



# RR-3

## ADMINISTRATIVE REPORT

Report Date: January 26, 2017  
Contact: Chris Higgins  
Contact No.: 604.871.6288  
RTS No.: 11658  
VanRIMS No.: 08-2000-20  
Meeting Date: February 7, 2017

TO: Vancouver City Council

FROM: General Manager of Planning, Urban Design and Sustainability and General Manager of Development, Buildings and Licensing

SUBJECT: Energy Efficiency Updates to Vancouver's Building By-law and Related Additional Changes

### *RECOMMENDATION*

- A. THAT Council approve amendments to the Building By-law, generally as described in this report and as set out in Appendix A to this report, to increase the energy efficiency requirements for multi-unit residential buildings under seven storeys, including townhomes, and for exceptionally large new single family dwellings, to take effect March 1, 2018;

FURTHER THAT that the Director of Legal Services be instructed to bring forward the necessary Building By-law amending by-law for consideration by Council.

- B. THAT Council approve amendments to the Electrical By-law, generally as set out in Appendix B to this report, to clarify the circumstances in which the energy efficiency requirements in the Building By-law would apply to electrical work during the renovation of an existing building, to take effect May 1, 2017;

FURTHER THAT the Director of Legal Services be instructed to bring forward the necessary Electrical By-law amending by-law for consideration by Council.

- C. THAT Council approve amendments to the Green Buildings Policy for Rezoning to require annual energy reporting generally as set out in Appendix C to this report.

- D. THAT Council instruct staff to develop recommendations to complement the energy efficiency requirements in A above, including:

- i. develop a definition of low-carbon energy systems and providing for an alternative compliance path within the Building By-law for buildings connected to, or utilizing, said systems;
- ii. reviewing City by-laws, policies and plans that currently require buildings to be connectable to a neighbourhood energy system and recommending changes to clarify that these connectivity requirements only apply if a low-carbon energy supply, as will be defined per D.i. above, has been secured; and
- iii. reviewing City by-laws and recommending changes to ensure that useable floor space is not reduced as a result of increased wall thickness required to accommodate increased insulation requirements in A above;

FURTHER THAT staff be instructed to report back on the above by no later than June 30, 2017.

### ***REPORT SUMMARY***

This report recommends amendments to Vancouver's 2014 Building By-law (BBL) that focuses on reducing energy use and greenhouse gas (GHG) emissions in new multi-family residential buildings 6 storeys and under by aligning the efficiency requirements for these buildings with those already in place for detached houses. If approved, this alignment will simplify compliance for builders and limit increases in GHG emissions from new development as newly built multi-family buildings will emit between 40% and 55% fewer emissions than under the current BBL requirements.

The changes are consistent with the approach recommended in the Zero Emissions Building Plan adopted by Council in 2015. Negligible construction cost increases are expected and it is estimated that the modest if any increase in monthly mortgage costs would be more than offset by energy utility bill reductions, saving new condo owners \$9/month as soon as they move in. While this is a modest savings when considering housing costs in Vancouver, the energy savings to homeowners and renters over the five years that these changes are expected to be in-effect would total an estimated \$2.8 million.

In addition to these savings, occupants of the new units will benefit from decreased street noise and improved thermal comfort as well as improved indoor air quality.

The report also recommends: the creation of a performance path for these new requirements in the BBL for new buildings connecting to a low-carbon energy system; developing changes to other by-laws as necessary to ensure that the added insulation requirements do not reduce allowed floor space; establishing a cap on the maximum GHG emissions for exceptionally large new houses; requiring that buildings seeking to be rezoned commit to reporting their annual energy usage; and that those buildings undergoing renovation and not requiring a building permit, be required to meet the applicable electrical safety and energy efficiency requirement of the Electrical By-law and the Building By-Law.

### *COUNCIL AUTHORITY/PREVIOUS DECISIONS*

In July 2004, Council adopted the Green Building Strategy, to demonstrate leadership in energy and water efficiency in new civic facilities in order to help normalize these building and design approaches and facilitate their adoption by the broader market.

In June 2008, Council adopted a set of Building By-law amendments directed at reducing the environmental impacts of new one- and two-family dwellings and introduced new requirements for air tightness and heat recovery ventilation.

In July 2010, Council approved the Green Building Policy for Rezoning which required all applicable developments applying for rezoning to achieve a LEED Gold rating with an emphasis on energy and water efficiency. This policy was developed to use a well-established City process (rezoning) to help transition industry toward more sustainable building practices including the development of more energy efficient low-rise multi-family buildings.

In October 2012, Council approved the Vancouver Neighbourhood Energy Strategy and Energy Centre Guidelines to foster the development of shared infrastructure capable of delivering renewable heat energy to new and existing buildings in high density neighbourhoods.

In April 2014, Council adopted the 2014 Building By-law that further increased the energy efficiency requirements for one- and two-family dwellings and laneway houses.

In July 2016, Council approved the Zero Emissions Building Plan to achieve zero emissions for all newly permitted buildings by 2030 that included intermediary, time-stepped GHG emission and energy efficiency limits for each building type for inclusion in the Building By-law.

In November 2016, Council approved changes to the Green Buildings Policy for Rezoning that began the implementation of the Zero Emissions Building Plan by establishing GHG and heat loss limits on rezoned buildings while also requiring air tightness testing and direct ventilation.

### *CITY MANAGER'S/GENERAL MANAGER'S COMMENTS*

The recommended amendments will align the energy efficiency requirements for multi-family buildings 6 storeys and under with those already in place for detached homes and simplify compliance for builders and suppliers. These improvements will achieve significant GHG reductions from an increasingly popular form of development without affecting housing affordability. The City Manager supports these recommendations.

## *REPORT*

### *Background/Context*

The Zero Emissions Building Plan calls for time stepped reductions in greenhouse gas emissions and heat loss for new buildings.

The energy efficiency measures proposed for these Building By-law amendments for low-rise multi-family buildings have been used successfully for a number of years in the part of the Building By-law dedicated to 1&2 family homes. These measures which focus on increased insulation, improved window performance, building air tightness, heat recovery ventilation and equipment efficiencies have delivered a 48% reduction in greenhouse gases in 1&2 family buildings. The use of heat recovery ventilators in residential buildings has been demonstrated to not only reduce energy use but also to improve indoor air quality and health outcomes for occupants. Builders and developers have demonstrated these measures are effective and that the equipment and materials are widely available locally, are cost effective, and result in better homes.

Many of the same designers, builders and trades that build single family homes also build town homes and residential buildings up to and including 6 storeys and this success can be achieved by these similar building types.

In addition, many new buildings of this form have been developed under the City's Green Buildings Policy for Rezoning and have successfully incorporated many of the measures in the proposed Bylaw updates. These buildings have shifted standard construction approaches towards more efficient lighting, heating, and water systems along with improved ventilation system designs. As approved in the Zero Emission Plan, practices and building systems that have been successfully applied by over 5 years through the rezoning policy should be incorporated into the building bylaw to establish a new minimum baseline of performance.

The Zero Emission New Building Plan establishes a series of actions to achieve zero emissions new buildings. The proposed By-law updates continue the implementation of this plan as Vancouver moves towards zero emission new buildings.

### Consultation

A broad range of consultation activities was undertaken using multiple formats and across a wide diversity of stakeholders. Consultation took the form of stakeholder workshops, letters, electronic surveys, and meetings and correspondence with individual stakeholders. The range of stakeholders engaged included: homeowners, landlords, building owners/operators, and professional associations; industry groups; equipment manufacturers and suppliers; energy utilities; and developers, designers, and builder groups.

A full list of organizations consulted with in the development of these Building By-law amendments is listed in Appendix D and includes:

- Condominium Home Owners Association
- Greater Vancouver Homebuilders Association
- Urban Development Institute
- Architectural Institute of British Columbia
- Association of Professional Engineers and Geoscientists of British Columbia
- Landlord BC
- Fenestration British Columbia
- Fortis BC
- BC Hydro

The original draft recommendations for energy efficiency were developed with stakeholder interests in mind. These included the simplification of building operation and maintenance for owners and occupants, streamlining of requirements and permitting processes, cost effectiveness, and industry capacity to implement the proposed changes.

That said, numerous changes and additions to the recommendations were made resulting from the feedback and ideas generated through this consultation. Especially important to stakeholders was to allow at least one year from the time that the Bylaw amendments were finalized before they came into effect and ensuring that the increased wall thickness required to accommodate the increased insulation would not diminish useable floor space. As a result, general support for the final recommendations was achieved.

In addition, stakeholders commended the joint consultations that occurred in the development of these changes and those recommended to improve water efficiency. They strongly urged that a coordinated approach to all changes and implementation dates to city by-laws that impact new construction moving forward. We are working to implement this stakeholder feedback.

### *Strategic Analysis*

The proposed changes focus on improving energy efficiency in low-rise multifamily residential buildings as another step in implementing the Zero Emissions Building Plan and the Renewable City Strategy.

#### Zero Emissions Building Plan

On average, 82% of new Vancouver development square footage is residential, 2% is office space, and 16% is a wide variety of building types. Of the 82% of new development that is residential, low-rise multi-family (including town homes) represent a growing portion. This form of development is often built out of wood, so design, construction methods, and materials/equipment used have considerable overlap with other forms of wood frame buildings like 1&2 family homes.

The recommended Building By-law amendments for GHG reductions and energy efficiency apply only to new low-rise multi-family buildings (6 storeys and under, including townhouses). These changes will reduce greenhouse gas emissions from newly permitted low-rise multi-family buildings between 40% and 55% with a focus on reducing space heating demand through increased wall, foundation and roof insulation, improved air tightness and heat recovery ventilation, and increased equipment efficiency. The requirements for these elements have been aligned with those required for one and two family homes.

Currently there is one requirement for one and two family homes, a different requirement for multifamily under 4 storeys (including town homes), and another requirement for 4-6 storey multi-family buildings. Alignment of the Building Bylaw requirements for all these forms will streamline work flow for City staff (inspections, development planners, etc) while also simplifying work for developers, builders, and building equipment suppliers (such as windows).

The proposed Building By-law requirements for 4-6 storey residential buildings maintain two paths to demonstrate compliance as is currently allowed: a prescriptive path and a performance path. At present, half of new developments follow the prescriptive path and half follow the performance Path.

Each path's proposed changes are discussed below. The recommended amendments to the Building By-law reflecting these changes are as generally set out in Appendix A.

#### Prescriptive Compliance Path

The prescriptive compliance path establishes clear minimum energy efficiency performance requirement for each key building element. This path provides simplicity and avoids the cost associated with energy modelling. The recommended prescriptive requirements align with those prescriptive requirements already in the Building By-law for new one and two family buildings. Consistent with the current By-law, the prescriptive path is the only path for multi-family buildings under 4 storeys.

TABLE 1: Prescriptive Envelope Requirements

| Components Metric (Imperial)      | 1&2 Family [Existing /Required] | MURB<4 Storeys (inc townhome) [Proposed] | MURB 4-6 Storey [Proposed]     |
|-----------------------------------|---------------------------------|--|--------------------------------|
| Walls (above and below grade) RSI | 3.85 (R22)                      | 3.85 (R22)                               | 3.85 (R22)                     |
| Flat or cathedral Roof RSI        | 4.3 (R28)                       | 5.28 (R30)                               | 5.28 (R30)                     |
| Full Attic RSI                    | 8.5 (R48)                       | 8.5 (R48)                                | 8.5 (R48)                      |
| Under slab RSI                    | 2.5 (R14)                       | 2.5 (R14)                                | 2.5 (R14)                      |
| Windows + sliding glass doors     | U 1.4 (.25)                     | U 1.4 (.25)                              | U 1.4 (.25)                    |
| Airtightness (not converted M/I)  | Testing + 3.5ACH50              | Testing + 3.5ACH50                       | Testing + 2.0/liters/second/m2 |

The above requirements for increased wall insulation will result in slightly thicker walls and therefore reduced usable floor area. If these recommended updates to Building By-law are approved by Council, staff will develop and recommend changes to the Zoning and Development By-law, or other bylaws and guidelines as required, to ensure no decrease in permitted useable floor area occurs.

**TABLE 2: Prescriptive Equipment Requirements**

| <b>Mechanical Components</b>                            | <b>1&amp;2 Family</b>                              | <b>MURB&lt;4 Storeys (inc townhome)</b>                        | <b>MURB 4-6 Storey</b>   |
|---|--|--|--|
| <b>Heat Recovery ventilator with Direct ventilation</b> | 65% sensible heat recovery efficiency (SRE) at 0C  | 65% SRE at 0C  | 65% SRE at 0C  |
| <b>Furnace / Make up air</b>                            | 92% Annual Fuel Utilization Efficiency (AFUE)      | 92% AFUE   | 92% AFUE   |
| <b>Boiler</b>   | 92% AFUE   | 92% AFUE   | 92% AFUE   |
| <b>Domestic Hot Water</b>                               | 78%, Energy Factor (EF) of .78                     | 78%, EF of .78   | 78%, EF of .78   |
| <b>Fireplaces</b>                                       | Direct Vent Electronic Ignition                    | Direct Vent Electronic Ignition + Must be on a fireplace timer | Direct Vent Electronic Ignition + Must be on a fireplace timer |
| <b>Outdoor fireplaces</b>                               | Electronic Ignition + Must be on a fireplace timer | Electronic Ignition + Must be on a fireplace timer             | Electronic Ignition + Must be on a fireplace timer             |

In addition to the above, requirements have also been established for lighting efficiency; drain water heat recovery, solar energy readiness, limiting thermal bridges in concrete, the use of programmable thermostats, and the use of EnerGuide. EnerGuide is the official mark of the Government of Canada for its energy performance rating and labelling program for homes. It is a comprehensive energy modelling and air tightness testing program that results in more comfortable, efficient homes with a lower operating cost. Details of these requirements are included in Appendix A.

### Performance Path

The performance compliance path provides for increased design flexibility in material and equipment selection for 4-6 storey buildings while still achieving similar efficiency outcomes as would occur using the prescriptive path. For example, slightly reduced wall insulation might be compensated for by having higher performance windows to ensure the overall performance requirements of the building are maintained.

Under this compliance path, a building energy model following City approved modelling guidelines is required to ensure that the building meets the established performance requirements. As recommended under the Zero Emissions Building Plan, the recommended changes to the performance path under the BBL applicable to new multi-family building 6 storeys and under are not permitted to exceed maximum allowed limits for GHG emissions or heat loss (i.e. thermal energy demand intensity TEDI).

#### Proposed Performance Compliance Path Upper Limits for Multi-Unit Residential Buildings 6 Storeys and Under

|                                  | GHG kg/m <sup>2</sup> *a | TEDI kWh/m <sup>2</sup> *a | EUI kWh/m <sup>2</sup> *a |
|----------------------------------|--------------------------|----------------------------|---------------------------|
| Proposed By-law Performance Path | 5.5                      | 25                         | 110                       |

### GHG Reductions for Large New Single Family Homes

In addition to the recommended Building By-law changes for multi-family residential buildings 6 storeys and under, this report also recommends that large new single family homes will be required to demonstrate leadership in energy efficiency and low-carbon design. The recommended Building By-law amendments as generally set out in Appendix A require new homes over 325 square meters (approximately 3500 square feet) to be designed so as to limit the total greenhouse gas footprint to that of a 325 square meter (~3500 square feet) home. The larger the home above this threshold, the greater leadership in improved design, better building envelopes, and improved equipment that will be required to comply with the carbon pollution cap.

This house size was identified as a small portion of the overall number of homes with a significant greenhouse gas footprint. Vancouver's average new single family home size (including both East and West side developments) is 2,600 square feet. For reference, the average new home size in BC is 1,900 square feet. Large luxury homes have the opportunity and ability to demonstrate energy efficiency leadership. Greenhouse gas and energy modelling has shown that reducing greenhouse gases for homes of this size is straightforward with commonly used local methods and technology.

### Cost Implications

The energy efficiency and GHG improvements recommended here were specifically developed to ensure that changes resulted in cost savings on a monthly basis for



residents. The costs of these measures and savings that are expected to be achieved were shared with stakeholders to ensure reasonable assumptions and accuracy. Detailed financial analysis is available in Appendix E.

The new requirements for townhouses are expected to add an average of \$4 per square foot and while it's unlikely this would result in a change in purchase price (which is established by the market and not construction costs), if the purchase price was impacted it would increase the mortgage payment by an estimated \$27 per month. This modest increase in cost would be offset by the estimated \$37 in monthly energy cost savings. A new purchaser would benefit from reduced monthly housing costs while enjoying improved thermal comfort and indoor air quality. Additional detail can be seen in Appendix E.

The new requirements for multi-family buildings add between \$2-\$4 per square foot which theoretically adds an extra \$11 a month in mortgage cost. These energy savings average \$20 a month, resulting in an immediate monthly savings of \$9. Additional detail can be seen in Appendix E.

#### Building By-law Amendments Implementation Planning

Should Council adopt the By-law amendments generally as set out in Appendix A, staff recommend that the amendments come into effect March 1, 2018. This ensures industry has sufficient time to prepare for the changes and allow for the development of compliance tools and training for both industry and staff. Activities to prepare the industry to meet the changes will include but not be limited to:

- updating the "COV Guide to Building R22 Effective Walls" to provide designers and builders of low-rise multi-family buildings guidance and examples for meeting the new insulation requirements;
- developing guidance and training on designing, building, and testing new low-rise multi-family homes to meet the air tightness requirements;
- hosting education and awareness sessions with GVHBA, UDI, AIBC and other industry partners; and
- training on building science and procedures for Energy Advisors who will work with townhouse and low rise multi-family projects to submit high quality applications.

To prepare City staff and avoid any delays in processing permits, work will include but not be limited to:

- training for development planners, plan checkers and inspectors on what acceptable applications look like under the new Building By-law; and
- Sustainability staff will working with development planners, plan checkers and inspectors on the first number of projects to ensure a smooth uninterrupted flow under the new building by-law.

### Development of a Low-Carbon Energy Performance Compliance Path

The Zero Emissions Building Plan recommended that buildings connected to a low-carbon energy system (such as the City's Neighbourhood Energy Utility in South East False Creek) have slightly less stringent heat loss and energy use intensity limits than non-connected buildings. Low-carbon energy system connected buildings would be required to meet the same GHG limits as non-connected buildings through a hybrid of investing in both envelope improvements and connection to a low-carbon energy system to meet the buildings heating needs.

In order to develop this compliance option, the City must define what is required to be recognized as a low-carbon energy system and establish a policy to guide decisions as to when a low-carbon energy supply has been secured.

In addition, the City has numerous areas where neighbourhood energy utility connectivity is required but a low-carbon energy supply has not yet been secured. In these situations, it will not be practical for buildings to comply with the proposed GHG limits recommended in the Building By-law. If a building is required to be built to be low-carbon NEU connectable and low-carbon energy is not secured, the intended GHG limits proposed could be exceeded by as much as 70%.

To avoid this situation from arising when the Building By-law changes recommended come into effect, the City must also amend all existing by-laws, plans and policies that currently require NEU connectivity to clarify that connectivity requirements only apply when low-carbon energy supply has been secured and connection can be compelled.

### Additional New Building Energy Efficiency Updates

In addition to the Building By-law and related changes discussed above, staff also recommend that the Rezoning Policy for Green Buildings be amended to require annual energy use reporting and that the Electrical By-law be amended to ensure that buildings undergoing renovations comply with the electrical efficiency requirements.

#### Green Buildings Policy for Rezonings:

Energy reporting was intended as an important requirement of the Green Building Policy updates approved by Council in November 2016. While this requirement was supported by stakeholders during the consultations for the Policy updates, it was not included in the amendments in November as a mechanism to secure energy reporting had to be finalized. An appropriate mechanism has now been confirmed and staff recommends this minor amendment to the Green Buildings Policy for Rezonings as set out in Appendix C.

Energy reporting, including the annual compilation, normalization, and reporting of whole-building energy use using a standardized platform such as Energy Star Portfolio Manager will enable building owners to identify opportunities to conserve use and will provide the City with critical actual performance data essential to streamlining and optimizing energy efficiency policies and bylaws.

**Electrical By-law Amendment:**

Staff recommend amendments to the Electrical By-Law as generally set out in Appendix B to ensure that those developments undergoing renovation and not requiring a building permit conform with the applicable electrical safety standards in Electrical By-law and the energy efficiency standards in the Building By-law.

***Implications/Related Issues/Risk (if applicable)******Financial***

There are no financial implications for the City. That said the energy savings to homeowners and renters would total an estimated \$2.8 million over 5 years, \$7 million over 10 years, and over \$15 million over 20 years.

***Human Resources/Labour Relations***

There are no human resources / labour relations implications.

***Environmental***

The changes recommended in this report will limit the increases in GHG emissions from new development as newly built multi-family buildings will emit between 40% and 55% fewer emissions than under the current BBL requirements. This will prevent greenhouse gasses of 7,600 metric tonnes after 5 years, 18,500 metric tonnes after 10 years and over 40,000 metric tonnes after 20 years.

***Legal***

The Vancouver Charter authorizes Council to enact by-laws for regulating the construction of buildings where the conservation of energy or water, or the reduction of greenhouse gases is concerned.

***CONCLUSION***

This report recommends amendments to Vancouver's 2014 Building By-law (BBL) that focus on reducing energy use and greenhouse gas (GHG) emissions in new multi-family residential buildings 6 storeys and under by aligning the efficiency requirements for these buildings with those already in place for detached houses. If approved, this alignment will simplify compliance for builders and limit increases in GHG emissions from new development as newly built multi-family buildings will emit between 40% and 55% fewer emissions than under the current BBL requirements.

The changes are consistent with the approach recommended in the Zero Emissions Building Plan adopted by Council in 2015.

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BY-LAW NO. \_\_\_\_\_

**A By-law to amend the Building By-law No. 10908  
Regarding Sustainability & Energy Efficiency amendments.**

THE COUNCIL OF THE CITY OF VANCOUVER, in public meeting, enacts as follows:

1. This By-law amends the indicated provisions of Building By-law No. 10908.
2. In Book I, Division A, Part 1, Council amends Article 1.4.1.2. by adding in alphabetical order the following definition:

*“Greenhouse Gas* has the meaning attributed to it in section 559 of the Vancouver Charter”

3. In Book I, Division A, Part 1, Council amends Article 1.4.2.1. by adding in alphabetical order the following abbreviations:

“ERV ..... Energy Recovery Ventilator  
GHG ..... Greenhouse Gas  
HRV ..... Heat Recovery Ventilator”

4. In Book I, Division B, Part 1, Article 1.3.1.2., in Table 1.3.1.2.(1) Council:

- a) strikes out the line:

“

|     |                  |  |              |
|-----|------------------|--|--------------|
| CSA | CAN/CSA-F326-M91 | Residential Mechanical Ventilation Systems | 9.32.3.1.(1) |
|-----|------------------|--|--------------|

”

and substitutes:

“

|     |                  |  |                                |
|-----|------------------|--|--------------------------------|
| CSA | CAN/CSA-F326-M91 | Residential Mechanical Ventilation Systems | 9.32.3.1.(1),<br>10.2.3.17.(3) |
|-----|------------------|--|--------------------------------|

”

; and

- b) adds in alphanumeric sequence:

“

|     |                       |  |            |
|-----|-----------------------|--|------------|
| CSA | CSA 2.6/ ANSI Z83.8   | Gas unit heaters, gas packaged heaters, gas utility heaters and gas-fired duct furnaces  | 10.2.2.14. |
| CSA | CSA 4.3/ANSI Z21.10.3 | Gas Water Heaters Volume III, Storage Water Heaters, with Input Ratings above 75,000 Btu per hour, Circulating and Instantaneous | 10.2.2.12. |

”

|     |                         |   |               |
|-----|-------------------------|---|---------------|
| CSA | CSA B55.1-15            | Test Method for Measuring Efficiency and Pressure Loss of Drain Water Heat Recovery Units                         | 10.2.2.11.(3) |
| CSA | CSA B55.2-15            | Drain water heat recovery units   | 10.2.2.11.(3) |
| CSA | CAN/CSA B415.1-10       | Performance Testing of Solid-Fuel-Burning Heating Appliances  | 10.2.2.16.    |
| CSA | CSA C22.2 No. 113M-1984 | Fans and Ventilators  | 10.2.3.17.(3) |
| CSA | CSA C191-04             | Performance of electric storage tank water heaters for domestic hot water service                                 | 10.2.2.12.    |
| CSA | CSA P.2-07              | Testing Method for Measuring the Annual Fuel Utilization Efficiency of Residential Gas-Fired Furnaces and Boilers | 10.2.2.13.    |
| CSA | CSA P.3-04              | Testing Method for Measuring Energy Consumption and Determining Efficiencies of Gas-Fired Storage Water Heaters   | 10.2.2.12.    |
| CSA | CSA P.7-10              | Testing Method for Measuring Energy Loss of Gas-Fired Instantaneous Water Heaters                                 | 10.2.2.12.    |

5. In Book I, Division B, Part 10, Council strikes out Section 10.2 and substitutes the following:

## “SECTION 10.2. ENERGY EFFICIENCY

### 10.2.1. Energy Design Building Classification

#### 10.2.1.1. Application

1) Except as permitted by Sentence (2), a *building* shall be designed and constructed in conformance with this Subsection for the purpose of energy efficiency.

2) A structure that cannot be identified by the characteristics of a *building* in this Subsection shall comply with the requirements of 10.2.1.2., or as deemed *acceptable* to the Chief Building Official.

3) To meet the energy efficiency requirements of Articles 10.2.1.2. to 10.2.1.5., the design requirements of Subsection 10.2.2. shall form an integral part of this Subsection.

#### 10.2.1.2. Residential Buildings Over 6 Storeys in Building Height and Commercial Buildings (with or without Residential Components)

1) All *buildings* other than those designed in accordance with 10.2.1.3 through 10.2.1.5., shall

- a) be designed in accordance with Article 10.2.2.2. or Article 10.2.2.3.,
- b) Reserved,
- c) Reserved,
- d) Reserved,
- e) be provided with vestibules for all doors in accordance with Article 10.2.2.8.,
- f) be provided with metering equipment in compliance with Article 10.2.2.9,
- g) be provided with lighting controls in conformance with Article 10.2.2.10. ,
- h) be provided with mechanical equipment complying with Articles 10.2.2.11. through 10.2.2.14. ,
- i) conform with Article 10.2.2.15. where fire places are provided, and
- j) conform with Article 10.2.2.17. where heat recovery ventilators are provided.

#### 10.2.1.3. Residential Buildings of 4 to 6 Storeys (other than 1 or 2 Family Dwellings)

1) Except as otherwise required by this Subsection, a *building*, other than a 1 or 2 Family Dwelling, which is 4 to 6 *storeys* in building height and which is classified as Group C *major occupancy* containing no other *major occupancies*, excluding Group F Division 3 (Storage Garage) occupancy subsidiary to the Group C *major occupancy*, shall

- a) be designed in accordance with Article 10.2.2.2. or Article 10.2.2.3.,
- b) be designed in compliance with the enhanced energy requirements of Article 10.2.2.5. ,
- c) be provided with insulation in conforming with Article 10.2.2.6. ,
- d) be provided with windows and doors conforming with Article 10.2.2.7. ,
- e) be provided with vestibules for all doors in accordance with Article 10.2.2.8. ,
- f) be provided with metering equipment in compliance with Article 10.2.2.9. ,
- g) be provided with lighting controls in conformance with Article 10.2.2.10. ,
- h) be provided with mechanical equipment complying with Articles 10.2.2.11. through 10.2.2.14. ,
- i) conform with Article 10.2.2.15. where domestic gas fireplaces are provided, and
- j) conform with Article 10.2.2.17. where heat recovery ventilators are provided.
- k) provide documentation and a rating system audit in accordance with Article 10.2.2.20.

#### 10.2.1.4. Residential Buildings of 1 to 3 Storeys (other than 1 or 2 Family Dwellings)

1) Except as otherwise required in this Subsection, a *building*, other than a 1 or 2 Family Dwelling, which is less than 4 *storeys* in *building height*, and which is entirely classified as Group C *major occupancy*, excluding Group F Division 3 (Storage Garage) *occupancy* subsidiary to the Group C *major occupancy*, shall

- a) be provided with thermal insulation in conformance with Article 10.2.2.6.,
- b) be provided with windows and doors conforming with Article 10.2.2.7.,
- c) be provided with vestibules for all doors in accordance with Article 10.2.2.8.,
- d) be provided with metering equipment in compliance with Article 10.2.2.9.,
- e) be provided with lighting controls in conformance with Article 10.2.2.10.,
- f) where provided, domestic hot water heating shall comply with Article 10.2.2.11. through 10.2.2.13. as applicable,
- g) comply with Article 10.2.2.14. where domestic gas heated furnaces or make-up air units are provided,
- h) comply with Article 10.2.2.15. where domestic gas fireplaces are provided,
- i) conform with Article 10.2.2.17. where heat recovery ventilators are provided,
- j) be designed with a solar photovoltaic ready pipe run in accordance with Article 10.2.2.19., and
- k) provide documentation and a rating system audit in accordance with Article 10.2.2.20.

#### 10.2.1.5. One and Two Family Dwellings

1) Except as otherwise required in this Subsection, a *one family dwelling* and *two-family dwelling*, with or without *secondary suites* or *lock-off units*, and including *laneway houses*, shall

- a) be designed with thermal insulation in conformance with Article 10.2.2.6.,
- b) be designed with windows and doors conforming with Article 10.2.2.7.,
- c) be provided with metering equipment in compliance with Article 10.2.2.9.,
- d) be provided with lighting controls in conformance with Article 10.2.2.10.,
- e) where provided, domestic hot water heating shall comply with Article 10.2.2.11. through 10.2.2.13. as applicable,
- f) where provided, domestic gas heated furnaces or make-up air units shall comply with Article 10.2.2.14.,
- g) where provided, domestic fireplaces shall comply with Article 10.2.2.15. and 10.2.2.16. as applicable,
- h) except for *laneway houses*, conform with Article 10.2.2.17. where heat recovery ventilators are provided,
- i) be designed with a solar ready pipe run in accordance with Article 10.2.2.18., and
- j) provide documentation and a rating system audit in accordance with Article 10.2.2.20.

#### 10.2.2. Design Measures for Energy Efficiency

##### 10.2.2.1. Application

1) This Subsection applies to all *buildings* and parts of the *buildings* that are required to be energy efficient under Subsection 10.2.1.

#### 10.2.2.2. ANSI/ASHRAE/IESNA 90.1

1) A building designed in accordance with this Article shall, be designed and constructed in accordance with ANSI/ASHRAE/IESNA 90.1, "Energy Standard for Buildings, except Low-Rise Residential Buildings", and with

- a) a climate zone of 5,
- b) ventilation in conformance with ASHRAE 62 (except addendum n),
- c) the 5 per cent in Table 11.3.1.5. Building Envelope, Exception a., being replaced by 2 per cent, if designed in accordance with ASHRAE 90.1, Section 11,
- d) no requirement to comply with the Fenestration Orientation provisions of ASHRAE 90.1, Article 5.5.4.5.,
- e) no requirement to comply with Automatic Receptacle Control, per ASHRAE 90.1, Article 8.4.2., and
- f) lighting control per ASHRAE 90.1 Article 9.4.1.3.(b), except that the maximum period of no activity shall be reduced to 20 min.

#### 10.2.2.3. National Energy Code of Canada for Buildings

1) A *building* designed in accordance with this Article shall be designed and constructed in accordance with the National Energy Code of Canada for Buildings (NECB), except that the provisions of this By-law shall apply where the NECB refers to the National Building Code of Canada (NBCC), and shall be designed with

- a) a climate zone of 4,
- b) ventilation in conformance with ASHRAE 62 (except addendum n),
- c) window-to-wall and skylight-to-roof area ratios of the reference *building* identical to area ratios of the proposed *building*,
- d) a vertical glazing Solar Heat Gain Coefficient which does not exceed an assembly maximum of 0.40,
- e) a Skylight Solar Heat Gain Coefficient without curb, or with curb and glass, which does not exceed an assembly maximum of 0.49, where the ratio of the aggregate skylight area to roof area is less than or equal to 2.0 per cent,
- f) a Skylight Solar Heat Gain Coefficient without curb, or with curb and glass, which does not exceed an assembly maximum of 0.39, where the ratio of the aggregate skylight area to roof area is greater than 2.0 per cent and less than or equal to 5.0 per cent, and
- g) a Skylight Solar Heat Gain Coefficient with curb and plastic which does not exceed an assembly maximum of 0.77, where the ratio of the aggregate skylight area to roof area is less than or equal to 2.0 per cent.



10.2.2.4. Reserved.

10.2.2.5. Building Envelope Opaque Elements and Simulation Performance

1) A *building* required to comply with this Article, shall be designed and constructed in accordance with Table 10.2.2.5.(1), and simulated in accordance with performance values of the proposed building not exceeding an annual site energy use intensity of 110 kWh/m<sup>2</sup>, and an annual *greenhouse gas* emissions intensity of 5.5 kg/m<sup>2</sup>, and an annual *thermal energy demand intensity* of 25 kWh/m<sup>2</sup>.

| Table 10.2.2.5.(1)<br>Minimum Effective Thermal Resistance of Assemblies in <i>Buildings</i> of Group C Major Occupancy Containing No Other <i>Major Occupancies</i><br>Forming part of Sentence 10.2.2.5.(1) |   |
|---|---|
| <i>Building Assembly</i>  | Assembly Minimum RSI Value(m <sup>2</sup> ° K/W), |
| Full Attic <sup>(1)</sup> & Other   | 8.5   |
| Cathedral Ceilings and Flat Roofs   | 5.28  |
| Walls (above & below grade)   | 3.85  |
| Concrete Slabs at grade or below grade <sup>(2)</sup>   | 2.1 (nominal)                                     |

Notes to Table 10.2.2.5.(1):

<sup>(1)</sup> The thermal transmittance rating of attic space insulation may be reduced to value required for frame walls for a distance of 1.0 m from the exterior wall.

<sup>(2)</sup> For buildings more than 1000 m<sup>2</sup> in *building area*, thermal insulation shall be provided for a distance of 1.2 m inboard of the slab perimeter.

2) [Reserved]

3) Notwithstanding the requirements of Sentence (1), the associated components of a *building* required to comply with this Article need not comply with the Thermal Transmittance and Equipment Minimum Energy Efficiency requirements of Sentence (1) where

- a) in a *building* designed in accordance with Article 10.2.2.1., the performance values exceed that required by ANSI/ASHRAE/IESNA 90.1, "Energy Standard for Buildings, except Low-Rise Residential Buildings", or
- b) in a *building* designed in accordance with Article 10.2.2.2., where performance values are exceeded by National Energy Code of Canada for Buildings (NECB).

10.2.2.6. Building Envelope Opaque Elements

1) Except as otherwise required in this Subsection, a *building* required to comply with this Article shall be provided with thermal insulation complying with the values in Table 10.2.2.6., between

- a) heated space and unheated space,
- b) heated space and exterior air,
- c) heated space and exterior *soil*,
- d) heating floor assemblies and heated space,
- e) heating floor assemblies and unheated space,
- f) heating floor assemblies and exterior air, and
- g) heating floor assemblies and exterior *soil*.

| <b>Table 10.2.2.6.<br/>Minimum Effective Thermal Resistance of Assemblies in Buildings of Group C Major<br/>Occupancy Containing No Other <i>Major Occupancies</i><br/>Forming part of Sentences 10.2.2.6.(1)</b> |  |
|---|--|
| <b>Building Assembly</b>  | <b>Assembly Minimum RSI Value<br/>(m<sup>2</sup>° K/W)</b> |
| Attic Space other than one and two family dwellings <sup>(1)</sup>  | 6.8  |
| Attic Space for one and two family dwellings <sup>(1)</sup>   | 8.5  |
| Roof Joist Assemblies for one and two family dwellings<br>(Cathedral Ceilings/Flat Roofs)   | 4.3  |
| Roof Assemblies other than one and two family dwellings<br>(Cathedral Ceilings / Flat Roofs)  | 5.28   |
| Frame Walls other than one and two family dwellings<br>(including frame crawl space walls)  | 3.85   |
| Frame Walls for one and two family dwellings (including<br>frame crawl space walls)   | 3.85   |
| Concrete or Masonry Walls (other than foundation walls)   | 3.85   |
| Suspended Floors (framed)   | 4.2  |
| Suspended Floors (concrete slab)  | 4.2  |
| Foundation Walls  | 3.85   |
| Concrete Slabs on Ground at, above, or below grade<br>(insulation under all slab area and around edge of slab))   | 2.5  |
| Radiant Heating Suspended Floor Assembly Over Heated<br>Area (insulation between heated floor and heated area<br>below) <sup>(2)</sup>  | 2.5  |
| Concrete Balconies, Eyebrows, and Exposed Slab Edge<br>(wrapped or using manufacturer thermal break in<br>structure)  | 0.42   |

**Notes to Table 10.2.2.6.:**

<sup>(1)</sup> The thermal resistance rating of attic space insulation may be reduced to value required for frame walls for a distance of 1.0 m from the exterior wall.

<sup>(2)</sup> Not applicable when heating elements or piping are located within a concrete topping on a suspended floor assembly or within an internally heated suspended slab.

2) Insulation and the installation of insulation in a *building* designed to the requirements of Part 9 shall conform to Subsection 9.25.2. or Part 5.

3) The effective total “R” value of the opaque envelope area, the non-opaque envelope area, and the overall envelope area, calculated by a design professional, shall be submitted as part of an application for a *building permit*.

**10.2.2.7. Building Envelope Windows, Skylights, and Doors**

1) Except as otherwise required in this Subsection and as permitted by Sentence (2), exterior windows, skylights, and doors shall have a maximum thermal transmittance (u-value) in conformance with Table 10.2.2.2.(1) and shall be labeled accordingly. (See Appendix A)

| <b>Table 10.2.2.7.(1)</b><br><b>Maximum Thermal Transmittance of Exterior Closures for One and Two-family Dwellings, One and Two-Family Dwellings with Secondary Suites or Lock-off unit, and Laneway Houses</b><br>Forming part of Sentence 10.2.2.2.(1) |  |
|---|--|
| Type of Closure   | Maximum Thermal Transmittance (W/(m <sup>2</sup> K)) |
| Windows and sliding doors with glazing  | 1.4  |
| Doors without glazing   | 1.8  |
| Side hinged doors, glazed or opaque   | 1.8  |
| Door transoms and sidelites   | 1.8  |
| Fire Rated Doors that are exempt from air water structural  | Exempt   |
| Roof access hatches   | 2.9  |
| Skylights   | 2.4  |
| Curtainwall Assemblies  | 1.4  |

2) Entry doors consisting of one or two leafs installed in the principle entrance of a building, need not comply with Table 10.2.2.2.(1), but shall be thermally broken metal or wood (where allowed) with multiple panes of glass, argon fill, 1+ low e coating and shall be labeled so as to clearly identify their thermal transmittance. (See Appendix A)

3) Doors, windows and glazed assemblies shall be labeled so as to clearly identify their thermal transmittance. (See Appendix A)

**10.2.2.8. Building Envelope Vestibules**

1) Except as permitted in Sentence (2), in a *building* required to comply with this Article there shall be an enclosed vestibule in all *building* entrances separating a conditioned space from the exterior, designed such that

- a) all doors opening into and out of the vestibule shall be equipped with self-closing devices,
- b) the interior and exterior doors of the vestibule shall be separated by no less than 2.1 m when closed,
- c) the exterior envelope of a conditioned vestibule shall comply with the design requirements for a conditioned space, and
- d) the interior and exterior envelope of an unconditioned vestibule shall comply with the design requirements for a semi heated space.

2) An enclosed vestibule is not required for

- a) a *building* entrance with revolving doors,
- b) a door not intended to be used as the *building* entrance,
- c) a door opening directly to the exterior from a *dwelling unit*,
- d) a *building* entrance, in a *building* less than 278.7 m<sup>2</sup> in gross *floor area*, and
- e) a door which is separate from the *building* entrance and opens directly to the exterior from a space that is less than 278.7 m<sup>2</sup> in gross *floor area*.

#### 10.2.2.9. Building Services Submetering

1) Every *building* shall be equipped with metering equipment capable of collecting *building* energy performance data for the *building* and for every portion of the *building* which supports a separate use or *occupancy*.

2) Submetering required by this Article shall include the following

- a) hot water generated by a central hot water generation system
- b) natural gas used for air handling systems in common areas, and
- c) natural gas used for domestic hot water in amenity spaces, pools and spas.

#### 10.2.2.10. Lighting Controls in Residential Buildings

1) Except for a *building* designed in accordance with Article 10.2.2.1. or 10.2.2.2., where a residential *building* or a portion of a multi-use *building* contains more than 20 residential *suites*, the *building* shall be designed with

- a) *occupancy* based lighting sensor controls, located in all *exit* stair shafts and parking garages, compatible with the requirements of Sentence 3.2.7.3.(1) of Division B, and
- b) a switch near the principal entrance of each residential *suite* that controls all overhead lighting fixtures within the *suite*, except overhead lights serving corridors and stairs within the *suite*.

#### 10.2.2.11. Hot Water Tank Piping

1) In a *building* required to comply with this Article, the first 3 m of non-recirculating hot water piping leading from both electrically heated and gas

heated hot water tanks, and the last 1 m of piping leading to the hot water tank connection, shall have insulation with a minimum RSI value of 0.35.

2) Notwithstanding Sentence (1), a hot water piping system designed to constantly recirculate shall have insulation with a minimum RSI value of 0.35.

3) In a *building* required to comply with this Article, and except for 1 and 2 Family Dwellings, drain water heat recovery devices conforming to CSA B55.2, "Drain water heat recovery units", shall be installed that

- a) serve the principal shower in each dwelling unit,
- b) are of double walled construction, and
- c) have a steady state efficiency of 42% or greater when tested in accordance with CSA B55.1, "Test Method for Measuring Efficiency and Pressure Loss of Drain Water Heat Recovery Units."

#### 10.2.2.12. Domestic Gas-Heated Hot Water Heaters

1) In a *building* required to comply with this Article, gas-heated appliances providing domestic hot water only shall have an energy factor of not less than 78 per cent, except that existing homes may have an energy factor of not less than 62 per cent, as determined by the following

- a) CSA P.3-04, "Testing Method for Measuring Energy Consumption and Determining Efficiencies of Gas-Fired Storage Water Heaters",
- b) CSA P.7-10, "Testing Method for Measuring Energy Loss of Gas-Fired Instantaneous Water Heaters",
- c) CSA C191-04, "Performance of electric storage tank water heaters for domestic hot water service", or
- d) CSA 4.3/ANSI Z21.10.3, "Gas Water Heaters Volume III, Storage Water Heaters, with Input Ratings above 75,000 Btu per hour, Circulating and Instantaneous".

#### 10.2.2.13. Domestic Gas-Heated Boilers

1) In a *building* required to comply with this Article, domestic gas-heated boilers providing heat, or heat and domestic hot water, shall have an Annual Fuel Utilization Efficiency (AFUE) rating of not less than 92 per cent, as tested using CSA P.2-07, "Testing Method for Measuring the Annual Fuel Utilization Efficiency of Residential Gas-fired Furnaces and Boilers".

#### 10.2.2.14. Domestic Gas-Heated Furnaces or Make Up Air Units

1) In a *building* required to comply with this Article, domestic gas-heated furnaces or make up air units shall have an Annual Fuel Utilization Efficiency (AFUE) rating of not less than 92 per cent, as tested using CSA 2.6/ANSI Z83.8, "Gas unit heaters, gas packaged heaters, gas utility heaters and gas-fired duct furnaces".

#### 10.2.2.15. Domestic Gas-Fired Fireplaces

- 1) In a *building* required to comply with this Article, domestic gas-fired fireplaces in conditioned spaces shall be equipped with
  - a) intermittent pilot ignition (IPI) systems, or
  - b) on-demand ignition systems that automatically shut off within
    - i) 7 days of appliance non-use in a one or two family dwelling building, or
    - ii) 6 hours of appliance non-use in a multifamily dwelling.
- 2) In a *building* required to comply with this Article, domestic gas-fired fireplaces shall be direct vented.

#### 10.2.2.16. Domestic Wood Burning Heating Appliances

- 1) In a *building* required to comply with this Article, and except for cooking stoves and ranges, a wood domestic burning heating appliance installed in a residential *dwelling unit* shall be tested in accordance with CAN/CSA B415.1-10 "Performance Testing of Solid-Fuel-Burning Heating Appliances" or EPA Title 40, Part 60, Subpart AAA - "Standards of Performance for New Residential Wood Heaters", and shall
  - a) produce not more than 2.5 grams per hour of particulate air contaminant emissions for catalytic appliances, or
  - b) produce not more than 4.5 grams per hour of particulate air contaminant emissions for non-catalytic appliances.
- 2) Open masonry fireplaces and factory-built fireplaces are not permitted.

#### 10.2.2.17. Domestic Heat Recovery Ventilators

- 1) In a *building* required to comply with this Article, each dwelling unit shall be served by a heat recovery ventilator located in
  - a) each dwelling *unit*, or
  - b) a commonly accessible location if serving multiple *dwelling units*.
- 2) In a *building* required to comply with this Article, components of mechanical ventilation systems not specifically described in this Subsection shall be designed, constructed and installed in accordance with good engineering practice and as described in the ASHRAE Handbooks and Standards, HRAI Digest, TECA Ventilation Guideline, Hydronics Institute Manuals or the SMACNA manuals.
- 3) In a *building* required to comply with this Article, a heat recovery ventilator (HRV) shall

- a) be sized to run at its rated speed for continuous operation while achieving a 65 per cent sensible heat recovery efficiency (65 per cent Minimum SRE at 0°C) and be designed and tested in conformance with CSA 22.2 No. 113M-1984,
- b) be designed and tested to meet the CSA International Standard CAN/CSA-F326-M91, "Residential Mechanical Ventilation Systems",
- c) be installed and commissioned by persons trained by the Thermal Environmental Comfort Association (TECA) or the Heating, Refrigeration and Air Conditioning Institute of Canada (HRAI) or equivalent,
- d) supply outdoor air directly to the principal living area, to each bedroom, and to any *floor area* without a bedroom, including similar rooms within *secondary suites* and *lock-off units*, directly or indirectly, through a central recirculation system with a continuously operating fan,
- e) be designed to run continuously to comply with the minimum ventilation rates of Table 9.32.3.3.A of Division B,
- f) not be connected to kitchen and bathroom exhaust fans,
- g) have exterior connected supply-air ducts and exhaust ducts insulated to not less than RSI 0.75 (R 4.25) and shall have an effective vapour barrier,
- h) have balanced HRV supply and exhaust air flows within plus or minus 20 per cent of the actual normal operating exhaust capacity,
- i) be labelled with tested supply and exhaust air flows for high and low settings, measured in CFM, and
- j) be located within *conditioned space* and fully serviceable space in the dwelling unit for access.

4) In a *building* required to comply with this Article, the HRV system contractor or installer shall provide a completed Mechanical Ventilation Checklist to the Chief Building Official.

5) In a *building* required to comply with this Article, a contractor trained in the installation of energy recovery ventilators (ERV) may install an ERV in lieu of a heat recovery ventilator (HRV).

#### 10.2.2.18. Solar Ready Pipe Run

1) In a *building* required to comply with this Article, a solar ready pipe chase, consisting of at least two 50 mm PVC pipes, capped at both ends and having at least a 20° angle measured above the horizontal level, shall extend from a location near the *service water heater*, to the attic space.

#### 10.2.2.19. Solar Photovoltaic Ready Pipe Run

1) In a *building* required to comply with this Article, a solar ready pipe chase, consisting of at least one 25 mm pipe or liquid tight flexible Electrical conduit or electrical metallic tubing capped at both ends and having at least a 20° angle measured above the horizontal level, shall extend from a location near the service water heater, to the attic space.

**10.2.2.20. EnerGuide Rating System Audit or Passive House Planning Package File (PHPP)**

1) In a *building* required to comply with this Article, at the time of building permit application, the owner shall provide to the Chief Building Official *acceptable* documentation demonstrating that the building to be constructed will comply with EnerGuide, PHPP or other *acceptable* standards.

- a) At the time of final inspection, the owner shall provide the Chief Building Official with an EnerGuide Rating System Audit or PHPP file, *acceptable* to the Chief Building Official, and shall comply with the requirements of Sentence (2),
- b) A ground oriented dwelling unit shall have a maximum of 3.5 air changes per hour at 50 pascals or be sealed according to good engineering practice (see Appendix A), and
- c) A Multifamily building shall have a maximum of 2.03 L/s·m<sup>2</sup> at 75 pascals or be sealed according to good engineering practice (see Appendix A).

2) In a *building* required to comply with this Article, and where a *one family dwelling* or *two family dwelling*, with or without *secondary suites* or *lock-off units*, contains *conditioned space* of more than 325 m<sup>2</sup>, including *suites* that are not strata titled, the owner shall

- a) provide a calculation utilizing the EnerGuide rating system to demonstrate that the proposed home has a greenhouse gas (GHG) footprint that is no more than the greenhouse gas (GHG) footprint of a 325 m<sup>2</sup> home built to the minimum standards in the Building Bylaw, and
- b) meet the requirements of the modeling guidelines for large homes.

6. In Book I, Division B, Part 10, Council strikes out Section 10.4 and substitutes the following:

**“SECTION 10.4. ELECTRIC VEHICLE CHARGING**

**10.4.3. Electric Vehicle Charging for Buildings**

**10.4.3.1. Electrical Service and Capacity**  
(See Appendix A)

1) The electrical installations, including the service capacity of the installation, the number and distribution of circuits and receptacles, shall meet the requirements of the “Electrical Safety Regulation.”

2) Except as provided by Sentence (3), each storage garage or carport in one-family dwellings, two-family dwellings, one-family dwellings or two family dwellings with secondary suites or lock-off units, or laneway houses shall be provided with an electrical outlet, a receptacle or electric vehicle supply equipment where applicable, supplied by a branch circuit rated not less than 40 A at the nominal voltage of 208 V



or 240 V as applicable and labelled to identify its intended use with the electric vehicle supply equipment.

3) Where the requirements of Sentence (2) would cause the dwelling unit calculated load to exceed 200 A, the installation of a 40 A branch circuit may be omitted provided that a minimum nominal trade size of 21 raceway supplied with pull string leading from the dwelling unit panelboard to an electrical outlet box is installed in the storage garage or carport and is labelled to identify its intended use with the electric vehicle supply equipment.

4) One residential parking stall in each group of five residential parking stalls, and, one residential parking stall in any group of less than five residential parking stalls, in a multi-family building or in the multi-family component of a mixed use building that includes three or more dwelling units shall be provided with an electrical outlet, a receptacle or electric vehicle supply equipment where applicable, for the use of electric vehicle charging.

5) One commercial parking stall in each group of 10 commercial parking stalls, and one commercial parking stall in any group of less than 10 commercial parking stalls, in a commercial building, including the commercial component of a mixed use building shall be provided with an electrical outlet, a receptacle or electric vehicle supply equipment where applicable, for the use of electric vehicle charging.

6) The electrical outlet, receptacle or supply equipment described in Sentences (4) and (5) shall be supplied by a branch circuit rated not less than 40 A at the nominal voltage of 208 V or 240 V as applicable.

#### 10.4.3.2. Electrical Rooms

1) In a multi-family building or the multi-family component of a mixed use building, with three or more dwelling units, an electrical room shall be designed with sufficient space for the future installation of electrical equipment necessary to support electric vehicle charging in all residential parking stalls.

## Section 10.5. Objectives and Functional Statements

### 10.5.1. Objectives and Functional Statements

#### 10.5.1.1. Attribution to Acceptable Solutions

1) For the purposes of compliance with this {By-law} as required in Clause 1.2.1.1.(1)(b) of Division A of Division A, the objectives and functional statements attributed to the acceptable solutions in this Part shall be the objectives and functional statements listed in Table 10.4.1.1. (See Appendix Note A-1.1.1.2.(1) of Division A in Appendix A)

Table 10.5.1.1.

|   |
|---|
| Table 10.4.1.1. is located in Volume {2}, Attribution Tables. |
|---|

7. In Book I, Division B, Appendix A, Council repeals Appendix Note A-10.2.1.1.(3).
8. In Book I, Division B, Appendix A, Council strikes out the Appendix Note A-10.2.2.2. and substitutes the following:

**"A-10.2.2.7. Windows, Glass Doors and Skylights**

Compliance with the energy performance requirements of the By-law is demonstrated by means of labels affixed to the products at the manufacturing location.

The energy performance labels recognized for By-law compliance are the labels required by the BC Energy Efficiency Act (BCEEA). The BCEEA requires all manufactured windows, sliding glass doors and skylights to bear labels certifying the product U-values determined according to the NFRC 100-2010 or CSA A440.2-09 standards. Each product shall bear two labels: a removable "temporary" label indicating the product U-value, and a non-removable "permanent" marking or label identifying the certification entity and the manufacturer. All windows, sliding glass doors and skylights sold in BC are required to bear such labels.

Valid labels must bear the trademark of a third-party verifier. The following verification agencies are recognized for this purpose, and provide a permanent label:

- Canadian Standards Association (CSA) International, Toronto, ON, [www.csa-international.org](http://www.csa-international.org)
- Intertek Testing Services NA Ltd. (Warnock Hersey), Coquitlam, B.C., 604-520-3321 [www.intertek-etlsemko.com](http://www.intertek-etlsemko.com)
- Quality Auditing Institute Ltd. (QAI), Port Moody, B.C., 604 527-8378, [www.qai.org](http://www.qai.org)
- Agencies accredited by the National Fenestration Rating Council (NFRC), Greenbelt, MD, [www.nfrc.org](http://www.nfrc.org). These agencies include: WDMA, NAMI, Keystone and AAMA.

In the case of products complying with the By-law under the "flexibility provision", Professional engineers, and architects authorized to practice in British Columbia are designated for the purpose of verifying energy performance in the same manner as in BCEEA 4 (1.2) (a) and (b).

The certification programs that verify U-values according to these standards require these labels to be applied at the factory. They do not permit labels to be applied at the jobsite without prior authorization of the certifier.

Fenestration products may have more than one U-value label applied to them. For example, a window with an operable casement beside a fixed lite commonly has two labels: one on the fixed lite, another on the casement. The U-value of the operable component is typically higher. When there is more than one label on a fenestration

product, the one with the highest U-value is used to represent the performance of the product.

Permanent markings serve to identify the energy performance verifier, the product manufacturer, and the product line after the temporary labels are removed. They confirm that the product's energy performance has been verified, and allows records about that product line's energy performance to be retrieved by the verifier. Permanent markings may be in the form of an inconspicuous label adhered to the window or sliding door frame, sometimes on the edge of a sash so as to be less visible. They may also be etched into the glass at one of the corners of a pane.

The CEA shall verify that each fenestration product has a permanent marking from the same verifier as shown on the temporary label. A product that does not have such a permanent marking in addition to the temporary label is not verified, and does not comply with the By-law.

Products may comply with the By-law under a "flexibility provision" and demonstrate compliance with an energy performance certification accompanied by supporting documentation. A registered professional, usually a professional engineer specializing in energy performance simulation, will submit a signed and dated written energy performance certification accompanied by supporting documentation to establish that the average overall U-value of all the fenestration products in the home is not greater than  $1.4 \text{ x W}/(\text{m}^2 \text{ x K})$ .

The energy performance certification shall be affixed to a prominent fenestration product at the jobsite in a visible location. The CEA shall remove the energy performance certification and submit it to the City with the [insert name] inspection report.

The energy performance certification should include the following:

1. A cover letter on the professional's letterhead that includes:
  - a. The professional's identity and contact information.
  - b. The physical and legal addresses of the building.
  - c. The area weighted overall average U-value of all the fenestration in the building.
  - d. An attestation by the professional that he/she has verified that the information provided in the energy performance certification and accompanying documentation reports the overall average U-value of the products installed at the building.
  - e. The name, address and contact information of the fenestration product supplier(s).
  - f. The name, address and contact information of the glass supplier(s) (if different from the fenestration product supplier).
  - g. The name, address and contact information of the individual(s) or firm(s) that performed the energy performance simulations (if different from the professional).
  - h. A complete list of the supporting documentation attached to the letter.

- i. The professional's seal and signature.
2. An attached documentation package that includes:
  - a. A list of each fenestration product type, quantity, size, area, description, and NFRC 100-2010/CSA A440.2-09 U-value.
  - b. The sizes and configurations of the simulated products as shown by frame elevations and/or shop drawings, keyed to the list.
  - c. A table of the area-weighting calculations performed to determine the overall average U-value.
  - d. A description of each framing system used, including manufacturer name, series, and model numbers, as well as frame material and any internal reinforcing used.
  - e. A complete description of the glazing, including overall glass thickness, number of panes, pane thicknesses, gap width(s), low-E coating manufacturer and type, low-E coating emissivity, and surfaces to which coatings are applied, type of gap fill with percentage(s) of inert gas, complete description of spacer by make, series, and model, and its constituent materials, and insulating glass edge sealant materials.
  - f. Isotherms for each unique framing member used in each system covered by the letter (heads, sills, jambs, mullions)."
9. In Book I, Division B, Appendix A, Council strikes out the Appendix Note A-10.2.2.12.(2). and substitutes the following:

**"A-10.2.2.20.(1)(b) Alternative to the Prescribed Air Change Requirements** Acceptance of Division B Sentence 10.2.2.20.(1)(b) may be obtained by demonstrating that the dwelling has been sealed according to good engineering practice. Prior to the insulation inspection stage, an EGNH Certified Energy Advisor (CEA) must perform a visual inspection of the dwelling and provide the Chief Building Official with a letter of assurance with the CEA's signature indicating that the dwelling has been sealed according to good engineering practice based on a visual inspection. The CEA's letter must be accompanied with a completed "Energy Star Thermal Bypass Checklist" or a thermal scan of the dwelling identifying locations of air leakage or a pre-drywall blower door test."

10. In Book I, Attribution Tables of Division B, Council strikes out Table 10.4.1.1. and substitutes the following:

| Table 10.5.1.1.<br>Objectives and Functional Statements Attributed to the Acceptable Solutions in Part 10<br>Forming part of Sentence 10.5.1.1.(1) |   |
|--|---|
| Acceptable Solutions   | Functional Statements and Objectives <sup>(1)</sup> |
| 10.2.2.2. ANSI/ASHRAE/IESNA 90.1   |   |
| (1)  | [F85, F86-OE1]                                      |
| 10.2.2.3. National Energy Code of Canada for Buildings   |   |
| (1)  | [F85, F86-OE1]                                      |
| 10.2.2.5. Enhanced Energy Efficiency   |   |

| Table 10.5.1.1.<br>Objectives and Functional Statements Attributed to the Acceptable Solutions in Part 10<br>Forming part of Sentence 10.5.1.1.(1) |                  |
|--|------------------|
| (1)  | [F85, F86-OE1]   |
| (2)  | [F85, F86-OE1]   |
| <b>10.2.2.6. Building Envelope Opaque Elements</b>   |                  |
| (1)  | [F85-OE1]        |
| (2)  | [F85-OE1]        |
| <b>10.2.2.7. Windows, Glass Doors and Skylights</b>  |                  |
| (1)  | [F85-OE1]        |
| <b>10.2.2.8. Building Envelope Vestibules</b>  |                  |
| (1)  | [F85-OE1]        |
| <b>10.2.2.9. Sub-metering in Buildings</b>   |                  |
| (1)  | [F86, OE1]       |
| (2)  | [F86, OE1]       |
| <b>10.2.2.10. Lighting Controls in Residential Buildings</b>   |                  |
| (1)  | [F86, OE1]       |
| <b>10.2.2.11. Hot Water Tank Piping</b>  |                  |
| (1)  | [F85-OE1]        |
| (2)  | [F85, F86-OE1]   |
| (3)  | [F100-OE1]       |
| <b>10.2.2.12. Domestic Gas-Heated Hot Water Heaters</b>  |                  |
| (1)  | [F86-OE1]        |
| <b>10.2.2.13. Domestic Gas-Heated Boilers</b>  |                  |
| (1)  | [F86-OE1]        |
| <b>10.2.2.14. Domestic Gas-Heated Furnaces</b>   |                  |
| (1)  | [F86-OE1]        |
| <b>10.2.2.15. Domestic Gas-Fired Fireplaces</b>  |                  |
| (1)  | [F86-OE1]        |
|  | [F41, F44-OS3.4] |
|  | [F44-OH1.1]      |
| <b>10.2.2.16. Domestic Wood Burning Heating Appliances</b>   |                  |
| (1)  | [F86-OE1]        |
|  | [F44-OS3.4]      |
|  | [F44-OH1.1]      |
| <b>10.2.2.17. Domestic Heat Recovery Ventilators</b>   |                  |
| (1)  | [F85-OE1]        |
| (2)  | [F85-OE1]        |
| (3)  | [F85-OE1]        |
| <b>10.2.2.20. EnerGuide Rating System Audit</b>  |                  |
| (1)  | [F85-OE1]        |
| (2)  | [F85-OE1]        |

| Table 10.5.1.1.<br>Objectives and Functional Statements Attributed to the Acceptable Solutions in Part 10<br>Forming part of Sentence 10.5.1.1.(1) |           |
|--|-----------|
| <b>10.3.1.1. Fixture Fitting Maximum Flow Rates</b>  |           |
| (1)  | [F84-OE2] |
| <b>10.3.1.2. Fixture Efficiency</b>  |           |
| (1)  | [F83-OE2] |
| (21)   | [F83-OE2] |

Notes to Table 10.5.1.1.:

<sup>(1)</sup> See Parts 2 and 3 of Division A.

11. A decision by a court that any part of this By-law is illegal, void, or unenforceable severs that part from this By-law, and is not to affect the balance of this By-law.

12. This By-law is to come into force and take effect on March 1, 2018.

ENACTED by Council this                      day of                      , 2017

\_\_\_\_\_  
Mayor

\_\_\_\_\_  
City Clerk

BY-LAW NO. \_\_\_\_\_

**A By-law to amend Electrical By-law No. 5563  
regarding energy efficiency**

THE COUNCIL OF THE CITY OF VANCOUVER, in public meeting, enacts as follows:

1. This By-law amends the indicated provisions of the Electrical By-law.
2. In Section 7, following Sentence 7.3.5, Council adds the following:

**"7.3.6 Energy Efficiency**

Where a building is constructed, renovated, upgraded, or otherwise altered from the existing condition other than for the purposes of repair, an owner shall comply with the Energy Efficiency provisions in Parts 10 and 11 of the applicable Building By-law:

- (a) as they pertain to the installation of electrical equipment, devices, conductors, and all associated appurtenances, and
- (b) in the case of existing construction, to the extent required by the application of Parts 10 and Part 11 of the Building By-law."

3. A decision by a court that any part of this By-law is illegal, void, or unenforceable severs that part from this By-law, and is not to effect the balance of this By-law.
4. This Bylaw is to come into force and take effect on May 1, 2017.

ENACTED by Council this \_\_\_\_\_ day of \_\_\_\_\_, 2017

\_\_\_\_\_  
Mayor

## Amendment to Green Building Rezoning Policy

The following text will be added to section B(5) of the Green Buildings Policy for Rezonings, amended November 29, 2016:

“A rezoning applicant may 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. Such an agreement may provide for the hiring of an approved professional service provider to assist the building owner in collecting and submitting energy use data to the City.”

The full policy will then read:

# GREEN BUILDINGS POLICY FOR REZONINGS

*Adopted by City Council on July 22, 2010*

*Amended June 25, 2014*

*Amended November 29, 2016*

All rezonings must meet the following requirements of either:

- A) Near Zero Emissions Buildings, or
- B) Low Emissions Green Buildings.

This policy is effective immediately, and shall be mandatory for all Rezoning Applications received on or after May 1, 2017, with exceptions permitted at the discretion of the Director of Planning. For rezoning Applications received prior to May 1, 2017 that have not yet been approved by Council, applicants may choose to meet this updated version of the Policy or the preceding version.

## REQUIREMENTS

### A) Near Zero Emissions Buildings

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.

OR



## B) Low Emissions Green Buildings

### 1) LEED Gold - Building Design and Construction

All projects - with the exception of residential buildings - shall register with the Canadian Green Building Council (CaGBC) and be designed to achieve LEED Gold certification for Building Design + Construction (BD+C), or an alternate holistic 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.

AND

### 2) Performance Limits

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.

| Performance Limits - Buildings Not Connected to a City-recognized Low Carbon Energy System |                               |                               |  |
|--|-------------------------------|-------------------------------|--|
| Building Type  | TEUI<br>(kWh/m <sup>2</sup> ) | TEDI<br>(kWh/m <sup>2</sup> ) | GHGI<br>(kgCO <sub>2</sub> /m <sup>2</sup> ) |
| 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       |                               |  |

| Performance Limits - Buildings Connected to a City-recognized Low Carbon Energy System |                               |                               |  |
|--|-------------------------------|-------------------------------|--|
| Building Type  | TEUI<br>(kWh/m <sup>2</sup> ) | TEDI<br>(kWh/m <sup>2</sup> ) | GHGI<br>(kgCO <sub>2</sub> /m <sup>2</sup> ) |
| 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

AND

### 3) Airtightness Testing

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<sup>2</sup> @75 Pa (0.40 cfm/ft<sup>2</sup> @ 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\*m<sup>2</sup> @50 Pa (0.23 cfm/ft<sup>2</sup> @ 0.2" w.c.), as tested to ASTM E779 or an equivalent standard.

AND

### 4) Enhanced Commissioning

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.

AND

### 5) Energy System Sub-Metering and Reporting

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.

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.

AND

### 6) Refrigerant Emissions and Embodied Emissions

All projects shall calculate and report the life-cycle equivalent annual carbon dioxide emissions of each building, in kgCO<sub>2</sub>e/m<sup>2</sup>, 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.

All projects shall report the life-cycle equivalent carbon dioxide emissions (ie: global warming potential impact, or 'embodied carbon') of each building, in kgCO<sub>2</sub>e/m<sup>2</sup>, as calculated by a whole-building life-cycle assessment (LCA).

AND

### **7) Verified Direct Ventilation**

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.

AND

### **8) Low-Emitting Materials**

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.

AND

### **9) Indoor Air Quality Testing**

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.

AND

### **10) Integrated Rainwater Management and Green Infrastructure**

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.

AND

### **11) Resilient Drinking Water Access**

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.

## **REQUIREMENT 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 Sustainability.

## **HERITAGE BUILDINGS**

Where a project includes heritage retention, heritage components can be exempted from one or all of the requirements of this policy at the discretion of the Director of Planning.

### Full List of Groups Consulted

Energy updates to the building by-law completed multiple external engagement processes including a wide range of groups. Those groups included:

- Architectural Institute of British Columbia
- Association of Professional Engineers and Geoscientists of British Columbia
- Urban Development Institute
- Greater Vancouver Homebuilders Association
- Landlord BC
- Fenestration British Columbia
- Fortis BC
- BC Hydro
- Passive House Canada
- Canadian Certified Energy Advisors Association
- Natural Resources Canada
- Condominium Home Owners Association

Formal meetings with external stakeholders introduced the proposed updates, answered questions and collected feedback.

# MURB - Six Storey Costing

*This document is intended to be reviewed by those interested in greater detail on cost after reading the low rise Vancouver Building Bylaw update council report. This document contains cost ranges per square meter (per square foot) and takes an average cost for the calculations below. Data gathered in the first table is from a range of projects and published costing data compiled by RDH Building Science. In the case of metric / imperial conversions figures may be rounded.*

## Wood Frame MURB Cost Ranges

| TABLE B.1 LCC ANALYSIS FOR ARCHETYPE 1. |                         |        |
|---|-------------------------|--------|
|   | Incremental Cost, \$/sf |        |
|   | Low                     | High   |
| Walls effective R25                     | \$0.08                  | \$0.12 |
| Walls effective R38                     | \$1.37                  | \$2.06 |
| Roof R-30                               | \$0.15                  | \$0.23 |
| Roof R-40                               | \$0.31                  | \$0.45 |
| Roof R-60                               | \$0.62                  | \$0.91 |
| R15 slab on grade                       | \$0.33                  | \$0.50 |
| Windows U-0.27                          | \$0.89                  | \$1.08 |
| Windows U-0.20                          | \$1.77                  | \$2.17 |
| Windows U-0.14                          | \$2.66                  | \$3.25 |
| Airtightness - Seattle                  | \$0.19                  | \$0.25 |
| Airtightness - Passive House            | \$0.29                  | \$0.49 |
| HRV 60% efficient                       | \$0.82                  | \$0.98 |
| HRV 90% efficient                       | \$5.01                  | \$5.44 |
| Ductless ASHP                           | \$5.38                  | \$6.57 |
| High efficiency condensing MUA          | \$0.11                  | \$0.13 |
| High efficiency condensing DHW          | \$0.20                  | \$0.25 |
| DWHR - heat pump                        | \$0.83                  | \$0.99 |

|                              |        |        |
|------------------------------|--------|--------|
| system                       |        |        |
| DWHR - coil system           | \$0.03 | \$0.03 |
| Low flow water fixtures      | \$0.00 | \$0.39 |
| Lighting - LEDs in corridors | \$0.06 | \$0.09 |
| Lighting - occupancy sensors | \$0.10 | \$0.13 |
| Programmable thermostats     | \$0.05 | \$0.32 |
| A: Next Code Cycle           | \$2.18 | \$3.48 |

**Architype:** a 4700 m<sup>2</sup> (50,600 sqft) 6 storey wood framed building with 8 suites per floor and a lobby on the 1<sup>st</sup> floor and an average suite size of 88 m<sup>2</sup> (950sqft) with 47 suites in the building. This architype / model is a Pacific Northwest National Laboratory typical building and uses its assumptions of energy use.

**Monthly Mortgage Cost (+\$11.47):** Taking the upgrades proposed in the stakeholder engagement presentation, the cost range is in the \$23.67-\$37.66 m<sup>2</sup> (\$2.20-3.50 sqft) (Rounded to one digit in the presentation for simplicity), which yields an average incremental cost of \$30.66 m<sup>2</sup> (\$2.85 sqft). So for an 88 m<sup>2</sup> (950 sqft) dwelling that is \$2707.50 extra in mortgage cost. If a 25 year mortgage at 2% is obtained for a term of 5 years for the additional \$2707.50, that is an extra \$11.47 a month on the mortgage cost.

**Monthly Energy Savings (-\$20.43):** In terms of energy savings the proposed upgrades have been modeled by RDH building Science and others to save 56 kwh/m<sup>2</sup>, this is comprised of 9.2 kwh/m<sup>2</sup> in electrical savings and 46.8 kWh/m<sup>2</sup> in gas savings annually. So, at the rates below, that is 9.2 kwh/m<sup>2</sup> multiplied by the cost of electricity at \$0.1462/kwh which is \$1.345/m<sup>2</sup> multiplied by 88 m<sup>2</sup> equals \$118.36 annually saved, or \$9.86 a month saved. This assumes electrical savings occur at the second rate tier, if they occurred at the first rate tier savings would be about \$3.28 less. With regards to natural gas, 46.8 kWh/m<sup>2</sup> multiplied by the cost of gas at 0.0308/kwh which equals \$1.44 multiplied by 88 m<sup>2</sup> equals \$126.85 annually or \$10.57 a month. Combining monthly electrical savings of \$9.86 and gas savings of \$10.57 we get a total saved per month of \$20.43

**Monthly Net benefit (=\$8.96):** With an extra mortgage cost of \$11.47 and energy savings of \$20.43 the average new home owner has an extra \$8.96 a month in savings. This average case is better than the \$4 a month presented in the slides, part of this reason is the rate that Fortis charges its customers for natural gas was announced that it will be going up 80% effective October 1<sup>st</sup>, so I have used these updated numbers here but did not have them for . Also, for the presentation I was conservative in energy savings whereas here I have picked the average savings figure.







|                           |  |  |   |   |   |           |             |
|---------------------------|--|--|---|---|---|-----------|-------------|
| Above Grade Wall          | 2x6 @ 16"o.c. R20 batt insulation & R20 headers (if electric heat)                               | Double stud wall 2-2x4@16"o.c. R28 batt insulation & R28 headers | 836.75sq .ft AG wall surface area                   | upgrade 2x6 to Double stud wall (2-2x4s with 1/4" gap) with R28 batt, added surcharge for deeper flashing | \$ 620.34   | \$ 750.00 | \$ 1,370.34 |
| Roof Construction         | Engineered truss @ 24"o.c with R 40 batt insulation; cathedral and flat roof R28 batt insulation |  | 465sq.ft truss roof; 44.40sq.ft. R28 cathedral roof | truss roof R 40 batt insulation; cathedral and flat roof R28 batt insulation                              | \$ 200.00   | \$ -      | \$ 200.00   |
| Window Specification      | Dbl pane, metal spacer, no gas fill, no low E, existing frame modeled.                           | USI factor: 1.4  | 188.50sq .ft.                                       |   | \$ 2.50   |           | \$ 471.25   |
| Ventilation Specification | Bathroom and Kitchen fans  |  | 4   | fans  | Delete 3x\$50 per fan +2 hour of labour at \$75 an hour |           | \$ (300.00) |

|                           |                                     |   |                                     |   |   |                                      |             |
|---------------------------|-------------------------------------|---|-------------------------------------|---|---|--------------------------------------|-------------|
| Ventilation Specification | Bathroom and Kitchen fans           | Heat Recovery Ventilator , designed and tested to meet CSA F326                                   | 1                                   | HRV   |   |                                      | \$ 2,500.00 |
| Air Tightness             | Existing 'as built' Air Change Rate | 3.5ACH@50Pa   |                                     | Upgrade electrical boxes to "airtight" plastic boxes, caulk bottom of sill plates to subfloor, additional attention to details with taping/sealing poly air barrier | 30 airtight electrical boxes @\$2.00 upcharge, plus 5 tubes of caulking | 4 additional hours labour @\$75/hour | \$ 385.00   |
| Heating                   | Electric                            | Baseboards  |                                     | No upgrade needed   |   |                                      |             |
| Domestic Hot Water        | Electric                            | Electric Resistance tank  |                                     | No upgrade needed   |   |                                      |             |
| Drain water Heat Recovery | 42% efficient                       |   |                                     |   | 646   | 75                                   | \$721       |
| Low energy lighting       | none                                | Minimum 40% of light fixtures to be wired so as to not accept incandescent or halogen light bulbs | 20 lights in total. 40% is 8 lights | CFL's   | \$ 39.92  | 0                                    | \$ 39.92    |

**Archetype:** a 1510 square foot 3 level middle unit townhome. This is an all-electric (no gas used for space heat or DHW) townhouse as is typical based on a review of permits and talking to developers for a range of townhome projects. This archetype / model is an actual (and typical) project and uses standard Hot2000 assumptions of plug, lighting, appliance and DHW energy use.

**Monthly Mortgage Cost (+\$26.58):** Taking the upgrades proposed in the stakeholder engagement presentation, the cost is \$4.16 sqft. For a 1510 sqft middle unit dwelling, that is \$6278.69 extra in mortgage cost. If a 25 year mortgage at 2% is obtained for a term of 5 years for the additional \$6278.69, this is an extra \$26.58 a month on the mortgage cost.

**Monthly Energy Savings (-\$37.53):** In terms of energy savings, the proposed upgrades have been modeled by E3 EcoGroup to save 2309 kwh annually. At the rates below, that is 3081kwh multiplied by the cost of electricity at \$0.1462/kwh equals \$450.44 saved annually, or \$37.53 saved per month. This assumes electrical savings occur at the second rate tier, which would be typical for an all-electric townhome.

**Monthly Net benefit (=\$10.95):** With an extra mortgage cost of \$26.58 and energy savings of \$37.53, the average new home owner has an extra \$10.95 a month in savings. In the presentation this was conservatively rounded down to \$10.

| Residential Rate          |          |      | Rate Rider | GST | PST | Effective Rate |      |
|---------------------------|----------|------|------------|-----|-----|----------------|------|
| Energy Charges            |          |      |            |     |     |                |      |
| <1350 kWh over two months | \$0.0829 | /kWh | 5%         | 5%  | 7%  | \$ 0.0975      | /kWh |
| >1350 kWh over two months | \$0.1243 | /kWh | 5%         | 5%  | 7%  | \$ 0.1462      | /kWh |
| Demand                    | none     |      |            |     |     |                |      |
|                           |          |      |            |     |     |                |      |

\*It is of note that the energy savings from the drain water heat recovery were not available at the time of initial industry consultations, so they were excluded. When included this will improve the monthly benefit for homeowners by about \$9 at the step 2 rate, or \$6 at the step 1 rate as the savings is in the 772 kwh's annually range for a home with one shower according to Natural Resources Canada. NRCan doubles the figure for homes with two showers.