**Problem:**

There is a conflict between the ventilation rates required by the Ontario Building Code (OBC), The Passive House (PH) Standard, and The Toronto Green Standard (TGS). The mechanical ventilation rates of large scale Passive House multifamily mid-rise and high-rise buildings are determined by the local continuous exhaust ventilation rates in kitchens and bathrooms. The OBC requires multifamily residential projects to follow ASHRAE 62.1 *Ventilation for Acceptable Indoor Air Quality* which mandates continuous exhaust ventilation rates for kitchens and bathrooms that are significantly higher than the ventilation rates required by The Passive House Standard, ASHRAE 62.2 *Ventilation and Acceptable Indoor Air Quality in Residential Buildings,* and The International Mechanical Code.

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 the PH standard or the TGS. As a result, the current OBC requirement to follow ASHRAE 62.1 for ventilation design is not aligned with the general goal of the TGS step code which promotes an increasingly stringent TEDI threshold over time. The higher ventilation rates required by ASHRAE 62.1 may have been justifiable in older exhaust only ventilation arrangements, but Passive House buildings have balanced arrangements 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.

Each and every Passive House and TGS multifamily building design in Ontario will struggle under the current OBC and ASHRAE 62.1 ventilation code requirements, 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. To promote the adoption of high-performance building standards such as Passive House and TGS Tier 2, 3, and 4 the OBC should be updated to require multifamily building ventilation design in residential projects to ASHRAE 62.2 or The International Mechanical Code.

**Example:**

- ASHRAE 62.1-2019 Ventilation for Acceptable Indoor Air Quality, Table 6-2:
    - *Residential Kitchens* continuous exhaust rate 50 CFM
    - *Toilets – Private* continuous exhaust rate 25 CFM
- ASHRAE 62.2 Ventilation and Acceptable Indoor Air Quality in Residential Buildings, Table 5-2:
    - *Enclosed Kitchen* continuous exhaust rate 5 ACH (25-40 CFM typ. based on kitchen size)
    - *Bathroom* continuous exhaust rate 20 CFM
- The International Mechanical Code, Table 403.3.2.3:
    - *Kitchens* continuous exhaust rate 25 CFM
    - *Bathroom and Toilet Rooms* continuous exhaust rate 20 CFM
- The Passive House Institute recommends **only 11.7 – 17.7 CFM/person to maintain hygienic** indoor air. See table below showing total CFM and CFM/person under OBC and ASHRAE 62.1, compared to estimated total CFM and CFM/person under International Mechanical Code, ASHRAE 62.2, and Passive House Recommended ventilation rates.

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| Typical Dwelling Unit Type | OBC & ASHRAE 62.1 | International Mechanical Code | ASHRAE 62.2 | Passive House Institute Recommendation |
|---|---|---|---|---|
| Studio, 1 bathroom | 75 CFM<br>75 CFM/person | 45 CFM<br>45 CFM/person | 55 CFM<br>55 CFM/person | 11.7 – 17.7 CFM/person |
| 1 Bedroom, 1 bathroom | 75 CFM<br>37.5 CFM/person | 45 CFM<br>22.5 CFM/person | 55 CFM<br>27.5 CFM/person | 11.7 – 17.7 CFM/person |
| 2 Bedroom, 2 bathroom | 100 CFM<br>33.3 CFM/person | 65 CFM<br>21.6 CFM/person | 75 CFM<br>25 CFM/person | 11.7 – 17.7 CFM/person |
| 3 Bedroom, 2 bathroom | 100 CFM<br>25 CFM/person | 65 CFM<br>16.25 CFM/person | 75 CFM<br>18.75 CFM/person | 11.7 – 17.7 CFM/person |

- Additionally, The Passive House Institute **recommends a minimum of 0.3 and a maximum of 0.5 Air Changers per Hour (ACH)** for each apartment, and with under OBC and ASHRAE 62.1 **we are providing 2-4X that amount at 0.78 – 1.37 ACH**. See table below showing ACH for a typical dwelling unit under OBC and ASHRAE 62.1, compared to estimated ACH under International Mechanical Code, ASHRAE 62.2, and Passive House Recommended ventilation rates.

| Typical Dwelling Unit Type | OBC & ASHRAE 62.1 | International Mechanical Code | ASHRAE 62.2 | Passive House Institute Recommendation |
|---|---|---|---|---|
| Studio, 1 bathroom | 1.37 ACH | 0.82 ACH | 1.01 ACH | 0.3 ACH |
| 1 Bedroom, 1 bathroom | 1.07 ACH | 0.64 ACH | 0.78 ACH | 0.3 ACH |
| 2 Bedroom, 2 bathroom | 0.93 ACH | 0.6 ACH | 0.69 ACH | 0.3 ACH |
| 3 Bedroom, 2 bathroom | 0.78 ACH | 0.51 ACH | 0.58 ACH | 0.3 ACH |

**Proposed Solution & Recommended Change to the OBC:**

1) Adopt ASHRAE 62.2 *Ventilation and Acceptable Indoor Air Quality in Residential Buildings* under the OBC for all residential buildings, and remove the requirement for residential buildings to comply with *ASHRAE 62.1 Ventilation for Acceptable Indoor Air Quality*.

**OR**

2) Provide an *Alternative Compliance Path for Ventilation Rates* for multifamily Passive House or TGS Tier 2, 3, 4 buildings under the OBC, allowing these buildings to be designed to meet the continuous exhaust rates under ASHRAE 62.2 Table 5-2 (**NOT** ASHRAE 62.1) **OR** International Mechanical Code Table 403.3.2.3:

The justification for this proposed change to the OBC is as follows:

- 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 goals of the TGS

- A Passive House and/or TGS Tier 2, 3 4 building will include a balanced ventilation arrangement 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. With a continuous supply of fresh filtered air the indoor air quality can be maintained in dwelling units with lower continuous exhaust volumes.
- Passive House buildings require additional on-site commissioning of the ventilation system performed by a Testing and Balancing Contractor to confirm the ventilation flow rates. 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.
- 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 86$^{th}$ Street, 211 West 29$^{th}$ street, 3365 Third Ave, etc)