GUIDE TO LOW CARBON ENERGY SYSTEMS FOR ENERGY ADVISORS

Effective February 28th, 2021, the following Energy Step Code compliance paths will be required for new residential construction in West Vancouver:

Building Type	Low Carbon Energy System	Mechanical system not conforming to LCES requirements
Part 9 Residential (single family, duplex, townhouse)	Step 3	Step 5
Part 9 Detached Secondary Suite	Step 2	Step 5
Part 3 Residential (multi-family and apartment buildings)	Step 2	Step 4

Low Carbon Energy System (LCES) means a mechanical system providing all thermal conditioning and all domestic hot water heating for a building primarily from low-carbon energy sources with the following characteristics:

(a) system seasonal average co-efficient of performance greater than two;

(b) modeled Greenhouse Gas Intensity of no more than 3 kg CO2e/m2/yr; and

(c) any natural gas fired peak demand heating equipment is appropriately sized to augment the primary low carbon system under peak demand conditions.

What is included?

Only thermal conditioning and domestic hot water equipment providing outputs in the energy model are included in the scope of the Low Carbon Energy System.

The following equipment and appliances typically would not be included:

- Fireplaces (if usage set to “never” in the energy model)
- Stoves, ranges, or other cooking equipment
- Backup power generators
- Outdoor heaters
- Swimming pools and hot tubs
- Driveway heating coils

What about combination systems with limited fuel-fired equipment?

The Coefficient of Performance (COP) and Greenhouse Gas Emissions Intensity (GHGI) metrics may permit the usage of limited fuel-fired equipment for supplementary heating. For example, a single family house with an air source heat pump mini-split supplemented by a natural gas-fired hydronic heating system in the basement.

When a combination of fuel source types are specified, the more greenhouse gas intensive (i.e. fuel-fired) equipment must be modeled as the primary system even if it is intended for backup during peak periods. In other words, any fuel-fired equipment must be modeled to its full output capacity when calculating the System COP and GHGI limits required for a Low Carbon Energy System.

Modeling for Part 9 Residential Projects:

LCES Requirement (A): System Seasonal Average Co-efficient of Performance (COP) > 2

The terminology used in the *Building Bylaw* is somewhat misleading, as the COP metric should not be adjusted for seasonal demand. The System COP is the average efficiency of all modeled space heating equipment.

To calculate the System COP in the *HOT2000 Report*, divide the Space Heating System Load by the Annual Space Heating Energy Consumption, as illustrated in Figure 1.

ANNUAL SPACE HEATING SUMMARY

Gross Space Heat Loss:	169551 MJ
Gross Space Heating Load:	169551 MJ
Usable Internal Gains:	24871 MJ
Usable Internal Gains Fraction:	14.7 %
Usable Solar Gains:	44104 MJ
Usable Solar Gains Fraction:	26.0 %
Auxilary Energy Required:	100598 MJ
Space Heating System Load:	100423 MJ
Heat Pump and Furnace Annual COP:	1.364
Heat Pump Annual Energy Consumption:	34634 MJ
Furnace/Boiler Annual Energy Consumption:	392 MJ
Annual Space Heating Energy Consumption:	35025 MJ

System Average COP:

100423 MJ / 35025 MJ = 2.87

Figure 1 - Annual Space Heating Summary section of the HOT2000 Report

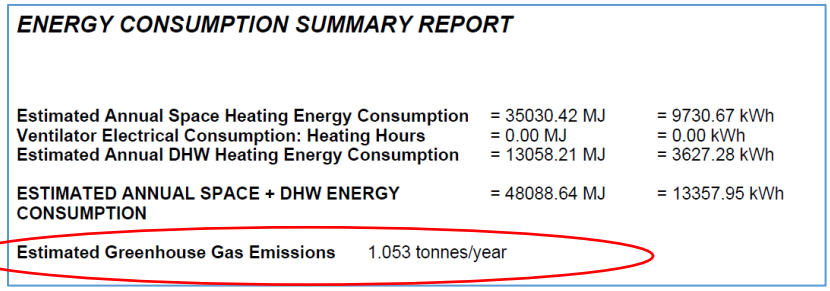
The calculated System COP should be referenced with the description of the heating equipment in Section B of the *BC Energy Compliance Report* as illustrated in Figure 2.

Space Conditioning (Heating & Cooling)	Space Heating: Condensing Natural Gas Boiler (95% AFUE) Air-Source Heat Pump: Heating & Cooling Mini Split (16 SEER)	%, HSPF, or SEER	2.87 System COP

Figure 2 - Example space conditioning characteristics from Section B of the BC Energy Compliance Report

LCES Requirement (B): Modeled Greenhouse Gas Intensity (GHGI) < 3 kg $CO^2e/m^2/yr$

Energy Advisors may reference the estimated greenhouse gas emissions figure provided in the Energy Consumption Summary Report section of the *HOT2000 Report* (see Figure 3). This metric must be converted from tonnes/yr to $kg/m^2/yr$ to determine compliance with the Low Carbon Energy System requirement.



ENERGY CONSUMPTION SUMMARY REPORT

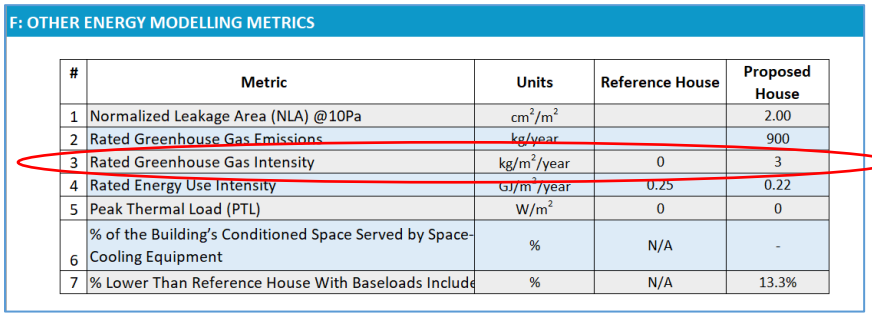
Estimated Annual Space Heating Energy Consumption	= 35030.42 MJ	= 9730.67 kWh
Ventilator Electrical Consumption: Heating Hours	= 0.00 MJ	= 0.00 kWh
Estimated Annual DHW Heating Energy Consumption	= 13058.21 MJ	= 3627.28 kWh
ESTIMATED ANNUAL SPACE + DHW ENERGY CONSUMPTION	= 48088.64 MJ	= 13357.95 kWh
Estimated Greenhouse Gas Emissions	1.053 tonnes/year	

Figure 3 - Example Estimated Greenhouse Gas Emissions from the HOT2000 Report

In the example above, the conversion would be completed as follows for a building with 360 m^2 of conditioned floor area:

1.053 tonnes/yr x 1000 kg/tonne ÷ 360 m^2 conditioned floor area = 2.93 kg $CO^2e/m^2/yr$

The Rated Greenhouse Gas Intensity for the Proposed House must be referenced in Section F of the *BC Energy Compliance Report* as illustrated in Figure 4.



F: OTHER ENERGY MODELLING METRICS

#	Metric	Units	Reference House	Proposed House
1	Normalized Leakage Area (NLA) @10Pa	cm^2/m^2		2.00
2	Rated Greenhouse Gas Emissions	kg/year		900
3	Rated Greenhouse Gas Intensity	$kg/m^2/year$	0	3
4	Rated Energy Use Intensity	$GJ/m^2/year$	0.25	0.22
5	Peak Thermal Load (PTL)	W/m^2	0	0
6	% of the Building's Conditioned Space Served by Space-Cooling Equipment	%	N/A	-
7	% Lower Than Reference House With Baseloads Include	%	N/A	13.3%

Figure 4 - Greenhouse Gas Intensity metric provided in Section F of the Energy Compliance Report

Alternatively, the Energy Advisor may provide a manual calculation for GHGI using the Total Annual Consumption of each fuel source multiplied by the respective Emissions Factor. The following emissions factors must be used unless otherwise approved by the District:

Electricity: 0.011 kg CO^2e/kWh

Natural Gas: 0.185 kg CO^2e/kWh

LCES Requirement (C): Gas-fired heating equipment is appropriately sized

There is no prescriptive metric to define the term “approximately sized.” As discussed on Page 1, gas-fired equipment must be modeled as the primary system and utilized to its full output capacity when calculating the System COP and GHGI metrics described in the previous two sections. If the COP and GHGI requirements are met, the gas-fired equipment is deemed to be supplementary and appropriately sized.

When a combination of different fuel sourced systems are specified, the modeller will typically be required to set the specified output capacity for the fuel-fired equipment. Modeling using a calculated output capacity when fuel-fired equipment set as the primary system is likely to result in COP and/or GHGI metrics exceeding the limits prescribed for a Low Carbon Energy System.

Modeling for Part 3 Residential Projects

Mechanical Design

A qualified engineer must provide written verification that the Low Carbon Energy System is designed to comply with the three requirements described on Page 1 (and in Part 4 of the *Building Bylaw*).

The System COP should be referenced in Section F of the *Energy Report for Part 3 Buildings* in the comments for Heating System Type as illustrated in Figure 5.

	Plant	Suite	Other/Comments
Heating System Type	Air Source Heat Pump	VRF Units	System COP: 3.75
Cooling System Type	Air Source Heat Pump	VRF Units	
DHW System Type	Dedicated Heat Pump - Air Source		

Figure 5 - Example of Section F of the Energy Report for Part 3 Buildings

The Modeled GHGI is calculated in Section E of the *Energy Report for Part 3 Buildings*.

Where a combination of fuel sources are proposed for heating equipment in a Part 3 residential building, additional information may be requested by the District in order to demonstrate that the fuel-fired equipment is appropriately modeled.