July
2017

TECHNICAL BULLETIN NO. 1-2017

SUBJECT: REVISIONS to **BC Housing's Sustainability Standards**

as described in

REFERENCE: **BC Housing's Design Guidelines & Construction Standards 2014, Section 3 Energy and Environmental Design**

PURPOSE:

To incorporate BC Housing's building and energy performance target in accordance with the new Provincial Energy Step Code and other sustainability requirements.

Delete entire Section 3 Energy and Environmental Design, BC Housing Design Guidelines and Construction Standards 2014, page 65 – 70 of 306 and replace with attached Section 3 Energy and Environmental Design, 11 pages.

DESCRIPTION:

BC Housing's Sustainability Standards for all BC Housing projects includes:

- the minimum Building and Energy Performance Target verified with energy modelling and airtightness testing;
- passive design strategies;
- energy efficient appliance, incentives and reporting;
- energy conservation measures (ECM);
- water efficient products and design;
- construction, renovation and demolition (C&D) waste management;
- sustainable site management, including construction activity pollution prevention;
- building material selection, including low emitting material requirements.

BRITISH COLUMBIA

BC HOUSING

section

3 Energy and Environmental Design

- Sustainability Goals
- Building and Energy Performance Targets
- Passive Design Strategies
- Energy Efficient Products, Incentives and Reporting
- Construction, Renovation and Demolition Waste Management
- Water Efficient Design
- Building Material Selection
- Sustainable Site Management

1 Sustainability Goals

1.1 BC Housing is committed to actively support the provincial government's actions leading to creation of a low-carbon economy and sustainable future.

1.2 BC Housing's sustainability plan focuses on three strategic areas:

.1 Development of cutting-edge expertise in demonstrated delivery of sustainable social housing.

.2 Gaining recognition within the social housing sector and construction industry as leaders in sustainable social housing.

.3 Establishing a best practice approach to integrating sustainability into all levels of decision making.

1.3 The plan is supported by the following objectives related to buildings:

.1 Reduce energy consumption levels and GHG emissions

.1 BC Housing became Carbon Neutral in 2010.

.2 BC Housing will reduce its greenhouse gas emissions from PRHC owned and leased buildings relative to 2005 baseline by 80% in 2050.

.3 BC Housing monitors and reports to the BC Government energy consumption, and related greenhouse gas emissions, for all of PRHC owned and leased buildings under the legal requirement of Bill 44 – 2007: Greenhouse Gas Reduction Targets Act. The emissions data, as well as GHG reduction actions and plans, and statement of relevant carbon offsets applied, are submitted by BC Housing as a Carbon Neutral Action report to the BC Government. The reports are made publicly available every year by the end of June.

.4 BC Housing has independently adopted a GHG policy for new construction projects that it funds (irrespective of the building ownership) with the goal of reducing GHG emissions to the greatest extent possible while being cost effective. It also requires project managers to include GHG reduction strategies in renovation projects where applicable.

.2 Achieve BC Housing's Building and Energy Performance Targets

BC Housing established the following minimum Performance Targets for all new projects:

- Thermal Energy Demand Intensity (TEDI) (kWh/m^2/yr)
- Total Energy Use Intensity (TEUI) (kWh/m^2/yr)
- Envelope Air Leakage Rate (EALR$_{n75}$) (l/s/m^2)
- Interior Partitions Air Leakage Rate (IPALR$_{n50}$) (l/s/m^2)
- Peak Thermal Load (PTL) (W/m^2)
- Mechanical Energy Use Intensity (MEUI) (kWh/m^2/yr)

Where required by the local by-laws, the BC Housing's Building and Energy Performance Targets should be achieved in addition to the municipal requirement of achieving LEED or other certification. Consult the re-zoning and energy by-law requirements of the Municipality having jurisdiction before establishing the performance criteria for the project.

.3 Improve indoor environmental quality for tenants

BC Housing will ensure high quality, healthy living conditions for its occupants by integrating daylighting and outdoor views into rooms, selecting materials that either reduce or eliminate indoor pollutants and providing high levels of air exchange.

.4 Enhance resource efficiency

BC Housing projects will improve resource efficiency by reducing water consumption, waste generation, and potential damage to the natural environment during construction, renovation, operation and demolition of buildings.

.5 Reduce operating and maintenance costs

BC Housing projects will preferentially select materials and designs that emphasize durability and ease of maintenance to minimize the long term operating costs for the non-profit owner-operators.

.6 Maintain a sustainable procurement policy

The purchase of new products, equipment and appliances shall be limited to green labeled and/or meet a minimum set of criteria for commonly purchased equipment (i.e. heat pumps, hot water tanks, furnaces, boilers and other type of equipment) approved by BC Housing. These items shall be selected from a pre-qualified list of products provided through either Natural Resources Canada (NRCan), BC Hydro or FortisBC (depending on the product).

2 Building and Energy Performance

2.1 REQUIREMENTS

.1 The minimum Performance Targets for all new BC Housing projects shall be as follows:

.1 Part 3 Projects – Combustible (i.e. wood frame)

Climate Zone	Step Code Level	Building Envelope – Maximum TEDI (kWh/m²/yr)	Equipment & Systems – Maximum TEUI (kWh/m²/yr)	EALR$_{N75}$ (L/s*m² @75 Pa)	IPALR$_{N50}$ (l/s/m² @50 Pa)
4	Step 4	15	100	2.0	1.2
5	Step 3	30	120		
6, 7, 8	Step 2	45	130		

.2 Part 3 Projects – Non combustible (i.e. concrete)

Climate Zone	Step Code Level	Building Envelope – Maximum TEDI (kWh/m²/yr)	Equipment & Systems – Maximum TEUI (kWh/m²/yr)	EALR$_{N75}$ (L/s*m² @75 Pa)	IPALR$_{N50}$ (l/s/m² @50 Pa)
4	**Step 3**	**30**	**120**	**2.0**	**1.2**
5, 6, 7, 8	**Step 2**	**45**	**130**		

.3 Part 9 Projects:

All part 9 projects will require Provincial Energy Step Code 4 and blower door testing.

Climate Zone	Step Code Level	Building Envelope	Equipment & Systems	Airtightness Testing (ACH@50pa)
4	**Step 4**	TEDI ≤ **25** kWh/m² /year OR PTL ≤ **25** W/m²	**40%** better than EnerGuide Reference House, OR MEUI – **35** kWh/ m²/year	**≤ 1.5**
5		TEDI ≤ **40** kWh/m² /year OR PTL ≤ **40** W/m²	**40%** better than EnerGuide Reference House, OR MEUI – **45** kWh/ m²/year	
6, 7, 8		TEDI ≤ **50** kWh/m² /year OR PTL ≤ **45** W/m²	**40%** better than EnerGuide Reference House, OR MEUI – **55** kWh/m²/year	

.2 The Energy Targets shall be verified through a mandatory building and energy modelling as described in the Provincial Energy Step Code, performed by an experienced Energy Modeler hired by the Owner/Consultant. Energy modelling shall be performed in all type of BC Housing projects and results shall be submitted to the Owner and development team during schematic design stage. Any changes as the drawings and specifications progress that may impact energy performance shall require submission of a recalculated energy model.

.3 The actual Envelope Air Leakage Rate shall be confirmed through a mandatory testing performed in accordance with the requirements of the Provincial Energy Step Code. Airtightness of suites is to be tested and reported for residential buildings and must demonstrate compliance with a suite-level air-leakage target as tested to ASTME 779 or equivalent standard. The air tightness testing result shall be submitted by the Contractor at substantial completion. The sample set shall require testing of at least 10% of total units and be representative of the variety of unit types in the building.

.4 Certified Passive House projects are encouraged as they exceed the above targets.

3 Passive Design Strategies

3.1 INTENT OF PASSIVE DESIGN

"Passive design" is an approach to building design that uses the building architecture to minimize energy consumption and improve thermal comfort. The building form and thermal performance of building elements (including architectural, structural, envelope and mechanical elements) are carefully considered and optimized for interaction with the local micro-climate. It is intended to establish a common vision and support decision making for new developments that will maximize occupant health and comfort and minimize energy use by relying less on mechanical and electrical systems. Furthermore, it is intended to move toward a new, higher standard of energy efficiency without sacrificing thermal comfort.

This section is not prescriptive, but rather discusses and analyzes recommended design approaches and the energy saving opportunities each presents. The design teams should understand the basic concepts and implement the strategies recommended in the following section to optimize passive performance and achieve the many spinoff benefits of energy efficient, thermally comfortable buildings. The application of passive design must be carefully considered within the specific constraints and opportunities of each project.

3.2 RECOMMENDED PASSIVE DESIGN STRATEGIES

.1 Site and Orientation

The Building's orientation determines the amount of solar radiation it receives and affects energy and comfort implications of solar shading and window-to-wall area ratio. The south facing windows will capture desirable solar gains during winter when the sun angle is low providing desirable passive solar heating during winter. The same solar gains should be reduced through properly designed external shading to reduce requirements for mechanical cooling and to increase comfort of occupants in summer. Windows on the east and west orientations should be carefully planned as they receive the second highest radiation intensities.

.2 Building Shape and Geometry

Building shape and geometry have the potential to reduce building energy intensity. Buildings with a smaller exterior area, minimal articulation and projections, and a more compact shape will achieve better energy performance. Building geometry must also be considered in relation to daylighting and natural ventilation.

.3 Landscape

Properly designed landscape can reduce ambient temperature and limit the heat island effect around the building, protect the building from sun, wind and rain, and reduce solar intensity. Planting deciduous trees in front of the building's south and west orientations will provide shading, lower the cooling load in summer, and allow sun to warm a building in winter.

.4 Space Planning

Planning and locating spaces with specific requirements in their ideal thermal locations in the building can reduce mechanical heating and cooling energy by taking advantage of the building's natural thermal responses. Locating spaces with large internal heat gains (such as commercial kitchens and administrative offices) on north or east facing orientations or introducing south

facing buffer zones can reduce energy use for mechanical cooling.

.5 Buffer Spaces

Enclosed balconies are a good example of buffer spaces. Integrating occupied buffer spaces such as corridors and entryways as transition spaces can also be beneficial as they can accept a wider thermal comfort range compared to the fully occupied spaces.

.6 Solar Shading

Effective shading design requires a balance between admitting desirable solar gains during winter and blocking undesirable solar gains during summer. The optimal shading strategy would be adjustable for different times of the year. Fixed external shading devices can be effectively used for the south and east facing orientations. Excessive solar gains on the west orientations coincide with the hottest part of the day and are difficult to reduce with fixed external shading devices. Use of window coatings, adjustable louvers, trellises, motorized or manually operated external blinds should be considered to help blocking undesired solar radiation on the west orientations. Internal shading helps blocking direct solar glare and radiation from penetrating into the conditioned space; however the solar energy is still transmitted through radiant and convective heat transfer. Proper design of a combination of the external and internal shading devices is an important passive design strategy.

.7 Windows

Windows are the weakest thermal elements in a building's insulated envelope and have significant impact on indoor thermal comfort and building energy consumption. Transmitting solar radiation through windows is beneficial during winter and undesirable during summer. Carefully selecting window-to-wall ratios for different orientations, choosing adequate shading devices and utilizing good thermal and visual transmittance characteristics are important passive design strategies. Window performance shall be properly modelled in accordance with the Provincial Energy Step Code. For residential buildings the most effective combination should include double or triple-pane window assembly with thermally broken or non-metallic frames and a low-e coating glass for good winter performance in combination with external shading for good summer performance.

.8 Continuous Thermal Insulation

Effective thermal insulation of the building's opaque elements is one of the most critical design parameters of a building envelope. Thermal insulation impacts the surface temperature on the envelope interior, which directly impacts thermal comfort. Better thermal insulation not only reduces energy use for heating and cooling, but also can significantly reduce the peak heating / cooling demand and the need for a larger HVAC system. Design of a building envelope should reduce to minimum or completely eliminate thermal bridging through exposed slab edges, roof, balcony overhangs or exposed concrete elements. Effective thermal performance of the building's opaque elements shall be properly modelled in accordance with the Provincial Energy Step Code to capture effect of all thermal bridging.

.9 Air and Moisture Tightness

The air and moisture tightness of a building envelope is a critical factor in its thermal performance and durability. Incorrectly detailed building envelope with undesirable air and moisture diffusion can result in reducing effective thermal insulation, uncontrolled air and moisture exchange between the exterior and interior, potential condensation within the

envelope, physical damage of the envelope components from condensation, and occupant health impact associated with mildew and fungus growth. Additional airtightness criteria, specific for the BC Housing projects, also requires all partition walls of a residential suite to prevent transfer of tobacco smoking and cooking odors between the suites and to a corridor. Envelope Air Leakage Rate and Interior Partitions Leakage Rate shall meet the minimum Performance Targets and shall be confirmed by a mandatory testing performed in accordance with the Provincial Energy Step Code.

.10 Passive Cooling

To enhance passive cooling, low and high level operable windows should be considered. More effective is cross-ventilation, where operable windows are located on adjacent or opposite walls and allow drawing outdoor air across the occupied space. Utilizing passive natural cooling strategies can contribute to reducing energy use for mechanical cooling and improving indoor thermal comfort. Using overnight mechanical ventilation to remove heat accumulated in the building mass during the day and supplying cooler night air can also be an effective passive cooling strategy. Window shading, window coatings and landscape design can also reduce the need for mechanical cooling.

4 Energy Efficient Products, Incentives and Reporting

BC Housing is committed to achieving optimal energy performance on equipment and materials that are specified for our existing buildings and in new developments. As such, BC Housing is committed to selecting energy efficient materials and securing all rebates and incentives associated with these energy efficient choices.

.1 Energy-using equipment shall be selected in consideration of its effect on the Energy Performance Target.

.2 Energy efficiency measures are meant to reduce the amount of energy consumed while maintaining or improving the level of comfort in the building. System design and equipment selection should consider the suitability, capital, ease of cost of operation and maintenance, experience and reputation of the equipment manufacturer, local availability, durability, lifespan, energy benefit, environmental health attributes and safety.

.3 Products shall be green labeled and/or meet a minimum set of criteria for commonly purchased energy-using equipment approved by BC Housing, and selected from a pre-qualified list of products provided through either Natural Resources Canada (NRCan), BC Hydro or Fortis BC.

4.1 ENERGY EFFICIENT SYSTEMS

.1 Heating, Ventilation, Air Conditioning (HVAC) Systems:

The heating system will meet the requirement of Section 1 – 8.2 Building and Energy Performance, Mechanical and Electrical Systems. All furnaces shall be ENERGY STAR® rated high efficiency condensing appliances with minimum 95% Annual Fuel Utilization Efficiency (AFUE). "Right sizing" an HVAC system improves efficiency, reduces noise, offers greater cooling/heating comfort and saves money.

All major ventilation systems shall include heat recovery with a minimum sensible heat recovery effectiveness of 75%.

All boilers shall be high-efficiency appliances with minimum Annual Fuel Utilization Efficiency (AFUE) of:

- 94% and ENERGY STAR® rated for 299 MBH and less;
- 94% and listed on Fortis BC Eligible Commercial Boiler List for condensing boiler with 300 MBH and greater.

4.2 LIGHTING

.1 Lighting fixtures should be energy efficient and low maintenance; it is strongly recommended to consider LED type light source for all areas. Refer to Section 5 – Construction Standards Division 26 00 00 Electrical.

4.3 APPLIANCES

.1 Refrigerators, freezers, dishwasher, clothes washers and dryers, and any other appliances under ENERGY STAR® rating system shall be ENERGY STAR® rated. Cooking appliances and microwaves should be energy efficient, and at the lower end of current EnerGuide rating scale.

4.4 UTILITY INCENTIVE AND REBATE DOCUMENTATION

.1 The Consultant shall ensure that any applicable rebates and incentives programs available from the local Utility Providers and Public Agencies for implementing energy efficient designs are included and captured in all projects.

.2 The Contractor will provide all documentation necessary to apply for all applicable incentives, including, but not limited to, appliance invoices, lighting invoices, exhaust fan invoices, boiler invoices, and any related mechanical equipment invoices. Invoices must state the manufacturer, model, unit price, quantity, and physical installation address. For the appliances, lighting, and exhaust fans, a suite or unit breakdown should be provided outlining corresponding lighting and appliances, including make, model type and confirmation of ENERGY STAR® rating. All documentation must be submitted to the BC Housing staff responsible for managing the project within 30 days of equipment purchase.

4.5 METERING AND REPORTING

.1 Independent Utility metering shall be provided for each of the following areas:

- Electricity: separate BC Hydro or Fortis Electric meters for residential areas, common areas, lease spaces and common lease space. Each residential unit shall be provided with a meter base for future individual metering.
- Gas: separate meters for residential areas, common areas and lease spaces.
- Refer to Section 1 – General Design Guidelines, Article 8 Building Systems.

.2 The Operator shall ensure that building is set up to track and report their annual energy use using the ENERGY STAR Portfolio Manager® tool.

4.6 ENERGY CONSERVATION MEASURES (ECM)

.1 For all renovation and conversion projects, the Consultant shall provide the list of potential ECMs with associated implementation cost, savings and payback periods. ECMs should be identified to improve the energy efficiency of building infrastructure, such as lighting, heating/cooling/ventilation systems, utility systems, building envelope systems, windows, etc.

.2 If installing new equipment or appliances, products shall meet the most up-to-date requirement of BC Housing's energy efficient products as mentioned in above articles.

5 Construction, Renovation and Demolition Waste Management

BC Housing is committed to reducing resource consumption and waste, as mandated in the *livegreen* BC Housing's Sustainability Plan. Waste reduction and diversion from landfills will be targeted for all construction, renovation and demolition (C&D) projects funded by BC Housing across the Province.

5.1 REQUIREMENTS

.1 Projects must achieve a C&D waste diversion target of 80% of the total waste generated in the Lower Mainland and on Vancouver Island, and 60% for projects elsewhere in the Province. The total waste generated excludes any hazardous or excavated materials. All materials banned and prohibited from landfills according to the regional regulations shall be recycled.

.2 C&D waste reduction and diversion from landfills is required across the Province for all projects that receive the majority of funding from BC Housing including:

.1 all new construction projects;

.2 all demolition projects regardless of budget; and

.3 all renovation and capital improvement projects over $100,000 (public tender).

.3 The development team shall incorporate the Waste Management requirements into the contract documents and project specifications

.4 The Consultant shall submit the Waste Management Plan before signing the construction contract.

.5 The Contractor is responsible for tracking waste diversion rates throughout the construction project, and shall submit the Waste Management Reporting Form, outlined in Appendix C. The completed form is required to submit at the following stages:

.1 completion of demolition (if applicable);

.2 50% construction progress claim; and

.3 substantial completion.

A deficiency holdback will be retained for incomplete or non-submitted waste tracking forms as set out in the contract documents.

6 Water Efficient Design

Water conservation strategies should be employed to reduce water consumption at a facility through efficient water system design, water efficient plumbing fixtures and appliances, water metering, etc.

6.1 WATER EFFICIENT FIXTURES AND APPLIANCES

.1 Low water consumption fixtures shall be provided for all units:

.1 Aerated bathroom faucet with flow rate of 2 LPM (0.5 GPM);

.2 Low flow showerhead with flow rate of 5.7 LPM (1.5 GPM);

.3 Low Flush Water Closets: single flush 4.8 LPF (1.3 GPF), and complies with the latest edition Maximum Performance (MaP) testing rated at 1000 gram of waste per flush;

.4 Kitchen sink faucet: 5.7 LPM (1.5 GPM) flow pressure compensating aerator outlet,

.5 Refer to Section 5 – Construction Standards, Division 22 00 00 Plumbing, for details on plumbing fixtures and accessories

.2 Water efficient appliances with ENERGY STAR® certification shall be provided, including clothes washer and dishwasher, where required.

6.2 WATER METERING

.1 A total building water meter shall be provided. Where applicable, provide separate water sub-meters to areas with separate lease agreements. Confirm requirements for water sub-metering with BC Housing.

7 Building Material Selection

7.1 LOW EMITTING MATERIALS REQUIREMENT

.1 Select low emitting materials and products for interior paints, coatings, adhesives, sealants, flooring, composite wood, ceilings, walls, and thermal and acoustic insulation.

.1 Paints and coatings must meet Canadian Volatile Organic Compound (VOC) Concentration Limits for Architectural Coatings Regulations (SOR/2009-264).

.2 Adhesives and sealants must meet SCAQMD Rule 1168, effective July 1, 2005.

.3 Paints, coatings, adhesives and sealants must not contain methylene chloride and perchloroethylene.

.4 Stone, ceramic, powder-coated metals, plated or anodized metal, glass, concrete, clay brick and unfinished or untreated solid wood flooring must not include integral organic-based surface coatings, binders or sealants.

.5 Composite Wood to comply with California Air Resources Board (CARB) ultra-low-emitting formaldehyde (ULEF) resins or no added formaldehyde resins. Composite wood cannot

exceed 0.05 ppm of formaldehyde as tested under EN-717-1:2004, ISO 16000-3:2010, ISO 16000-6: 2011, ISO 16000-9:2006, ISO 16000-11:2006 or CEN/TS 16516: 2013.

7.2 RECYCLED PRODUCT AND LOCAL AVAILABILITY

.1 Consider using materials that are sourced locally and have high recycled content. Utilize existing materials on site when possible. The selection of interior and exterior materials is a vital part of a project's sustainability.

8 Sustainable Site Management

8.1 CONSTRUCTION ACTIVITY POLLUTION PREVENTION

.1 Pollution, erosion and sedimentation control plan for all construction activities associated with the project should be created and implemented. The plan must conform with the erosion and sedimentation requirements of the 2012 US Environmental Protection Agency (EPA) Construction General Permit (CGP) or local equivalent, whichever is more stringent.

.2 In sensitive environmental areas (adjacent to waterways, wetlands, flood plains, etc.) an environmental consultant should be engaged.

8.2 SUSTAINABLE SITE WATER MANAGEMENT AND LANDSCAPE

.1 Incorporating passive landscape design strategies into the project sustainability strategy should be considered, to contribute to the environmental quality of the project and to minimize heat island effect around the building.

.1 To address erosion control and storm water management, a comprehensive site water management strategy should be developed by the project team, such as implementing pervious paving, rain gardens, and bio swales.

.2 To promote water conservation, provide native or drought resistant landscaping in order to avoid the need for a permanent landscape irrigation system. Providing temporary irrigation from hose bibs on the exterior of the building to help establish initial planting may be considered.

.3 To minimize the heat island effect around the building, and reduce solar intensity, locate deciduous trees in front of the building's south and west orientations to provide shading, lower the cooling load in summer, and to allow the sun to warm the building in winter.

8.3 RECYCLING AND COMPOSTING AREA

.1 All sites shall be equipped with a collection and storage area for garbage, recyclable materials and organics, in accordance with municipality requirement. Refer to Section 1 – General Design Guidelines for further details.

End of Section