

Decoding Passive House Design: A Blueprint for Net-Zero Ready **Living Spaces**

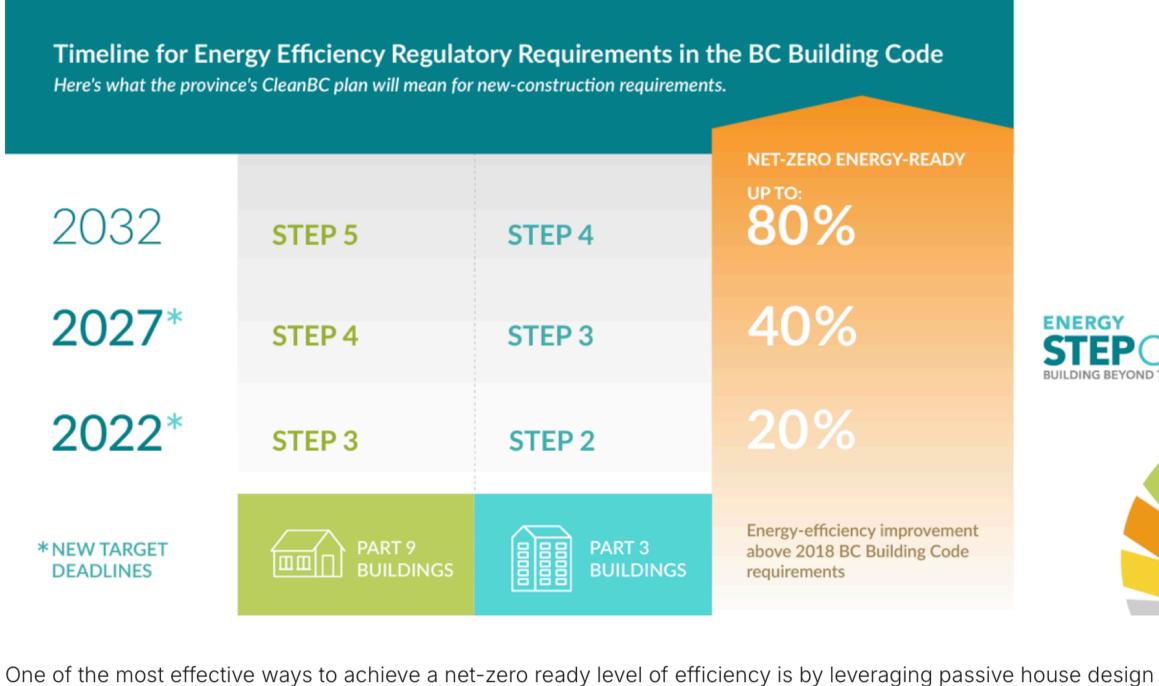
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decarbonize and improve the resiliency of Canada's construction sector through its Greening Government Strategy (GGS), with a "buy clean" policy approach that promotes the adoption of construction materials with low embodied carbon and renewable. These materials include wood, reclaimed and recycled materials and low-emission concrete and steel.

Climate change and energy efficiency have taken center stage in the media recently. The Canadian Government is working to

non-profits. The target is for all new homes (Part 9 buildings) to achieve Net-Zero Energy Ready (NZEr) by 2032. This represents an energy-efficiency improvement of up to 80% above the 2018 BC Building Code requirements.

In British Columbia, the BC Energy Step Code was co-developed with the construction industry, local governments, utilities, and



principles. These comprise a tried and true construction concept that maximizes your home's ability to maintain comfortable indoor conditions, with minimal energy use, and at an affordable price. What is passive house design?

improve energy efficiency.

comfortable living environment.

Passive House is considered the most rigorous, voluntary, internationally recognized energy-based building standard. It prioritizes energy efficiency by optimizing the use of passive design elements like insulation, airtightness, and solar gain.

make efficient use of the sun, internal heating or heat pump sources and heat recovery. In the summer months, they take advantage of passive cooling techniques like strategic shading to keep the house comfortably cool. High-performance windows and an airtight building envelope consisting of a super-insulated roof, floor slab and exterior walls

Passive houses consume up to 90% less energy than conventional code-built homes. During the cooler months, passive houses

keep the desired warmth in the house, or undesirable heat out. A silent ventilation system delivers constant fresh air, for superior air quality, without any drafts. A highly efficient heat recovery system returns the heat from the exhaust stream back into the incoming stream of filtered air.

Passive house buildings are designed, optimized, and verified by the <u>Passive House Planning Package (PHPP)</u>, an easy to use

planning tool for energy efficiency for the use of architects and planning experts. 5 core passive design principles for net-zero ready homes

Super-insulated building envelope: Installing thick, continuous insulation, made of low-conductivity materials, significantly

reduces the transfer of heat through the building envelope, keeping your indoor spaces warm in winter and cool in summer. This continuous thermal barrier consists of the outside walls, roofs, and floors.

The aim when designing and building your passive house is to use assemblies that provide enough insulation to double or triple

the heat resistance of current Canadian building code requirements. Superinsulating minimizes the need for active heating and cooling systems, cutting your energy consumption by up to 90% compared to conventional homes built to code. Super-insulated envelopes eliminate cold surfaces and drafts, so your family will enjoy consistent indoor temperatures and greater thermal comfort. Passive House windows: Walls typically make up the largest surface area in your home's façade, but window and door glazing

systems often play a greater role when it comes to heat-flow resistance. Providing visibility and light means that glazing systems cannot be insulated to the same degree as the walls, roofs, and floors. It is therefore critical that high-performance passive house glazing systems include double- or preferably triple-glazed units, with

argon or krypton inert gas between the panes, to reduce heat transfer. They will typically have multiple low-e coatings, and warm-edge or nonconductive spacers. Thermally broken frames and multi-chamber designs eliminate thermal bridging. Passive house windows and doors are also engineered to be exceptionally airtight.

months while minimizing overheating in the summer. This allows beneficial natural light to enter your living spaces, while blocking excessive heat. The windows should ideally be positioned within 30 degrees of true south to capture the most sunlight. Any north-facing windows should be minimized so they provide minimal solar gain. Heat recovery ventilation strategy: Passive houses are airtight, so a ventilation system is required to bring in fresh, filtered air

Placement is also critical. The optimal direction for windows and doors to face is south, to maximize solar heat gain during colder

and remove the stale air, odours, pollutants, CO2, and moisture. During the winter months, warm air would be exhausted to the outdoors, and cooler air would be brought in to replace it, which would require heating to room temperature; very inefficient. To remedy that problem, a heat recovery ventilator (HRV) extracts heat from the exhaust air and feeds it back into the incoming air, without directly mixing the two airstreams together. Passive house HRV systems recover at least 75% of the heat.

Airtight construction: Airtight building envelopes minimize the air leakage rate. They prevent conditioned air from escaping and unconditioned air from infiltrating your home, reducing heating and cooling demands. Your home's air barrier is a layer of

Passive house-certified ventilation systems include a summer bypass damper that diverts air around the heat recovery core, to

membranes, tape, and seals around the envelope that restricts the movement of air in and out of the building. The passive house standard requires airtightness levels below 0.6 air changes per hour at 50 Pascals (n50 \leq 0.6 h-1 @ 50 Pa).

When combined with superior insulation and high-performance windows, airtight construction provides a quiet, thermally

safeguards the building's structural integrity, extending its lifespan and reducing maintenance costs along the way.

the risk of localized cold spots, condensation and mould growth around the thermal bridges.

Drafts and cold spots are eliminated, so your home maintains consistent indoor temperatures throughout the year. Airtightness also prevents moisture infiltration and thermal stress, eliminating condensation, mould growth, and potential structural damage. It

Thermal-bridge-free detailing: Thermal bridges are the result of voids and architectural interface details where heat can bypass the insulation, leading to increased energy loss. With highly insulated passive house envelopes, thermal bridging can significantly reduce the benefits of superinsulating. Heat can bypass the insulation and escape from your home, which increases

Thermal bridging is best avoided at the design stage. Eliminating direct conductive connections between the interior and exterior is critical. Over insulating in front of certain connections, wrapping insulation around protruding details, or using thermal break materials are some of the ways to reduce thermal bridges. How windows are installed in their openings can have a significant impact on heat flow. Windows need to line up with the insulation layer, and many frames are available with thermal breaks to interrupt the flow of heat and minimize heat loss through the frame itself.

for in the provided U-values. By eliminating the potential thermal bridges you simplify energy modeling, for more accurate predictions of building performance. Net-zero or net-zero ready; what's the difference?

According to Natural Resources Canada, a Net Zero Energy (NZE) home produces at least as much energy as it consumes on an

Thermal bridging complicates energy calculations by introducing multidimensional heat transfer factors that can't be accounted

annual basis. Net zero homes already have a renewable energy source or sources installed.

mechanical systems your home can easily achieve net-zero ready certification.

A Net-Zero Energy Ready (NZEr) home is designed and built to the very same energy-efficiency standards as a net zero energy (NZE) home. The primary difference is that the net-zero ready home has not had its renewable energy system installed yet. It's been designed and wired so that the solar panel system can be easily installed in the future.

By allowing these homes to become net zero energy homes when the owners are ready, net zero energy ready homes make new home purchases more affordable, while offering a future proof investment to the buyers.

Net-zero homes are extremely well built, with superior insulation, high-performance windows, and airtight construction to minimize heating and cooling needs. By following a holistic passive house approach, with its five principles, through the design and construction process, you will have a solid foundation for your net-zero ready build.

How passive design principles provide the foundation for a net-zero home

Decoding, understanding and embracing passive design principles will help you achieve net-zero ready status. By optimizing building orientation, super-insulation, airtightness, high-performance glazing and ventilation, those passive house principles will significantly reduce energy demands and enhance your family's comfort. When low energy needs are paired with high-efficiency

Then when you are ready, a renewable energy source can be added, and your home will transition from net-zero energy ready

(NZEr) to fully net-zero energy (NZE), minimizing your household's environmental impact, while also reducing your long-term

Resources

Net-Zero and Passive House Synergy: How Passive House Design Principles Contribute to Achieving Net-Zero Energy Targets How to Build an Affordable Passive House on BC's West Coast Passive House Retrofits: Strategies and Techniques for Retrofitting Existing Homes

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operating costs.

The takeaway

The Canada Green Buildings Strategy: Transforming Canada's buildings sector for a net-zero and resilient future Five Principles of Passive House Design and Construction Passive House or Net Zero: Which is Right for Your BC Custom Home?

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