TechHaven

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Sustainability and Social Entrepreneurship Fellowship (Spring 2024)

Problem Statement

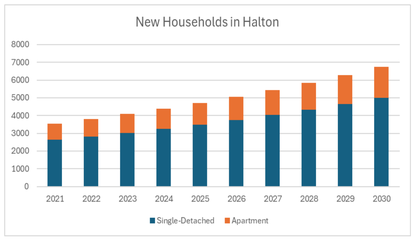
As Halton expects to double its current population by 2050, new households are rapidly being built and overall energy consumption continues to rise. There is a need to adopt more stringent energy efficiency standards and practices that reduce energy use and GHG emissions in the region.

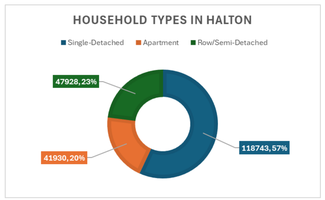
Objectives

- Reduce household secondary energy consumption in the Halton region.
- Implement passive house design strategies.
- Develop programs to incentivize residents.

Housing in Halton

Single-detached homes and apartments make up 80% of households in the Halton region. New homes are being built at a rate of 7.4% annually. [1]





Passive House

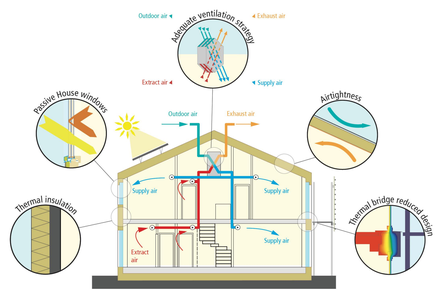
Highly energy-efficient buildings designed to minimize heating and cooling needs through super-insulation, airtight construction, high-performance windows, and heat recovery ventilation system. [2],[3]

Primary Principles:

•Air tightness

•Continuity of insulation

•Efficient heating and cooling



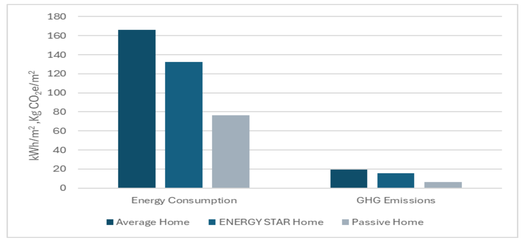
Analysis

Constraints

- Households considered: single-detached and apartment
- 2021 Ontario census data used for GHG emissions and energy end-use analysis on average home [4]
- Main energy use for households is space heating (~61%)
- Focus on reducing space heating energy consumption by applying passive house design criteria [2]

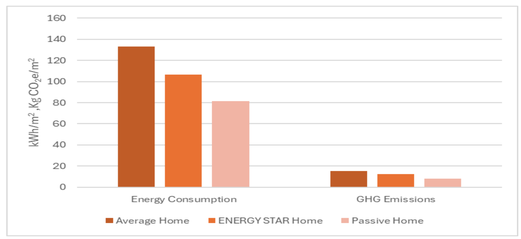
Performance per Household

Single-Detached



- Space heating energy reduction of **85%**
- GHG emissions reduction of **66%**
- Overall energy savings of **54%**
- Annual energy bill reduced by 6.5%

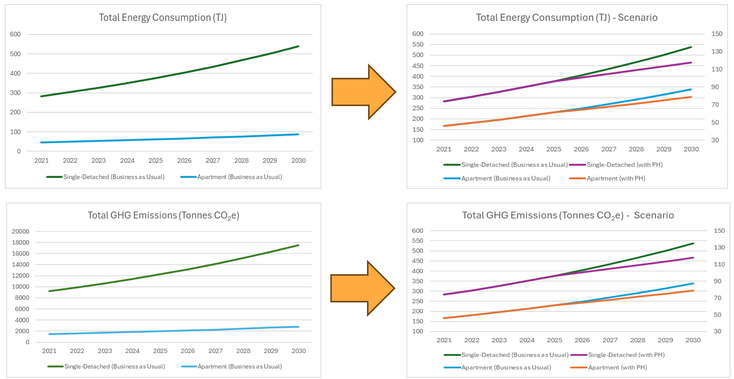
Apartment



- Space heating energy reduction of **77%**
- GHG emissions reduction of **49%**
- Overall energy savings of **39%**
- Annual energy bill reduced by 4.5%

Overall Housing Trends

Scenario: 5% annual increase in new passive homes (apartment and single-detached) in Halton, from 2026 to 2030.



Potential Savings - Scenario

- Energy Savings: 198 TJ (single-detached) + 23 TJ (apartment) = 221 TJ ~ *61.4 million kWh*
- GHG Emissions Reduction: 2528 tonne CO_2e (single-detached) + 300 tonne CO_2e (apartment) = 2828 tonne of CO_2e ~ *2.9 x 10^7 Kg of CO_2e*

Our Strategy

We suggest adopting passive home standards to reduce energy use by up to 60%. Key improvements like enhanced insulation, airtight construction, triple-glazed windows, heat recovery ventilation, optimized solar gain, and efficient heating systems can significantly enhance energy efficiency. These measures not only reduce energy consumption but also improve comfort and sustainability [2],[3].

Methods to Improve Energy Efficiency

Thermal Insulation [2]	Air Tightness [2]
• Eliminate cold spots and drafts • Maintain consistent indoor temperature • Eliminate or minimize thermal bridges • Superior insulation materials with higher R and lower U values for walls, windows, floors • Continuous insulation layer	• Minimize air leakage by maintaining tight building envelope • Airtight construction techniques • Verification via blower door tests to ensure a highly airtight building envelope • Moisture control

What Can Halton Do?

Engage Stakeholders: Set Building Performance Standards (BPS) [5] for airtightness, insulation, and heating energy on new homes

Data Collection: Perform inspections for accurate energy trends

Non-Compliance: Fine for exceeding energy and emission limit.

Tax Reduction: Lower property taxes for new passive homes to offset 8.5% [6] higher cost

Electricity Reduction: 20% off-peak rate cut for passive homes.

Impact: Reduce emissions, energy demand, align with climate goals, improve household resiliency, savings for homeowners

References:

[1] "Occupied Dwellings 2021 Total Number of Dwellings Single-detached Apartment Row/Semi- detached Age of Dwellings 2021 I Quarterly Housing Sales in Halton 2 Year Quarter Housing Sales Average Price Average DOM* 9% Housing Starts and Completions." Accessed: Jul. 26, 2024. [Online]. Available: https://www.halton.ca/getmedia/4c44d46c-da8d-49af-be18-c7aa2422b65e/LPS-Buildings_Residential-Real-Estate.aspx
[2] Passive House Institute, "Passive House," https://passivehouse.com, accessed Jul. 25, 2024.
[3] Passive House Institute US, "Passive House Institute US," https://www.phius.org/, accessed Jul. 25, 2024.
[4] N. R. C. Government of Canada, "Residential Sector – Ontario," oee.nrcan.gc.ca, Apr. 01, 2005. https://oee.nrcan.gc.ca/corporate/statistics/neud/dpa/menus/trends/comprehensive/trends_res_on.cfm
[5] E. Tzekova, "Building Performance Standards A Policy Primer for Municipalities in the Greater Toronto & Hamilton Area September 2023 | The Atmospheric Fund." Accessed: Jul. 26, 2024. [Online]. Available: https://taf.ca/custom/uploads/2023/10/TAF-BPS-Primer_202310.pdf
[6] [1]"Does High Performance Construction Cost More?," BC Housing, Jun. 01, 2024. https://www.bchousing.org/sites/default/files/media/documents/Building-Innovation-Case-Study-June-2024-Final.pdf (accessed Jul. 22, 2024).