TECHNOFORM

Passive aggressive

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1468 Alberni is one of two high-rise Passive House residential projects currently planned in the City of Vancouver and several more are in discussion. The 1468 Alberni Street team includes: lead architectural firm Robert A.M. Stern Architects of New York, coordinating architectural firm MCM Partnership of Vancouver, Passive House design firm A2M of Brussels/New York, Passive House certifier RDH Building Science of Vancouver. Photo Credit: Asia Standard Americas.

Passive house design appears to be moving closer to the mainstream, driven by aggressive stringency increases in Canadian energy codes, which will likely be followed by those in the U.S. This topic is fraught with misunderstandings and challenges with implementation in North America. If done well, it can yield excellent building performance, but there are pitfalls to beware.

Passive House is a design concept that was first implemented in the 1990s in Germany and has since spawned the Passivhaus Institute (PHI) and the "Passivhaus standard." We call it "Passive House" in English; but it isn't just for houses. This misunderstanding is due to a loss in translation. In German, "haus" is not just the word for house, it also relates to buildings in general.

In their session titled "Passive Aggressive" Monte Paulsen (RDH Building Science) and Stuart Hood (Integral Group) gave a great summary of passive house concepts at the Façade Tectonics Institute's (FTI's) Vancouver forum. They explained the relationship of PHI's standard from Europe to the aggressive new step codes in British Columbia and the Canadian Building Code.

PHI's standard is based on a few very simple tenets, which are used to achieve an annual heating or cooling energy demand of 15 kWh/m^2 or less:

- Super-insulating building envelope, including triple-pane glazing, warm-edge spacers and super-insulating frames.
- Air-tight building envelope (no more than 0.6 times the building volume per hour)
- Elimination of thermal bridging
- Use of passive solar heat gain through fenestration to supply heating
- Use of natural ventilation where possible, and where ambient conditions are not conducive, mechanical ventilation with more than 75% heat recovery

Seems simple, right? The challenge, though, is to ensure that the details of the design make sense across very different climate zones and building types. The envelope requirements needed to achieve the energy demand performance in Miami and Minneapolis may be very different to those in Munich.

The German-based PHI also certifies products, such as windows and their components, which are listed in a Component Database. For windows, listings give a U-factor, an efficiency class and applicable climate zone. Potential pitfalls lie in the fact that if a window is considered PHI-certified for a temperate climate (versus cold or arctic climates), it may not meet even the minimum energy codes in the northern U.S. or Canada.

Situations already have arisen where Canadian builders have purchased a "Passive House certified" window from Europe, unaware that it was inappropriate for the Canadian climate, according to Lisa Bergeron, JELD-WEN's government relations manager and Fenestration Canada's current president.

Another key challenge of adopting the PHI's standard is bridging the gulf in U-factor translation. It is not simply a case of converting the units for U-Factor in the Passive House standard, which are given in W/m^2K, into $BTU/^{o}f.hr.ft^2$. The North American and European U-factor calculation methods are different, and even when given in the same units they are not at all comparable.

As an alternative, in the U.S., the Passive House Institute U.S. (PHIUS) has developed a standard which, while still based on the underlying tenets of PHI's standard, is promoted as using cost-effective, climate-specific metrics and North American U-factors.

Back in Canada at FTI's forum, Paulsen said that by 2032 Vancouver's new step code will require that the maximum Thermal Energy Demand Intensity (TEDI) of building envelopes meet the stringent $15kWh/m^2/yr$ (4,760 btu/sqft/yr) target set in the European-born PHI standard, using Canadian standards to measure performance. He also noted that the National Building Code of Canada is moving toward this outcome by 2030. To put this change into perspective, the average TEDI of Canadian buildings is currently 150 $kWh/m^2/yr$. Canadian codes will be moving in steps over the next 15 years to achieve these targets.

Passive house design concepts that improve building envelope thermal performance certainly make sense, especially since reduced energy demand is essential to achieve low-energy and net-zero-ready buildings. However, implementation of passive house standards in North America, especially those developed in Europe, needs a great deal of care to ensure successful outcomes.