The Science and Planning of Building to Step Code 4

Achieving High Efficiency with a Building-as-a-System Approach

Vancouver, BC

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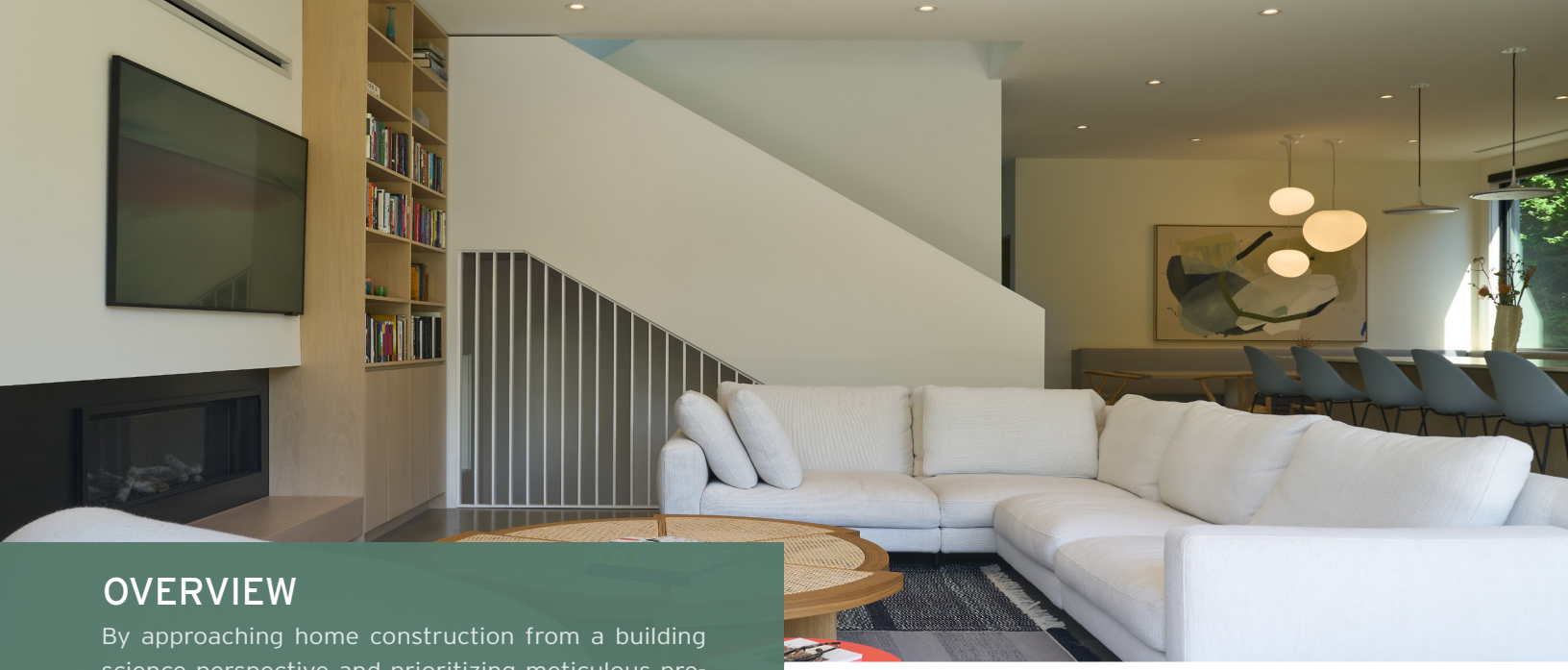

OVERVIEW

By approaching home construction from a building science perspective and prioritizing meticulous pre-construction planning, Lepp consistently manages to build highly efficient homes. This large home manages to achieve Step Code 4 through the use of exterior rigid insulation, SIGA wraps, an "Air Barrier Champion" tasked with ensuring the integrity of the thermal envelope throughout the construction process, and other innovative techniques to improve both efficiency and comfort.

BUILDER PROFILE

Lepp Construction collaborates with leading architects and custom home designers to create clean, functional, and efficient spaces. Lepp prioritizes building science and planning in their approach to home design and construction. With dual goals of lifetime customer cost savings and improved home comfort, Lepp focuses on their homes' thermal envelopes and airtightness, including working with architects directly to ensure that aesthetic appeal compliments efficient design.

CHAMPIONING BUILDING SCIENCE

In addition to a meticulous focus on air barrier integrity throughout the construction process, Lepp uses modeling software to estimate the airtightness and space heating and cooling requirements. Lepp draws the building envelope and vapor barrier planes and uses those to more accurately assess the overall thermal performance of the home, making design modifications as necessary. This allows them to appropriately size the radiant heating system and other mechanical systems. This is especially important in high-performance homes since oversizing mechanical systems can increase project costs, reduce system efficiency, and negatively impact occupant comfort.

HOME PROFILE

Location	Vancouver (Climate Zone 4)
Construction	2021
Size	3,280 ft^2
Bedrooms	5
Bathrooms	4.5
BC Energy Step Code Level	
Targeted/Achieved	Step 4

"An Air Barrier Champion will go around with the proper tapes and sealants and address each hole specifically. That gives us the consistency that's needed around the house to make sure we eliminate leaks and get the best score possible for airtightness."

Kenton Lepp, Owner, Lepp Construction

EARLY DESIGN COLLABORATION

Close collaboration between Lepp and the home's architect allowed for design changes that facilitated comfort and energy efficiency without compromising aesthetics or floor space. Extra space for mechanical chases, a suitable mechanical room, and a slightly lower roof pitch all helped facilitate efficient construction and simpler ongoing maintenance. Modeling mechanical and thermal systems at a very early stage allowed for changes to the architectural design without creating project delays and saved money in the construction process.

MECHANICAL SYSTEM INNOVATIONS

Lepp opted for natural gas space and water heating due to homeowner preference and to manage utility costs with the home's large size. The team implemented an integrated system to maximize efficiency, using a condensing boiler to provide hot water at two temperature setpoints; one for radiant floor heating and another for a 60-gallon indirectly fired storage tank for domestic hot water. Lepp also used a smart recirculation pump in conjunction with dedicated hot water recirculation piping to ensure hot water is available at any fixture within a moment's notice. This system saves energy and reduces water consumption by eliminating waiting periods for hot water and the smart controls ensure that the pump is only running when it needs to be.

INNOVATIVE APPROACH

Lepp prioritized thermal efficiency from day one, collaborating with the home's architect to ensure that the Scandinavian-influenced design accommodated high-efficiency space and water heating, as well as exterior rigid insulation, which enables a comprehensive house wrap. To achieve an extremely airtight envelope, Lepp also designated an "Air Barrier Champion" to ensure that airtightness was always top of mind and that any holes for plumbing fixtures and other equipment were properly sealed. The early collaboration, meticulous pre-construction planning, and science-based approach allowed Lepp to reach Step Code 4 on a modest budget.

RENEWABLE NATURAL GAS[1] (RNG)

For projects where the gas system is the preferred option from a technical and customer perspective, connecting to our gas system gives access to RNG—a low-carbon[2] energy that can help customers reduce overall GHG emissions. Visit fortisbc.com/rngbuild.

PROJECT DETAILS

ENVELOPE	
Airtightness	0.48 ACH_{50}
Attic Insulation	R33 (6" XPS on exterior)
Foundation Insulation	R22, insulated concrete forms
Under Slab Insulation	R12
Wall Construction	2x6 walls
Wall Insulation	R28.5 (2" XPS on exterior, 5.5" R-22 batts in walls)
Window/Wall Area	17.4%
Windows	Double glazed, low-E, argon filled, stainless spacers, 1.36 U-value

MECHANICAL SYSTEMS	
Space and Water Heating	Condensing natural gas boiler (102.5 kBtu/hr, 95% AFUE) supply water at two temperature setpoints. Radiant in-floor heating. Water heating through indirectly fired storage tank with smart recirculation pump.
Space Cooling	Central AC
Ventilation	HRV (68% efficiency, 57 cfm flowrate)

LOADS, COST & REBATES	
Heating Load (TEDI)	19 kWh/m^2 per year
Mechanical Load (MEUI)	37 kWh/m^2 per year
Natural Gas Consumption	35 GJ per year
% More Efficient than Typical New Home	29.5%
FortisBC Home Performance Rebates*	$6,000 Step 4 Rebate + $800 Energy Advisor Support

[1] Renewable Natural Gas (also called RNG or biomethane) is produced in a different manner than conventional natural gas. It is derived from biogas, which is produced from decomposing organic waste from landfills, agricultural waste and wastewater from treatment facilities. The biogas is captured and cleaned to create RNG. When RNG is added to North America's natural gas system, it mixes with conventional natural gas. This means we're unable to direct RNG to a specific customer. But the more RNG is added to the gas system, the less conventional natural gas is needed, thereby reducing the use of fossil fuels and overall greenhouse gas emissions.

[2] When compared to the lifecycle carbon intensity of conventional natural gas. The burner tip emission factor of FortisBC's current Renewable Natural Gas (also called RNG or biomethane) portfolio is 0.27 grams of carbon dioxide equivalent per megajoule of energy (gCO_2e/MJ). FortisBC's current RNG portfolio lifecycle emissions for stationary combustion are -22 gCO_2e/MJ. This is below B.C.'s low carbon threshold for lifecycle carbon intensity of 30.8 gCO_2e/MJ as set out in the 2024 Greenhouse Gas Reduction Regulation amendments.

FortisBC Energy Solutions Managers are here to help. Contact us to discuss your next new construction project. www.fortisbc.com/energyteam

*Rebates are subject to change. For current rebate information, visit www.fortisbc.com/newhome

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