City of Vancouver *Planning By-law Administration Bulletins*

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GREEN BUILDINGS POLICY FOR REZONING - PROCESS AND REQUIREMENTS

(Formerly: Green Rezoning Process)

Authority - Director of Planning
Effective July 22, 2010
Amended June 25, 2014, June 8, 2015, January 14, 2016, and April 28, 2017

(Applies to rezoning applications between April 28, 2017 and June 13, 2019)

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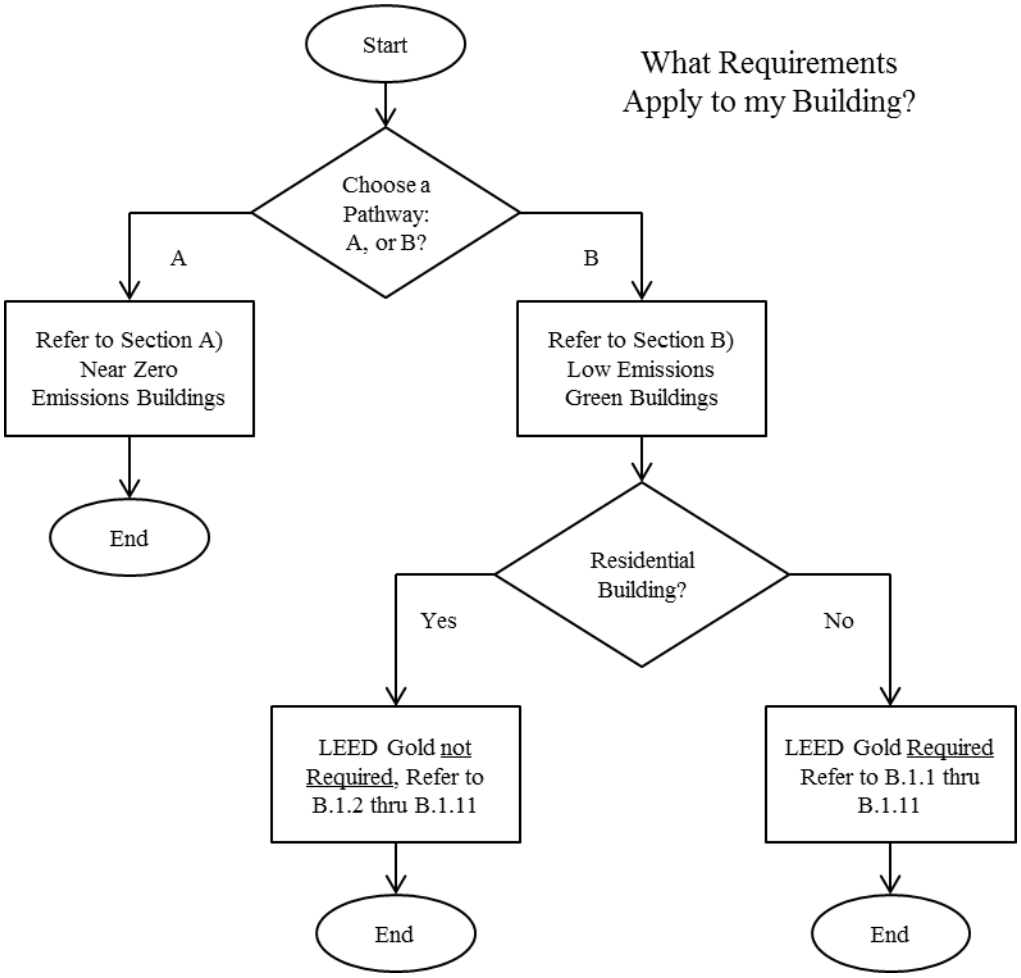
INTRODUCTION

This Administration Bulletin was developed to provide applicants information on the required process and submissions related to the Green Buildings Policy for Rezonings ('the policy'), amended by Council on November 29, 2016, and amended to add energy reporting on February 7, 2017. For convenience the contents of the policy have been reproduced here, however in the case of any discrepancy between this bulletin and the policy, the policy text shall take precedence.

The policy offers two pathways to compliance, A) Near Zero Emissions Buildings, and B) Low Emissions Green Buildings. The flow chart below shows how requirements vary depending on the pathway chosen by the applicant and the building type. Applications with multiple buildings must separate buildings where possible, and identify the pathway and requirements appropriate to each building in the application. Refer to B.1.1 for more detail on the definition of 'residential' and 'building'.



Each pathway and the associated submission requirements are described in detail in the following sections, and for convenience they are summarized in a table in Appendix A.

For more information on how this policy applies to renovations, townhomes, and small residential buildings, refer to the Administration section at the end of this document.

A NEAR ZERO EMISSIONS BUILDINGS

A.1) Detailed Requirements for Near Zero Emissions Buildings

From the policy:

> "Projects shall be designed to meet Passive House requirements and apply for certification, or to an alternate near zero emissions building standard, such as the International Living Building Institute's Net Zero Energy Building Certification, as deemed suitable by the Director of Sustainability."

For the purposes of this policy, a Passive House building is one that meets the definition in the Vancouver Zoning & Development By-law. For projects pursuing alternate building standards under this pathway, such as the ILFI's Net Zero Energy Certification or the CaGBC's Zero Carbon Building Standard, applicants should seek more information from their Project Facilitator.

Passive House is a well-established ultra-low energy building performance standard and certification process. There are over 40,000 Passive House buildings built in a wide range of climates and typologies. Passive design is based on the principle that a high quality envelope can reduce most costs associated with heating and cooling. With thoughtful design, better energy efficiency can be achieved and costly heating and air conditioning systems are eliminated without sacrificing thermal comfort. Certifying a building built to the Passive House standard is a rigorous quality assurance process that determines whether a building meets all of the requirements of the Passive House standard, and confirms that the building has been designed to achieve high levels of occupant comfort with very low energy consumption.

Criteria for Passive House Certification (summarized)

- Space Heat Demand: Maximum 15 kWh/m²a OR Heating load max. 10 W/m²
  - The building must be designed to have an annual heating and cooling demand **as calculated with the Passive House Planning Package (PHPP)** of not more than 15 kWh/m² per year in heating and 15 kWh/m² per year cooling energy OR to be designed with a peak heat load of 10W/m².

- Pressurization Test Result: Maximum 0.6 ACH @ 50 Pa
  - The Passive House Standard demands a minimum tested airtightness level of 0.6 air changes per hour (ACH) @ 50 Pa (pascals), both for under pressure and overpressure during a blower door test. Must be conducted by a licensed technician.

- Total Primary Energy Renewable (PER): Maximum 60 kWh/m²a
  - The total energy to be used for all domestic applications (heating, hot water and domestic electricity) must not exceed 60 kWh per square meter of treated floor area per year.
  - Note: Primary Energy (PE) is an alternative metric under PHPP 9, with a maximum of 120 kWh/m²a.

All heating and cooling calculations are based on the treated floor area of the building. If cooling (air conditioning) is required, the annual cooling energy demand must also not exceed 15 kWh/m². For a description of the full criteria for certification or for more information, please see Passive House Canada's web site at: http://www.passivehousecanada.com and consult with a Certified Passive House Designer or Consultant.

A.2) Submissions Requirements for Near Zero Emissions Buildings

This section outlines submission requirements for Passive House projects to demonstrate compliance with the Green Buildings Policy for Rezonings. Projects seeking relaxations of other policies or guidelines related to Passive House should refer to the relevant guidelines and bulletins for guidance on their requirements.

Please note the different roles and responsibilities of the:

1. Certified Passive House Designer (CPHD) or Certified Passive House Consultant (CPHC);
2. Passive House Building Certifier (Building Certifier).

The documentation required at each of the stages will include, but may not be limited to, the requirements listed below.

Rezoning Enquiry

As part of the rezoning enquiry package, proponents should note that the development will be pursuing Passive House certification, provide contact information for their Certified Passive House Designer/Consultant, and note the key design strategies anticipated to meet the PH standard.

Rezoning Application

Applicants must submit:

- A letter from a Certified Passive House Designer/Consultant confirming they have been retained as a consultant on the project, summarizing the main PH criteria from the preliminary PHPP model, and describing the key design strategies to achieving certification.

Development Permit Application

Applicants must submit:

- Current project models using the PHPP software, demonstrating how the Passive House Classic requirements as maintained by the Passive House Institute are met, including:
  - the pre-construction PHPP model (an electronic copy of the Excel file);
  - a printout of the "verification" page and relevant notes;
- A letter from the Certified Passive House Designer/Consultant noting that a Passive House Building Certifier has been retained on the project and will review the detailed design before building permit application.

Building Permit Application

Applicants must submit:

- The project's compliant PHPP model together with a Passive House Design Summary report that details critical assemblies, components, and strategies;
- A letter from a Passive House Building Certifier noting specifications (assemblies, building components), and stating that the project design and specifications have been reviewed and, in the opinion of the Building Certifier, the project is capable of achieving Passive House certification. **If any areas of concern have arisen, these issues must be resolved before applying for Building Permit.**
- A written Passive House Commissioning Plan. The Plan will be used to verify construction assemblies, components, insulation, air barrier, air tightness performance etc., and is designed to be a similar step to the ASHRAE checklists provided by Registered Professionals at this point in the permit process for projects not pursuing Passive House. The Plan will be prepared by the project team and the CPHC/D and approved by the Building Certifier (as part of his/her design stage review). This plan will be managed and verified by a Registered Professional on behalf of the project team and the CPHC/D, and must include, *at a minimum*:
  - The name and credentials of the Registered Professional who will document and verify construction to plan.
  - The number of planned site visits, and at what intervals.
  - A written plan for monitoring and grading insulation installation in all assemblies - including inspections of insulation layers below-grade and insulation installation within assemblies - to verify that all assemblies, insulation materials, and components (including windows, doors and ventilation equipment) are installed as per the specifications provided in the Building Certifier's letter.

- A written plan for monitoring and verifying continuous air barrier in all assemblies and components.
- A written plan for verifying all key components and assemblies specified in the Building Certifier's letter.
- A written plan for air tightness testing, including who will conduct mid-construction and final blower door tests to the protocol prescribed by the Passive House Institute
- Written plan for ventilation commissioning, including who will conduct.
- Written plan for occupant training, including who will conduct.

- **If, at any point, any element of the plan should become non-compliant, this must be immediately brought to the attention of the City of Vancouver.**

Occupancy Permit Application

Buildings may be certified by any of the Passive House Institute Accredited Building Certifiers operating worldwide. In addition to the documents already required at final inspection, applicants must provide the City with:

- a sealed letter from a Registered Professional, confirming that work implemented was as prescribed in the Passive House Commissioning Plan and that they are not aware of any reason the project will fail to certify.
- a letter from the Building Certifier stating that the final PHPP and relevant documentation have been received and are being reviewed for final certification. The Building Certifier's letter must include a suggested date by which the City may expect to be notified of final certification to the Passive House Institute standard.

Post-Occupancy

Certification to the Passive House standard must be achieved to support any relaxations pursued. The Building Certifier will review the project documentation, including the PHPP model, building envelope drawings, mechanical systems and other information. Once the project is certified by the Passive House Institute, a copy of the certificate must be provided to the City of Vancouver.

B LOW EMISSIONS GREEN BUILDINGS

The low emissions green buildings pathway represents City priority outcomes, establishing limits on heat loss, energy use, and greenhouse gases, and drawing on industry best practices to create more efficient, healthy and comfortable homes and workplaces.

B.1) Detailed Requirements for Low Emissions Green Buildings

1. Requirements for Leadership in Energy and Environmental Design (LEED)

From the policy:

> "All projects - **except residential buildings** - shall register with the Canadian Green Building Council (CaGBC) and achieve LEED Gold certification for Building Design + Construction (BD+C), or an equivalent green building rating system. A residential building is defined as a building in which at least 50% of the Gross Floor Area is residential space. Where a project has multiple buildings, each building shall be evaluated separately.
>
> The BD+C project type applies to buildings that are being newly constructed or going through a major renovation, and includes many rating systems designed for various building types. The applicant is responsible for choosing the rating system (within BD+C) that is most applicable to the project."

LEED registration may also take place through the USGBC. For the purposes of LEED registration, a building means any independent structure or portion of a structure able to establish a reasonable LEED boundary, and thus is able to be registered with LEED as a building. For example, an application may

have a residential and an office tower, connected by a common parking garage or retail. In this case LEED has procedures for how to establish a LEED boundary, and the office tower would be expected to register as a LEED project.

2. Requirements for the Performance Limits

From the policy:

> "All buildings shall meet or exceed performance limits according to their building type summarized in the tables below, as modelled according to the City of Vancouver Energy Modelling Guidelines. The Energy Modelling Guidelines set standard assumptions and requirements for energy models when assessing compliance with the limits, including accounting for thermal bridging, consideration of summertime thermal comfort, and the treatment of mixed-use buildings.

Table B.1.2a: Performance Limits - Buildings Not Connected to a City-Recognized Low Carbon Energy System			
Building Type	TEUI (kWh/m^2)	TEDI (kWh/m^2)	GHGI ($kgCO_2/m^2$)
Residential Low-Rise (< 7 storeys)	100	15	5
Residential High-Rise (7+ storeys)	120	32	6
Office	100	27	3
Retail	170	21	3
Hotel	170	25	8
All Other Buildings	EUI 35% below 90.1-2010		

Table B.1.2b: Performance Limits - Buildings Connected to a City-recognized Low Carbon Energy System			
Building Type	TEUI (kWh/m^2)	TEDI (kWh/m^2)	GHGI ($kgCO_2/m^2$)
Residential Low-Rise (< 7 storeys)	110	25	5
Residential High-Rise (7+ storeys)	130	40	6
Office	110	27	3
Retail	170	21	3
Hotel	210	25	8
All Other Buildings	EUI 35% below 90.1-2010		

> TEUI: Total Energy Use Intensity
> TEDI: Thermal Energy Demand Intensity
> GHGI: Greenhouse Gas Intensity"

The CoV Energy Modelling Guidelines have been published as a separate bulletin, accessible on the City's website. The project shall use the latest version available.

To demonstrate energy savings for All Other Buildings, applicants may use the National Energy Code for Buildings (NECB) 2011 as an alternative to ASHRAE 90.1-2010.

3. Requirements for Whole Building Airtightness Testing

From the policy:

> "Whole-building airtightness for each building is to be tested and reported, and all buildings are to be designed and constructed with the intention of meeting an air leakage target of 2.0 $L/s*m^2$ @75 Pa (0.40 cfm/ft^2 @ 0.3"w.c.), or sealed according to good engineering practice.

> Airtightness of suites is to be tested and reported for residential buildings and must demonstrate compliance with a suite-level air-leakage target of 1.2 L/s*m² @50 Pa (0.23 cfm/ft² @ 0.2"w.c.), as tested to ASTM E779 or an equivalent standard."

Projects shall conduct suite airtightness testing on 10% of the first 100 units, and 5% of all units above that.

As noted in the policy all testing shall be conducted according to ASTM E779 with the following modifications, or to an equivalent standard acceptable to the Chief Building Official:

1. Tests shall be accomplished using both pressurization and depressurization.
2. The test pressure range shall be from 25 Pa to 80 Pa, but the upper limit shall not be less than 75 Pa, and the difference between the upper limit and the lower limit shall not be less than 25 Pa.
3. If the pressure exponent n is less than 0.45 or greater than 0.85, the test shall be re-run with additional reading over a longer time interval.

All airtightness testing and reporting must be performed by a qualified person who can demonstrate experience conducting testing in buildings of similar size and complexity, or has completed airtightness testing training acceptable to the City.

Buildings that fail to achieve the airtightness target must find and seal the sources of air leakage (using techniques such as visual inspection, smoke testing, and/or thermal imaging), and then re-test the building. If the building is still unable to meet the target, a lessons learned report must be provided for public use that includes the findings of a visual air barrier inspection, any air leaks found and sealed, likely remaining sources of air leakage and why they could not be readily sealed, and recommendations for future buildings to achieve the target.

For more information on how to design, construct, and test to achieve an airtight building, refer to the *Illustrated Guide to Achieving Airtight Buildings (2017)*.

4. Requirements for Enhanced Commissioning

From the policy:

> "An enhanced commissioning process for all building energy systems is to be completed in accordance with ASHRAE Guideline 0-2005 and 1.1-2007, or an alternate commissioning standard."

A third-party Commissioning Authority must be designated to oversee the enhanced commissioning process. Where the proposed Commissioning Authority is from the same company as a member of the design or project team, a disclosure letter signed by the Commissioning Authority and the owner must be provided that describes how the Commissioning Authority will remain independent and objective in fulfilling their duties to the owner. The Commissioning Authority must be able to demonstrate experience commissioning projects of similar size and complexity, and either be a registered professional qualified to practice in building commissioning, or possess a certification in building commissioning acceptable to the City.

The owner and Commissioning Authority are responsible for developing and documenting the Owner's Project Requirements (OPR), and the design team and Commissioning Authority are responsible for developing and documenting the Basis of Design (BOD). Both documents should contain the project and design requirements of this Policy and other applicable green building and sustainability policies and standards.

The Commissioning Authority is responsible for ensuring the Commissioning Plan and Commissioning Report contain, at a minimum, the following:

1) Commissioning Plan:
    a. Review the Owner's Project Requirements (OPR), Basis of Design (BOD), and project design, summarize and provide commentary where required;
    b. Outline roles and responsibilities of the design and construction team in the commissioning process;
    c. Confirm incorporation of commissioning requirements into the construction documents;
    d. Approximate timelines of commissioning activities;
    e. Details of the planned commissioning activities, such as a list of equipment and systems to be commissioned, functions to be tested, test conditions, and/or performance criteria;
    f. Commissioning documentation to be provided, and final acceptance criteria (aligned with the OPR); and,
    g. If a project chooses to pursue Ongoing or Monitoring Based Commissioning, a Monitoring and Verification (M&V) Plan should be included in the Commissioning Plan.

2) Commissioning Report:
    a. Summarize how design and installation has met with OPR and BOD requirements;
    b. Summarize the results of commissioning activities described in the Commissioning Plan, including:
        i. final test procedures and criteria;
        ii. functional performance test results;
        iii. deficiencies noted and corrections made;
        iv. a list of unresolved deficiencies or deferred tests, along with climatic conditions required to perform them;
        v. a record of training given to the owner or operator(s), including a summary of any remaining training to be completed;
        vi. a summary or status report of the Operating and Maintenance (O&M) Manuals, as-built drawings and final building energy model; and,
    c. Note any further actions that the owner needs to take in the warranty period of the equipment to ensure efficient operation, or that the system is balanced and optimized.

As part of the commissioning process, the following items must be provided to the owner:
1) The final Commissioning Report;
2) Operating and maintenance manuals;
3) Training for operators or building managers;
4) A digital copy of the full O&M manuals, a full PDF set of building as-built drawings, a copy of the BIM files if applicable, and the final building energy model file.

Alternate commissioning standards may be proposed for acceptance by the City, such as ASHRAE Standard 202-2013 The Commissioning Process for Buildings and Systems, CSA Z320-11 Building Commissioning Standard, CSA Z8001-13 Commissioning Standard of Health Care Facilities, or the upcoming CSA Z5000, Building Commissioning For Energy Using Systems.

For projects pursuing LEED v4, achievement of the Enhanced Commissioning credit, Option 1, Path 1, is acceptable to meet the intent of this requirement.

5. Requirements for Energy System Sub-Metering and Reporting

5.1. Energy System Sub-Metering

From the policy:

> "Separate master metering for each energy utility (eg: Electricity, Gas, etc.) and each building is to be provided as well as sub-metering of all major energy end-uses and major space uses within each building."

Master metering for each energy utility and each building must be installed to provide the basic tools for energy auditing and benchmarking. To provide the tools for building owners to better understand where and how energy is used in buildings, the Policy also requires sub-metering of major energy end-uses and/or space uses within each building.

Major energy end-uses for sub-metering may include, but are not limited to, domestic hot water, space heating, make-up air heating, cooling, fans, lighting, plugs, EV charging, and others.

Major space uses for sub-metering may include, but are not limited to parkades, common and amenity areas, retail, and other spaces that differ from the primary space type of the building.

While other applicable standards or by-laws may contain additional requirements, this policy does not require sub-meters for: each individual residential suite, where meters are not otherwise required by a utility; energy end-uses contained entirely within a residential suite; or, energy end-uses estimated to use approximately 10% of total building energy use or less. If the project includes metering of individual suites, meter data from suites must be aggregated to include 20 suites or more, or otherwise be made anonymous.

The energy sub-metering strategy used should be appropriate for the size and complexity of the building. Smaller or simpler buildings with less systems and space uses may require relatively few meters compared to a large mixed-use building with complex energy systems. To maximize cost-effectiveness and the quality of metered data, the strategy may choose to: use a combination physical and virtual meters; interface with the Building Automation System (BAS), which can collect and aggregate energy use data from mechanical equipment and other systems; or connect digitally with meters already provided or required by utilities. The strategy should be created with direct input from the mechanical and electrical designers as well as the Commissioning Authority, and must be designed to provide building owners with the level of sub-meters and data necessary to conduct a high-quality energy assessment or retro-commissioning activities.

Meters should typically be capable of reporting hourly, daily, monthly, and annual energy use, and the sub-meter data collection system used must be capable of storing meter data for at least 36 months, providing remote data access for the building owner or energy advisor, and secure back-up of data.

For projects pursuing LEED v4, achievement of the Advanced Energy Metering credit is acceptable to meet the intent of this requirement.

5.2. Energy Reporting

From the policy:

> "An Energy Star Portfolio Manager account is to be setup for each building and must include all basic property information for each building as designed, including setup of meters for all energy utilities servicing the building.
>
> A rezoning applicant will enter into an agreement with the City, on terms and conditions acceptable to the City, that requires the future owner of the building to report energy use data, on an aggregated basis, for the building as a whole and certain common areas and building systems. Such an agreement will further provide for the hiring of an approved professional service provider to assist the building owner for a minimum of three years in collecting and submitting energy use data to the City."

The energy reporting requirements of this section are not applicable to residential buildings that contain less than 20 units.

As noted in the Policy, the project team is responsible for setup of an EnergyStar Portfolio Manager account for each building, including all relevant property information (ie: types of use, gross floor areas, etc.) and setup of meters. Where possible, meters shall be setup at the level of major space uses and/or building systems, and these meters clearly named to represent space use or system they represent, so that sub-metered data may be directly shared with the City. Where the service is available, the ongoing collection and entry of meter data shall be automated through the setup of electronic data exchange with utilities.

A qualified service provider must be retained to assist building owners with annual energy benchmarking reports to the City, and review the reporting for accuracy, for a period of at least three years after occupancy.

6. Requirements for Calculating Refrigerant and Embodied Emissions

6.1. Refrigerant Emissions

From the policy:

> "All projects shall calculate and report the life-cycle equivalent annual carbon dioxide emissions of each building, in kgCO2e/m², from the emission of refrigerants. This requirement does not apply to projects where the total installed heating and cooling capacity of equipment containing refrigerants is less than 35kW."

Emissions from refrigerants shall be calculated using the following formula:

$$kgCO_2e/m^2 = [GWP_r * R_c * (0.02 * L + 0.1)] / (L * A)$$

Where:

GWP_r:	Global Warming Potential of the refrigerant, in $kgCO_2e$ per kg_r
R_c:	Total Refrigerant Charge in the system, in kg_r
L:	Life of the system, in years
A:	Modelled Floor Area of the building, in m²
0.02, 0.1:	Assumes an annual leakage rate of 2%, with 10% end-of-life leakage

If the total heating and cooling capacity of all installed heating and cooling equipment containing refrigerants (excluding plug-in appliances) is less than 35kW, then it is considered small and this requirement does not apply.

Table B.1.6.1a: Global Warming Potential of Refrigerants

Refrigerant	Global Warming Potential
CFCs	
CFC-11	4,680
CFC-12	10,720
CFC-114	9,800
CFC-500	7,900
CFC-502	4,600
HCFCs	

HCFC-22	1,780
HCFC-123	76
HFCs	
HFC-23	12,240
HFC-134a	1,320
HFC-245fa	1,020
HFC-404a	3,900
HFC-407c	1,700
HFC-410a	1,890
HFC-507a	3,900
Natural Refrigerants	
Carbon dioxide (CO_2)	1
Ammonia (NH_3)	0
Propane	3

Note: Reproduced from the LEED Canada 2009 and v4 Reference Guides, with permission from the CaGBC.

Service life should be based on the system in question using the table below. A different service life may be used if supported by documentation.

Table B.1.6.1b: Default Equipment Lifetime	
Equipment	**Default Equipment Life**
Window air-conditioner, heat pump	10 years
Unitary, split, packaged air-conditioner, package heat pump	15 years
Reciprocating and scroll compressor, reciprocating chiller	20 years
Absorption chiller	23 years
Water-cooled packaged air-conditioner	24 years
Centrifugal chiller	25 years

Note: Reproduced from the LEED Canada 2009 and v4 Reference Guides, with permission from the CaGBC.

For projects pursuing LEED v4, calculations created to demonstrate achievement of the Enhanced Refrigerant Management credit, Option 2, and reporting of the results, are acceptable to meet the intent of this requirement.

6.2. Requirements for Calculating Embodied Emissions

From the policy:

> "All projects shall report the life-cycle equivalent carbon dioxide emissions (ie: global warming potential impact, or 'embodied carbon') of each building, in kgCO2e/m², as calculated by a whole-building life-cycle assessment (LCA)."

In addition to reporting the embodied emissions intensity in kgCO2e/m², projects must also report the total lifecycle embodied emissions in kgCO2e, and the equivalent annual embodied emissions intensity in kgCO2e/m²/year.

There are design team LCA software tools currently available that can greatly streamline the workflow of LCA and that meet the technical requirements below, such as the free Canadian-based Athena Impact Estimator. For consistency in LCA calculations, projects shall use the following standard requirements:

1) The LCA must include all envelope and structural elements (including parking structure), including footings and foundations, and complete structural wall assemblies (from cladding to interior finishes, including basement), structural floors and ceilings (not including finishes), roof assemblies, and stairs construction, but exclude excavation and other site development, partitions, building services (electrical, mechanical, fire detection, alarm systems, elevators, etc.), and parking lots;
2) The LCA must assume a building lifetime of 60 years;
3) The life-cycle boundary must account for cradle-to-grave impacts, including resource extraction, product manufacturing and transportation, building construction, product maintenance and replacement, and building demolition/deconstruction/disposal (EN 15804/15978 modules A1-A5, B2-B4, and C1-C4). Operating energy and water consumption are excluded.
4) The Life-Cycle Inventory (LCI) database used must be ISO 14040, 14044, and 21930 compliant, and regionally-specific, if possible;
5) The Life-Cycle Impact Assessment (LCIA) method used must be the US EPA's Tool for the Reduction and Assessment of Chemical and Other Environmental Impacts (TRACI);
6) If the service life of a product used in initial construction is greater than the building's assumed service life, the impacts associated with the product may not be discounted to reflect its remaining service life.

In addition to reporting the embodied carbon as detailed above, projects shall separately report, where readily available, the impacts and benefits beyond the system boundary (EN 15804/15978 module D). This is a quantification of environmental benefits or loads associated with reuse, recycling and energy recovery from flows exiting the system boundary. Note that these impacts are reported for information only, and are not counted towards the embodied carbon of the building.

Projects are also encouraged, but not required, to report:

1) The lifecycle impacts associated with other building elements that are excluded from the mandatory Embodied Carbon reporting.
2) Other calculated life-cycle indicators and impacts, such as ozone layer depletion, acidification, eutrophication, photochemical ozone creation, primary renewable energy use, fresh water consumption, human toxicity, respiratory inorganics, eco-toxicity, and other impacts;
3) A breakdown of impacts by activity (materials/products, transportation, on-site activities, wastage, etc), life-cycle stages (extraction, manufacturing, construction, use/maintenance, end of life), product category (structure, foundation, wall, glazing, etc.), and material type (steel, wood, concrete, plastic, etc).

For projects pursuing LEED v4, calculations created to demonstrate achievement of the Life-cycle Impact Reduction credit, Option 4, and reporting of the proposed building results, are acceptable to meet the intent of this requirement.

7. Requirements for Verified Direct Ventilation

From the policy:

> "All buildings shall be designed and constructed with a ventilation system that provides outdoor air directly to all occupiable spaces, in the quantities defined by code. This includes bedrooms, living rooms, and dens in residential units. The ventilation system shall allow for the designed flow rates to be tested and verified at the occupiable space level as part of the enhanced commissioning process."

This requirement applies to all building types, and is consistent with LEED interpretations of ASHRAE 62.1 for residential buildings. For example, where air is assumed to flow into suites via door undercuts from pressurized corridors, with or without in-suite exhaust fans, is not considered sufficient to provide ventilation directly to all occupiable spaces such as bedrooms and living rooms.

8. Requirements for Low Emitting Materials

From the policy:

> "Emissions from interior materials containing volatile organic compounds (VOCs) or added urea formaldehyde are to be minimized by meeting the content requirements of Green Seal, Green Label, Green Label Plus, FloorScore, South Coast Air Quality Management District (SCAQMD) Rules, or alternate low VOC criteria as applicable to each material or product, and shall contain no added urea formaldehyde resins."

The following table lists the requirements for low emitting material by product category.

Table B.1.8: Detailed Requirements for Low Emitting Materials	
Product Category	Requirement
Interior Paints and Coatings	100% of newly installed products meet California Air Resources Board (CARB) 2007, Suggested Control Measure (SCM) for Architectural Coatings, or South Coast Air Quality Management District (SCAQMD) Rule 1113, effective June 3, 2011 for VOC content.
Interior Adhesives and Sealants	100% of newly installed products meet South Coast Air Quality Management District (SCAQMD) Rule 1168, July 1 2005 for VOC content.
Flooring	At least 95% of newly installed flooring products, by area, meet the requirements of Green Label, Green Labe Plus, or FloorScore certifications, as applicable.
Interior Composite Wood	100% of newly installed composite wood products contain no added urea-formaldehyde resins.

For projects pursuing LEED v4, achievement of at least two points through the Low Emitting Materials credit is acceptable to meet the intent of this requirement.

For projects pursuing WELL v1.1, achievement of the VOC Reduction precondition is acceptable to meet the intent this requirement.

9. Requirements for Indoor Air Quality Testing

From the policy:

> "Indoor air quality testing is to be conducted for formaldehyde, particulates, ozone, total volatile organic compounds, and carbon monoxide prior to occupancy, and report results to the City as compared to acceptable target concentration levels and standards."

The following table lists the target maximum concentrations for low emitting material by product category and measurement method. While it is not required that all tests meet the target concentrations, results that are significantly above the targets (2x or more) must be accompanied by a narrative describing likely contaminant sources contributing to the above-target results.

Table B.1.9: Target Maximum Concentrations by Contaminant Type			
Contaminant	Target Concentration (less than)	ASTM and US EPA Methods	ISO Method
Formaldehyde	27 ppb	ASTM D5197; EPA TO-11 or EPA Compendium Method IP-6	ISO 16000-3
Particulates	$PM_{2.5} < 15$ µg/m³ $PM_{10} < 50$ µg/m³	EPA Compendium Method IP-10	ISO 7708
Ozone	75 ppb	ASTM D5149-02	ISO 12964
Total volatile organic compounds	500 µg/m³	EPA TO-1, TO-15, TO-17, or EPA Compendium Method IP-1	ISO 16000-6
Carbon Monoxide	9 ppm	N/A	ISO 4224

Note: Reproduced from the LEED Canada 2009 and v4 Reference Guides, with permission from the CaGBC.

Residential projects shall conduct air quality testing on at least 10% of the first 100 units, and 5% of all units above 100. Other building types shall test 5% of all major spaces and tenant spaces, with a minimum of 5 test locations.

For projects pursuing LEED v4, achievement of the Indoor Air Quality Assessment credit, Option 2, is acceptable to meet the intent of this requirement.

For projects pursuing WELL v1.1, achievement of the Air Quality Standards precondition is acceptable to meet the intent of this requirement.

10. Requirements for Integrated Rainwater Management and Green Infrastructure

From the policy:

> "Explore and describe measures for the management of the site's rainfall through integrated rainwater management and Green Infrastructure (GI) as described in the City-Wide Integrated Rainwater Management Plan. Project teams can refer to the Citywide Integrated Rainwater Management Plan Volume I: Vision, Principles and Actions and Volume II: Best Management Practice Toolkit, for specific targets and examples of green infrastructure for rainwater management."

The policy allows design teams to select and demonstrate the measures best suited to the project, and points to the City-Wide Integrated Rainwater Management Plan (IRMP) as the measure of success. Volume I creates a city-wide plan for treating rainwater as a resource and enhancing biodiversity, and establishes targets to:

1) Return the first 24mm of rainwater per day into natural pathways such as infiltration into subsoils or evapotranspiration to the air;
2) Treat the water quality of the next 24mm of rainwater per day to remove pollutants such as hydrocarbons, heavy metals, sediments from erosion, excess nutrients and bacteria.
3) Convey safely rainwater from storm events over 48mm per day to minimize damage to buildings or property.

Volume I also highlights biodiversity demonstration projects using green rainwater infrastructure.

Volume II of the City-Wide IRMP is a toolkit of grey and green infrastructure measures available on the City's website that teams can use to identify measures appropriate for the project.

In describing measures included on site, rezoning applications involving new and retrofit development shall develop a site Integrated Rainwater Management Plan (IRMP), that describes how green and grey infrastructure are included in the design manage site rainwater. Staff will work with the applicant early in the process to identify opportunities on private and public property for implementation of best practices and demonstration projects in proximity to the site. The completed site IRMP must include calculations by a qualified professional documenting how the planned grey and green measures perform compared to the City-Wide targets noted above.

For projects pursuing LEED v4, calculations created to demonstrate achievement of the Rainwater Management credit, and reporting of the site design results, are acceptable to meet the intent of this requirement.

11. Requirements for Resilient Drinking Water Access

From the policy:

> "A water fountain, bottle-filling station, or other fixture capable of operating on city water pressure alone and without electricity is to be provided in a location easily accessible to all building occupants."

The potable water access point must be located on a lower floor where residual city water pressure is a minimum of 10 psi. Larger multifamily buildings should consider having one such fixture for every 75 occupants.

B.2) Submission Requirements for Low Emissions Green Buildings

The following sections describe in detail the required submissions for Low Emissions Green Buildings at each project phase. All submissions must reflect the current design at a given stage of development.

Rezoning Enquiry

As part of the Rezoning Enquiry package, the applicant should indicate that they will be pursuing the Low Emissions Green Buildings path within the Green Buildings Policy for Rezoning, and include a preliminary strategy to achieve the energy, heat loss, and greenhouse gas limits. Preliminary strategies, opportunities, or constraints for the site IRMP should also be identified at this stage.

Rezoning Application

Applicants must submit:

- A Sustainable Design Strategy confirming that the design submitted is on target to meet the requirements of the policy, that describes the sustainable design elements and strategies included in the project, and shall specifically include the following:
    - B.1: For LEED projects, a preliminary LEED checklist and narrative strategy to achieve a Gold rating, completed by a LEED AP;
    - B.2: Brief summary of strategies and measures to achieve performance limits for energy use, heat loss, and greenhouse gas emissions;
    - B.6.2: Preliminary embodied emissions calculations, and a description of specific measures that will be explored during design to reduce embodied emissions;
    - B.10: The site IRMP, describing the chosen strategies and green and grey infrastructure measures included in the landscape and building design. The IRMP must describe how these measures contribute to the city-wide IRMP targets for water volume reduction and quality treatment, and may include calculations to compare site performance to the City-Wide targets;
    - Commitment by the owner to meet the requirements of the Green Buildings Policy for Rezonings with documentation to be submitted at a later project phase, including:
        - B.3: design, build, and test to meet an airtightness target of 2.0 L/s/m² @ 75 Pa;
        - B.4: complete an enhanced commissioning process;
        - B.5: design and build to include building metering and sub-metering of energy, and to enter into agreement on energy reporting, including assistance for building future owners;
        - B.6.1: complete refrigerant emissions calculations;
        - B.7: design and build a direct ventilation system;
        - B.8: design and build with low-emitting materials;
        - B.9: test indoor air quality prior to occupancy;
        - B.11: design and build a resilient potable water access point.
- B.2: Preliminary Zero Emissions Building Plan (ZEBP) Energy Checklist, completed by the project energy modeller, showing that the project meets the performance limits for energy use, heat loss, and greenhouse gas emissions, together with key inputs;
- B.2: 2-4 page summary of detailed energy model inputs for detailed and/or 3rd party review; and,
- B.10: Landscape and architectural plans highlighting the green and grey infrastructure measures described in the site IRMP.

Development Permit Application

The applicants must submit the following, updated to reflect any significant changes since Rezoning Application:

- An updated Sustainable Design Strategy, confirming that the design submitted is on target to meet the requirements of the policy, and describing the specific built features planned for the development;
- B.1: For LEED projects, a copy of the project registration must be provided and the project registration number must be included on an updated LEED checklist.

In addition, applicants must submit:

- B.10: The completed site IRMP, and calculations comparing the site performance to the City-Wide targets. All grey or green infrastructure features must be detailed sufficiently on the plans and documents prior to development permit issuance. Development permit drawings may be used for the final visual inspection at the end of the project.

Building Permit Application

Applicants must submit the following as part of the standard drawing submission:

- B.3: On the architectural plans, sections, and details, indicate and highlight:
    - the location of the continuous air-barrier;
    - notes or references for specification of the air-barrier materials, and/or techniques;
    - notes or references for specification of the airtightness plan, and airtightness testing.
- B.5.1: On the mechanical and/or electrical drawings, indicate master energy meters as well as sub-meters (including virtual meters or associated control points, where possible);
- B.7: On the mechanical drawings, indicate the direct ventilation system(s) and volumes provided directly to all occupiable spaces, including bedrooms, living rooms, and dens;
- B.10: On the architectural, landscape, and mechanical plans, indicate green and grey infrastructure design measures, as described in the site integrated rainwater management plan;
- B.11: On the plumbing drawings, indicate a water-access point capable of operating without power;

In addition to the above, applicants must submit the following:

- B.1: For LEED projects, a LEED checklist representing the building permit stage design, completed by a LEED AP, showing compliance with the requirements of this policy;
- B.2: Zero Emissions Building Plan (ZEBP) Energy Checklist, showing the building permit stage design meets the performance limits for energy use, heat loss, and greenhouse gas emissions, together with key inputs;
- B.2: 2-4 page summary of detailed model inputs for 3rd party review;
- B.4: Commissioning Plan signed by the Commissioning Authority;
- B.6.2: Embodied emissions calculations representing the building permit stage design, and a description of what measures, if any, were taken to reduce embodied emissions;
- B.6.1: Refrigerant emissions calculations representing the building permit stage design;
- B.8: Letter signed by the project architect or designer, confirming that low-emitting materials were specified.

Occupancy Permit Application

Applicants must submit:

- B.2: Final Zero Emissions Building Plan (ZEBP) Energy Checklist, updated to reflect any major changes during construction that affect the performance of the building. The updated checklist must be completed by the project energy modeller, and show the project still meets the performance limits for energy use, heat loss, and greenhouse gas emissions, together with key inputs;
- B.2: Final 2-4 page summary of detailed model inputs for 3rd party review;
- B.3: Airtightness testing report summarizing the test procedure and results, or intermediate testing report for phased occupancy projects, together with drawings clearly showing testing zones, blower door locations, and other important testing items;
- B.4: Draft Commissioning Report signed by the Commissioning Authority, detailing commissioning activities completed to date (including, at a minimum, a summary of the functional performance testing completed for all energy using systems and associated issue logs), activities scheduled for after occupancy, and testing and balancing reports for the ventilation system;
- B.6.1: Final refrigerant emissions calculations, updated to reflect any major changes during construction to the refrigerant types or volumes used the building;
- B.6.2: Final embodied emissions calculations, updated to reflect any major changes during construction that affect the embodied emissions of the building;
- B.8: Letter signed by the project architect, general contractor, and owner confirming that low-emitting materials were installed, and a summary table of installed products by category;
- B.9: A brief indoor air quality test report from the testing agency summarizing the results, and for results above the target concentrations, a narrative of likely contaminant sources causing the high readings.

Post-Occupancy

Applicants must submit the following within 12 months of occupancy:

- B.1: For LEED projects, confirmation of successful LEED certification from a LEED AP;
- B.3: For projects that followed a phased-occupancy process, the final airtightness testing reports;
- B.4: Final Commissioning Report, including results of deferred activities and seasonal commissioning;
- B.5.2: Confirmation that the Portfolio Manager account has been setup, and a qualified service provider retained to assist with and review annual energy benchmarking to the City for at least three years.

ADMINISTRATION

Projects demonstrating that the building is extremely ill-suited to achieving a specific requirement may request that the requirement be modified, or deemed not applicable, at the discretion of the Director of Planning.

Renovations

Note that this policy applies to new buildings (including additions) and reconstructions.

Reconstruction is defined in the Building By-law as any project where: extensive renovations are being carried on throughout the entire building and the building is completely gutted; where all drywall and plaster has been removed from the interior walls; all drywall, plaster, insulation and exterior cladding has been removed from the exterior walls; and all floor and roof membranes and coverings have been removed. Reconstruction also includes substantial reconfiguration of the interior floor space. Reconstruction means exposing the primary structure of the building on all interior and exterior walls, floors and roof with only the primary structural elements remaining in place (the building skeleton). Where work which might otherwise be considered as reconstruction, is undertaken solely to facilitate the repair of a building due to envelope damage, insect infestation, mould abatement or asbestos abatement, then the work would not be considered a reconstruction: it would be considered a repair, minor renovation or a major renovation as defined in the Building By-law.

Renovations of existing buildings that are not reconstruction must still meet all building code and upgrade requirements, and are encouraged to incorporate the requirements of this policy where possible.

Townhomes

Buildings consisting entirely of townhomes (including stacked townhomes) may use the following modifications to the requirements for Low Emissions Green Buildings:

1) In lieu of the TEUI, TEDI, and GHGI performance limits for low-rise residential buildings, townhomes may be designed and built to meet an equivalent EnerGuide score and GHGI acceptable to the City;
2) In lieu of whole-building airtightness testing, projects may design, build, and test each townhome individually to meet a limit of 3.5 ACH@50Pa;
3) In lieu of the full requirements of Section B.4, Enhanced Commissioning of townhomes may focus on the start-up, testing, balancing, and verification of proper operation of the mechanical systems, including the heat recovery ventilator, ventilation system, and the heating and cooling systems;
4) As noted in Section B.5.1, sub-meters are not required for individual residential suites;
5) As noted in Section B.5.2, energy reporting requirements are not applicable to buildings with less than 20 units.

Small Residential Buildings

Small residential buildings that can be modelled using the EnerGuide software (buildings under four storeys and less than 1,800m²) may use the following modifications to the requirements for Low Emissions Green Buildings:

1) In lieu of the TEUI, TEDI, and GHGI performance limits for low-rise residential buildings, small residential buildings may be designed and built to meet an equivalent EnerGuide score and GHGI acceptable to the City.
2) As noted in Section 5.2, energy reporting requirements are not applicable to buildings with less than 20 units.

APPENDIX A: SUMMARY TABLE OF SUBMISSION DOCUMENTS

Note: This table is a summary of the submission documents – for full details refer to the relevant sections.

Requirement	Submission Documents				
	Rezoning Application	**Development Permit**	**Building Permit**	**Occupancy Permit**	**Post-Occupancy**
A.1 Passive House or alternate	• Letter from CPHC with preliminary PHPP results and design strategies	• PHPP model and copy of verification page • Letter from CPHC stating that a Certifier has been retained	• PHPP model and PH design summary report • Design Stage Assurance Letter from PH Certifier • PH Commissioning and Airtightness Plan	• Final letter from PH Certifier • Letter from a Registered Professional	• Copy of certification from PHI
B.1 LEED Gold (if applicable)	• Sustainable Design Strategy (SDS), with preliminary LEED Checklist and Narrative from LEED AP	• Updated SDS with LEED Checklist and Narrative from LEED AP • Copy of LEED registration	• Updated LEED Checklist and Narrative from LEED AP		• Copy of LEED Gold Certification from LEED AP
B.2 Performance Limits	• ZEBP Energy Checklist • 2-4 page summary of energy model inputs	• Updated ZEBP Energy Checklist • Updated 2-4 page summary of energy model inputs	• Updated ZEBP Energy Checklist to reflect detailed design • Updated 2-4 page summary of energy model inputs	• Final ZEBP Energy Checklist • Final 2-4 page summary of energy model inputs	
B.3 Airtightness	• SDS committing the owner to design, build, and test to airtightness target		• Architectural drawings detailing continuous air barrier and referencing specs for airtightness	• Airtightness testing report • Drawings showing testing zones and fan locations	• Final airtightness testing report for projects with phased occupancy
B.4 Enhanced Commissioning	• SDS committing the owner to enhanced commissioning process		• Commissioning Plan	• Draft Commissioning Report	• Final Commissioning Report
B.5.1 Energy System Sub-Metering	• SDS committing the owner to energy system sub-metering		• Mechanical/electrical drawings must show sub-meters		
B.5.2 Energy Reporting	• SDS committing the owner to energy reporting				• Confirmation of setup of Portfolio Manager account • Confirmation of assistance with benchmarking for min. 3 years
B.6.1 Refrigerant Emissions	• SDS committing the owner to refrigerant emissions calculations		• Calculations of refrigerant emissions	• Final calculations of refrigerant emissions	
B.6.2 Embodied Emissions	• SDS with preliminary embodied emissions calculations		• Calculations of embodied emissions	• Final calculations of embodied emissions	
B.7 Direct	• SDS committing the owner to		• Mechanical drawings must show a		

Requirement	Submission Documents				
	Rezoning Application	**Development Permit**	**Building Permit**	**Occupancy Permit**	**Post-Occupancy**
Ventilation	design and build direct ventilation system		direct ventilation system		
B.8 Low Emitting Materials	• SDS committing the owner to design and build direct with low emitting materials			• Letter from Architect, owner, contractor stating low-emitting materials were used, with summary table of products by category	
B.9 IAQ Testing	• SDS committing the owner to IAQ testing			• IAQ test report, with narrative for high readings	
B.10 Site IRMP and Green Infrastructure	• SDS with site IRMP	• Final site IRMP with calculations	• Mechanical and/or landscape drawings must show grey and/or green infrastructure measures		
B.11 Resilient Water Access	• SDS committing the owner to design and build resilient water access point		• Plumbing drawings must show resilient water access point(s)		