Achieving Step-Code:
Cost effective, high performance traditionally framed single family home

Regional District of Kootenay Boundary

STEP CODE 4 EXCEEDED

This home is 50% more energy efficient than 2018 BC Building Code (exceeding the requirement for Step Code 4 by an additional 10).

KEY BENEFITS

This owner/builder achieved Step Code 4 with minimal cost premiums. They couldn't say enough about the comfort level in their new home, and the knowledge that the systems they put in place will last for years to come.

BUILDING SYSTEMS

HVAC	Air-Source heat pump (ASHP): 1 outdoor unit and 3 indoor units serve the second floor, providing both heating and cooling. Backup heating by natural gas combi-boiler radiant in-floor heating and wood burning fireplace.
Mechanical Ventilation	Energy-Recovery-Ventilator (ERV) with electric resistance pre-heat
Water Heating	High-efficiency natural gas combi-boiler also provides hot water to a domestic storage tank
Glazing	Triple-pane, Low-E, argon-filled windows, 16.8% fenestration-door-to-wall ratio
Foundation	Slab on grade, 6" extruded polystyrene (XPS) insulation underneath

BUILDING TYPE
Traditional Framed Single Family Detached Dwelling

LOCATION
Rossland, BC

ORIENTATION
South Facing

CLIMATE ZONE
6

SIZE, FLOORS
2,600 ft^2 / 242 m^2 – 2 floors

YEAR BUILT
2021

ROOMS
3 Bed / 2.5 Bath / 2-Car Garage

KEY FEATURES
Family oriented home, designed and built with energy efficiency, mechanical performance, and site orientation at the forefront of the design process.

Architectural details:

- Shed style vaulted roof for main living area
- Large covered deck on southern exposure
- Site orientation and design details maximize winter heat gain and minimize summer heat gain from solar exposure

ESTIMATED COSTS

Total build cost:
$850,000 ($327/ft^2)

Step Code cost premium:
$42,500 (5%) over a traditionally built house

Estimated annual energy cost:
$1,200

Building Envelope

CEILING DETAILS

Roofing System	Asphalt shingles with low slope application
Air Barrier	5/8″ plywood wall sheathing with Intello Smart membrane & seams taped with Intello Tescon Vana tape
Framing	Engineered roof trusses @ 24″ on-centre (OC)
Insulation	R-60 blow in cellulose –19″
Interior Finish	1/2″ gypsum board

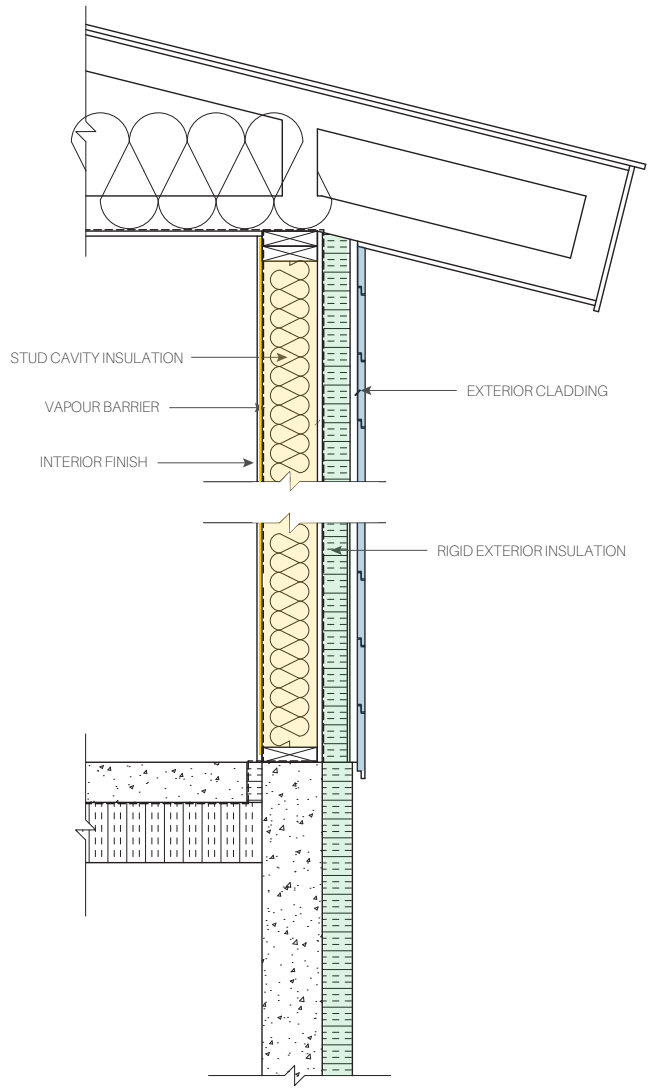
EXTERIOR WALL DETAILS

Cladding	LP SmartBoard engineered wood board & batten siding
Exterior Wall Insulation	R-12 3″ ROCKWOOL® comfortboard rigid insulation
Air Barrier	1/2″ plywood wall sheathing, TYVEK® building wrap, acoustic sealed perimeter and openings & taped seams with Intello Tescon Vana tape
Stud Cavity Insulation	R-24 ROCKWOOL® batt insulation, 4″ 2lbs spray foam for headers
Framing	2″ x 6″ @ 24″ OC
Vapour Barrier	6mm clear poly vapour barrier
Interior Finish	1/2″ gypsum board drywall

FOUNDATION DETAILS

Floor Insulation	R-24 6.6″ extruded polystyrene (XPS) rigid insulation
Wall Insulation	R-16 3″ extruded polystyrene (XPS) rigid insulation

TYPICAL WALL SECTION



Mechanical room and high efficiency natural gas boiler for backup space heating and domestic hot water

Interior framing and ceiling with smart barrier

Efficient wood fireplace to minimize air leakage

Air-Source heat pump for central heating and cooling

Balancing Design + Efficiency

When finalizing architectural and mechanical design considerations, often traditional Owner 'wants' will have an impact on energy efficiency and mechanical system costs or performance trade-offs:

"We wanted a large, vaulted ceiling above the main living area, which negatively impacts the energy efficiency of the home as the warm air gets trapped at the peak of the ceiling. To address this, additional ERV ports were added near the vaulted peak to better circulate warm air."

"We initially desired the ambiance of a wood-burning fireplace with a big glass viewing area for the main living room, but after considering the negative impacts on airtightness, we were swayed to a more efficient model."

"Talk to others and gain real world knowledge about unfamiliar systems—for example, placing a heat pump outdoor condenser unit on a small outdoor deck will have a drastic impact on the ambient noise level. Its best located well out of the way."

Builder's insights

"We engaged an Energy Advisor early on to ensure a wholistic approach from the start."

"Continuous air sealing around the foundation and adding exterior insulation greatly helped us achieve the Step Code airtightness requirement."

"We wish we added more exterior insulation, it was so easy to install and very effective."

Tips for success

Education
Educate yourself and ensure all workers on-site are familiar with best practices for airtightness and are taking the appropriate measures to effectively seal any exterior penetrations created throughout the course of construction.

Details
Details really do matter. Airtightness needs to be a consideration from the very beginning. Get an Energy Advisor on your team at the start.

Accountability
Develop methods for accountability on-site, especially surrounding any air-sealing work. There is risk of significant backtracking to correct deficiencies after the fact.

"We're really happy with the outcome of this project. We've proven that energy efficiency can look great, and that achieving Step Code 4 is well within reach for other new builds in the area.

KATE SEVERIN - SEVERIN BUILT

> We've done a lot of our own research with efficiency, performance, and reliability as key criteria for the products we selected. We also applied input from past projects and what systems work best in different applications. Step Code really emphasized the need for pre-planning and thoroughly understanding how the building systems and details interact with each other.
>
> **JON SEVERIN - SEVERIN BUILT**

ENERGY ASSESSMENT RESULTS

PERFORMANCE CATEGORY AND METRIC	TARGET (STEP 4)	ACHIEVED (STEP 4)
Building Equipment and Systems Compliance Metric: Mechanical Energy Use Intensity (MEUI	55 kWh/(m²·yr)	23 kWh/(m²·yr)
Building Envelope Compliance Metric: Thermal Energy Demand Intensity (TEDI)	30 kWh/(m²·yr)	13 kWh/(m²·yr)
Airtightness Compliance Metric: Air Changes per Hour at 50 Pa (ACH@50PA)	1.5 ACH	1.2 ACH
Energy Use Reduction vs. EnerGuide Reference House		50%
Annual Energy Consumption (Estimated from Energy Model)	Electricity	10,056 kWh
	Natural Gas	10.8 GJ

Mechanical Energy Use Intensity (MEUI) is the sum of energy used for space heating, cooling, domestic hot water and ventilation. Measured per square metre of heated floor area per year. – kWh/m²/yr

Thermal Energy Demand Intensity (TEDI) is the annual heat energy needed after accounting for internal heat gain and solar heat gain. Measured per square metre of heated floor area per year. – kWh/m²/yr

Air Changes Per Hour (ACH@50Pa) is the metric used for blower door airtightness testing. Measured per hour at a 50 Pascal pressure differential.

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Builder	Severin Built Ltd. severinbuilt.ca
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Energy Advisor	Energy Advise energyadvise.ca

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