Passive House Canada asks the federal government to redevelop the criteria proposed in the performance-based energy-efficiency tiers proposed in part 9.36. of the 2020 National Building Code (NBC). The proposed requirement would mandate that, when modelling for compliance with any tier in the performance path, the peak cooling load for the proposed house cannot be greater than the peak cooling load for the reference house. The consequences of this code 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.

There are a number of issues with this proposal that PHC believes will need to be changed to set Canada up for the upcoming years for building climate-resilient and healthy buildings. There are three concerns PHC has with this proposed code: the use of the reference building approach, using the reference building approach in conjunction with a peak cooling load limit creates a tunnel vision approach to building, and neglecting alternative approaches that will have better outcomes for creating high-performance building that can meet our climate targets.

The Reference Building Approach

The “reference building approach” in assessing the energy performance of buildings has been used as a code compliance tool to demonstrate the operating energy efficiency of a proposed building is better than it could have been under a base building code. The statement that this approach produces is that the proposed building is a percentage better than its theoretical reference building, but it does not provide an actual prediction of the energy consumption of the proposed building. With the ability to manipulate the reference building via the design of the building, this approach does not produce a reliable estimate of an actual building performance but is simply a code compliance tool. Its widespread use is one of the largest contributors to the endemic “building performance gap”, the difference between anticipated and actual performance of a building. This building performance gap produces buildings presented as green or efficient during design but end up consuming far more energy than a building designed to a performance-based target or approach.

Peak Cooling Load Requirement with the Reference Building Approach

The reference building approach with the proposed peak cooling load requirement can cause unintended consequences that negatively impact the design of high-performance buildings.

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 over heat. 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 code also 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.

There are limits in the modeling of passive solar shading objects in the methodology of the reference building approach. Apart from window overhangs, the code assumptions for modelling do not account for most passive solar measures such as shading through trees or shutters or the impact of existing terrain or neighboring buildings.

Installing air-conditioning will not provide an exemption from this new requirement. 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 building 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.

Recommendations

1. Use 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.
2. 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
3. Make sure these metrics recognize effective solar design in energy efficient buildings and take into account shading devices and objects

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Code requirements for energy efficiency need to limit the risk of overheating in homes without causing the unintended consequences of penalizing good high performance building design. A performance-based framework is needed to require designing and modeling of high-performance buildings to specific targets (TEDI and CEDI) so we can reach our carbon emissions targets faster and responsibly.

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