding Innu perspectives (Desmeules, 2015), even though economists and environmentalists deemed its construction could have been avoided through comprehensive national energy efficiency strategies (Pineau, 2010).

High energy intensity has impacts along the supply chain: from high bills downstream to traumatic land and diet disruption. It is not only the government's problem to transition: it involves our homes as well.

## Acknowledgments

We acknowledge the heavy past of renewable electricity development on the territory we call "Quebec" which caused harm to First Nations and Inuit Nations communities (Portrait of Indigenous Nations, Hydro-Québec). We also acknowledge that the land on which we developed this research paper and that we call "Montreal" throughout our research is the traditional and unceded territory of the Kanien'keha:ka (Mohawk), a place which has long served as a site of meeting and exchange amongst nations.

## Method

We conducted our research by using scientific articles, consulting strategies and policies from different jurisdictions, studying accessible data on Montreal's building stock, and meeting with certain actors in the field including professionals from Hydro-Québec and the real estate industry.

# UNDERSTANDING THE CHALLENGE

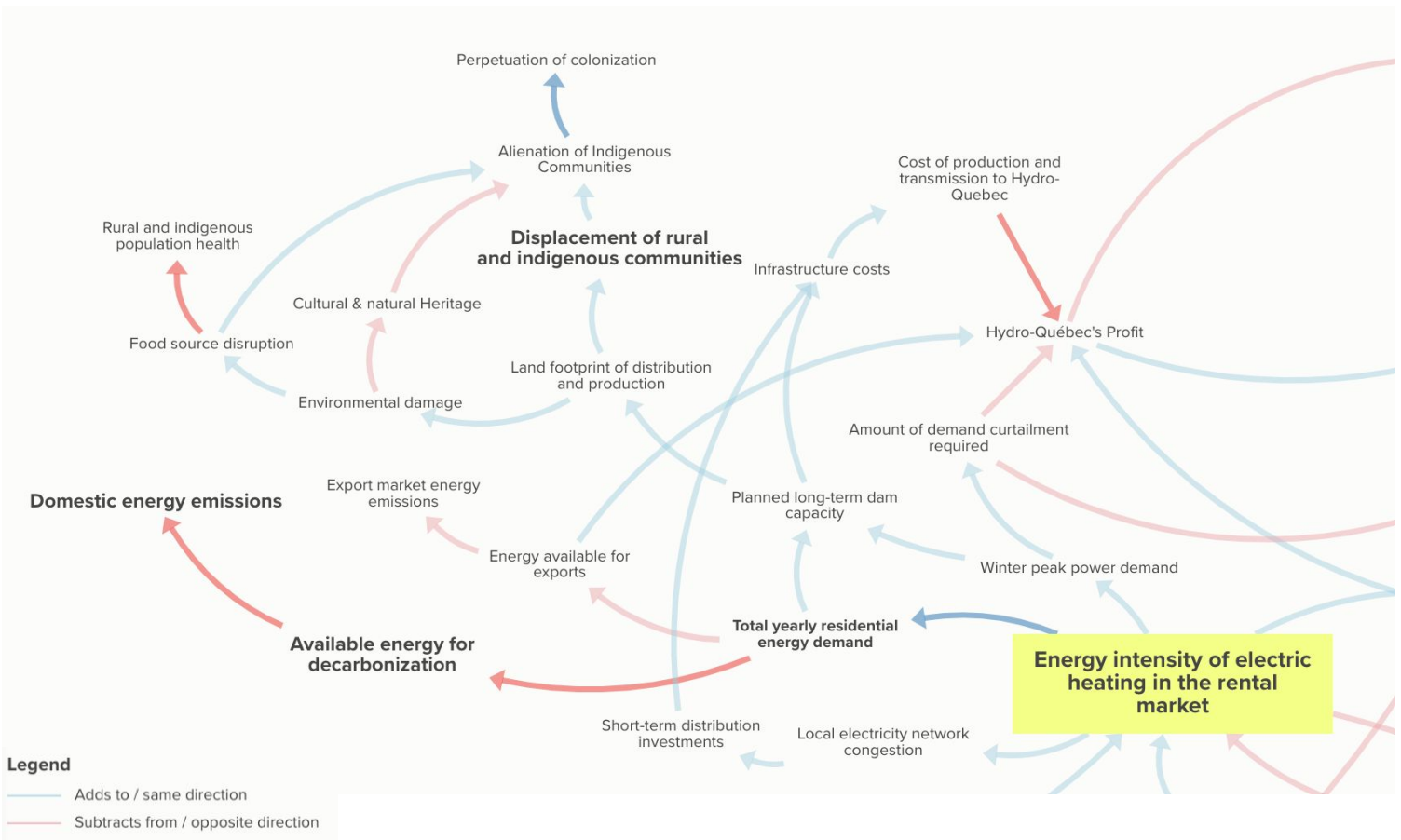
## Energy overconsumption

Quebec residents use 35 % more energy than Finnish residents to heat their homes (Official Statistics of Finland, 2020; Vanio et al., 2015) — despite the fact that both places are equally cold and it is sunnier in Quebec. In the past, this extravagance was fulfilled by Hydro-Québec and its many dams, feeding the impression of abundance that remains with us nowadays.

The disproportionate allocation of electricity for heating prevents the complete electrification of the economy. Moreover, more power in colder months means more transmission and generation of energy that could raise bills and make Quebec reliant on energy imports from higher-carbon grids (Rolland, 2022).

Lower residential consumption can reduce Hydro-Québec's need to build more dams and power lines in rural, often Indigenous lands; lessening the demand for infrastructure that perpetuates settler-colonial development patterns of land appropriation and community displacement.

## Mapping the macro-problem



## Many and forgotten: renters in Montreal

### Scale

The Quebec government and Hydro-Québec both recognize the potential of energy savings in homes, but the systems of regulations, ownership, and financial incentives slows progress overall, and keeps it at a standstill for existing dwellings, in particular those that are rented out. Montreal is Quebec's biggest rental market, with 20% of the province's population renting there (Agglomération de Montréal, 2020).

### Lack of programs

Rules and programs abound for new buildings, but few target the energy performance of existing buildings — which experts expect will represent 80% of the housing stock in 2050 (Grainger, 2022).

### Lack of control

For tenants in existing buildings, most energy consumption is out of their hands. They are barred from renovating, and landlords are under no obligation to do so either. Lowering temperatures and avoiding open windows only goes so far, and discomfort and health issues can follow if building quality is low enough.

#### Montreal's residential buildings stock

Number of households	1 200 000
Share of households using electricity for heating	88%
Electricity used per year	22.3 TWh
Share of electricity used for heating	45 %
Total electricity used for heating	10 TWh
Average building age	45 years
Ventilation with windows	1/week or more

#### Potential of electricity savings

Retrofits with 30% energy savings	3 TWh (600 000 EVs on the road)
Retrofits with 60% energy savings	6 TWh (1 200 000 EVs on the road)

(Statistic Canada; Haley & Torrie, 2021)

# What causes high energy intensity of electric heating?

## Passive building characteristics

Air leaks, poor insulation and bad orientation increase the energy needed to maintain comfortable temperatures.

Air leaks come from windows and doors with bad seals or mismatched frames. Insulation depends on the type and thickness of materials used for walls, and roofs, with windows being poor insulators (Sadineni et al. 2011).

## Active systems

Active systems regulate temperature and air quality in homes.

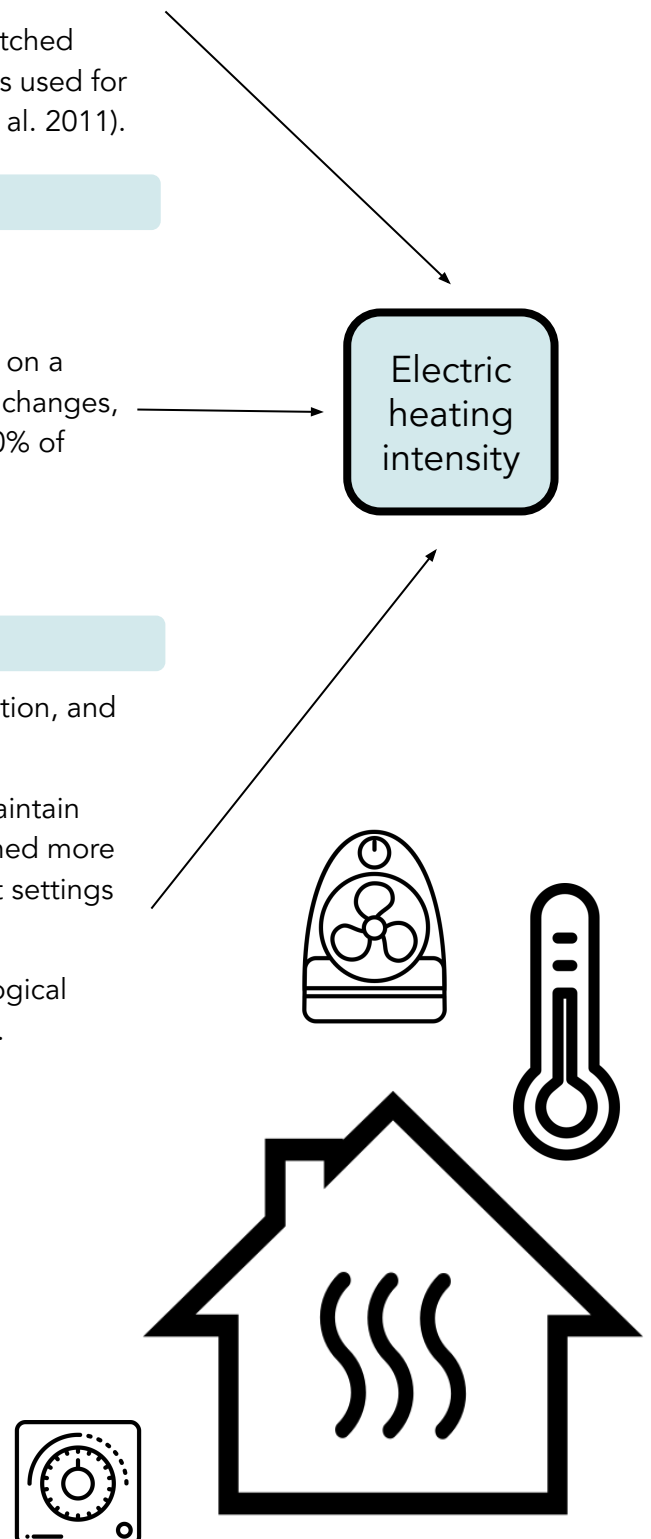
Active system retrofits can mean heat pumps to replace electric baseboards, or heat-recovering air exchangers to supply fresh air on a schedule without opening windows and leaking heat. Even small changes, such as swapping analog thermostats for digital ones can save 10% of heating bills (Hydro-Québec, n.d.)

## Behaviours

People manage their homes to maintain thermal comfort, ventilation, and acceptable bills.

For instance, a drafty home may need higher temperatures to maintain comfort, or a lack of air exchangers may mean windows are opened more frequently to change out stale air. For example, lower thermostat settings can net 5-7% savings for a 1°C reduction (Hydro-Québec, n.d.).

Low energy prices may induce careless consumption, while ecological concern may compel some to monitor their consumption closely.





# Stakeholders

## Local

Renters • landlords •  
City of Montreal •  
borough councils

## Provincial

Government of Quebec •  
Hydro-Québec • Energy  
Regulator • Building  
Regulator • Housing  
Tribunal

## Federal

Government of Canada •  
Natural Resources  
Canada • Canada  
Mortgage Housing  
Corporation

## Industrial

Engineering firms •  
building contractors •  
material suppliers •  
banks • insurance  
companies

*See Appendix A for tables describing these actors' interests, general actions, and interventions.*

## Highest Stake: Renters, landlords, Hydro-Québec, and transition offices across governments

Predictably, the actors who feel the consequences of high heating electricity consumption are those who make environmental pledges and consumers.

Renters in Montreal live with the causes and consequences of heating electricity consumption as they manage thermostats and ventilation to maintain their comfort and health. In most dwellings in Montreal, renters pay their energy bills—so the financial consequences fall on renters too.

Owner-residents feel the impacts alongside their renters. Their proximity and participation give them more agency than landlords who live elsewhere. Multi-property landlords have less direct information and control, and prioritize revenue—so renovations are likely rarer.

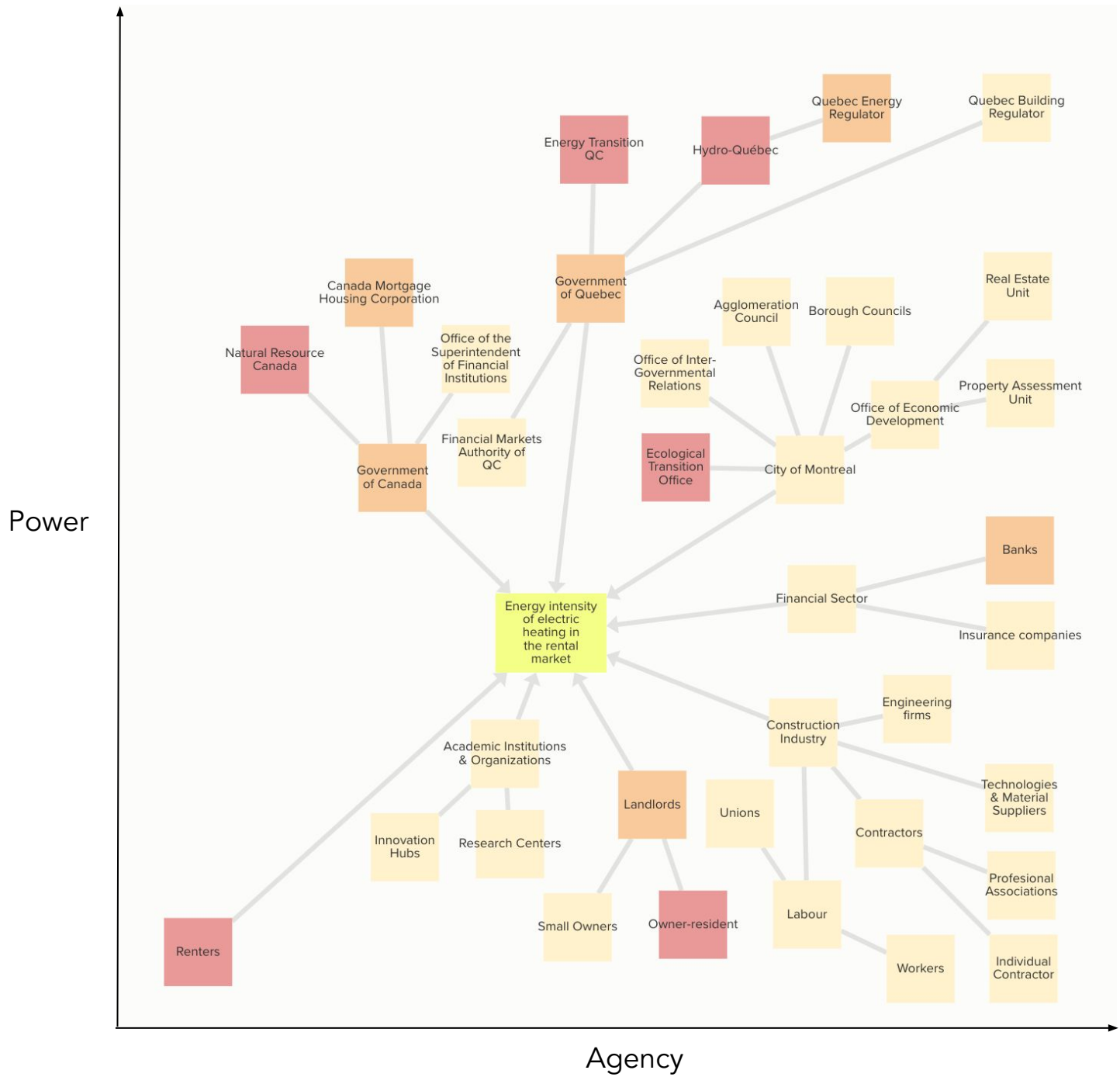
For instance, the Sustainability Office of the City of Montreal sets a sustainability strategy and environmental targets. Montreal's building stock directly impacts these energy efficiency targets, and Montreal's role in C40 Cities creates international pressure to meet ambitious emissions reduction pledges of 50% (C40 Cities).

The provincial government aims to reduce its emissions through increased electrification in high-emission sectors of the economy. Efficient electricity thus supports Québec's climate and economic strategy. Transition Québec, the agency responsible for energy innovation and retrofits, is the governmental division with the highest stake in housing.

Hydro-Québec (HQ) faces an energy and power supply crunch. Higher electricity intensity in homes strains capacity, especially in winter. Beyond fulfilling its social mission to supply affordable electricity, HQ generates revenues through the export and sale of energy to the industrial market at higher rates (HydroQuébec, 2022).

In the federal government, energy and building codes fall under Natural Resources Canada. Their targets serve "to meet the country's global commitments related to the sustainable development of natural resources" (Natural Resource Canada). The ministry manages retrofit and home performance programs.

# Map 1. Stakeholders in Montreal’s heating ecosystem according to extent of stake, power and agency



**Stake**  
 Degree of concern on the issue  
 ■ Most concerned  
 ■ Concerned  
 ■ Less Concerned

**Power**  
 Degree of leverage on the structure and control on the status quo

**Agency**  
 Directness of the control the actor has over the outcome

View the system here:  
<https://embed.kumu.io/b8027741511347bf0e8cfedfd0424a55>

## Highest agency: contractors, bankers and city's policymakers

The city's real estate strategy, property assessments, and urban planning departments issue renovation permit; contractors pick materials and methods, and bankers design the project's financing schemes. They have high agency, as their decisions have a direct impact on what gets built and what doesn't. Unfortunately, contractors only build according to designated plans, and bankers wait for market or regulatory signals before internalizing risks.

## Most power over buildings: Quebec's Building Regulator, City of Montreal, Natural Resource Canada

The municipal and provincial levels have strong legal control over Montreal's building stock. Meanwhile, Natural Resources Canada sets ambitious building guidelines that filter through Quebec's Building Regulator.

Quebec's Building Regulator develops the provincial building code and ensures municipalities apply it. The building code dictates what can be built and how, which is tightly linked to energy performance. The Building Regulator is traditionally concerned with safety issues rather than environmental issues (Régie du bâtiment du Québec).

Next in line is the City of Montreal. It can make the provincial building codes more stringent, depending on urban context. A borough's construction and renovation rules influence the owner's propensity to undertake housing modification projects, especially those that change the building's appearance.

Natural Resources Canada develops Canada's building strategy. Its national building code is modified by the provinces. The ministry has also created multiple building performance labeling programs. Among these programs is EnerGuide (Energide, Natural Resources Canada), a nationwide label that only the provinces of Alberta and British Columbia have officially adopted.

## Most power over consumer electricity: not Hydro-Québec

Quebec's Energy Regulator regulates Hydro-Québec's distribution activities, which includes controlling electricity rates for residential clients. It can set rates or decide on HQ's requests for rate changes. As such, the Regulator has the potential to influence residential electricity consumption.

# SOLUTIONS LANDSCAPE

## Summary of the current interventions

### 1. Targets

Following the 2016 Paris Agreement, the governments of Canada formulated ambitious GHG targets, notably being net-zero by 2050, and cutting emissions in half by 2030. Quebec's government has set a goal to improve energy use efficiency by 15% by 2030 (Energy Transition, Government of Quebec).

### 2. Changes to the provincial building code

In 2015, Chapter I of the provincial building code changed to include new efficiency requirements, projected to increase energy performance by 30% for new buildings and newly-built extensions (Béland, 2022). These new guidelines targeted all building archetypes except small buildings (up to 3 floors and up to 600 m<sup>2</sup>).

### 3. Subsidies for energy retrofits across government levels

The City of Montreal runs RenoPlex and Affordable Housing Renovation programs, which target small apartment buildings. The province runs RénoClimat to fund renovations, and NovoClimat to fund new builds or major renovations (Energy Transition, Government of Quebec).

Grants have low value and are only disbursed after renovations are audited. Despite strict criteria, these programs do not bind owners to the 2015 building code's efficiency measures. Hydro-Québec funds the installation of heat pumps. The Government of Canada manages the Greener Homes programs which provide larger funds upfront (Greener Homes, Government of Canada), but renters and landlords are ineligible.

### 4. Multiple energy performance labels/disclosure initiatives

In 2022, Montreal legislated mandatory disclosure and rating of GHG emissions from large buildings (Lejtenyi, 2022). The city focuses on GHG emissions (nonexistent for hydroelectricity) and omits smaller apartment buildings. The federal government developed the EnerGuide Homes label in 1998 to provide a rating of owners' home energy consumption and help guide renovation (Energuide, Natural Resources Canada). It is underused and competes with more than 11 home performance or efficiency labels on the Canadian market.

### 5. Efficiency ad campaigns

The Quebec Building Regulator, Transition Quebec, and Hydro-Québec launched ad campaigns beginning in 2015 (Hydro-Québec, 2022). Hydro-Québec has launched many similar campaigns since the '90s. Significant gains were made in the past while most remaining overconsumption belongs to inefficient homes (Hydro-Québec, 2022).

# LEVERS OF CHANGE

## Gaps & Levers

### 1. Government targets and support programs are fragmented

Gaps

Targets, support and funding programs from disparate governments overlap in principle but differ in details. The fragmentation of grants is time-consuming for owners trying to budget for and execute retrofits. Most subsidies are contingent on retrofit audits following construction, increasing perceived risk for owners.

Levers

coherence of program scopes with jurisdictional powers • relationships between jurisdictions • effort required to navigate available subsidies • certainty of funding

### 2. The building code is dated and moot for most buildings we'll have in 2050

Gaps

The building code's efficiency chapter to new buildings and major renovations only. In Montreal, rental housing is at the boundary between "small buildings" and "other buildings," leading to regulatory complexity for owners and contractors. Borough-modified building codes are often cited as too strict, increasing resistance to building modifications of any kind.

Levers

scope of application of efficiency chapter • variability of requirements across building types and locations

### 3. Renters and landlords have conflicting and insufficient incentives

Gaps

Low electricity prices limit renter requests for improvements. Retrofits reduce electricity bills that renters usually disburse while generating bills for landlords. Undertaking a retrofit is costly and guarantees no short-term payback if the property is not sold after improvement or there is no significant increase in rent. Despite the Housing Court regulating allowable increases in rents, major renovations can lead to evictions as new leases may include heightened rents. In a market with low housing supply, renters cannot easily find alternatives, so they are stuck with poor building conditions, for which landlords are rarely audited.

Levers

housing supply cost and benefit integration • renter's power in housing quality • inspection rate • electricity rate

### 4. Limited data or proxies for data to make decisions

Gaps

Electricity is tracked by Hydro-Québec, while dwelling data is held by the City. No government agency has publicly disclosed detailed studies of Quebec's building stock and its energy performance. Program design depends on this information, as does evaluation of programs and citizen education. Even data proxies, such as energy labeling programs, are poorly adopted. Without information, the construction industry and financial sectors are limited in actions on energy performance.

Levers

information to decision-makers and buyers • access to data across agencies

### 5. Construction industry is ill-prepared and ill-informed

Gaps

A labour shortage amid declining productivity in the construction sector constraints retrofit growth (Lejtenyi, 2022). Expertise in energy performance is lacking for materials installers, suppliers, and designers; it's a whole new science introduced into a fairly archaic sector. Most small projects are completed by small contractors with little oversight and training in new techniques and materials.

Levers

cutting edge knowledge in supply chain • trained laborer supply • unitary retrofit costs

## Possible intervention

### What we propose:

1. that existing buildings be required to comply to the building code's energy performance section
2. that verification take place through energy audits carried out in conjunction with property value assessments.

## Driven by the Quebec Building Regulator and the City of Montreal

The safety mandate of the Regulator already requires it to ensure buildings comply with changing codes such as fire safety. A similar proactive enforcement can take place for energy performance, and could be devolved to municipalities that are better enforcers through planning and permitting.

To assess progress, audits can happen during routine assessments of building value. In Montreal, this occurs every 3 years. If evaluators are paired with energy auditors, these visits can build an energy database that enables compliance assessment, and doubles as a data source for future government programs.

## Using regulatory fiat

If subsidies for retrofits provided by the government had tackled this issue, they would have made more of a dent in rental unit renovation rates. Increasing incentives for landlords or renters seems ineffective without also changing the nature of cost and benefit-sharing between them. Even including heating in rents as standard practice merely shifts the problem to contractual conflict resolution through the Housing Tribunal, which is already saturated with cases.

## Caveats

Delays for work planning are necessary and stepped compliance can be implemented, like in BC (Energy Step Code, Government of British Columbia), with delays meaning future renovations must be more comprehensive. Furthermore, requiring housing stock improvements puts pressure on a construction industry that is strapped for labor and expertise. Regulatory fiat has low cost, so the government's funds can not only be used for greater grants programs targeted at landlords' small buildings, but for supply chain programs that favor training, recruitment, and learning by doing.

# KEY INSIGHTS

## Conclusion

Housing is the nexus where an almost inextricable array of interests, constraints, and powers interact. It is key to meeting our climate targets. More of the same attempts at changing housing stock seems futile, and blind to where the mass of housing actually resides in Montreal: in rental housing.

We started our journey from our shared climate concern our experience as renters in old dwellings with stingy landlords. Digging into the “why” and “so what”, up and down causal chains, made us realize property relationships and deeply-held values regarding the availability of energy were unassailable in the short-to-medium term.

New regulatory pressures, as proposed on the previous page, seem to us the only effective means of addressing residential heating electricity consumption on a timeline consistent with climate safety—and the good news is it also improves living conditions.

## Lessons Learned

### Start sketching fast.

We spent considerable time searching for perfect formats, but they reveal themselves over iteration of partially completed maps.

### Specify the nature of what you're putting on paper.

Is it a quantity, an intensity, a mechanism, or something else? Thinking through these questions helps set a solid foundation for analysis.

Frame based on your needs and your audience. The boundary between gaps, levers, and solutions is where you decide it is: what matters is that where you set it enables analysis that others people can use.



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