

# Energy Step Code Model Sample Report Guideline

## Overview

The purpose of this Sample Report is to provide guidance to energy modellers providing energy modelling on British Columbia Energy Step Code (BC ESC). The focus is on Part 3 residential, office and retail buildings.

This Sample Report outlines information that should be present in energy model reports submitted for BC ESC compliance, in an effort to improve consistency between energy modelling submissions as well as to help modellers new to the BC ESC avoid missing key parameters.

This document is intended as a guidance. While project-specific information not mentioned in this sample document can be added as needed, items that aren't relevant to the project may be excluded unless required. For example, it is recommended that modellers use images and graphs to present information, but these are up to the individual's discretion and are not discussed in detail in this guide.

## Definitions

- **80% Acceptability Limits:** Defined in Section 4 Passively Cooled Buildings of the Energy Modelling Guidelines v2.0 (see link below).
- **Corridor Adjustment Factor:** Defined in the Energy Modelling Guidelines v2.0 (see link below).
- **Vertical surface area to Floor Area Ratio (VFAR):** Defined in the BC Energy Step Code Design Guide v1.0 (see link below)
- **Modelled Floor Area (MFA):** Defined in the Energy Modelling Guidelines v2.0 (see link below).
- **Overheating Hours:** This term is used to refer to the number of hours allowed above the *80% Acceptability Limits* that are defined in Section 4 Passively Cooled Buildings of the Energy Modelling Guidelines v2.0 and ASHRAE 55-2020 (see link below).
- **Partial Cooling:** This term is used to refer to the amount of mechanical cooling, if any, to the suites. Partial cooling is further defined as the following:
  - **Partial Cooling A** (i.e. living room only) = Some rooms supplied with mechanical cooling, Overheating analysis is required. Energy Modeller should turn OFF the mechanical cooling in the model and report overheating hours for all zones following ASHRAE 55 80% acceptability limits..
  - **Partial Cooling B** (i.e. tempered air or boosted ventilation, etc.) = Where tempered air or boosted ventilation is provided, overheating analysis is required.
- **Performance Limits:** Defined in the Energy Modelling Guidelines v2.0 (see link below).

## Resources

Some additional helpful resources are provided below:

- [BC Energy Step Code](#) (by Energy Step Code Council)
- [Energy Modelling Guidelines v2.0](#) (by City of Vancouver)
- [Building Envelope Thermal Bridging Guide \(BETBG\)](#) (by BC Hydro)
- [Joint Professional Practice Guidelines: Whole Building Energy Modelling Services](#) (by Engineers and Geoscientists BC and Architectural Institute of British Columbia)
- BC Housing Guidelines
  - [BC Housing Design Guidelines and Construction Standard](#)
  - [BC Housing Sustainability Standard Checklist](#)

# Energy Modelling Sample Report

## Executive Summary

Provide a summary of the project, current stage, energy model inputs and results including the Energy Step Code targets and whether they were achieved. It's suggested to include an image of the energy model to give the reader an overview of the building geometry.

## Project Background

### 1.1 Project Overview

The following project background information should be included in the report.

Project Information	Tips
<b>Description</b> <ul style="list-style-type: none"><li>Project name</li><li>Project Address &amp; municipality</li><li>Building use and occupancy</li></ul>	Clarify if multiple uses are present within the building
<b>Team</b> <ul style="list-style-type: none"><li>Company &amp; Contact names</li><li>Roles</li><li>Contact details</li></ul>	At a minimum, energy modeller, architect, coordinating registered professional (CRP), and mechanical & electrical engineers
<b>Drawing Set</b> <ul style="list-style-type: none"><li>Referenced drawing set file names</li><li>Dates</li></ul>	
<b>Building Size</b> <ul style="list-style-type: none"><li>Modelled floor area (MFA)</li><li>Gross floor area (GFA) from architectural plans</li><li>Number of storeys</li><li>Number of units</li><li>Vertical surface area to Floor Area Ratio (VFAR)</li></ul>	Indicate if the MFA is within 5% of the GFA, or provide justification, as required by the Energy Modelling Guidelines v2.0
<b>Climatic information</b> <ul style="list-style-type: none"><li>British Columbia Building Code (BCBC) Heating Degree Days (HDD) and associated Climate Zone (CZ)</li><li>Simulation weather file names</li></ul>	Indicate which weather files will be used for the thermal comfort analysis (i.e.. 2020, 2050's weather file)
<b>Energy Modelling Tool &amp; Simulation</b> <ul style="list-style-type: none"><li>Software &amp; version</li><li>Simulation file name</li></ul>	If this project is for BC Housing, remember to submit a copy of the energy model along with the report
<b>Project stage</b> (e.g. Schematic, Design Development, BP, or post-construction)	

## 1.2 Performance Limits

The *performance limits* targeted by the project should be stated, including if there are multiple targets (e.g. for BC Housing projects with both concrete and wood-framed structure) on the projects, these should be provided and explained.

Project Information	Tips
Step Code target <ul style="list-style-type: none"><li>Provide the TEDI, TEUI and GHGI targets</li></ul>	
Passively- or partially- cooled buildings <ul style="list-style-type: none"><li>State the overheating hours limit</li></ul>	Outline the maximum allowable number of hours as per BC Housing DGCS.  See Definitions for break-down of Partial Cooling requirements
Energy Statement Location <ul style="list-style-type: none"><li>Indicate which drawing this is provided on (for submissions to Authorities Having Jurisdiction)</li></ul>	See requirement from Joint Professional Practice Guidelines: Whole Building Energy Modelling Services (link in resources section)
Standards and Guidelines <ul style="list-style-type: none"><li>Refer to applicable standards and guidelines (e.g. BC Housing standards)</li></ul>	
Any other energy and sustainability targets on project	Indicate if the project is also subject to energy requirements for rezoning or a green building certification such as LEED Gold, etc.

## Simulation Overview

The following model inputs should be included in the report if they are relevant to the project. Provide a source for all inputs in this section, indicating where the information came from (e.g. drawings, standard, guideline, etc.). Some of this information could be provided in appendices according to the modeller's preference.

Project Information	Tips
Summary of energy efficiency measures	List all modelling assumptions that will be described in more detail below
<b>Architectural &amp; Building Enclosure</b>	
Provide assembly description AND <u>effective</u> R or U-value(s) based on Thermal Bridging Guide calculations for all types of: <ul style="list-style-type: none"><li>Walls (above and below grade)</li><li>Roofs</li><li>Floors</li><li>Doors</li><li>Windows, also provide Window-to-wall ratio and SHGC</li></ul>	Note that Thermal Bridging Guide calculations are <u>required</u> to be included in appendices  If unknown, use the minimum requirements from BCH DGCS

<p><b>Infiltration</b></p> <ul style="list-style-type: none"> <li>• Design Stage, provide: <ul style="list-style-type: none"> <li>○ Infiltration rate used in model during design [L/s.m<sup>2</sup> façade area]</li> <li>○ Calculated target airtightness rate [L/s.m<sup>2</sup> total envelope area at 75 Pa]</li> </ul> </li> <li>• Occupancy Stage, provide: <ul style="list-style-type: none"> <li>○ Actual airtightness test result [L/s.m<sup>2</sup> total envelope area]</li> <li>○ Updated infiltration rate used in final model [L/s.m<sup>2</sup> façade area]</li> </ul> </li> </ul>	<p>It's helpful to clearly outline the different areas being used for both calculations</p> <p>See section 2.4.1 of the Energy Modelling Guidelines for more information</p>
<p><b>Mechanical Systems</b></p>	
<p>Heating and cooling systems, describe:</p> <ul style="list-style-type: none"> <li>• Residential &amp; common area systems – type, efficiency</li> <li>• Terminal units</li> <li>• Heating and cooling setpoints and setbacks</li> <li>• Schedules</li> <li>• System temperature and controls</li> <li>• Fans capacity, power and drive</li> <li>• Pumps capacity, power and drive</li> <li>• Heat/ energy recovery effectiveness and controls</li> <li>• Economizer and controls, if applicable</li> </ul>	<p>Indicate the product detail (i.e. manufacturer, model number, etc.) once specified by mechanical.</p>
<p>Ventilation</p> <ul style="list-style-type: none"> <li>• Describe system(s)</li> <li>• Indicate if constant or variable volume, including boosting ventilation rate</li> <li>• Outline standard used for outdoor air rate sizing</li> <li>• Schedule</li> </ul>	<p>Indicate whether central, semi-central, or in-suite ERV is used.</p>
<p>Mechanical plant, describe:</p> <ul style="list-style-type: none"> <li>• Heating system plant equipment, capacities and efficiencies</li> <li>• Cooling system plant equipment, capacities and efficiencies</li> </ul>	
<p>Domestic hot water</p> <ul style="list-style-type: none"> <li>• Describe load calculation</li> <li>• Provide heating system equipment, capacities and efficiencies</li> <li>• Describe temperatures and controls and storage, as applicable</li> </ul>	
<p><b>Lighting, Plug and Other Loads</b></p>	
<p>Lighting</p> <ul style="list-style-type: none"> <li>• Interior: LPD, schedules, controls per space type</li> <li>• Exterior: Installed wattage, schedules, controls</li> </ul>	
<p>Plug/process Loads</p> <ul style="list-style-type: none"> <li>• Plug loads: Density &amp; schedule per space type</li> <li>• Residential Appliances: Fuel type, Energy Star if applicable</li> <li>• Elevator: Load per elevator &amp; schedule</li> <li>• Process loads</li> </ul>	
<p>Other Inputs</p> <ul style="list-style-type: none"> <li>• Occupancy: Density &amp; schedule per space type</li> <li>• Exceptional calculation methods</li> </ul>	<p>For exceptional calculation methods, explain methodology as well as why this calculation method is being used</p>

## Building Simulation Results

The results from the simulation should be provided alongside the original targets from section 2.2. It is recommended to use graphs and discuss any important aspects from the results.

Project Information	Tips
Summary of performance <ul style="list-style-type: none"> <li>Provide the <i>performance limit</i> targets and results for TEUI, TEDI and GHGI</li> <li>Provide results <u>before and after</u> the <i>Corridor Adjustment Factor</i> has been included</li> </ul>	
TEUI <ul style="list-style-type: none"> <li>Provide energy end use breakdown</li> <li>Provide breakdown by fuel type</li> </ul>	
TEDI <ul style="list-style-type: none"> <li>Provide contribution of envelope, infiltration and ventilation</li> </ul>	
GHGI	
Energy Conservation Measures <ul style="list-style-type: none"> <li>ECM summary, updated inputs and impact on results</li> <li>Provide ECM bundle results, as necessary</li> </ul>	A list of ECMs must be provided at schematic/ design development stage.

## Thermal Safety/ Overheating Analysis

Project Information	Tips
Passively- or partially-cooled Buildings <ul style="list-style-type: none"> <li>Using a 2020 baseline weather file, provide Overheating Hours Limit and Result per zone, for all units and zone locations (provided in appendix)</li> <li>Provide a 2050 weather file sensitivity analysis of Overheating Hours results per zone, number of units affected, and zone locations.</li> <li>Provide iteration if there are any passive cooling measures options being proposed.</li> </ul>	For passively cooled buildings, show how the <i>80% Acceptability Limit</i> for each month was calculated using the appropriate weather file for the project  See Definitions for break-down of Partial Cooling requirements  The sensitivity analysis shall be used to inform the design, as necessary
Passive cooling strategies <ul style="list-style-type: none"> <li>Describe shading elements and operation schedule (if applicable)</li> <li>Operable window assumption details: operable area, schedule and mode of operation</li> <li>Crack flow, ventilation rate used</li> <li>Peak temperatures in overheated spaces</li> <li>Temperature thresholds used (appropriate for local weather)</li> <li>Any other information that indicates modeller's methodology</li> </ul>	Note any significant shading from topographical elements or adjacent buildings included in the model.  Ensure window description is matching with architectural condition (i.e. window restrictor)

Cooling type	Overheating analysis	20-hour limit
No cooling	Required	Yes
Partial cooling A (living room only)	Required (cooling off)	No
Partial cooling B (Tempered cooling)	Required (on AND off)	Yes (on) /No (off)
Full cooling	Recommended (off)	No

# Conclusion

Provide a project summary, highlighting main results and any recommendations. Sign and seal the (see the *Joint Professional Practice Guidelines: Whole Building Energy Modelling Services* link in the resources section).

# Appendices

The following information should be included as appendices to the report.

Project Information	Tips
Thermal Bridging Guide Calculation <ul style="list-style-type: none"> <li>Include the main calculation page for every thermal bridging calculation performed on the project (walls, roofs, floors, etc.)</li> </ul>	
BC Energy <a href="#">Step Code Energy Report</a> <ul style="list-style-type: none"> <li>Overheating limit should be set as 20 hours.</li> </ul>	Authority Having Jurisdiction (AHJ) may already require Energy Report as a part of the permit process.
Thermal Safety/ Overheating Analysis <ul style="list-style-type: none"> <li>List of overheating hours results for all units and zone locations</li> </ul>	
Optional: Consider including additional information as may be relevant to the project and/or useful to the reviewer: <ul style="list-style-type: none"> <li>Zoning diagrams</li> <li>Area takeoffs</li> <li>Supplementary takeoffs for Thermal Bridging Guide calculations</li> <li>Lighting takeoffs, schedules and fixture cutsheets</li> <li>Mechanical takeoffs, schedules and equipment cutsheets</li> <li>Building envelope nominal values</li> <li>Appliance and plumbing fixture cutsheets</li> </ul>	
Optional: The following information can also be included in appendices where appropriate: <ul style="list-style-type: none"> <li>Renewable energy systems</li> <li>Summary of and explanation for any warnings and errors from the final simulation</li> </ul>	