Passive House Canada believes Ontario's proposed Ontario Building Code (OBC) is a big step back in improving the energy efficiency of new buildings in Ontario.

Our submission lays out our concerns about the impact of the proposed code and recommendations to improve the building code process. We provide technical solutions to enable the OBC to lead Ontario on a pathway to developing net-zero buildings.

A summary of key technical recommendations

- Instead of harmonizing with Tier 3 requirements of the National Building Code (NBC) for part 9 buildings (i.e. smaller buildings) and with Tier 1 of the National Energy Code for Buildings (NECB) for part 3 buildings (i.e. larger buildings), we recommend adopting performance targets, such as Thermal Energy Demand Intensity (TEDI) and Cooling Energy Demand Intensity (CEDI), and the same tiers in the BC building code. This can be done with minimal up-front cost increases and results in lower total cost of ownership.
- Cut unnecessary red tape by using a performance-based approach for the overall energy use of a building, instead of a reference building approach.
- Include mandatory air tightness testing in the OBC to improve comfort, performance, durability, and to save homeowners money.
- Allow the Passive House Planning Package (PHPP) to continue to be accepted as an energy modeling tool for Part 3 and Part 9 buildings to reduce the costs and need for additional redundant energy modeling.
- Adopt Cooling Energy Demand Intensity (CEDI) targets as an alternative compliance pathway for the Cooling Load requirements. The peak cooling load limits hinder the design and construction of high performance buildings
- Adopt ASHRAE 62.2 or the International Mechanical Code Table 403.3.2.3 for ventilation rates for high performance buildings so excessive energy is not used for ventilation while still maintaining good indoor air quality
- Include thermal bridges in determining the U-values of the building envelope for compliance so proper detailing is encouraged and thermal breaks are used where possible.
- Allow Heat Recovery Ventilator (HRV) testing for efficiency as an annual energy use limit versus having certain energy efficiency targets at certain test temperatures. Testing procedures for compliance with energy efficiency should include the ability to use technologies, such as ground loops for preheating.

Impact of Proposed Code

Failure to meet targets

The proposed update to the OBC is not aligned with the Federal Government's or the Government of Ontario's greenhouse gas (GHG) reduction targets. The failure to plan for energy savings in the buildings sector through the new code will require other sectors to reduce more emissions or cost the building sector more financially down the road in order to make up for this lost opportunity. You either pay less now or more later.

Hinder Municipalities

This proposed OBC would put pressure on municipalities to increase the need for minimum energy standards in green development standards while giving them no authority through the OBC to enforce them. They have authority through the Municipal Act, but the OBC could help give Municipalities a clear pathway to improve standards.

Increase Costs for Homeowners

The outcomes of the OBC will increase homeowners' operating/energy costs by not making homes more energy efficient. The cost premium to build a net-zero home to 90% efficiency is negligible and should not be used as an excuse to hinder adoption of a more stringent code. Financial industry research demonstrates that Passive House net-zero buildings have a lower total cost of building ownership compared to homes built to the code.

Improved Process

More Time for Consultation

Recommendation: Ontario should provide more time to comment.

The public was given an insufficient time to understand, process, and analyze the proposed changes to the OBC. This should be the start of several conversations, not the last. The OBC is the Ontario people's code not the building industry's code.

Improve Training and Enforcement

Recommendation: Ontario should provide support for building code implementation and enforcement through education and capacity building.

Ontario can support building code adoption through training and capacity building opportunities for local governments, industry, and other stakeholders. This includes advice and clarification on technical aspects of the code, training and peer support networks, plain-language communication materials, and strategies for cost reductions that include training programs, incentives, builders' guides, and pragmatic costing guidelines for various tiers of the code.

Technical Recommendations

Increase Efficiency & Adopt the Full Step Code Framework

Recommendation: Ontario should adopt performance targets, such as Thermal Energy Demand Intensity (TEDI) and Cooling Energy Demand Intensity (CEDI), and the same tiers in the BC building code.

Based on the review of the proposed changes, the province is not proposing a tiered code. Instead, they are proposing to:

- Harmonize with Tier 3 requirements of the National Building Code (NBC) for part 9 buildings (i.e. smaller buildings)
    - Tier 3 for Part 9 would maintain energy efficiency requirements resulting in no improvements in energy efficiency requirements over the 2015 NBC.
- Harmonize with Tier 1 of the National Energy Code for Buildings (NECB) for part 3 buildings (i.e. larger buildings)
    - From an energy efficiency perspective, Tier 1 for part 3 buildings would be less stringent and therefore reduce energy efficiency.

The current code and tiers of the National Model Building Code are not sufficient to get Ontario on a pathway to net-zero buildings by 2030, because the code does not push the efficiency envelope far enough. Despite numerous examples of buildings being built to 90% efficiency compared to baseline code with minimal cost increases, the proposed tiers only yields a 60% efficiency compared to the baseline. Ontario needs 1.5 million more homes over the next ten years, according to the Ontario Housing Affordability Task Force, and the global residential building stock is expected to double by 2060, according to the International Energy Agency (IEA) 2017 Global Status Report. With a large amount of the building stock to be added between now and 2050, the cost to retrofit these buildings to net-zero by 2050 will only cost more the later we start. It is cheaper to build them to net-zero now rather than later.

The province has outlined no plan to adopt net-zero energy ready codes by 2030 (or earlier). A 2030 commitment was made in the 2016 Pan-Canadian Framework on Clean Growth and Climate Change and the IEA's net-zero scenario requires governments to "act before 2025 to ensure zero-carbon-ready compliant buildings codes are implemented".[1] Instead, Ontario has stated it will adopt the lower tiers in the National Model Building Code and exclude the other tiers. Doing so will undermine both the value and intent of the 2020 model codes. This tiered approach is intended to deliver progressive increases in building energy performance at each tier, offer industry a clear regulatory path to net-zero, and transform the market for net zero energy and emissions buildings.

Adopting performance targets (TEDI and CEDI) and proposed tiers of the BC step code will help municipalities adopt various tiers as their baseline based on their own readiness, ambitions and local market conditions.

- https://free.bcpublications.ca/civix/document/id/public/bcbc2018/bcbc_2018dbp9s936r2 - See pages 35-40 (Part 9)
- https://free.bcpublications.ca/civix/document/id/public/bcbc2018/bcbc_2018dbs102r2 (Part 3)

Ontario should look to build on its leadership and existing capabilities. Rather than using 'harmonization' with the model building codes to stall progress, it can use the model building codes to advance towards greater energy efficiency.

A tiered standard that clearly outlines a timeframe for advancements to higher tiers will bring certainty to the industry and help foster the growth of low-carbon solutions and jobs here in Ontario. With a tiered approach that increases efficiency over time, there needs to be support in the implementation process with education and capacity building tools, in order for builders to use proven building science to reach these tiers, including high performance approaches such as the Passive House standard.

Remove the Reference Building Approach

Recommendation: Help cut red tape by switching to a performance-based approach for the overall energy use of a building, which includes annual heating and cooling energy limits, instead of a reference building approach.

Moving from a Reference Building approach to an performance-based standard is a red tape reduction win for business and government because it reduces the need to do additional, unnecessary energy modelling for hypothetical buildings used for reference examples. With a Reference Building approach, builders must complete two energy models to demonstrate compliance. When an additional compliance standard is a part of the development, such as the Passive House Institute (PHI) standard or, Leadership in Energy and Environmental Design (LEED) standard, three energy models are required. This results in three times the level of effort and compliance documentation, which costs are passed on to the end user. A single, absolute energy target-based standard in GJ or EUI (area-based or volumetric) would satisfy all modelling requirements with no need for reference models, reducing the cost and effort to model compliance.

Include Mandatory Airtightness Testing

Recommendation: Ontario should include mandatory air tightness testing in the OBC to ensure that unintentional airflow does not cause energy losses, structural damage, or poor indoor air quality in new buildings, while improving comfort, performance, durability, and homeowner pocketbooks.

According to comments in PCF 1617, the SC-EE (page 24) identified no public resistance to voluntary, rather than mandatory airtightness testing. Let this letter serve as notice that a significant chorus of independent expert organisations, professional and advisory bodies hereby strongly object to *voluntary* airtightness testing. Without *mandatory* airtightness testing, there is no valid data on compliance, or responsibility among builders and developers to meet compliance requirements. Therefore, predicted performance and actual performance will continue to be de-coupled from reality, ultimately affecting the consumer, consumer confidence, as well as imposing significant energy and durability costs on to the Canadian public.

It is well known that the Canadian Home Builders Association and other residential construction lobbies have resisted mandatory airtightness for decades. As 'non-technical authorities' before the courts, builder lobbies should not receive preferential treatment when weighting comments on proposed code changes, over professional, regulated associations and their members, such as architects and engineers. Studies have shown (N. Prescott 2008; Mark Bomberg, Tomasz Kisilewicz, and

Katarzyna Nowak 2015) that airtightness consistently improves comfort, performance, and durability at a minimum to zero capital cost. Excluding mandatory airtightness is not in the public interest.

We would recommend setting a target of 4L/s.m2 at 75Pascals or 0.6 ACH at 50 Pascals for buildings of all types.

On Performance Path Modelling per PCF 1608

Add PHPP as an Energy Modelling Software

Recommendation: Ontario should add Passive House Planning Package (PHPP) as an accepted energy modeling software for building code compliance.

The Passive House Planning Package (PHPP) is an easy-to-use planning tool for energy efficiency for the use of architects and planning experts. It is validated against ASHRAE 140P and was previously specified as acceptable for compliance in SB-12. It allows users to create a complete building model to determine the energy performance of both the whole building and its individual elements. The impact of design changes is instantly displayed, enabling designers to efficiently rule out non-compliant designs and optimize the building performance. It is not an hourly modeling tool though it has been verified against dynamic hourly modeling software. Super insulated and airtight buildings have a long lag time in regards to temperature changes so hourly modeling is not necessary as well. We would like PHPP to listed in the code and continue to be accepted for compliance of Part 3 and Part 9 buildings.

Adjust Peak Cooling Load Requirements

Recommendation: Ontario should adjust the proposed peak cooling load limits to use an alternative performance-based compliance approach for the overall energy use of a building, which includes annual heating (TEDI) and cooling energy (CEDI) limits, instead of a reference building approach.

- **As well, Ontario should use a metric for limiting overheating and allow mechanical cooling to exempt the building from this metric as long as the overall energy use target is met.**
- **Finally, Ontario should make sure these metrics recognize effective solar design in energy efficient buildings and take into account shading devices and objects.**

When modelling for compliance with any tier in the performance path in Ontario's proposed OBC, the peak cooling load for the proposed house cannot be greater than the peak cooling load for the reference house. The consequences of this requirement can be harmful to high performance building designs. The requirement proposed for the 2020 NBC may limit necessary solar gains in winter but may not control overheating in the summer in energy efficient homes.

Using a comparison approach of the peak cooling load between the reference building and the building as designed causes several problems. If both buildings have large solar gains, the proposed building may still overheat. If both buildings have very small solar gains, the proposed building may still exceed the reference building. Compliance to this new requirement may be easier for reference houses that have a large cooling load as well.

The proposed OCB sets a low Solar Heat Gain Coefficient (SHGC) of 0.26 for fenestration in the reference house, which is generally below the typical value used in practice (0.3-0.6) for high performance buildings. High performance buildings rely on harvesting energy from the sun to reduce the heating demand of the building. These default values for the reference would make compliance challenging for many high-performance buildings.

Installing air-conditioning will not provide an exemption from this new requirement as proposed. The proposed peak cooling load requirement would still apply even if mechanical space cooling was part of the design and accounted for in the energy modelling. Energy balance of high-performance buildings may be lower overall with some need for additional cooling demand since heating energy has a larger energy footprint than cooling. High performance buildings can be designed to use overall less energy with some additional mechanical cooling than without.

A target for the overall energy demand of a building [Thermal Energy Demand Intensity (TEDI) and Cooling Energy Demand Intensity (CEDI)] and limits for overheating are more beneficial for the buildings energy use than setting a limit of the peak cooling load. (See attached supporting documents – PHC letter for cooling load limits.pdf and Peak Cooling Analysis.pdf)

Adopt ASHRAE 62.2 for Ventilation

Recommendation: Adopt ASHRAE 62.2 Ventilation and Acceptable Indoor Air Quality in Residential Buildings under the OBC for all residential buildings or allow compliance with International Mechanical Code Table 403.3.2.3, and remove the requirement for residential buildings to comply with ASHRAE 62.1 Ventilation for Acceptable Indoor Air Quality

The OBC requires projects to meet ASHRAE 62.1 Ventilation for Acceptable Indoor Air Quality, and the local minimum continuous exhaust ventilation requirements under ASHRAE 62.1 vastly exceed the

Passive House minimum recommendations, and they exceed ASHRAE 62.2 as well as International Mechanical Code local minimum continuous exhaust ventilation requirements. The current requirement under OBC to follow ASHRAE 62.1 increases ventilation heat losses and makes it extremely difficult to meet the low Thermal Energy Demand Intensities (TEDI) required by high performance buildings.

The higher ventilation rates required by ASHRAE 62.1 may have been justifiable in older exhaust only ventilation arrangements, but high performance buildings have balanced ventilation with heat recovery where a constant volume of fresh filtered air is supplied to all bedrooms and living rooms at an equal volume to the exhaust air removed from kitchens and bathrooms. As such, with a balanced ventilation arrangement and a continuous supply of fresh filtered air, adequate indoor air quality can be maintained in dwelling units with lower continuous exhaust volumes.

Every high-performance multifamily building design in Ontario will struggle under the current OBC and ASHRAE 62.1 ventilation code requirements to meet low TEDI targets, so an OBC code change is needed that balances the necessity to develop high performance buildings with low TEDI while also maintaining healthy indoor air quality for occupants. Please see the supporting documents (OBC ASHRAE 62.1 PH Memo.pdf) for tables comparing the ventilation requirements between the different standards.

We recommend adopting ASHRAE 62.2 Ventilation and Acceptable Indoor Air Quality in Residential Buildings under the OBC for all residential buildings or allow compliance with International Mechanical Code Table 403.3.2.3, and remove the requirement for residential buildings to comply with ASHRAE 62.1 Ventilation for Acceptable Indoor Air Quality.

ASHRAE 62.2 and The International Mechanical Code are widely and successfully adopted in other code jurisdictions. Reducing the continuous exhaust volumes promotes buildings with low TEDI, and aligns the OBC with progressive energy step code tiers and carbon emission targets for 2030 and 2050. High performance buildings require additional on-site commissioning of the ventilation system performed by a Testing and Balancing Contractor to confirm the ventilation flow rates. Moreover, flow rates at all supply and exhaust registers are measured and confirmed during normal operation and compared against design flow rates to ensure that the ventilation system is operating as intended. Finally, there are built examples of large scale multifamily Passive House buildings that are designed under International Mechanical Code local continuous exhaust ventilation rates, that do not have indoor air quality Issues. (Cornell Tech, Betances V, 511 E 86th Street, 211 West 29th street, 3365 Third Ave, etc.)

Improve Approach for Thermal Bridging

Recommendation: Ontario should strip the requirement for 2% of envelop for 'major structural penetrations' and replace it with a minimum U-value for walls that take into account thermal bridges

The condition of 'major structural penetrations' as 2% of envelope is rarely met or enforced in traditional buildings. Therefore, it is better to have a performance-based U-value target for walls that take into account thermal bridges, such as balconies and fasteners for external insulation. We know that depending on how insulation is fastened to the building the effective U-value is impacted greatly. This approach would take into account the impact on fasteners and encourage good detailing and the use of thermal breaks. Please see attached supporting documentation (SWA Thermal Bridging Guide for Cladding).

HRV testing

Recommendation: Ontario should set Heat Recovery Ventilator (HRV) testing for efficiency as an annual energy use limit versus having certain energy efficiency targets at certain test temperatures. Testing procedures for compliance with energy efficiency should include the ability to use technologies such as ground loops for preheating.

CAN/CSA-C439 (Standard laboratory methods of test for rating the performance of heat/energy-recovery ventilators) favours recirc defrost and does not allow for testing with preheaters or ground loops to prove compliance for overall efficiency compliance versus having a specific efficiency at specified test points. When units that do use recirculation for defrost purposes, the building is not receiving fresh air as intended by the heat recovery ventilator. Units that use other options for preheating incoming fresh air, such as electric preheaters and ground loops, should not be penalized by the limitations of the current testing procedures.