

NEW FOUNDATIONS 3.

A SYSTEMS APPROACH TO HOUSING POLICIES

THE HOUSING SYSTEM AND ACHIEVING NET ZERO CARBON.

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1. Achieving Net Zero Carbon: Housing as a Key Sub-System in the System of Change.

The development and use of housing has major roles in shaping the use (and abuse) of natural capital, local bio-diversities, the quality of ambient flows of air and water and, of course comprises the dominant form in most built environments with consequences for the environmental qualities and amenities of neighbourhoods, towns, and cities. This paper focusses on the specific issue of housing effects on Greenhouse Gas (GHG) emissions and consequences for net zero carbon.

Housing system activities (e.g., land development, construction, maintenance, and financing) all involve the use of fossil fuels. Housing attributes similarly impact greenhouse gas (GHG) emissions; dwelling size, heating systems and insulation are key influences of how just living at home produces carbon; and dwelling location relative to the dispersed places that households physically access critically influences the uses of fossil fuels in connecting home with the wider world. Travel related emissions are too often seen as a 'transport' rather than a 'housing-accessibility' and this highlights how seeing the housing system as connected to other major policy areas also requires a system of sub-systems understanding of key policy issues and responses.

Within any metropolitan area or region, the housing system usually sorts different socio-economic groups into different locations as the quality and accessibility of homes and neighbourhoods has well defined geographic patterns. Higher income households tend to choose to live amidst other higher income households in high amenity neighbourhoods. Poorer households usually live in the worst neighbourhoods. As economies now begin to adjust to net zero targets it is likely that the costs of adjustment will disproportionately fall on the poor and if there is a sustained market competition for 'more green space' and/or for more 'ambulant accessibility' it is likely that there will be displacement of poorer households into the newly defined 'poor locations' that are prone to flooding, storm damage and over-heating.

Housing system issues in relation to GHG involve not just reducing embedded and emitted carbon in construction processes. There are also the imperatives of reducing GHG production in domestic energy use, curtailing travel related GHG production by more effectively linking key activity sites with homes (involving decisions about what housing to produce and where as well as changing travel modes) and ensuring housing system sorting processes do not produce a new geography of 'unjust transition'.

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Achieving Net Zero aims require an understanding of socio-economic activities, such as housing, as complex, evolving, recursive and overlapping systems. This requires coherent whole of government actions, and this means all governments, all together, need to address them.

Oddly, however, key environmental and GHG outcomes are still rarely incorporated in housing strategies, resource bids and the remits of Housing Ministers. The imperative for net zero requires a more integrated research and policy response to the ways in which housing systems can be repurposed to better meet the key goal of all Canadian governments.

2. Multiple Instruments in Multiple Sectors.

Achieving net zero carbon transitions involves major technological innovations and the challenge facing Canada, and others, is not the biggest challenge since, but including, the industrial revolution. There have already been major innovations in domestic heating and progress too in the development of potentially zero or low carbon travel between home and work. Behaviour change of individuals and firms will also be required. ***And politics and governance also have to change.***

Applied economics has a significant contribution to make to effective change strategies, aside from the distributional issues raised above, as key elements in the GHG problem, as for so many environmental issues, are externalities and real market failures. The housing system both captures and creates some of these effects. A multiplicity of instruments not-specifically aimed at housing will impact housing markets, for instance tax changes such as carbon taxes and local taxes of land, and regulations such as banning fossil fuel use in public transit systems or waste disposal rules. Government spending programmes will matter too. ***Those who work in and govern housing systems will need to be 'beyond system alert' and those who pull the cross-sectoral policy levers will need to understand the key sub-system effects. The policy shift in Canada toward net zero carbon is impressive in tone and the variety of localised innovation, but there needs to be better integration of the effects of different instruments and sub-systems, including housing, into clearer 'route-maps and missions' for progress.***

3. Decarbonising Construction.

Housing development displaces natural capital by transporting, assembling, and combining energy, labour, and materials. Even before construction commences fossil fuels are widely used in transporting materials and labour to building sites. Transforming raw materials into building materials, such as concrete and steel, uses major amounts of energy so that they have already 'embedded' the production of CO₂. Subsequent energy use in construction is made up of operational energy and embedded energy, mostly coming from non-renewable energy resources and some estimates of the construction 'carbon' chain also include estimates of the emissions that will arise in eventual demolition processes. Much more attention in new construction as well as housing renewal needs to be paid to 'circular economy' approaches.

Estimates of GHG production, using 'extended chain' estimates (including embedded and demolition related GHG) suggest that residential construction of close to a quarter of non-household GHG's.

There are significant innovations internationally, and within multiple local jurisdictions in Canada, of different ways to decarbonise the construction process. The review identified four

major methods that are being implemented in the Canadian construction sector to reduce energy use in, and emissions from, the construction sector. The main developments involve:

- reducing emissions from construction machinery (better designs, more efficient and different fuel sources).
- reducing embodied carbon in construction through the use of materials that require less energy during manufacturing, with a new interest in sourcing more natural and local materials.
- shifting away from fossil fuels as an energy source
- the encouragement of modular construction of homes, that seldom have contributed more than 5pc of housing output in Canada, and the output share is expected to double by the late 2020's (in the similar climates of Scandinavia, modular homes in Sweden comprise close to half of housing output and this not only reduces GHG per dwelling completed but is associated with higher labour productivity and significantly more elastic supply chains: that said, the UK's largest modular homes producer announced major cutbacks in April 2023 due to consumer resistance to their products, and clearly **major market research regarding modular homes in Canada is urgently required**).
- With similar and different process effects, retrofitting homes with new energy-related structures and systems have significant GHG emissions.

The GOC policy goals for 2030 and 2040 are to reduce overall GHG emissions from the housing construction sector, and not just emissions per home constructed. With the potential more than doubling of housing construction efforts in Canada to 2030, to address existing shortages, rising immigration rates, and new demands for retrofitting existing homes, **there has to be a recognition that in the absence of rapid decarbonisation (by implication reducing emissions, per home produced, in supply chains by at least 50 percent) expanded housing supply policy will substantially raise induced GHG emissions.**

Energy retrofitting of housing and infrastructure will be competing for many of the same construction sector resources and a more coherent, integrated supply system strategy for the new construction, infrastructure and energy retrofit sectors is very urgently required if targets are to be met effectively. As outlined below higher new housing standards and greatly expanded retrofitting of existing homes will improve housing affordability (lowering energy costs) and reduce GHG per dwelling but as retrofitting is progressed there will be a short-term increase in overall construction sector GHG and pressures on housing construction costs.

4. Domestic GHG Emissions: An Imminent Success?

National targets for reducing GHG emissions for 2030, and net zero aims for the 2040's are unlikely to be attained unless there are sharp reductions in GHG emissions arising from domestic energy use. **Canada has, by far, the highest per capita residential energy use in the OECD but residential CO2 (per capita) emissions are just above the estimated average, and this largely reflects the use of 'clean' electricity from hydro-power sources, particularly in Quebec.**

Households use housing attributes to produce 'housing services', such as comfortable space and instantly hot water, and this drives residential energy use. The residential sector in Canada accounts for a significant portion of both energy use and emissions, which constitutes around 17 per cent of the secondary energy use and 13 per cent of GHG emissions.

The experience of the past 20 years in Canada has demonstrated the significant impact of new technologies in improving energy efficiencies in space heating (64%), water heating

(18%), appliances (13%), lighting (3%) and space cooling (2%), that are usually associated with the switch to cleaner sources of energy.

These changes have made major progress in reducing energy consumption and, in consequence, GHG emissions. Further progress is anticipated, not just because of the post 2022 doubling (and more) of domestic energy costs but through improved design and energy standards for newly constructed buildings (that are evolving in Canada's Green Buildings strategy). However as new construction, with high new energy standards required will be likely to provide, at most, 5pc of Canada's housing stock by 2030, further rapid energy use descent in housing will require extensive, major retrofitting of existing homes. Over half of residential buildings in Canada are more than 30 years old, and over a fifth are older than 50 years or more. Retrofitting is especially relevant for achieving the net zero emissions goal in Canada. But raising current important demonstrator projects, that highlight real income gains and significant benefit to cost ratios, are inhibited by:

- a lack of structured approaches aimed at reducing energy consumption and greenhouse gas emissions from existing buildings.
- major issues of covering capital costs even when there are positive net benefits not too far into the future, and for a majority of Canadians this is a financing challenge rather than a question that the long-term will not be beneficial to investors in retrofitting. ***However, for the poorest quarter of Canadians there is a question of whether households can, themselves, pay for upgrading.*** The central issues then become the design of financial instruments to fund retrofitting by the majority of Canadians and ensuring a just transition in domestic heating systems for Canada's poorer populations.

Who will pay for energy retrofit or the higher energy standards of new homes? ***CMHC, provinces, cities, and property owners, all need a clearer strategic path to net zero and when and how 'green finance' will flow more rapidly into housing.***

There are encouraging signs that new domestic energy technologies (and sources) and energy management systems are moving Canada to much better housing energy use outcomes. However, there are still significant research gaps in understanding changing housing energy use. The most significant decision-makers in the housing supply chain are residential home builders, and as a result, they have the most control over how new housing responds to changes in technology, demographics, and housing policy. ***Much stronger, contemporary market evidence of behaviours about and barriers to residential energy transition in Canada are urgently needed. But the possibility of a policy 'triumph' is just visible. Arguably, past unearned asset gains for homeowners could be used, with suitable equity release loans in place, to fund substantial retrofitting of existing housing stock.***

5. Transit GHG emissions reflect housing options and choices, not just travel modes!

There is widespread underestimation of the GHG consequences of housing market processes and outcomes, especially residential location choices. Accessibility-related carbon emissions are usually regarded, in research and policy silos, as reflecting travel choices and are delegated to the 'transport sector silo' for action rather than identifying the strong synergies between housing and transport decisions and recognising that travel demands could be shifted by housing system changes.

The locational and neighbourhood characteristics of a dwelling are critical shapers of the extent to which a household can adequately localise their pattern of household activities and demands and their ability to connect to wider urban activity points.

Among all the factors contributing to energy use and GHG emissions in the transport sector, urban form/spatial structure is regarded as a main determinant of transport related GHG emissions.

Canada is characterised by low density, highly auto-dependent, segregated land uses, and insufficient infrastructure provision. These are the defining attributes of what is known as 'suburban sprawl'. Across the OECD countries, Canada is the country with the lowest urban population density, at approximately one-third of the OECD average. Road transport emissions per capita in Canada's urban areas are the second highest in the OECD and are higher than similarly dense urban areas in other OECD countries. These 'dirty footprints' reflect planning, policy, and household choices about how and where to live. New fuels (electric cars) and means of travel (the intra-urban small VTOL jet travel option, for instance) will reduce GHG per km commuted. ***However, it is clear that policy action will have to urgently hasten the reduction of mobility related GHG emissions.***

6. Housing, Infrastructure and Transport: Making Better Connections.

Housing, infrastructure, and transport departments (at all, and across all orders of government) need to work together, and collaborate across federal, provincial, and municipal levels. Understanding the geography of the housing system, how it is changing and how it needs to change is an important first step, that perhaps Canada has omitted, in designing the linked economy-housing-transport-infrastructure strategies for zero carbon. ***Interfaces with emerging policy ideas about '10/15-minute neighbourhoods', 'compact cities' and 'transport-oriented development', are highly relevant to housing decarbonisation purposes. CMHC needs to give more thought to how place-based non-profit housing providers, often with strong community boards, can develop stronger and wider roles in facilitating, and funding, neighbourhood reductions in GHG emissions.***

The housing system, and its sorting mechanisms, shape travel demands and patterns, and transport systems and structures shape housing choices. The homes of the older deteriorate faster than they need to, older households use higher-than-needed domestic energy, and younger families have to travel more to integrate the spatial points in their lives. ***This area of policy, where system interconnections so obviously shape outcomes, should be a model of integrated governance for the housing, infrastructure, and transport systems. In Federal Canada all these silos of policy already co-exist within the same Department, and this offers a real possibility to make fast progress in shaping better places with sharply reduced carbon footprints.***

7. Wicked Systems, Wicked Storms.

The review noted that carbon-induced climate change already has a recursive, negative effect on housing systems, impacting the price, quality and running costs of housing. These changes include natural and other catastrophes, bad weather, and a much more serious and sometimes unrecognised housing system risk from climate change, even where damage processes operate gradually rather than chaotically.

Inefficient property markets may imperfectly understand and imprecisely price such risks. This may become a major concern and task for CMHC. Given the mortgage insurance and market roles of CMHC there are clearly important implications in relation to risks associated with existing loans as well as much consideration to be given to loan allocations and insurance coverage for future CMHC-supported initiatives.

8. Moving Forward

What seem to be the housing system specific actions for governments to accelerate progress to net zero?

- A major concern for achieving the housing sector's contribution to net zero is the urgent need for and real prospect of rapid retrofitting of Canada's older homes.
- An immediate audit of housing and retrofit supply shortages and an action plan to reduce barriers (reviewing labour and materials shortages, the case for modular homes, converting redundant downtown office spaces to apartments, raising the input of public land, inclusionary zoning, incentivised removal of planning barriers) should be developed and report before Budget 2024.
- With effective coordination across housing, infrastructure, construction labour and immigration policies more, greener homes (and buildings) are a major opportunity.
- The federal government should immediately establish, a Green Housing Supply Commission to work with provinces and cities, private and non-profit developers, and relevant experts and serviced by CMHC, and to establish a clearer mission for green and affordable housing provision in Canada.
- Most smaller provinces do not have the technical staff available to articulate green housing strategies. CMHC should have a role in supporting provinces, with limited resources or a capacity for mutual learning, to implement best practices to shape the decarbonisation of local housing systems.

These, and other measures noted in the review, are key housing system measures to progress towards net zero. After a decade or two of confused rhetoric about global warming, Canadian governments are now making some progress in tackling GHG emissions in construction, very substantial progress in reducing domestic energy related GHG and a surprising lack of coherent progress in drawing infrastructure, transport and housing together to landscapes of cross-silo funded investments that will shape a greener, fairer, productive geography for Canada's future. ***When, as there is now in public policy now, a disruptive storm, we should not complain about the weather, We must learn to dance in the rain. And we all have to dance together.***