

Greenhouse Gas Intensity and Heat Energy Intensity Limits Reference Manual

Reference Manual

This manual is for office and retail building owners with buildings subject to GHGI and HEI limits under the City of Vancouver By-law No. 13472. It is a technical document intended to provide clarity on calculations related to GHGI and energy adjustments.

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TABLE OF CONTENT

TABLE OF CONTENT	2
1.0 INTRODUCTION	3
1.1 SECTION OVERVIEW.....	3
2.0 BUILDINGS COVERED BY GHGI AND HEI LIMITS	4
TABLE 1: BUILDING TYPES UNDER GHGI AND HEAT ENERGY LIMITS.....	4
3.0 COMPLIANCE AND REPORTING	6
OVERVIEW.....	6
3.1 DETERMINING BUILDING GROSS FLOOR AREA	6
3.1.1 MAJOR OCCUPANCY AND MIXED-USE	7
3.1.2 EXAMPLES	7
3.2 MIXED USE OFFICE & RETAIL BUILDINGS	8
3.3 Mixed Use Office and Retail Buildings with Residential Occupancies	9
3.3.1 NON-RESIDENTIAL NATURAL GAS USE.....	9
3.3.2 NON-RESIDENTIAL DISTRICT ENERGY USE	10
3.3.3 NON-RESIDENTIAL GROSS FLOOR AREA (GFA).....	10
3.3.4 EXAMPLE	11
4.0 CALCULATING GHGI AND HEI	11
4.1 DETERMINING ENERGY USE.....	12
4.1.1 ADJUSTMENTS FOR NATURAL GAS USAGE	12
4.1.2 PURCHASED RENEWABLE NATURAL GAS.....	13
4.2 CALCULATING GHG EMISSIONS INTENSITY (GHGI)	14
4.3 CALCULATING HEAT ENERGY INTENSITY.....	15
5.0 WEATHER NORMALIZATION	17
5.1 EXAMPLE	17
6.0 APPENDIX	18
6.1 DEFINITIONS.....	18
6.2 CONVERSIONS FACTORS	19

1.0 INTRODUCTION

The [Annual Greenhouse Gas \(GHG\) and Energy Limits By-Law](#) (No. 13472) adopted by City Council in 2022 establishes reporting rules for and limits on greenhouse gas emissions and heat energy use in the largest office and retail buildings. Heat energy refers to the total gas used in a building operation plus district heat that is consumed inside the building (excluding the electricity portion), while greenhouse gas emissions refer to the carbon dioxide equivalent (CO_{2e}), gases emitted as a result of energy consumption in a building. The City of Vancouver developed this Reference Manual (Manual) to assist building owners and their representatives in understanding and complying with the requirements of the By-Law.

This Manual is a companion to the *Greenhouse Gas Intensity Limits How-To Guide*, which offers in-depth guidance for the submittal of required forms and reports.

1.1 SECTION OVERVIEW

- **Buildings Covered By GHGI and Heat Energy Intensity (HEI) Limits** Section describes which building types and building sizes are subject to which requirements in the By-Law and when those requirements go into effect. It also identifies any exemptions from those requirements.
- The **Compliance and Reporting** Section provides a brief overview of the compliance and reporting pathways.
- The **Calculating GHG Emissions and Heat Energy Use** Section describes the calculations necessary to determine the GHG emissions and heat energy intensity of a building. This includes:
 - How to calculate the gross floor area of a building.
 - How to calculate the GHG emissions and heat energy intensity of a building, including how to handle qualified purchase of RNG.
 - How to make allowable adjustments to the GHG emissions and heat energy intensity of buildings for special circumstances such as process loads and restaurants.
 - How to calculate a custom GHG emissions limit for buildings that include both office and retail occupancies.
 - The process for calculating the GHG emissions and heat energy use of mixed-use buildings that include residential occupancies.
- The **Weather Normalization** Section describes the process that the City will use to adjust GHG emissions and heat energy limits in years with abnormally cold winters.
- The **Appendix** Section includes information such as definitions of terms used in the By-Law and this Manual and standard conversion factors for use in the calculations.

2.0 BUILDINGS COVERED BY GHGI AND HEI LIMITS

The gross floor area of a building and its major occupancy type, as it appears in the Annual Greenhouse Gas and Energy Limits By-law (GHG By-law) determines whether a building may be subject to the GHG By-law.

The requirements cover:

- A building that is equal to or exceeds 9,290 m² of gross floor area and has one of the following major occupancy uses:
 - Group D major occupancy use, or
 - Group E major occupancy use, or
 - A mixed-use building with greater than 50% of the floor area as Group D and or E, or
 - A mixed-use building with floor area of Group D and or E occupancy that exceeds 9,290 m² of gross floor area.

Table 1 provides a description of the major occupancy types from the Vancouver Building Bylaw and corresponding Major Use Type from ENERGY STAR Portfolio Manager. This table is provided for convenience to aid building owners and managers in determining if their buildings are covered by the GHGI and HEI Limits in the [GHG By-law](#).

TABLE 1: BUILDING TYPES UNDER GHGI AND HEAT ENERGY LIMITS

Group	Division	Description of Major Occupancy	Major Use Type from Portfolio Manager
D and MUB*	-	Business and personal services occupancies.	Office (Office refers to buildings used to conduct commercial or governmental business activities. This includes administrative and professional offices.) <ul style="list-style-type: none"> • Medical Office • Office • Veterinary Office • Radio Station (benchmark as Office in ESPM) Banking/Financial services <ul style="list-style-type: none"> • Bank Branch • Financial Office Personal Services <ul style="list-style-type: none"> • Barber and hairdressing shops • Beauty parlours

			<u>Dry cleaning, laundromats and other process loads are excluded from GHGI calculations. Please refer the appendix for further details.</u>
E and MUB*	-	Mercantile occupancies	Retail <ul style="list-style-type: none"> • Automobile Dealership • Convenience Store without Gas Station • Enclosed Mall • Lifestyle Center • Retail Store • Strip Mall • Wholesale Club/Supercenter <u>Supermarket/Grocery Store building use type is excluded from buildings covered by GHGI limits</u>

* MUBs in which the sum of the floor area of the included occupancies is 50% or greater of the building gross floor area. For more information, refer to the “MIXED USE BUILDINGS” section below.

Note: GHGI and HEI Limits do not apply to Group F/ Industrial buildings.

3.0 COMPLIANCE AND REPORTING

OVERVIEW

Along with submitting annual operational energy use data, building owners will also be required to submit additional data to calculate both the GHGI and HEI.

- **Determining Building Gross Floor Area:** All buildings will need to determine their Gross Floor Area (GFA). This is used to determine definitively if and when a building is subject to the different requirements in the By-Law. It is also used to calculate the GHG emissions and heat energy intensities of the building for compliance with the GHG emissions and heat energy limits in the By-Law.
- **Mixed Use Office & Retail Buildings:** All buildings will need to determine their Gross Floor Area (GFA). This is used to determine definitively if and when a building is subject to the different requirements in the By-Law. It is also used to calculate the GHG emissions and heat energy intensities of the building for compliance with the GHG emissions and heat energy limits in the By-Law.
- **Mixed Use Office and Retail Buildings with Residential Occupancies:** Buildings with separately metered residential occupancies will use this section to calculate the non-residential energy use and non-residential GFA of the building to be used in all calculations for compliance with the GHG emissions and heat energy limits.

3.1 DETERMINING BUILDING GROSS FLOOR AREA

All buildings subject to the 2026 GHGI limits will need to have their GFA calculated and verified when they submit their report to the city in 2027 (owners are encouraged to report a calculated GFA in 2024 but is it not a requirement). This will be a one-time process for most buildings and will only need to be repeated if a building adds or subtracts floor area, if building area is converted to or from unconditioned space, or there is a change in major occupancy. GFA can be determined from onsite measurements or permit documents for the building.

The GFA is defined as the sum of the area of every floor in a building, measured between the outside surface of the exterior walls; it excludes unconditioned areas of the building (i.e., those areas that do not include space heating other than freeze protection), parking areas, partial height spaces (e.g., crawl spaces and accessible plenums), and exterior spaces such as balconies, patios, and covered walkways. It is measured in square meters (m²).

Please refer the following resource for further details on GFA definition:

- [ENERGY STAR Portfolio Manager Gross Floor Area](#)

For details on GFA inclusions and exclusions, please refer the following resource:

- [Gross Floor Area inclusions and exclusions](#)

3.1.1 MAJOR OCCUPANCY AND MIXED-USE

The major occupancy is the occupancy within a building that comprises more than 50% of the Gross Floor Area (GFA). When a single occupancy covered by the Bylaw exceeds 50% of the GFA, or the combination of two occupancies equals or exceeds the floor area threshold specified in the Bylaw, the building will be subject to the requirements.

Some buildings with multiple occupancies do not have a single occupancy that exceeds 50% of the GFA. The By-Law considers these “Mixed-Use Buildings” (MUBs). The real estate market generally considers any building with more than one occupancy to be a mixed-use building, so it is important to note this difference in usage. The By-Law has requirements and timeframes that apply specifically to MUBs, particularly MUBs where office and retail occupancies are more than 50% of the GFA when taken together, or when either office or retail occupancies exceed floor area thresholds for GHGI and HEI requirements.

The 2026 GHGI Limits established in the By-Law are specific to different occupancies. Additionally, both the GHGI and HEI Limits are not intended to apply to residential portions of buildings with multiple occupancies. Therefore, this Manual includes rules for calculating the GHGI Limits for those particular buildings (see the “Buildings with Residential Occupancies” section below).

3.1.2 EXAMPLES

1. *A 5-storey building with a gross floor area of 15,000 m², housing an arena of 6,000 m² and a wholesale club of 9,000 m² that has electric and natural gas utilities.*

The building is over 9,290 m², the wholesale club is an E occupancy and comprises more than 50% of the GFA; therefore:

- the building will be subject to the energy and carbon reporting requirements in 2024.
- the building will be subject to the GHGI limits for an E occupancy in 2026 and 2040.
- the building will be subject to the HEI limits for an E occupancy in 2040.

2. *An 11,000 m² building with 4,000 m² of office, 4,000 m² of retail and a 3,000 m² theater, heated with a mix of gas and electricity.*

The building is over 9,290 m², neither the D or E occupancy comprises more than 50% of the GFA, but together they do comprise more than 50% of the GFA; therefore:

- the building is subject to the energy and carbon reporting requirements in 2024.
- the building will be subject to the GHGI Limits for a mixed-use building in 2026 and 2040 (see “[Mixed Use Office & Retail Buildings](#)” section below for calculating GHGI Limits for mixed use buildings).
- the building will be subject to the HEI limits for a mixed-use building in 2040.

3. An 15,000 m² building with 5,000 m² of office, 5,000 m² of retail and 12,000 m² of residential, heated with a mix of gas and electricity.

The building is over 9,290 m², and neither the D or E occupancy comprises more than 50% of the GFA, but together they do comprise more than 9,290 m² in GFA; therefore:

- the building is subject to the energy and carbon reporting requirements in 2024.
- the building will be subject to the GHGI Limits for a mixed-use building in 2026 and 2040 (see the “[Mixed Use Office and Retail Buildings with residential occupancies](#)” section below for calculating GHGI Limits for mixed use buildings).
- the building will be subject to the HEI limits for a mixed-use building in 2040.

3.2 MIXED USE OFFICE & RETAIL BUILDINGS

A building subject to GHGI Limits may be a mix of D occupancies and E occupancies, which each have different targets. In this case, a custom GHGI Limit needs to be calculated that reflects that mixed occupancy.¹ This is done by calculating a weighted average between the GHGI Limits for each occupancy.

This calculation is made with Equation 1. The equation is a standard weighted average calculation. The area of the building subject to each occupancy is divided by the area of both D and E occupancies to establish the weighting for that occupancy. Each occupancy area weighting is then multiplied by the associated GHGI Limit. Finally, the results are added together to create the weighted average of the two Limits.²

Equation 1: Mixed Occupancy GHGI Limit Calculation

$$MUB_{GHGL} = D_{GHGL} \times (D_A / (D_A + E_A)) + E_{GHGL} \times (E_A / (D_A + E_A))$$

Where:

MUB_{GHGL} = The weighted average GHGI Emissions Limit applicable to the mixed-use building.

D_{GHGL} = GHGI limit for Group D Occupancies

D_A = Total area of Group D Occupancies in m²

E_{GHGL} = GHGI limit for Group E Occupancies

E_A = Total area of Group E Occupancies in m²

The example below provides an illustration.

¹ The Heat Energy Intensity Limit is the same for Office and Retail occupancies, so there is no need to calculate a weighted average Heat Energy Intensity Limit for buildings with both Office and Retail occupancies.

² Note that the building areas of all other occupancies are ignored in this equation.

3.2.1 EXAMPLE

A 10,000 m² building has nine storeys of office occupancy (Group D) above one storey of retail (Group E). The office has an area of 9,000 m² and the retail area is 1,000 m². In 2026, the GHGI limit for Group D occupancies (D_{GHG}) is 25 kg CO₂e/m² and the limit for Group E occupancies (E_{GHGL}) is 14 kg CO₂e/m².

For this building, the equation above would look like this:

$$\begin{aligned} \text{MUB}_{\text{GHGL}} &= \text{D}_{\text{GHGL}} \times (\text{D}_A / (\text{D}_A + \text{E}_A)) + \text{E}_{\text{GHGL}} \times (\text{E}_A / (\text{D}_A + \text{E}_A)) \\ \text{MUB}_{\text{GHGL}} &= 25 \text{ kg CO}_2\text{e/m}^2 \times (9,000 / (9,000 + 1,000)) + 14 \text{ kg CO}_2\text{e/m}^2 \\ &\quad \times (1,000 / (9,000 + 1,000)) \\ \text{MUB}_{\text{GHGL}} &= 25 \text{ kg CO}_2\text{e/m}^2 \times 0.9 + 14 \text{ kg CO}_2\text{e/m}^2 \times 0.1 \\ \text{MUB}_{\text{GHGL}} &= 22.5 \text{ kg CO}_2\text{e/m}^2 + 1.4 \text{ kg CO}_2\text{e/m}^2 \\ \text{MUB}_{\text{GHGL}} &= \mathbf{23.9 \text{ kg CO}_2\text{e/m}^2} \end{aligned}$$

3.3 Mixed Use Office and Retail Buildings with Residential Occupancies

Some buildings subject to the GHGI and HEI Limits may include residential occupancies, with very different emissions and heat energy profiles. The intent of the established limits is to only regulate commercial (non-residential) buildings. Therefore, any residential portions of a covered building may be excluded from the calculations for GHG and heat energy, provided the natural gas and district energy for the residential occupancies are metered separately from the rest of the building. Residential areas can include amenity, corridor, and service spaces exclusively serving the residential portions of the building.

Residential portions of a covered building can be excluded by subtracting the residential natural gas and district energy usage from the total energy calculation, and the residential area from the GFA calculation in accordance with the Equation 2, Equation 3, and Equation 4 below. If energy consumption is reported in different units by the energy provider than those used in the equation below, use the 6.2 CONVERSIONS FACTORS section to obtain the units in the equation.

Note: If the residential section of the building is not separately metered, then the entire building will be subjected to the GHGI and HEI limits for the major occupancy of the building and will use the total building GFA for these calculations.

3.3.1 NON-RESIDENTIAL NATURAL GAS USE

The equation below shows how non-residential natural gas (NG_{NR}) usage is separated from residential gas usage for the purpose of calculating regulated GHG emissions and heat energy use.

Equation 2: Non-Residential Natural Gas Use

$$\text{NG}_{\text{NR}} = \text{NG}_{\text{M}} - \text{NG}_{\text{R}}$$

Where:

$$\text{NG}_{\text{NR}} = \text{The natural gas usage (in GJ) attributable to the non-residential portion of the building.}$$

- NG_M** = Total annual natural gas usage (in GJ) of the building as measured at the utility meter.
- NG_R** = The measured natural gas usage (in GJ) attributable to the residential portion of the building.

Note: If your building does not have a master meter and non-residential and residential meters are separate, you should enter your metered non-residential natural gas consumption for energy adjustment in your BPRS profile for GHGI calculation.

If your utility does not allow you to enter multiple/separate meters for auto upload on ESPM, you can either manually create and enter separate non-residential and residential meter on ESPM or get building level automatic data upload and claim adjustment for residential gas use on BPRS.

3.3.2 NON-RESIDENTIAL DISTRICT ENERGY USE

The equation below shows how non-residential District Energy (NG_{NR}) usage is separated from residential gas usage for the purpose of calculating regulated GHG emissions and heat energy use.

Equation 3: Non-Residential District Energy Use

$$DE_{NR} = DE - DE_R$$

Where:

- DE_{NR}** = The district energy usage (in GJ) attributable to the non-residential portion of the building.
- DE** = Total annual district energy usage (in GJ) of the building as measured at the utility meter.
- DE_R** = The measured district energy usage (in GJ) attributable to the residential portion of the building.

Note: If your building does not have a master meter and non-residential and residential meters are separate, you should enter your metered non-residential district energy consumption for energy adjustment in your BPRS profile for GHGI calculation.

If your utility does not allow you to enter multiple/separate meters for auto-upload on ESPM, you can either manually create and enter separate non-residential and residential meter on ESPM or get building level automatic data upload and claim adjustment for residential district energy use on BPRS.

3.3.3 NON-RESIDENTIAL GROSS FLOOR AREA (GFA)

The equation below shows how non-residential Gross Floor Area (GFA_{NR}) is calculated.

Equation 4: Non-Residential Gross Floor Area (GFA)

$$GFA_{NR} = GFA - GFA_R$$

Where:

GFA_{NR} = Gross Floor Area of the non-residential occupancies of the building in m²

GFA = Gross Floor Area of the whole building in m² as determined in accordance with the **definition above**

GFA_R = Gross Floor Area of the residential occupancies of the building in m². This includes common areas and utility areas that serve the residential units themselves (such as hallways, lobbies, mechanical rooms, etc).

3.3.4 EXAMPLE

A 10,000 m² majority office building has 4,500 m² residential floor area. The total natural gas usage of the building is 848 GJ (with no steam usage) and the residential portion of the building is separately metered for natural gas and has an annual usage of 330 GJ.

Calculate Non-Residential Natural Gas:

$$NG_{NR} = NG_M - NG_R$$

$$NG_{NR} = 848 - 330$$

$$NG_{NR} = 518 \text{ GJ}$$

Calculate Non-Residential GFA:

$$GFA_{NR} = GFA - GFA_R$$

$$GFA_{NR} = 10,000 - 4,500$$

$$GFA_{NR} = 5,500 \text{ m}^2$$

This building would then use a value of 518 GJ for the NG_{NR} variable in Equation 2 and 5,500 m² for the GFA_{NR} variable in Equation 4.

4.0 Calculating GHGI and HEI

Greenhouse gas and heat energy use intensities are both calculated using basic information about a building's energy usage and the building's floor area. This section describes the procedures for calculating and adjusting those values in special situations.

4.1 DETERMINING ENERGY USE

Both the GHGI and HEI Limits of the By-Law are calculated from the natural gas and district energy consumption of a building. While they are not included in the Limits, other energy sources (such as electricity, propane, diesel and biomass) are still required to be reported. This section details how to report the energy used in the building and provides a set of adjustments that are allowed to be made before converting those energy quantities into GHG emissions or heat energy. For buildings that are only subject to the reporting requirements and not subject to the GHGI and HEI limits, there is no need to make any adjustments before reporting.

4.1.1 ADJUSTMENTS FOR NATURAL GAS USAGE

The GHGI and HEI Limits are intended to regulate energy and emissions from heat energy, that is, the energy used to condition space and heat water. However, energy from natural gas might be used for other purposes in a covered building – such as process loads and certain food service loads – therefore buildings are allowed to adjust the natural gas use of the building to exclude these loads as detailed below. If no adjustments are claimed, the City will use the utility data submitted through Portfolio Manager to calculate the HEI and GHGI of the building automatically.

Available adjustments consist of:

1. Exclusion of energy consumption from separately metered process loads.
2. Exclusion of energy consumption from separately metered food service loads and grocery stores.

Separately Metered Process Loads

A process load is any energy use by a manufacturing, industrial, or commercial procedure or activity where the primary purpose is other than conditioning spaces and maintaining comfort and amenities for the occupants of a building.³ Building owners are allowed to exclude process loads from GHGI calculations because they are not the targeted end-use of the By-Law. Examples of process loads that could be present in buildings covered by the GHGI limits might include a pottery kiln, laboratory, a glass forge or a dry cleaner. Ventilation/air tempering is an example of a non-process load.

In cases where a process load's energy consumption is separately metered, the natural gas associated with that process load can be excluded from the building's total natural gas usage. This adjustment cannot be made if the load is not separately metered.

Grocery and Food Service Gas Use Adjustment

Gas used for cooking in grocery stores, restaurants, and other food service establishments is not the focus of the By-Law. As such, when these uses are located within larger buildings that are subject to GHGI limits and they are metered separately for their gas use, this gas use and

³ The National Building Code of Canada, BC Step Code and relevant Vancouver Codes make several references to process loads, but do not explicitly define the term. This definition of a process load is drawn from ASHRAE Standard 90.1.

corresponding floor area can be excluded from the building's overall GHGI according to the following table:

Separate Gas Meter for Grocery Store and Food Service Establishment		Separately metered gas includes space heating for the Grocery Store and Food Service Establishment	
Yes	Exclude gas use from building GHGI calculation	Yes	Food Service floor area is excluded from the building GHGI calculation
No	Gas use included in GHGI calculation	No	Food Service floor area is included in the building GHGI calculation

Equation 5 is used to calculate the natural gas usage of the building with allowable adjustments.

Equation 5: Adjusted Natural Gas Usage

$$NG_{adj} = NG_M - NG_{PL} - NG_{FL}$$

Where:

NG_{adj} = Natural Gas Usage of the building (in GJ) as adjusted by allowable adjustments.

NG_M = Total annual natural gas usage (in GJ) of the building as measured at the utility meter. If residential energy use adjustment is being claimed, the value for non-residential natural gas (NG_{NR}) calculated in Equation 2 should be used in place of metered natural gas (NG_M)

NG_{PL} = Annual Natural Gas usage (in GJ) for qualified process loads

NG_{FL} = Annual Natural Gas usage (in GJ) for qualified food service loads

4.1.2 PURCHASED RENEWABLE NATURAL GAS

An owner can purchase renewable natural gas (RNG) to lower the GHG emissions of their building.⁴

⁴ It is important to remember that the fossil natural gas supplied by FortisBC may include some portion of RNG. This RNG has been introduced into the natural gas system to meet other climate and regulatory goals and cannot be credited to the building's emissions since it has been accounted for in the emissions factor for fossil natural gas. Only qualified purchases of RNG can be included in the emissions calculations of the building.

Since the gas meter at the building does not capture the purchase of RNG, it is necessary to separate RNG and fossil NG from the total NG usage of the building. This is done with the following equation:

Equation 6: Renewable Natural Gas and Fossil Natural Gas

$$\mathbf{FNG} = \mathbf{NG_{adj}} - \mathbf{RNG}$$

Where:

FNG = Fossil Natural Gas or the portion of the total annual Natural Gas usage (in GJ) of the building that is not attributable to the qualified purchase of RNG

RNG = Total annual qualified purchase of Renewable Natural Gas (in GJ).

NG_{adj} = Natural Gas Usage of the building (in GJ) as adjusted by allowable adjustments (see Equation 5).

4.2 CALCULATING GHG EMISSIONS INTENSITY (GHGI)

The Vancouver GHGI Limits regulate building emissions based on emissions intensity in the units of kilograms of carbon dioxide equivalent, per square meter of GFA, per year (kg CO_{2e}/m²/year). The GHGI Limits cover emissions from the onsite combustion of natural gas (including any qualified purchases of RNG, see the 4.1.2 PURCHASED RENEWABLE NATURAL GAS section above) and GHG emissions from the production of district energy that is used in the building. As noted above, other amounts of energy consumed such as electricity, propane, diesel, biomass, and others are required to be reported, but are not included in this emissions calculation.

Energy consumption is converted into GHG emissions intensity according to the equation below. If energy consumption is reported in different units by the energy provider than those used in the equation below, use the conversion factors in the 6.2 CONVERSIONS FACTORS section to obtain the units in the equation. Current emissions factors will be published on the [Energize Vancouver webpage](#).

Equation 7: Total Annual Onsite GHG Emissions Calculation

$$\mathbf{GHGI} = \mathbf{[(FNG \times FNG_{ef}) + (RNG \times RNG_{ef}) + (DE \times DE_{EF})] / GFA}$$

Where:

GHGI = Total Annual Onsite GHG emissions intensity of the building in (kg CO_{2e}/m²/yr).

FNG = Total Annual Onsite Fossil Natural Gas Usage for the building in gigajoules (GJ) (see Equation).

FNG_{EF} = Emissions factor for Fossil Natural Gas (FNG).

RNG = Total Annual Onsite Renewable Natural Gas Usage for the building in gigajoules (GJ) (see Equation 6).

- RNG_{EF}** = Emissions factor for Renewable Natural Gas (RNG).
- DE** = Total annual metered energy use for the building from district energy system in gigajoules (GJ). If residential energy use adjustment is being claimed, the value for non-residential district energy (DE_{NR}) calculated in **equation 3** should be used in place of metered district (DE).
- DE_{EF}** = Emissions factor for District Energy (DE). Different emission factors may be associated with individual buildings based on the rates offered by the DE provider.
- GFA** = Gross Floor Area of the whole building in m² as determined in accordance with the **definition above**. If residential energy use adjustment is being claimed, the value for non-residential gross floor area (GFA_{NR}) calculated in **equation 4** should be used in place of gross floor area (GFA)

4.3 CALCULATING HEAT ENERGY INTENSITY

The Vancouver HEI Limits regulate the amount of heat energy from natural gas and district energy that is used by covered buildings. These limits are expressed in terms of the total heat energy in gigajoules per square meter per year (GJ/m²/year). Although fossil natural gas and renewable natural gas may have different emissions factors, they have the same heat energy and therefore the purchase of RNG does not provide a benefit for compliance with the HEI Limits. As noted above, other amounts of energy consumed – such as electricity, propane, diesel, biomass, and others – are required to be disclosed, but are not included in this emissions calculation. Heating energy from electricity is excluded from the HEI limit. Although parkade floor area is excluded from other calculations, parkade heating is included in the HEI calculation.

The relevant energy consumption is converted into HEI according to the equation below. If energy consumption is reported in different units by the energy provider than those used in the equation below, use the conversion factors in the 6.2 CONVERSIONS FACTORS section to obtain the units in the equation.

Equation 8: Total Annual Onsite Heat Energy Intensity Calculation

$$\text{HEI} = (\text{FNG} + \text{RNG} + \text{DE}) / \text{GFA}$$

Where:

- HEI** = Total Annual Onsite heat energy intensity of the building in (GJ/m²/yr).
- FNG** = Total Annual Onsite Fossil Natural Gas Usage for the building in gigajoules (GJ) (see Equation 6).
- RNG** = Total Annual Onsite Renewable Natural Gas Usage for the building in gigajoules (GJ) (see Equation 6).

- DE =** Total annual metered energy use for the building from district energy system in gigajoules (GJ). If residential energy use adjustment is being claimed, the value for non-residential district energy (DE_{NR}) calculated in Equation 3 should be used in place of metered district (DE).
- GFA =** Gross Floor Area of the whole building in m^2 as determined in accordance with the **definition above**. If residential energy use adjustment is being claimed, the value for non-residential gross floor area (GFA_{NR}) calculated in Equation 4 should be used in place of gross floor area (GFA)

5.0 Weather Normalization

The Vancouver GHGI and HEI Limits are based on typical weather patterns. In years with abnormally cold winters, buildings will likely be required to use more heating energy than they will under typical weather conditions. In those years, the City of Vancouver will make an adjustment to the GHGI and HEI Limits accordingly. A year with an abnormally cold winter is defined as any year where the Heating Degree Days (HDD) deviate from the median by more than 5%. Since 1998, the HDD have ranged from 2,497 to 3,043 with a median HDD of 2,844.⁵ The coldest winter during this period only deviated from the median HDD by 7% and the HDD has deviated from the median by 5% or more (colder) twice. This weather normalized GHGI and HEI Limits will be calculated and published by the City with no need for any additional action from building owners.

Equation 2 will be used by the City to calculate the weather normalization ratio. This is done by creating a ratio between the HDD of the cold year and the HDD median to establish the magnitude of the adjustment. The City will apply this ratio to the GHGI and HEI Limits for the applicable year.

Equation 9: Weather Normalization Ratio

$$WNR = (HDD_x / HDD_B)$$

Where:

- WNR:** The weather normalization ratio that will be applied to the GHGI and HEI Limits for years with abnormally cold winters. Limits will not be adjusted down for warmer years.
- HDD_x:** The Heating Degree Days (HDD) for the year with extreme weather.
- HDD_B:** The baseline Heating Degree Days (HDD), which is 2844.

5.1 EXAMPLE

The HDD in 2008 were 3043. If Vancouver were to experience another year with these heating degree days, which should happen rarely, the equation would look like this:

$$WNR = HDD_x / HDD_B$$

$$WNR = 3043 / 2844$$

$$WNR = 1.07$$

In this example, both the GHGI and GHGI Limits for that year would be multiplied by 1.07.

⁵ <https://vancouver.weatherstats.ca/metrics/hdd.html>

6.0 Appendix

6.1 DEFINITIONS

“Building” means any structure with a gross floor area equal to or larger than 4,645 m² used or intended to support or shelter any use or occupancy that is listed in Table 2.

“Building By-law” means the Building By-law of the City.

“City” means the City of Vancouver.

“Director of Planning” means the person appointed by Council under section 560 of the Vancouver Charter and any person authorized to act on behalf of the Director of Planning.

“Energy and carbon reporting” means providing to the City the total energy consumed, separated by fuel type, for the previous calendar year and other descriptive information for a building in a form established by the Director of Planning for an ongoing review of a building’s energy and greenhouse gas emissions performance.

“Existing buildings” means buildings lawfully constructed and completed under a building permit, if a building permit was required.

“Greenhouse gas (GHG) emissions” means carbon dioxide (CO₂), methane (CH₄), and nitrous oxide (N₂O) gases emitted as a result of energy consumption in a building, and expressed in carbon dioxide equivalent (CO₂e), a unit of measure that combines the three gases by multiplying each by their global warming potential and adding them together.

“Gross floor area” or **“GFA”** means the sum of the area of every floor in a building, measured between the outside surface of the exterior walls, including all areas inside a building, other than crawl spaces or exterior spaces such as balconies, patios, parking and covered walkways.

“Heat energy” means the total gas used in a building operation plus district heat that is consumed inside the building (excluding the electricity portion), measured in gigajoules of energy equivalent per square meter of gross floor area per year (GJ/ m²/year).

“Lessee” means a person or organization occupying a building, or part of a building or premises under a rental or lease agreement.

“Major occupancy” means the principal occupancy for which a building or part thereof is used or intended to be used as classified in Table 1, and must comprise at least 50% of the building GFA to be considered the major occupancy.

“Mixed Use Building” or **“MUB”** means a building that contains multiple occupancies set out in Table 1, none of which are greater than 50% of the total GFA, including parking GFA.

“Owner” means a registered owner, a holder of an agreement for sale and purchase and, in the case of Crown-owned lands, owner shall mean the occupier.

A “**process load**” is any energy use by a manufacturing, industrial, or commercial procedure or activity where the primary purpose is other than conditioning spaces and maintaining comfort and amenities for the occupants of a building.⁶

“**Site energy**” means electricity, natural gas, steam, or other fuel types including renewable on-site electricity generation that are used directly by the building and reflected on the utility bills.

“**Utility provider**” means a person or organization that distributes or sells natural gas, electric, water, district heating and cooling or thermal energy services for buildings.

6.2 CONVERSIONS FACTORS

Area:

- 0.092903 m² / ft²

Fossil Natural Gas:

- 0.106 GJ / therm

Renewable Natural Gas:

- 0.106 GJ / therm

Steam:

- 2000 lbs / ton

GHG Emissions:

- See the [Energize Vancouver webpage](#) for the current GHG emissions factors.

⁶ The National Building Code of Canada, BC Step Code and relevant Vancouver Codes make reference to process loads, but do not explicitly define them. This definition of a process load is drawn from ASHRAE Standard 90.1.