

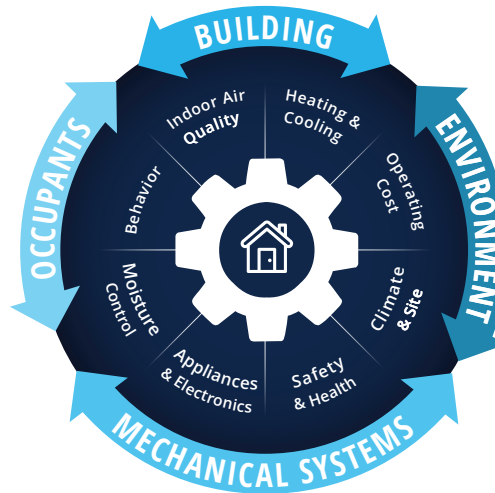


HAAS DEFINED

House As A System (HAAS) is a building science concept that defines the house as an energy system made up of four interdependent components, each of which affect the performance of each other and the entire system. The HAAS approach to home energy retrofits considers the intended or unintended effects that changing one component can have on other components, in terms of energy performance, moisture levels, air quality, occupant comfort, safety and home durability.

A house system consists of four main components:

- 1 **OUTER LAYER OR BUILDING ENVELOPE**
- 2 **INNER PARTS OR MECHANICAL SYSTEMS**
- 3 **OCCUPANTS**
- 4 **ENVIRONMENT**



The benefits of a HAAS approach to home energy retrofits:



ENHANCED HOME COMFORT



AFFORDABLE TO OPERATE



A HEALTHIER HOME



IMPROVED HOME EQUITY



SMALLER ENVIRONMENTAL FOOTPRINT



IMPROVED HOME DURABILITY

HAAS SAFETY CONSIDERATIONS

While there are many important factors to be considered in a well-planned and implemented HAAS home energy retrofit, three important safety considerations are asbestos, carbon monoxide, and mould.

Asbestos

From the 1930s to the 1990s, asbestos was used in many building materials such as vinyl and linoleum flooring, stucco, insulation, roof felt shingles, gypsum board filling compound, incandescent light fixture backings, and deck under-sheeting. When disturbed, it can be released into the air, rendering it harmful to anyone working or living on the property. In order to properly identify asbestos, a qualified testing company or asbestos surveyor must be retained to ensure the safety of your installation crews and of the homeowners.

If materials containing asbestos are identified in the home, the next step is to have them removed by a qualified asbestos abatement contractor. For more information: [WorkSafe BC – Asbestos](#)

Carbon Monoxide and Combustion Spillage

Carbon Monoxide (CO): A colourless, odourless, and tasteless gas that can be produced by household appliances that use fossil fuels or solid fuels (natural gas, oil, propane, diesel, kerosene, or wood) for combustion. It is impossible to detect without a CO detector and elevated concentrations can cause disorientation, loss of consciousness, and even death. All homes with combustion systems should ensure that a sufficient number of CO detectors are installed in appropriate locations around the home and maintained regularly. Unvented combustion systems should be upgraded to high efficiency direct vented systems or other non-combustion options. For more information:

[NRCan – Things You Should Know About Combustion Spillage](#)

Mould

Mould is a type of fungus. We cannot stop it, but we can avoid it in our buildings. If mould is visible or odour is detectable, there is too much mould. Exposure to mould can have health impacts. Before you work to remediate mould, consult a qualified professional and research best practices for mould removal. The Canada Mortgage and Housing Corporation (CMHC) has detailed guidelines for how to clean up mould safely, and when to call in a qualified mould remediation expert. For more information: [Canadian Mortgage and Housing Corporation](#).

In Summary

The HAAS approach considers the intended or unintended effects that retrofitting one component of a home can have on other components. By taking HAAS into consideration when planning each home retrofit, contractors and renovators can advise homeowners on the importance of well-planned whole-home renovations and offer retrofit solutions that will both fix existing issues with the home and avoid creating new issues.



FOR ADDITIONAL INFORMATION ABOUT HAAS VISIT
www.homeperformance.ca/contractor-resources/



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The Transition 2050 Residential Retrofit Acceleration Project is supported through the Municipalities for Climate Innovation Program, delivered by the Federation of Canadian Municipalities and funded by the Government of Canada.

HAAS SOLUTIONS

A house with its systems out of balance may cause a building failure (e.g. high energy consumption, wood rot, mould, drafts, combustion spillage, and condensation). When retrofitting one part of the home there will be an impact on the overall system. Quality implementation of multiple complementary HAAS solutions can help bring the house back into balance and/or avoid unintended consequences from single retrofits.

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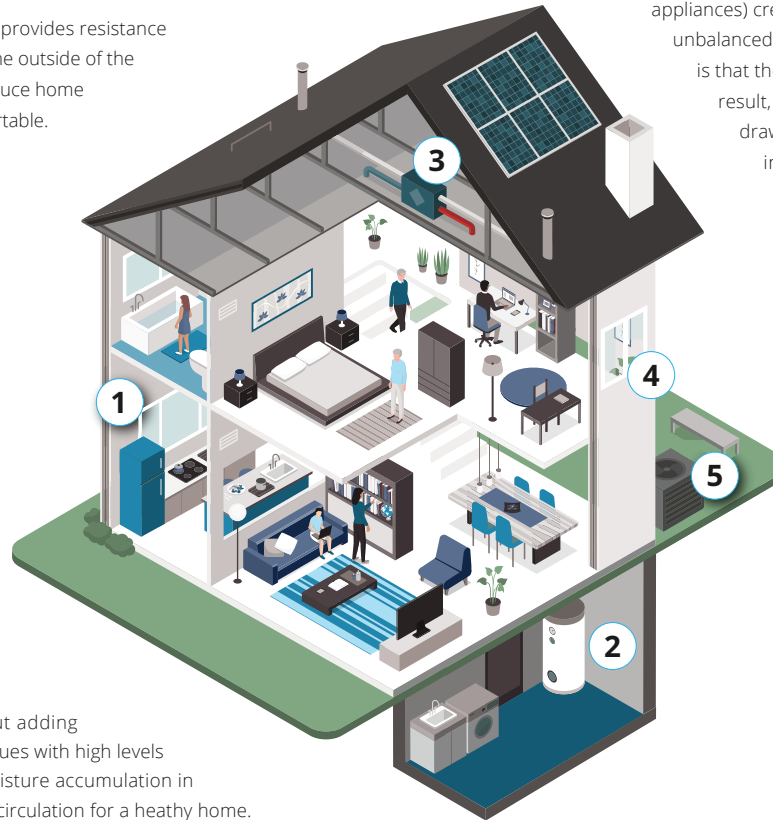
- 1 Air Sealing** helps to create a continuous air barrier that provides resistance to the flow of air (and moisture) between the inside and the outside of the house (and into the walls). Undertaking air sealing can reduce home energy bills and make homes less drafty and more comfortable.

In the majority of homes, the most significant air leaks are found in the attic/top floor and basement/lowest floor. This is due to the stack effect: in a heated home, less dense warm air rises and expands, creating a higher-pressure area near the top of the house. In colder months, this higher pressure pushes air out through cracks at the top of the house (exfiltration) and reduces the pressure at the bottom of the house, drawing in cold outdoor air (infiltration). When conducting air sealing, it is important to prioritize the locations that will allow for bigger reductions in air leakage and reduce the negative impacts of the stack effect. High priority areas often include, in this order: big holes, regardless of location; smaller holes at top floor ceiling or attic; smaller holes on bottom floor; and smaller holes on main floors.

- ★ HAAS Consideration:** Undertaking air sealing without adding appropriate and sufficient ventilation may create new issues with high levels of humidity in the home, condensation on windows, moisture accumulation in walls and attic, and mould growth and/or insufficient air circulation for a healthy home.

- 2 Insulation** slows the transfer of heat between the inside and the outside, keeping a home warm in the winter and cool in the summer. Other benefits of insulation include maintaining an even temperature throughout the home, reducing unwanted outdoor noise, and reduced energy bills.

- ★ HAAS Consideration:** Before insulating, air sealing should be completed on air leakage pathways into walls and attics to maximize the efficiency of the insulation and to prevent moisture from entering into the insulated area and damaging new insulation or creating mould or wood rot.



- 3 High Efficiency Ventilation Systems** that are correctly sized and installed help improve air circulation, maintain appropriate humidity levels, remove indoor pollutants, and increase the comfort, safety, and energy-efficiency of a home.

- ★ HAAS Consideration:** A home with too little ventilation may result in issues identified in the Air Sealing HAAS Consideration. A home with too much ventilation may be uncomfortable, expensive to heat, and (if there are combustion heating systems or appliances) create issues with combustion spillage. The problem with homes with unbalanced (only exhaust) ventilation (standard bathroom fan and range hood) is that the supply air is coming through cracks in the building envelope; as a result, there is no opportunity to filter incoming air and there is potential to draw moisture into the building envelope. The best option for ventilation in homes with appropriate levels of air tightness, is a heat recovery ventilator, which uses the air being exhausted to heat incoming air. Once a home has achieved an air tightness of 3 air changes per hour (measured at 50 pascals), or lower, a heat recovery ventilator is recommended.

- 4 Efficient Windows and Doors** provide better year-round comfort by reducing heat loss in the winter and heat gain in the summer, reducing condensation, and decreasing outside noise. Advances in technology mean that windows can be more efficient than ever, with low-emissivity (low-E) coating, double or triple glazing, inert gas fill, insulated spacers and frames, and professional installation.

- ★ HAAS Consideration:** Reducing air leakage by installing new windows may require the installation of additional, or better, ventilation to manage humidity and moisture within the home. Proper window selection should consider the glass, frame, U-Factor, solar heat gain coefficient, and visible transmittance, as well as window orientation.

- 5 Efficient Heating Systems** should be appropriately sized and well installed to provide occupants with reliable home comfort and affordable energy bills.

- ★ HAAS Consideration:** Installing a high efficiency heating and cooling system in a home before addressing air leakage issues or upgrading insulation may result in the installation of an oversized heating system that does not provide the energy savings or comfort expected. Undersized equipment may leave occupants with a heating system that does not heat the home adequately, is expensive to operate, and may not last long. The improper installation of heating systems may severely impact efficiency and performance.