This course will explain the concept of house as a system, while exploring industry resources to determine appropriate enclosure components and assemblies, mechanical components, and construction approaches that can be used to achieve house as a system best practices. Examining the step code for dwellings, aimed at reducing the energy consumption and greenhouse gases produced by houses.

- Evaluate recent local weather changes in summer and winter, exploring how local life styles affect a house as a system
- Explore the selection of newly available durable building components, assemblies, and construction approaches in the diverse local climate and market for British Columbia.
- Review five key design and construction criteria of cost efficiency, constructability, air-tightness, moisture durability, and sustainability in selecting an appropriate enclosure assembly with house as a system in mind.
- Explore benefits of an exterior-insulated assembly compared to an interior-insulated assembly in terms of house as a system
- Examine ventilation, indoor air and heating, building technology installations, and the adjustments with commissioning of building technology.

Evaluate window products based on key characteristics including energy, durability, and design options.

- Review methods to mitigate the potential impacts of solar heat gain on occupant comfort, including a basic understanding of the solar heat gain coefficient, low-e coatings, window operability, and influence of mechanical systems.

Evaluate enclosure elements and construction practices for achieving airtightness and those intended for vapour control.

- Examine pipe lead-trough's and their installation, flue ducts, and electrical installation lead-trough's.
- Review typical ranges of assembly R-values associated with wood- frame, below-grade concrete and wood-frame roof assemblies in terms of house as a system.
- Determine house as a system principles to guide the evolution of the design and construction of building enclosures with increased R- value in the "envelope first" approach, accounting for local climate and diverse building types and occupancies.

Evaluate Cost Benefit Analysis Tool (CBAT) updates and review how to use computer program.

The House as a System
Building Toward The Step Code
Course Outline

Part 9	Step 1, 2, 3	Step 4, 5
Design, construction & regulatory process	• Basic understanding of the BC Energy Step Code • Principles of performance-based codes • Schedules for testing and demonstration of compliance	**All lower step learning outcomes, and:** • improved integration of project team
Building science	• Understanding of the "envelope first" building approach • Impacts of building form and massing on energy performance	**All lower step learning, and:** • Application of building science to determine insulation, glazing and airtightness requirements • Reducing overall loads and simplified equipment
Energy modelling & metrics	• Modelling tool outputs and how to integrate them into the design process • Thermal energy demand intensity (TEDI), energy use intensity (EUI), mechanical energy intensity and power transfer limit (PTL) standards	**All lower step learning outcomes, and:** • Advanced modelling tools
Airtightness	• Design and construction of an airtight building envelope to achieve 3.5 ACH • Conducting blower door testing • Detection and control of air leakages and managing envelope penetrations	**All lower step learning outcomes, and:** • How to design and build an airtight envelope to achieve <1.5 ACH
Building envelope assemblies	• Elements of an effective building envelope • Envelope quality control and assurance	**All lower step learning outcomes, and:** • Minimizing thermal bridging • Advanced framing, alternative envelope solutions (SIPs, box truss walls, etc.)
Insulation (Building envelope & mechanical)	• Envelope insulation requirements (defined by model, climate zone, etc.) • Temperature bearing systems required for insulation (heating and cooling)	**All lower step learning outcomes, and:** • Thermal bridge-free design, consideration of slab edges, balconies, etc. • Heavier and fatter walls, smaller windows, passive design, and shading

Part 9	Step 1, 2, 3	Step 4, 5
Windows, skylights & doors	• Role of fenestration in heat loss calculations • Labels, standards, shading coefficients, and U-values	**All lower step learning outcomes, and:** • Thermal bridge-free installation strategies • Smaller and heavier windows, passive design, and shading
Supply chain	• Sourcing new/unfamiliar products and services required for compliance (energy model, blower door test, commissioning, etc.)	**All lower step learning outcomes, and:** • New forms of procurement to assure accountability • New forms of delivery methods that foster collaboration, use of digital tools and prefabrication • New / certified products and materials, labels, and standards
Mechanical systems & equipment (heating, cooling, and ventilation)	• Metering, monitoring and controls • Mechanical ventilation in homes, MURBs and ICIs • Heat pumps, heat recovery/recycling, low temperature hydronic solutions, solar, etc. • Commissioning	**All lower step learning, and:** • Simple systems (design, layout, and equipment) to minimize run lengths • Renewable energy solutions • Whole building commissioning, M&V • Basic building science and the importance of air barrier integrity
Electrical systems & equipment	• Ventilation equipment, lighting, appliances, electric HVAC equipment (fans, pumps, etc.) • Metering / submetering, monitoring and controls • Building commissioning	**All lower step learning, and:** • Renewable energy solutions • Whole building commissioning, M&V • Basic building science and the importance of air barrier integrity