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Approach for Developing the Proposed Operational Greenhouse Gas Emissions Levels for Part 9 of the National Building Code of Canada

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Abstract

This paper presents the methodology developed to quantify operational GHG emissions and set performance levels in the proposed updates to be included in the 2025 edition of the National Building Code (pending approval).

The GHG requirements build on the reference vs proposed method widely used in energy codes. Reference GHG emission factors were selected and verified using 240 contemporary house archetypes, which utilized natural gas for space and service water heating. From this baseline six performance levels (from A to F) were defined, with A being the most stringent (≥ 90% improvement compared with the target), and F the least stringent (<10% improvement).

The results emphasized that the most significant reduction in GHG emissions can be attributed to changes in the electricity grid mix and equipment selection. In locations where average grid emissions factors are less than 100 g CO_2e/kWh, heat pump systems demonstrated the most significant reduction in GHG emissions compared to the reference, and ultimately compliance with higher operational GHG emissions performance levels (A and B).

When adopted into code, authorities having jurisdiction will set the minimum required operational GHG performance level.

Introduction

In Canada, approximately 13% of the total operational greenhouse gas (GHG) emissions are directly attributed to the built environment (residential and commercial buildings). These emissions result from using fossil fuels for space and service water heating. If the off-site or source energy emissions associated with electricity consumption for cooling, lighting, and appliances is taken into account, the percentage raises the overall contribution of buildings to GHG emissions to approximately 18% (Government of Canada, 2021). Figure 1 illustrates the contribution of each type of building load to the annual amount of operational GHG emissions for an average house. As can be seen, space and water heating represent three-quarters of the energy use, so equipment choices will likely have a significant impact on total GHG emissions.

In the 2020 edition of the National Building Code (NBC) of Canada, energy efficiency tiers were introduced, which contain targets that progressively increase energy efficiency and reduce the amount of energy needed to operate a house. These requirements play a crucial role in reducing GHG emissions by focusing on the amount of energy used. However, energy savings alone will not necessarily achieve the goal of reducing operational GHG emissions to zero or near zero because different sources of energy have different GHG emissions factors. The objectives and technical requirements of the NBC are being updated to consider both the amount of energy used and the GHG intensity of the energy sources used by houses in order to meet the goal of the Pan-Canadian Framework on Clean Growth and Climate Change (Government of Canada, 2022).

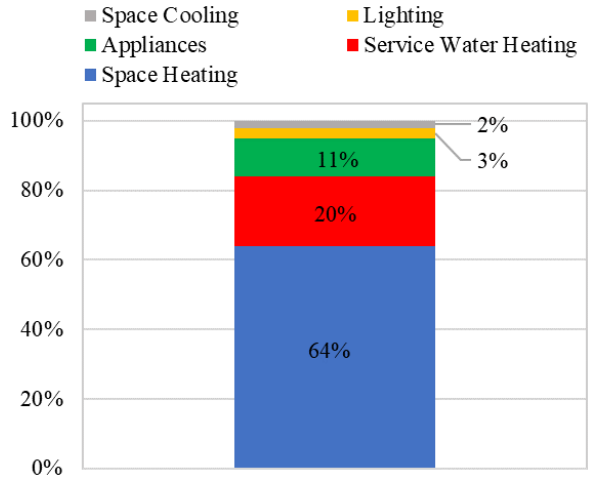


Figure 1: 2020 GHG emissions for an average Canadian house (Natural Resources Canada, 2022).

Energy use in buildings is expected to continue to rise over the next decade (Natural Resources Canada, 2019), and more stringent building energy codes play a critical role in reducing energy demand and GHG emissions associated with this energy use. To reach the goal of reducing GHG emissions by 40 percent below 2005 levels by 2030, and achieve zero emissions by 2050, the climate action plan set by the Canadian government in Canada's 2030 Emissions

Reduction Plan calls for stronger building codes and to do this, limits are needed on the operational GHG emissions of new houses.

GHG emissions across Canadian provinces and territories exhibit substantial variations, influenced by factors such as population density, climate, energy sources, and economic considerations (Government of Canada, 2023). Provinces and territories with larger populations, resource-based economies or heavy reliance on fossil fuels for electricity generation generally register higher emissions levels. This demonstrates a greatly varied energy landscape across Canada.

A flexible framework for regulating GHG emissions due to building operation, with 'levels' that move towards lower operational GHG emissions was proposed for the 2025 edition of NBC (Canadian Board for Harmonized Construction Codes, 2023). Providing a tiered approach to reduce operational GHG emissions prepares the industry for future reductions in operational carbon emissions, leading to the design and construction of zero or near zero emissions buildings as part of Canada's commitment to GHG emissions reduction.

Approach for developing operational GHG emissions performance levels

Technical requirements for the National Model Codes are developed by code development committees operating under the Canadian Board for Harmonized Construction Codes (CBHCC). The standing committee currently responsible for energy efficiency and GHG emissions provisions in NBC Section 9.36 is the Standing Committee on Energy Efficiency (SC-EE). The development of operational GHG emissions performance levels was undertaken by the Task Group on Operational GHG Emissions (TG), a task group of the SC-EE.

The operational GHG emissions performance levels were derived using building performance simulations of archetypes selected from new construction housing stock. This section describes the scope, simulation tool, archetypes, and locations used for developing the operational GHG emissions levels proposed for the 2025 edition of the NBC.

Scope

Broadly speaking, the quantification of operational GHG emissions for the built environment includes the following (Low Carbon Materials, 2023):

- Direct GHG emissions (Scope 1), resulted from on-site fuel combustion (e.g., natural gas used on-site for cooking, water heating, and/or space heating) and refrigerant leaks;
- Indirect GHG emissions (Scope 2), resulted from purchased electricity from the grid (i.e., usage on an electricity bill) and other centralized energy sources (e.g., steam);
- Other indirect GHG emissions (Scope 3), resulted from material extraction and production, waste disposal, commuting and travel, water consumption and disposal, and others.

According to the policy developed by the CBHCC (Canadian Board for Harmonized Construction Codes, 2023), for the purpose of establishing operational GHG emissions performance levels, only scope 1 and scope 2 GHG emissions were taken into account. The TG further refined the scope:

- refrigerant leaks will be excluded from scope 1 (no data available), and
- electricity consumption due to lights and appliances will be excluded from scope 2 (loads not regulated by NBC).

Building simulation tool

HOT2000 (Natural Resources Canada, 2018) is an energy simulation modelling software that was used in order to predict the energy metrics (space heating load and energy use, service water heating load and energy use, etc.) required to assess the annual amount of operational GHG emissions for the reference and proposed house, respectively.

HOT2000 is based on a modified bin method for evaluating whole building energy analysis using monthly average weather data (Energy, Mines and Resources Canada, 1991). HOT2000 contains complete monthly and annual climate data for 126 locations across Canada. It is a key component of provincial and federal energy rating, labelling, and incentive programs, provides calculations for building performance code compliance, and is used by design professionals and builders to improve residential house design (Asaee, Ferguson, & Wills, 2019).

NRCan tested HOT2000 Version 11.3 against a subset of the tests in ASHRAE Standard 140-2014 (Parekh, Charron, & Poirer, 2018). The study found that heating energy results calculated by HOT2000 were within the range of benchmark values listed in the ASHRAE Standard, and overall, the whole building energy consumptions were within acceptable ranges. However, they found that HOT2000 generally under-predicted cooling energy consumption. For this study, HOT2000 v11.8b18 was used to develop the operational GHG emissions levels.

The Housing Technology Assessment Platform (HTAP), developed by Natural Resources Canada to identify optimized techno-economically feasible approaches for housing design, was used for this analysis. HTAP brings together HOT2000, building stock data, energy conservation measures, rulesets and energy targets, economic data, and cloud computing to analyze technology combinations and identify optimized design scenarios. HTAP was developed for applications regarding Part 9 of the National Building Code of Canada, representing housing and small buildings (Asaee, Ferguson, & Wills, 2019).

For each archetype, HTAP allows the user to apply specific rulesets, and evaluate the cumulative impact of several upgrades in each location of interest. A unique feature of HTAP is the built-in ruleset and energy targets. This feature automatically applies the requirements of codes and energy conservation programs on each archetype to evaluate the impact of those rulesets on the energy performance of new houses. HTAP significantly increases the speed with which building models are generated, batch simulations are started, and results are extracted. Results can be analyzed to identify the optimum energy use, possible energy savings, and operational GHG emissions reduction for a given scenario (Asaee, Ferguson, & Wills, 2019).

Building archetypes and locations

To support development of code provisions toward net zero energy solutions, NRCan developed 240 new housing archetypes for eight Canadian regions (Asaee & Ferguson, 2019). These archetypes reflect recent housing data, and contain various types of housing.

Table 1: Locations selected for analysis.

Province/ Territory	Location	Climate Zone	HDD
Alberta	Calgary	6	5000
	Edmonton	7A	5120
	Fort McMurray	7A	6250
British Columbia	Vancouver	4	2825
	Victoria	4	2650
	Summerland	5	3350
Manitoba	Thompson	8	7600
	Winnipeg	7A	5670
New Brunswick	Moncton	6	4680
	Saint John	6	4570
Newfoundland and Labrador	Deer Lake	6	4760
	Saint John's	6	4800
Nova Scotia	Halifax	5	4000
	Sydney	6	4530
Northwestern Territory	Yellowknife	8	8170
	Inuvik*	8	9600
Nunavut	Hall Beach*	8	10720
	Iqaluit*	8	9980
	Baker Lake*	8	10700
Ontario	Ottawa	6	4500
	Sudbury	6	5180
	Toronto	5	3520
Prince Edward	Charlottetown	6	4460
Quebec	Montreal	6	4200
	Quebec City	6	5080
	Mont-Joli	7A	5431
Saskatchewan	Prince Albert	7B	6100
	Regina	7A	5600
	Saskatoon	7A	5700
Yukon Territory	Whitehorse	7B	6580
	Dawson City*	8	8120

The eight regions used are:

- Atlantic;
- Québec;
- Greater Toronto Area;
- North and East Ontario;
- Prairies;
- British Columbia – Lower Mainland;
- British Columbia – Interior;
- Territories.

For this study, representative locations from each province/territory were selected. Table 1 lists the locations by province/territory. For the locations marked with an asterisk, only 19 archetypes were selected from the total 240 (archetypes with unheated crawl spaces only).

Reference and proposed building approach

To determine the operational GHG emissions performance levels, the archetypes were modelled using the reference versus proposed approach described in Subsection 9.36.5 of the 2020 NBC (Canadian Commission on Building and Fire Codes, 2022). Using this approach aligns with the methodology followed for the tiered energy efficiency performance compliance path, and maintains consistency in approach between the pathways for improving energy efficiency and reducing operational GHG emissions in buildings. HTAP was used to convert each archetype to the corresponding 2020 NBC reference building. To calculate the annual amount of operational GHG emissions for the reference house (Target), the following were considered: the non-heating regulated energy uses (ventilation, cooling, including pumps, fans), the space heating thermal energy demand (load), and the service water heating thermal energy demand (load). For calculating the annual amount of operational GHG emissions for the proposed house the energy use associated with the non-heating regulated loads (ventilation, cooling, including pumps, fans), space heating and service water heating systems were considered.

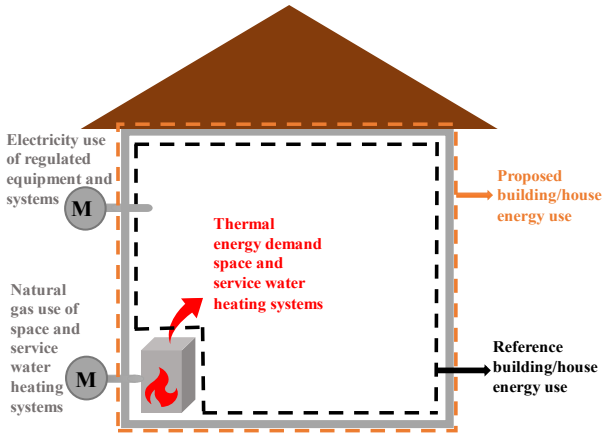


Figure 2: Energy loads/uses considered for the calculation of annual amount of GHG emissions for the reference and proposed houses.

Figure 2 presents the energy loads/uses considered for calculating the annual amount of GHG emissions for the reference and proposed houses. The methodology followed

for calculating the annual amount of operational GHG emissions performance levels is presented in detail in the following section.

Calculation of operational GHG emissions for the reference and proposed house

This section presents the assumptions made when selecting emissions factors, and the methodology followed for calculating the annual amount of operational GHG emissions for the reference and proposed houses.

GHG emissions factors

Natural gas is the dominant source of GHG emissions for the Canadian residential sector (Natural Resources Canada, 2020), and as such, the TG decided that the reference house will be modelled with natural gas space and service water heating systems.

Simulation results showed that reference emission factors of 235 g CO_2e/kWh for space heating and 260 g CO_2e/kWh for service water heating, result in more than 80% of the archetypes meeting the target. Hence, the TG decided to adopt these values for the calculation of the operational GHG emissions of the reference house..

Electric utilities are presently shifting away from coal power generation, while gas utilities are experimenting with new technologies to lower emissions through use of hydrogen and renewable biogas sources. These changes are expected to occur in the near future; some provincial utilities expect to reduce electric emissions by 60% or more by 2030 (see Figure 3).

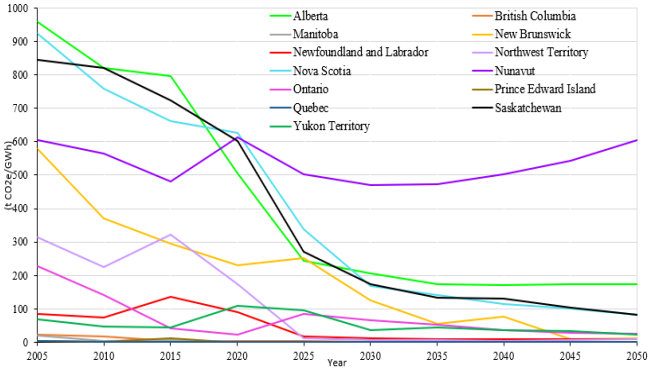


Figure 3: Variation of emissions factors for electricity for all provinces/territories (Environment and Climate Change Canada, 2023).

In this environment, referencing the most recent (2021) emissions data currently available in the building Codes could encourage the construction of buildings with higher-than-expected emissions. For this reason, the proposed change to introduce operational GHG emissions performance levels in the NBC includes the best available future-looking forecasts for utility emissions, averaged for the years 2031 to 2035 (Environment and Climate Change Canada, 2023) (see Table 2).

While no similar projections are currently available for natural gas utilities, such projections are expected in future years and could be incorporated into the Codes at a later date.

Table 2: GHG emissions factors for energy sources by province or territory.

Province/ Territory	GHG Emissions Factors	
	Electricity (g CO_2e/kWh)	Utility Gas (g CO_2e/kWh)
Alberta	181.86	187
British Columbia	1.32	187
Manitoba	0	183
New Brunswick	77.88	183
Newfoundland and Labrador	11.08	183
Northwest Territories	6.82	187
Nova Scotia	161.64	183
Nunavut	465.16	187
Ontario	57.9	183
Prince Edward	80.42	183
Quebec	0.38	184
Saskatchewan	146.6	183
Yukon	25	187

Emissions factors for other energy sources can be found in the National Inventory Report (Government of Canada, 2023).

Operational GHG emissions for the reference house (Target)

The methodology for calculating the annual operational GHG emissions for the reference and proposed house is presented in detail in Proposed Change Form (PCF) 2004 (Operational GHG Emissions: Tiered Performance Requirements in the NBC). While the proposed change is targeting the NBC 2025, there are still several code development steps ahead, including a public review.

The annual operational GHG emissions of all regulated loads was determined by modelling the reference building in accordance with Subsection 9.36.5. of 2020 NBC, to estimate the value of each type of load/energy consumption.

The annual operational GHG emissions of all non-heating regulated loads (CO_{2e}otherregloads), in kg CO_2e, was determined by multiplying the total energy use of all non-heating regulated loads (including fans, pumps, and cooling equipment-E_{NHreg}), in kWh/year, by the GHG emissions factor for electricity (GEF_{elec}), in kg CO_2e/kWh (see Eq.1).

$$CO_{2e}\text{otherregloads} = E_{NHreg} \times GEF_{elec} \quad (1)$$

The annual amount of operational GHG emissions from space-heating (CO_{2eSH}), in kg CO_2e, was determined by multiplying the annual thermal energy demand of the space-heating system (load), in kWh, by a reference GHG emissions factor of 0.235 kg CO_2e/kWh (see Eq.2).

$$CO_{2eSH} = TED_{SH} \times 0.235 \quad (2)$$

The annual amount of operational GHG emissions from service water heating (CO_{2eSWH}), in kg CO_2e, was

determined by multiplying the annual thermal energy demand of the service water heating system (load), in kWh, by a reference GHG emissions factor of 0.260 kg CO_2e/kWh (see Eq.3).

$$CO_{2e}SWH = TED_{SWH} \times 0.260 \quad (3)$$

Finally, the annual amount of operational GHG emissions for the reference building ($CO_{2e}target$), in kg CO_2e, was determined by adding the annual amount of GHG emissions of all non-heating regulated loads ($CO_{2e}NHreg$), the annual amount of GHG emissions from space heating ($CO_{2e}SH$), and the annual amount of GHG emissions from service water heating ($CO_{2e}SWH$), as presented in Eq. 4.

$$CO_{2e}target = CO_{2e}NHreg + CO_{2e}SH + CO_{2e}SWH \quad (4)$$

Operational GHG emissions for the proposed house

The annual amount of operational GHG emissions for the proposed house was determined by modelling the proposed house in accordance with Subsection 9.36.5. of 2020 NBC.

The estimated total energy use, in kWh/year, for each energy source (ES) of all regulated equipment and systems, including fans, pumps, service water system, heating and cooling equipment in the proposed house was multiplied by the GHG emissions factor of the corresponding energy source (GEF_{ES}), in kg CO_2e/kWh (see Table 2 for electricity and natural gas). The summation of all values resulted in the annual amount of operational GHG emissions for the proposed house ($CO_{2e}proposed$), in kg CO_2e (see Eq.5).

$$CO_{2e}proposed = \sum_{ES} (E_{reg,ES} \times GEF_{ES}) \quad (5)$$

Operational GHG Emissions Performance Levels

Table 3 presents the proposed operational GHG emissions performance levels. For compliance, the proposed house shall be designed and constructed to meet one of the performance levels.

Table 3: Operational GHG emissions performance levels.

GHG Emission Performance Level	Percent GHG Emissions Target	Percent Improvement
A	≤ 10%	≥ 90%
B	≤ 25%	≥ 75%
C	≤ 50%	≥ 50%
D	≤ 75%	≥ 25%
E	≤ 90%	≥ 10%
F	≤ 100%	≥ 0%

The operational GHG emissions performance levels A to F, specified in Table 3, are determined by:

- dividing the annual operational GHG emissions of the proposed house by the operational GHG emissions target of the reference house, to derive the percent building GHG emissions target, or
- subtracting the proposed house annual operational GHG emissions from the building operational GHG emissions of the reference house (target) and dividing the result by the operational GHG emissions of the reference house (target), to derive the percent improvement.

For locations where the building cannot reasonably be connected to the provincial or territorial electricity power grid, compliance will be achieved by reporting annual operational GHG emissions of the proposed house.

Verification of reference GHG emissions factors

Using the reference emissions factors described in the previous sections, and the natural gas and electricity emissions factors for each province/territory (presented in Table 2), the annual amount of operational GHG emissions was calculated for each archetype and for all locations presented in Table 1. These were then used to calculate the percentage improvement of the annual operational GHG emissions of the equivalent proposed house assumed to be using natural gas equipment for space and water heating.

The box and whiskers graphs presented in Figure 4 illustrate the distribution of the operational GHG emissions percent improvement of the 240 archetypes, for all locations. The boxplots show data distributions as a five-number summary: minimum, first quartile, median, third quartile, and maximum. The horizontal line inside the median box indicates the mean value.

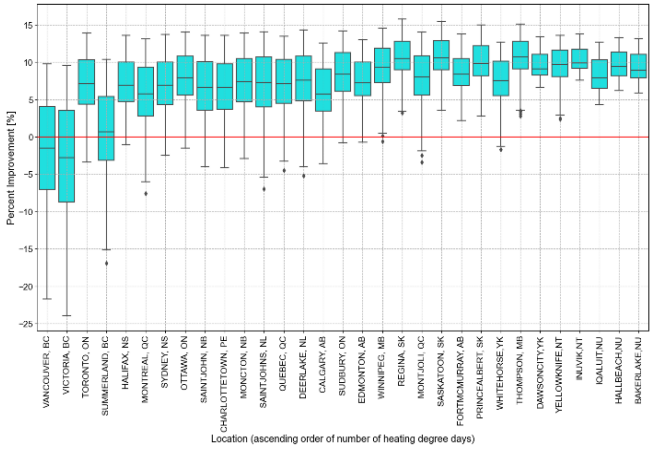


Figure 4: Distribution of operational GHG emissions percent improvement for each location.

As Figure 4 illustrates, most archetypes using natural gas for both space and service water heating will reach Level F (i.e., percent improvement ≥ 0%) and Level E (i.e., percent improvement between 10% and 25%). In the case of Toronto for example, around 10% of the archetypes are not meeting the target (percent improvement value below the red line marking 0% improvement). It can be seen that in 50% of the cases (values corresponding to the median box), the percent improvement is between 4.5 and 10% (Level F). The horizontal line inside the box indicates the median value of the percent improvement, that in this case is approximately 7%. The third quartile (upper whisker) has values between approximately 10 and 14%, indicating that 25% of the values are in this range (Level E). For some locations there is a small number of archetypes that will not meet the operational GHG emissions target. According to

the results, in the majority of cases, the non-compliant homes are small, with floor area less than or around 100 m^2.

An exception to the previously presented trend are the locations in British Columbia (BC), where more than 50% of the houses are not meeting the target emissions. Due to a milder climate, in these locations the service water heating load is the dominant load in many house archetypes. The efficiency of the service water heating system taken into account when calculating the reference GHG emission factors is higher than the minimum efficiency required by the 2020 edition of the NBC (71% versus 60.1%).

However, considering that starting May 1, 2023, the BC Building Code required 20% better energy efficiency for most new buildings throughout the province (Government of British Columbia , 2023), new homes are expected to be able to comply with the operational GHG emissions target.

Development of performance levels

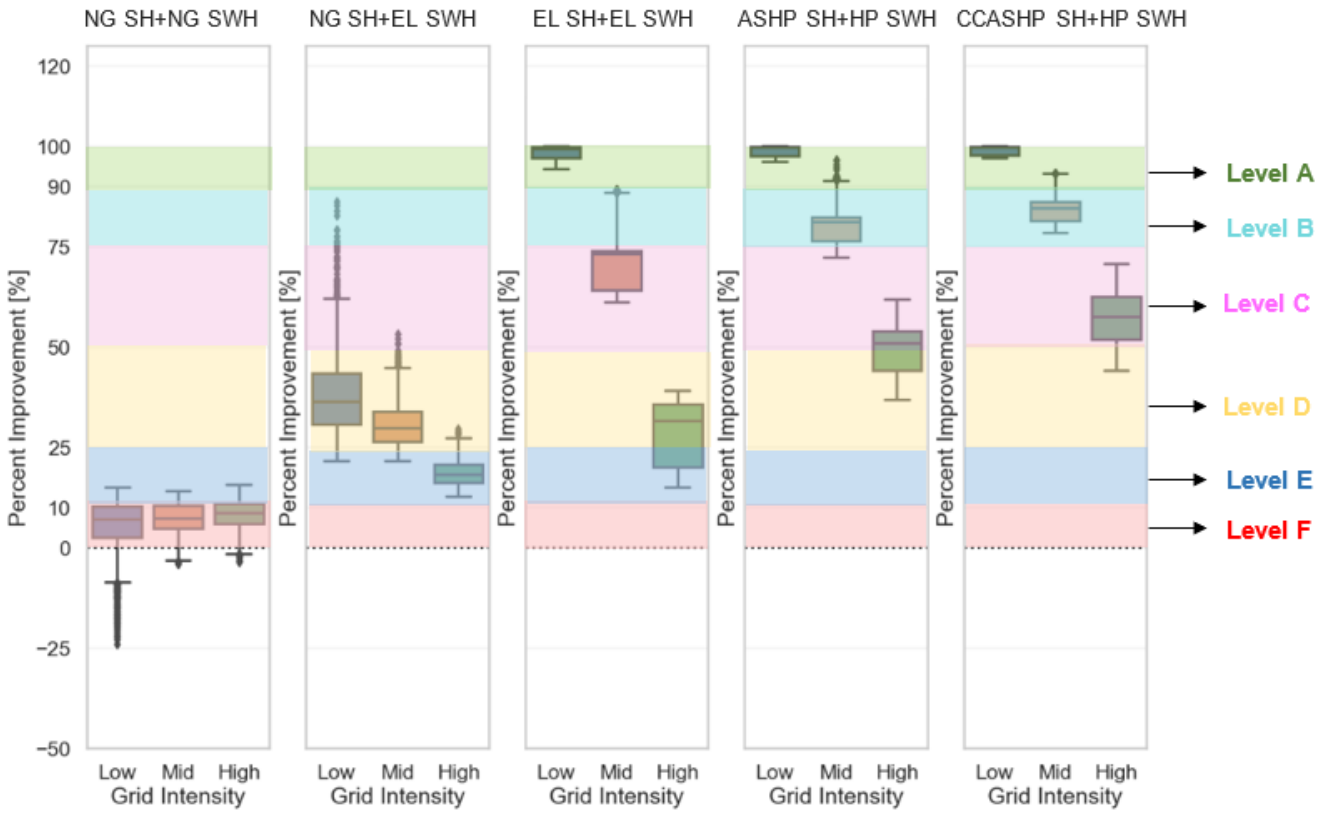
To explore the maximum operational GHG emissions performance level that can be achieved by houses meeting energy efficiency tier 1 of the 2020 NBC (current code minimum) various combinations of energy sources and mechanical systems were investigated.

Figure 5 illustrates the maximum operational GHG emissions performance level that can be achieved in different scenarios involving two of the most used energy sources (natural gas and electricity).

Based on the values of electricity GHG emissions factor, presented in Table 2, the provinces/territories were grouped in three bins in Figure 5:

- Low emissions grids (emissions factor less or equal to 25 g CO_2e/kWh);
- Moderate emissions grids (emissions factor higher than 25 g CO_2e/kWh and less than or equal to 100 g CO_2e/kWh);
- High emissions grid (emissions factor higher than 100 g CO_2e/kWh).

As can be seen in Figure 5, switching the energy source from natural gas to electricity, even with conventional space and service water heating systems, the proposed codes requirements result in an improved in operational GHG emissions performance level.



Legend: SH- Space Heating; SWH – Service Water Heating; ASHP – Air Source Heat Pump; CCASHP – Cold Climate ASHP HP – Heat Pump; NG – Natural Gas; EL - Electricity

Figure 5: Energy sources/technologies for achieving higher operational GHG emissions levels.

In locations with low emissions grids, all archetypes are able to reach level A. For locations with moderate emissions

grids, the majority of archetypes are able to reach level C. Finally, for locations with high emissions grids, more than 50% of archetypes are able to reach level D. This data shows that, in some locations, equipment selection alone is insufficient to reach the highest GHG performance levels. In these cases, complimentary energy efficiency improvements will be required to reach the highest GHG emission levels.

Code compliance paths

The introduction of tiered operational GHG emissions performance levels will provide the provinces/territories with the option to adopt the operational GHG emissions performance level that is the most suitable for their needs (e.g. based on industry readiness, policies). Further, the tiered performance levels prepare the industry for future reductions in operational carbon emissions, leading to the design and construction of zero or near zero emissions buildings as part of Canada's commitment to GHG emissions reduction. There are two pathways to demonstrate compliance with the operational GHG emissions performance levels that were developed:

- performance path (PCF 2004), and
- prescriptive path (PCF 2026).

Performance path (PCF 2004)

Compliance with operational GHG emissions performance levels via performance path is similar with the tiered energy efficiency compliance performance path, see Section 9.36.7 of the 2020 NBC (Canadian Commission on Building and Fire Codes, 2022). Compliance with the operational GHG emission target is determined based on one of the following conditions:

- the target "percent improvement" is met or exceeded, or
- the target "percent reference house GHG emissions" is not exceeded.

Prescriptive path (PCF 2026)

Even though energy performance modelling is used in the building industry, in order to provide simplicity in demonstrating compliance with operational GHG emissions performance levels, the NBC will also provide a prescriptive compliance path. As an example, Table 4 illustrates prescriptive measures for compliance with the most stringent GHG emissions performance level (A).

The 2020 edition of the NBC introduced energy efficiency tiers, containing measures that progressively increase energy efficiency and reduce the amount of energy needed to operate a house. Energy conservation points are assigned to various energy conservation measures, and the code user can choose these measures depending on the energy tier adopted. The amount of operational GHG emissions is directly corelated with the amount of energy used by a house. In order to provide simplicity for the NBC users in achieving both energy efficiency and operational GHG emissions reduction, a combination of various energy sources/mechanical systems and energy tiers were used to derive compliance solutions for each GHG emissions level.

Table 4: Prescriptive measures for operational GHG emissions performance level A.

Energy Source Space Heating	Energy Source Service Water Heating	Electricity GHG Emission Factor (GEF) (g CO_2e/kWh)	Minimum Energy Performance Tier
Electricity	Electricity	GEF ≤ 25	2
		25 < GEF ≤ 100	4
Heat pump with electric backup	Electric storage tank or electric heat pump water heater	GEF ≤ 25	1
		25 < GEF ≤ 100	3
Heat pump with natural gas or propane backup	Electric storage tank or electric heat pump water heater	GEF < 100	5
Heat pump with electric backup	Electric storage tank or electric heat pump water heater	GEF ≤ 25	1
		25 < GEF ≤ 100	3
		100 < GEF < 200	5
Other sources with GEF ≤ 25	Other sources with GEF ≤ 25	GEF < 200	2

As Table 4 illustrates, a code user in a location with a low emissions grid (emissions factor less or equal to 25 g CO_2e/kWh) can achieve GHG emissions performance level A if the house is designed to meet energy efficiency tier 2 (energy use reduction at least 10% compared with the reference house). On the other hand, a code user in a location with a high emissions grid (emissions factor higher than 100 g CO_2e/kWh), will be able to achieve GHG emissions performance level A only by installing a fully electric heat pump and designing the house to achieve energy efficiency tier 5 (energy use reduction at least 70% compared with the reference house).

Conclusions

The paper presents the methodology followed for developing a new tiered operational GHG emissions approach for inclusion in Section 9.36 of the 2025 National Building Code of Canada (PCFs 2004 and 2026). There are six operational GHG emission performance levels proposed, from A to F, with A being the most stringent (more than 90% reduction of annual amount of operational GHG emissions), and F the least stringent (between 0 and 10% reduction of annual amount of operational GHG emissions).

To determine the operational GHG emissions performance levels, the archetypes were modelled using the reference versus proposed approach, described in Subsection 9.36.5 of the 2020 NBC (Canadian Commission on Building and Fire Codes, 2022). Considering that natural gas is the dominant source of GHG emissions for the Canadian residential sector, according to the decision of TG, the

reference house was modelled with natural gas space and service water heating systems. Various technologies were used in the proposed houses.

As per the decisions of CBHCC and TG, for the purpose of the present study, only direct GHG emissions resulted from on-site fuel combustion (scope 1, except refrigerant leaks) and indirect GHG emissions, resulted from purchased electricity from the grid and other centralized energy sources (scope 2, except electricity consumption due to unregulated loads) were taken into account when quantifying the annual amount of operational GHG emissions.

Code compliance with one of the operational GHG emissions performance levels can be demonstrated via a performance path (PCF 2004) or a prescriptive path (PCF 2026). The performance path is concerned with determining compliance through modelling of the energy performance of components, systems, and assemblies that are installed in the proposed house. The prescriptive path provides simplicity for the NBC users in achieving both energy efficiency and operational GHG emissions reduction; based on achieved energy tier and GEF, the code user selects equipment from a table to demonstrate operational GHG compliance.

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