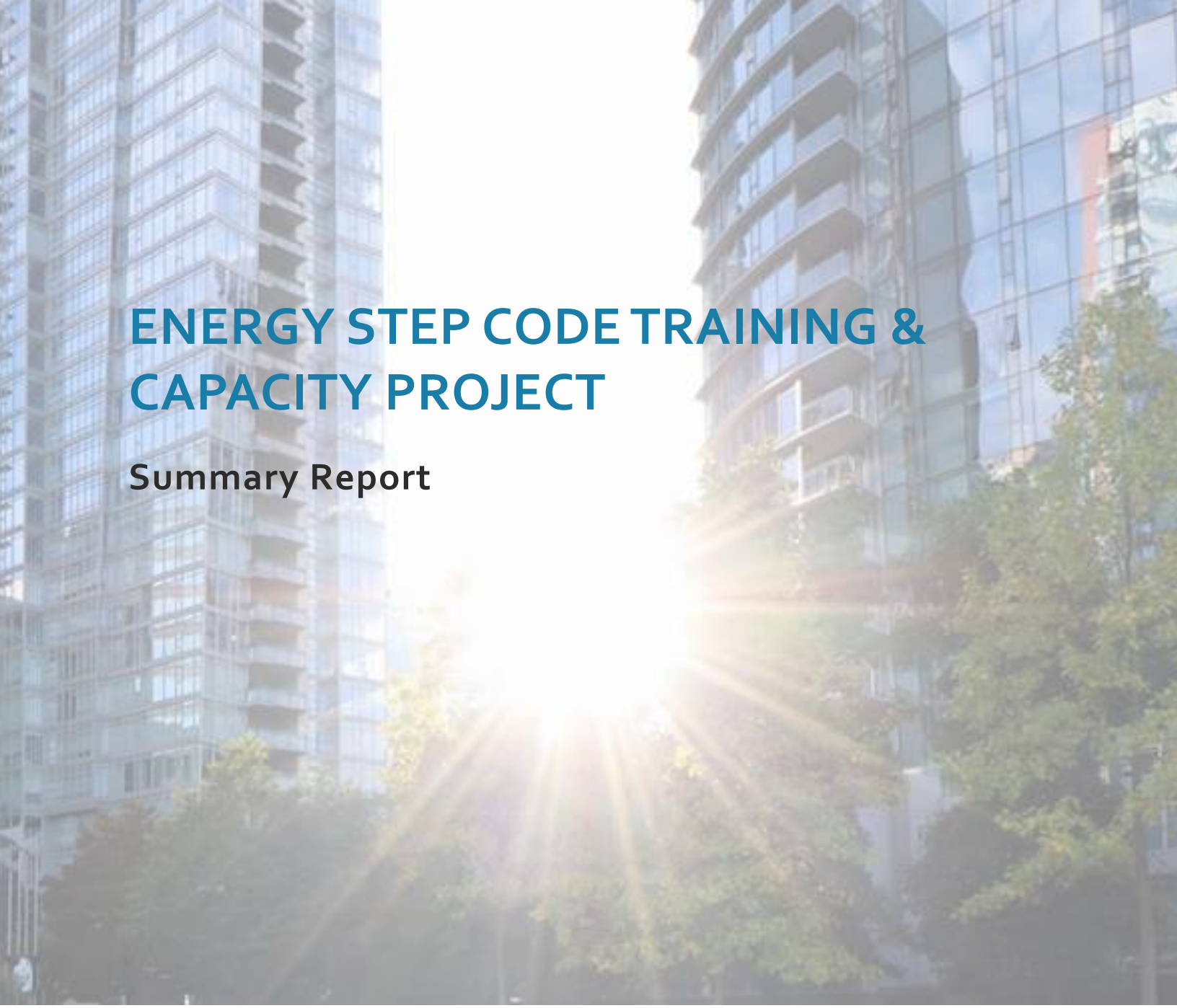

ENERGY STEP CODE TRAINING & CAPACITY PROJECT

Summary Report

MODUS PLANNING, DESIGN & ENGAGEMENT INC.
BRANTWOOD CONSULTING

April 2017

Community Energy Association

MODUS
from insight to impact

Brantwood consulting

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EXECUTIVE SUMMARY

On behalf of the Energy Step Code Communications and Education Subcommittee, MODUS Planning, Design and Engagement and Brantwood Consulting worked together to conduct research, analysis and strategic planning for the Energy Step Code Training and Capacity Project. The project involved a province wide Training Gap Analysis and Industry Capacity Assessment, and the development of a comprehensive Training Strategy, complete with implementation tools and resources to move the project from insight to impact.

The Training Gap Analysis and Industry Capacity Assessment indicate that the Part 3 building industry has the capacity to achieve Lower Steps (Steps 1 and 2) for all new Part 3 construction slated for completion in 2017.[1] With the implementation of the proposed Training Strategy, the Part 9 industry will have sufficient capacity to achieve Lower Steps (Steps 1, 2 and 3) in approximately 60% of new Part 9 construction by 2018. Based on anticipated uptake of the BC Energy Step Code this is sufficient for this initial phase. It is estimated that the entire Part 9 industry will be able to achieve Lower Steps in all new construction by 2020.

BC is home to a number of international leaders in Part 3 and Part 9 building design and construction who have paved the way for the rest of industry to follow suit (see Appendix C). The Training Strategy focuses on disseminating their knowledge and skills to target audiences who provide BC Energy Step Code compliance services through established training delivery agents across all regions of BC. This approach provides an efficient means of training BC's building industry, while ensuring consistency of educational quality and reach. The strategy focuses on strengthening Lower Step competencies in the first three years of implementation (2017 to 2020) and coordinating province wide deployment of existing training that supports Lower and Upper Step competencies at the same time.

Recommended actions put forward in the Training Strategy reflect this approach while filling specific training and capacity gaps identified within the Part 3 and Part 9 industries.

- Part 3 recommendations focus on increasing the quality and consistency of energy modeling and airtightness testing for multi-unit residential buildings (MURBs) and industrial, commercial, and institutional (ICI) buildings, as well as increasing access to qualified energy modellers.
- Part 9 recommendations focus on ensuring a sufficient number of energy advisors and ensuring builders know where and how to integrate energy advisors into building projects.

Investments in high performance building research and development in BC have helped establish it as a hub of innovation. The wealth of high performance building knowledge in the province has created an ideal environment in which to support the BC Energy Step Code training effort. The research findings and training implementation tools and resources leverage this environment to support province wide industry implementation of the BC Energy Step Code. Successful implementation will not only increase the energy efficiency of buildings, but also ensure the building and construction industry in BC remains competitive in the wake of increasing international market competition, rising construction costs, and tight labour markets, providing benefits for government, industry and community stakeholders alike for years to come.

[1] See Industry Capacity Assessment for details.

INTRODUCTION

BC is a leader in high performance building design and construction. The birthplace of the Canada Green Building Council, BC brought the LEED building standard to Canada. BC is the only province in Canada to adopt LEED Gold as the standard for public buildings. Years ago, the first Living Building Challenge projects outside of the US were constructed in BC. More recently, Canada's first Passive House homes have been built in BC and Passive House multi-unit residential buildings (MURBS) are following suit.

A training strategy to support implementation of the new BC Energy Step Code is needed to ensure that BC's building industry has the knowledge and skills to remain a leader in energy efficient building design and construction. The BC Energy Step Code is a new regulatory tool for local governments to encourage or require greater energy performance in Part 3 buildings (MURBs and industrial, commercial and institutional [ICI] buildings) and Part 9 buildings (homes and small structures) than is currently required by the BC Building Code.

Introducing the BC Energy Step Code is a complex undertaking and significant work has already been done to understand how to support successful implementation. The Energy Step Code Implementation Recommendations, developed in 2016, represent the agreement of the Stretch Code Implementation Working Group (now the Energy Step Code Council) to work together on implementing the BC Energy Step Code. These recommendations pointed to the need for an analysis of existing industry capacity and training to deliver BC Energy Step Code buildings. The Energy Step Code Training and Capacity project was commissioned in response to this need.

The analysis outlined in this report is a first step in understanding the complex landscape of education and training that supports the BC building industry and how this system can support implementation of the BC Energy Step Code. As such, it serves as an essential foundation for more detailed analysis, planning, and delivery of communications and training programs.

The Energy Step Code Training and Capacity Summary Report includes findings from all of the research conducted as part of the Energy Step Code Training and Capacity Project. The project involved:

1. **Establishing a research framework**: Identifying core competencies and learning outcomes for Part 3 and Part 9 buildings.
2. **Consulting with key stakeholders**: Gathering primary research data from industry professionals via an online survey fielded to major training providers, interviews with 35 industry leaders representing a diversity of stakeholder groups, and collecting feedback from stakeholder group representatives throughout the research process.
3. **Assessing industry capacity:** Interviewing a cross section of the building industry to get a deeper understanding of the opportunities and challenges of delivering Part 3 and Part 9 BC Energy Step Code buildings. This was supplemented by gathering readily available quantitative industry data to model future capacity based on assumptions informed by survey and interview data.
4. **Identifying training gaps**: Surveying training providers to understand what training is currently available and what regions of the province it can be accessed from. This was supplemented by a web search of training programs.
5. **Developing a training strategy**: Analyzing all of the data and research to develop an industry appropriate training strategy, setting a foundational support for long term success while meeting specific short term training needs.

The report presents the findings from each of these research activities by laying out what knowledge and skills it takes to deliver a BC Energy Step Code building and what relevant training is currently available (Training Analysis), the current state of the BC building industry and its ability to deliver BC Energy Step Code buildings (Industry Capacity Assessment), and a strategy to strengthen industry capacity (Training Strategy). Recognizing the unique challenges and opportunities for Part 3 and Part 9 buildings, each section of the report addresses them separately.

WHAT'S IN THE REPORT

The project aims to move from insight to impact, by using extensive research as a basis for developing practical implementation resources and tools. The report package includes the following, either in the attached appendices or as separate documents:

- **Training Strategy**: tangible actions that can be taken to support province wide implementation of the BC Energy Step Code in an efficient manner.
- **Training Leaders**: a searchable inventory of 28 "training leaders," who have existing curriculum that aligns with BC Energy Step Code core competencies and learning outcome. The inventory provides information on existing and planned training, the core competencies they cover, program format, location, reach and target audience (see Appendix C).
- **Regional training delivery agents**: lists of organizations that are well suited to deliver BC Energy Step Code training to local audiences in each region of the province. Training delivery agents could deliver programs that have already been developed by training leaders to expand the reach of existing curriculum (see Appendix D).

METHODS

Lower and Upper Steps

The report distinguishes between Lower and Upper Steps for Part 3 and Part 9 buildings. For Part 3 buildings, Lower Steps include Steps 1 and 2, while Upper Steps include Steps 3 and 4. For Part 9 buildings, Lower Steps include Steps 1, 2 and 3, while Upper Steps include Steps 4 and 5. A summary of the Lower and Upper Steps classification is provided in Figure 1.

Figure 1. Energy Step Code: Lower Steps and Upper Steps for Part 3 and Part 9 buildings

The distinction between Lower and Upper Steps is based on a threshold beyond which compliance is considered more challenging, based on technical requirements.[2] When pursuing Lower Steps, energy performance targets may be left in the hands of key specialists, such as building scientists or energy advisors. The Upper Steps require all members of a project team to place emphasis on energy efficiency from an early stage of the project. In Upper Step projects, energy performance may influence everything from the building form, layout and aesthetics, to the detailed design and construction processes. Business as usual building approaches are no longer technically and/or economically feasible. Key features of Lower and Upper Step projects are listed below.

Lower Steps:

- Rely on established best practices in envelope detailing and system optimization.
- Have little impact on building form, layout and aesthetics.
- May be delivered via industry accepted procurement models and existing trade relationships.

Upper Steps:

- Potentially substantial impact on building form, layout and aesthetics.
- Rely on project team integration and collaboration.
- May require new trade relationships and responsibilities.
- Require attention to detail during construction.
- May require new forms of project delivery.

[2] Lower and Upper Steps were identified through interviews with a cross section of industry stakeholders and consultation with the Energy Step Code Training & Education Sub Committee and technical experts.

The report focuses on expanding the building industry's capacity to deliver Lower Steps of the BC Energy Step Code for Part 3 and Part 9 buildings over the next 1 to 3 years. Lower Step competencies are prerequisites for establishing Upper Step capacities.

Limitations

The purpose of the report is to provide an overview of industry capacity to deliver buildings that meet Lower Steps of the BC Energy Step Code and the existing educational programs/resources available to support this effort. Our intention is to scan industry capacity and existing training to highlight significant gaps that threaten the implementation of the BC Energy Step Code.

A comprehensive review of industry capacity would require a detailed labour market study, which is beyond the scope of this project. We have provided estimates in relation to industry audiences that are BC Energy Step Code stakeholders to provide a high level assessment of industry capacity.

This report is intended to inform local government decisions about regulation of BC Energy Step Code performance. Because this report primarily focuses on province wide capacity, with limited regional information, local governments will also need to undertake additional work to assess their own local industry capacity. This report also does not assess the capacity of building officials, but focuses on the capacity of private industry.

The report is not intended to provide a comprehensive inventory of all training available across BC, although it does cover major training providers across all regions of the province. The assessment of courses included in the inventory of Training Leaders does not assess the adequacy of each program in detail. Given the number of training providers and courses, more resources would be needed to do this.

Furthermore, the analysis we developed provides limited information on the ability of Training Leaders to scale up their offerings. Further consultation with Training Leaders would be needed to confirm our estimates, which are based on aggregated survey data.

Working within these limitations, this report provides an overview of industry capacity and training resources, proposing actions to support successful implementation of the BC Energy Step Code. The various implementation tools and resources are intended to aid further implementation.

TRAINING ANALYSIS

What Does Building to the BC Energy Step Code Take?

This section outlines required practices and/or services to deliver Part 3 and Part 9 BC Energy Step Code projects. Requirements for both Lower Steps and Upper Steps are presented, although more detail is provided for Lower Steps.

Core competencies and learning outcomes

In order to identify what knowledge and skills are needed to deliver BC Energy Step Code projects our team developed a framework of core competencies and learning outcomes that correspond to BC Energy Step Code compliance.[3] The framework includes ten core competencies:

1. **Design, construction & regulatory process**: Building design in which all equipment and components are part of a holistic system. This requires the project team to work collaboratively, and for the regulatory process to support and complement the design and construction sequence, accommodating specific services, such as energy modeling and the airtightness testing. There is a general shift to outcome/performance based processes (no “point chasing”).
2. **Building science**: The fields of science and engineering concerned with the technical performance of buildings, building materials, and building systems. The area is broad enough to include construction technology, material science, heat and mass transport physics, meteorology, and envelope and structural design, to name a few.
3. **Energy modelling & metrics**: Virtual or computerized simulation of a building or complex that analyzes energy consumption, utility bills and life cycle costs of various energy related items (such as air conditioning, lights, and hot water). Models use energy performance metrics in the form of Thermal Energy Demand Intensity (TEDI), Energy Use Intensity (EUI), Mechanical energy intensity and Power Transfer Limit (PTL) standards. Knowledge is required to use models to compare different energy efficiency options, predict monthly energy consumption and greenhouse gas (GHG) emissions. To achieve the Upper Steps, energy performance will inform the building form and massing (not the other way round). Also, optimization of passive design benefits and shading may result in impacts on Floor Wall Ratio (smaller windows) and Floor Area Ratio (fatter walls), all of which may impact existing local government design guidelines.
4. **Airtightness**: Energy performance is underpinned by an understanding of the function and protection of the air barrier, how to design an airtight building envelope and the capacity to deliver airtight construction. This includes air leak detection and control, the use of thermographics to identify cold/hot spots and managing envelope penetrations. Airtightness testing is necessary by placing the building under both positive and negative pressure to test for leaks (e.g. the blower door test), which needs to be factored into the project scope and schedule.
5. **Building envelope assemblies**: To achieve an energy efficient building the "envelope comes first." The type, composition and quantity of the various components and layers of materials that go into the walls, roof and other exterior areas, and how they are put together, have significant impacts on how efficiently the building performs. For example, thermal bridging (where there is a significantly higher heat transfer on account of lack of insulation and/or high thermal conductivity of a material) can result in an overall reduction in thermal insulation of the

[3] Core competencies were identified through interviews with a cross section of industry stakeholders and consultation with the Energy Step Code Training & Education Sub Committee and technical experts.

building. Thermal bridging can be minimized via continuous insulation, thermally protecting exposed slab edges, addressing balcony design, etc.

6. **Insulation (building envelope & mechanical)**: Energy efficient building starts with addressing heat loss/gain through the building envelope (walls, roof, etc.) through the provision of adequate insulation in the walls, roof and other exterior areas. Similarly, insulation should be applied to any temperature bearing systems (mechanical equipment, pipework, etc.).
7. **Windows, skylights & doors**: Glazed areas of the building are typically the points of greatest heat loss/gain so the area, location and performance of the glazing and frames is an important factor.
8. **Supply chain**: Energy efficient buildings incorporate high performance envelope products and components that may be unfamiliar to designers and builders, such as such as triple glazed windows with thermally broken frames, thermal isolators to concrete balconies, new types and configurations of insulation, etc. These products may require new supply chains to be established and may need to be tested for application in BC.
9. **Mechanical and electrical systems & equipment**: Upper Steps may require the design, availability and installation of new efficient heating, cooling, ventilation and domestic hot water technologies, equipment and associated distribution solutions (e.g. heat pumps, low temperature hydronic solutions, direct current wiring) along with a range of heat recovery systems (e.g. heat recovery ventilators, heat scavengers, and wastewater heat extractors). Increasingly, renewable solutions such as solar hot water heating, photovoltaic system, etc. are being included, although there may be conflicts with district energy systems / offset opportunity for renewable energy. Increasingly, the communication systems between these devices and the user controls are becoming more advanced. In all cases, metering, monitoring, commissioning and testing are required along with owner/occupant education.

Each core competency has 3 to 4 required learning outcomes to build to Lower and Upper Steps of the BC Energy Step Code for Part 3 and Part 9 buildings. The framework of core competencies and learning outcomes is provided in Appendix B. The learning outcomes listed are cumulative (i.e. all learning outcomes needed to build to Step 1 are required to build to all other Steps).

Who is involved in delivering Part 3 and Part 9 Buildings?

Delivering a BC Energy Step Code building is a team effort that involves many stakeholders, who are the "audiences" for capacity building efforts. While achieving Lower Steps generally require adding specialized professionals to project teams, achieving Upper Steps may involve adding specialized professionals to project teams and adjusting the roles and responsibilities of existing project team members. Audiences responsible for delivering Part 3 ICI, Part 3 MURBs and Part 9 buildings are listed in Table 2.

Table 2. Audiences involved in delivering buildings that comply with the BC Energy Step Code

Audiences involved in delivering buildings that comply with the BC Energy Step Code		
Part 3 ICI	**Part 3 MURBS**	**Part 9**
• Commercial developers • Public and private owners; purchasers • Architects & spec. writers • Mechanical engineers • Electrical engineers • Structural engineers • Building scientists • Energy modellers • General contractors • Trade contractors (HVAC; electricians; steel stud & drywall; roofing; insulators) • Suppliers (windows, doors, HVAC, etc.) • Building officials (building inspectors, plan checkers)	• Residential developers • Architects & spec writers • Mechanical engineers • Electrical engineers • Energy modellers • Structural engineers • Building scientists • General contractors • Trade contractors (HVAC; electricians; steel stud & drywall; roofing; insulators) • Suppliers (windows, doors, HVAC, etc.) • Building officials (building inspectors, plan checkers)	• Residential developers • Home builders • Architects and home designers • Energy advisors • Trade contractors (plumbers & HVAC, electricians, carpenters & framers, roofing, insulators) • Suppliers (windows, doors, HVAC, etc.) • Building officials (building inspectors, plan checkers)

The opinions of a cross section of these audiences were captured in interviews with 33 industry and government representatives. The discussions were designed to gather input on existing industry capacity to implement the BC Energy Step Code and understand the scale of additional training needed. Interviewees included representatives from provincial government institutions (3), local governments (2), builders (7), construction and trades associations (5), energy modellers (2), energy advisors (2), high performance building experts (5), energy efficient equipment suppliers (5). These representatives have experience “on the front lines” of high performance building projects. The interview questions focused on their experience accessing the services required for lower levels of the BC Energy Step Code for Part 3 and Part 9 buildings, as well as anticipated challenges and opportunities for implementation.

Priority training for Part 3 and Part 9 buildings was identified by comparing the required competencies and learning outcomes with the existing capacity of key audiences. Particular attention was paid to competencies and capacities necessary to achieve Lower Steps in Part 3 and Part 9 buildings. The training needs for Lower Steps are categorized as “priority training” for Part 3 and Part 9 buildings. Priority training needs to be addressed in the short term. Additional training for Part 3 and Part 9 buildings will build capacity to meet Upper Steps in the long term. These training needs are outlined in the respective sections below.

While existing services are referenced in priority training, a high level description of competencies and learning outcomes is used to describe additional training for Upper Steps. Some competencies for Upper Steps are not yet readily available industry services.

TRAINING FOR PART 3 BUILDINGS

Priority Training for Lower Steps

Compliance with the Lower Steps of the BC Energy Step Code for Part 3 buildings requires the following services:

- **Energy modeling:** An energy model must be developed by an energy modeller to evaluate and describe the predicted energy performance of the building.
- **Airtightness testing:** A building envelope consultant must conduct airtightness analysis, along with on-site testing, to validate the airtightness of the building.
- **Regulatory review:** A plan checker and a building inspector must check that the building and all the various systems and assemblies are designed and built in compliance with the BCBC and any other applicable regulations.

Industry audiences involved in these activities include energy modellers; building scientists; and building officials (plan checkers, inspectors, etc.). Each of these priority audiences need to have adequate capacity and/or access to training to ensure the provision of effective services.

Additional Training for Upper Steps

Compliance with Upper Steps for Part 3 buildings requires some audiences to have greater knowledge of the BC Energy Step Code core competencies and corresponding skills training. These audiences include:

- Developers and owners;
- Architects;
- Structural, mechanical and electrical engineers;
- Specialist consultants (building envelope consultants, code consultants, specification writers, sustainability consultants, etc.);
- Energy modellers;
- General contractors and trades;
- Building officials.

Competencies for each audience to achieve Upper Steps are described below.

Developers and owners

Developers and owners will need to know to market high performance buildings to potential consumers in order to tap into the energy efficient building market. In order to capitalize on this market, developers and owners, along with their brokers, agents and marketers, need a general appreciation for the implications of passive design principles on building design and aesthetics, project scheduling and costs. They also need to understand the impacts of energy performance targets on their procurement processes. Best practices for procurement of innovative and high performance buildings are available from BCCA[4], but these may need to be adjusted to include metrics that align with the BC Energy Step Code (e.g. EUI targets).

Architects

Architects will need to understand how their practice impacts the energy performance of buildings, as well as passive design principles so they can use design features to deliver energy performance and

[4] BC Construction Association (2016).

thermal comfort while reducing the reliance on mechanical systems. This will require some building science training.

Architects will also need training on the quality of construction documents expected by contractors so buildings achieve optimal performance once they are built.

The importance of architects in designing passive design buildings suggests there needs to be a "re-balancing" of the responsibility for energy performance in Part 3 buildings from the mechanical engineer to the architect. This may lead to questions of liability and a re-balancing of risk allocations.

Building envelope consultants

Pressurization and airtightness testing is not new in BC, even for complex buildings in extreme climates.[5] However, these processes are not routine and many building envelope consultants will need a greater understanding of the various airtightness testing methods. This will help them apply testing methods appropriately and integrate them into their project management process.

ICI specialists are most familiar with designing airtight building envelopes. This skill is less commonplace for those involved with high-rise MURBs, for whom more training may be necessary to address both envelope design and project processes.

The quality of building services varies. Training on best practices needs to be diffused throughout the building envelope community. BC is home to international building science experts who should guide the development of best practice training.

Structural, mechanical and electrical engineers

Training on the principles of low energy design will be needed for all engineers. In order to reduce reliance on mechanical systems to deliver thermal comfort and performance, structural engineers need to understand the implications of passive design solutions on envelope structure. Mechanical and electrical engineers need training on mechanical ventilation and low energy thermal comfort systems so they are able to accommodate envelope performance in their calculations and source "right sized" equipment for low heating loads. Mechanical and electrical engineers will also need to learn how to integrate renewables into building systems.

Complete and thorough detailing of the building envelope and systems is essential to high performance buildings. All consultants will need training on the quality of construction documents expected by contractors so they can achieve the energy performance requirements.

Energy modellers

Energy modellers will need a deeper understanding of building science so that they can play a larger role in the initial building design through an integrated design process. Training will need to be developed for energy modellers to understand their new role in the integrated design process. A greater understanding of building science amongst energy modellers will also result in the production of more reliable models.

[5] Davidson (n.d.).

General contractors and trades

The roles and responsibilities of general contractors and trades in delivering an energy efficient building need to be communicated to these audiences. Training will be needed on project team sequencing and coordination. Key trades (HVAC, framers, roofers and insulators) will need to have the technical skills to deliver energy efficient construction.

General contractors will also find it beneficial to become familiar with enabling technologies, such as lean construction, pre-fabrication, and virtual design and construction tools to manage productivity, quality and construction efficiency. They need to know where to source new products and technologies.

Building officials

Building officials, particularly building inspectors and plan checkers, need to have a basic understanding of building science in order to evaluate buildings based on anticipated performance, as opposed to prescriptive features. Some local governments have already started to develop energy performance checklists, evaluation forms, and other tools to ensure that information is prepared and presented consistently.[6] Ongoing training may also be needed for building officials to build awareness of new products and technologies.[7]

TRAINING FOR PART 9 BUILDINGS

Priority Training for Lower Steps

Compliance with Lower Steps of the BC Energy Step Code for Part 9 buildings requires the following services:

- **Energy advising:** An energy advisor must complete an energy model to document the energy performance of the building and conduct a blower door test to document its airtightness.[8]
- **Energy efficient construction trades:** Construction trades must provide proper detailing and installation of equipment.
- **Successful building inspection:** A building inspector must inspect the building to ensure it complies with the BCBC and any other applicable regulations.

Industry groups involved in these activities include home builders and their construction trades; energy advisors; and building inspectors. Each of these audiences need to have adequate capacity and/or access to training to ensure adequate provision of services.

Additional Training for Upper Steps

Compliance with Upper Steps for Part 9 buildings requires some audiences to have greater knowledge of BC Energy Step Code core competencies and corresponding skills training. These audiences include:

- Architects and home designers;

[6] City of Vancouver (2017).

[7] Certification of new building materials and/or products will continue to be addressed by appropriate provincial regulatory bodies, however building inspectors and plan checkers will require ongoing training to ensure familiarity with these products.

[8] Energy advisors may also provide other energy efficiency measures which are not required to comply with the BC Energy Step Code.

- Mechanical and electrical engineers;
- Energy advisors;
- Residential builders and construction trades;
- Building officials.

Competencies and learning outcomes for each audience are described below.

Architects and home designers

Home designers often play a large role in the design of single family homes, as a registered architect is not required on projects less than 470m^2 (5,059ft^2), which covers most single family homes.[9] Home designers tend to be trained in architectural technology, but they are not necessarily affiliated with the Architectural Institute of British Columbia (AIBC), the professional accreditation body for architects in BC.

Architects and home designers will need to have a general understanding of passive design principles and their implications on building design and aesthetics, project scheduling and costs. A central component of their training will be reducing the reliance on mechanical systems for thermal comfort and performance. This will require some training on building science. Architects and home designers will also need training on the quality of construction documents expected by contractors so buildings can achieve optimal performance.

Mechanical and electrical engineers and technologists

Training on the principles of passive design will be needed for mechanical and electrical engineers in order to reduce reliance on mechanical design to deliver thermal comfort and performance. Mechanical and electrical engineers need training on mechanical ventilation and low energy thermal comfort systems. They also need to be able to accommodate envelope performance, source "right sized" equipment for low heating loads, etc. It should be noted that for single family homes, mechanical and electrical designs are frequently carried out by the relevant trade contractor.

Energy advisors

The current training required to become an energy advisor is sufficient to achieve up to Step 3 for Part 9 buildings (roughly equivalent to the current Vancouver Building Bylaw standards).[10] Some energy advisors are capable of reaching Steps 4 and 5 because of additional training they have acquired. More building science will need to be integrated into the energy advisor training program to ensure all energy advisors have greater understanding of passive design (particularly as it relates to building envelope, mechanical and electrical systems).

Residential builders and trades contractors

Most residential builders will need some building science training, particularly to appreciate the impact of thermal bridging and form factor on the energy performance of homes and small residential structures.

General contractors and trades will need training on their roles and responsibilities in delivering an energy efficient building, particularly project team coordination to effectively sequence trades. Key trades need to understand the level of technical skill required to deliver an energy efficient building.

[9] Architectural Institute of BC (2017).
[10] Estimate of energy advisor capacity informed by interview data.

Contractors will need to know where to source new products and technologies (e.g. HRVs and very small heating appliances), as well as how to choose and install the proper products. Specific training will be needed on the integration of renewable energy solutions.

Building officials:

Just as with Part 3 buildings, plan checkers and building inspectors need to have a basic understanding of building science in order to evaluate building based on anticipated performance, as opposed to prescriptive features. Ongoing training may also be needed to build awareness of new products and technologies.[11]

EXISTING TRAINING FOR PART 3 AND PART 9 BUILDINGS

Existing and planned training programs that support BC Energy Step Code core competencies and learning outcomes for Part 3 and Part 9 audiences are listed in the Training Leaders inventory (Appendix C). The inventory provides an overview of the adequacy of existing and planned training to support BC Energy Step Code implementation.[12]

Examination of the inventory, results of the survey of major training providers, consultant knowledge and extensive web research offer the following insights.

Building design, construction and regulatory processes

Thirteen survey respondents currently offer, or plan to offer, training on building design, construction and regulatory processes. Existing and planned curriculum covers all learning outcomes necessary to deliver Lower and Upper Steps for Part 3 and Part 9 buildings.[13] Additional learning outcomes that surpass (or may be tangential to) those necessary to support BC Energy Step Code implementation are also included in the curriculum, such as HVAC and architectural interaction, and how to achieve energy efficiency targets for buildings (such as VBBL, ENERGY STAR, 20% Lower Than ERS Reference House).[14]

Most survey respondents who provide training on building design, construction and regulatory processes reported training eleven to twenty-five individuals per year. Eleven of these provide training in a classroom setting. A number of these courses require specialized facilities, such as labs and workshops. Six institutions offer their training online.

The reach of training in this competency area spans all regions of BC. Skeena Northcoast and Northeast have the lowest levels of access, with only one survey respondent teaching courses on building design, construction and regulatory processes in these regions.

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[11] Certification of new building materials and/or products will continue to be addressed by the appropriate provincial regulatory bodies, however building inspectors and plan checkers will require ongoing training to ensure familiarity with these products.

[12] Core competencies discussed in the section below do not match the core competencies listed on page 6 and 7 because some core competencies were combined in the training provider survey to make the survey more manageable for respondents.

[13] Training provider survey responses include existing training programs and those planned for the next calendar year (2016 to 2017).

[14] Training provider survey respondents were asked to include information on all training curriculum planned for delivery and/or development in 2017.

Energy modeling and metrics / Energy advising

Eleven survey respondents currently offer, or plan to offer, training on energy modeling and metrics or energy advising. Existing and planned curriculum covers all learning outcomes necessary to deliver Lower and Upper Steps for Part 3 and Part 9 buildings. Additional learning outcomes that surpass those necessary to support BC Energy Step Code implementation are also included in the curriculum, including energy benchmarking, energy measurement and verification, commissioning for new and existing buildings and energy auditing.

Most survey respondents who provide training on this competency reported training eleven to twenty-five students per year. Nine institutions deliver their training in a classroom setting. A number of these courses require specialized facilities, such as labs and workshops. Four institutions currently offer their training online.

The reach of training in this competency area spans all regions of BC. Again, Skeena Northcoast and Northeast had the lowest levels of access, with only one survey respondent teaching courses on energy modeling and metrics or energy advising in these regions.

Building science

Optimal thermal performance of building envelopes

Eight survey respondents currently offer, or plan to offer, training on optimal thermal performance of building envelopes. Existing and planned curriculum covers all learning outcomes necessary to deliver Lower and Upper Steps for Part 3 and Part 9 buildings.[15]

Most respondents who provide training on this core competency reported training more than one hundred individuals per year. Six training providers deliver their training in a classroom setting. A number of these courses require specialized facilities, such as labs and workshops. Three institutions offer their training online.

The reach of training in this competency area spans all regions of BC. Skeena Northcoast has the lowest levels of access.

Airtight building envelopes

Seven survey respondents currently offer, or plan to offer, training on airtight building envelopes. Existing and planned curriculum covers most learning outcomes necessary to deliver Lower and Upper Steps for Part 3 and Part 9 buildings. However only one training provider reported teaching students to conduct airtightness tests for Part 3 buildings. Follow-up interviews suggest that this is due to the informal training that has been developed in-house at engineering and building science consulting firms, which specialize in Part 3 buildings. Additional learning outcomes related to airtight building envelopes are also included in the existing curriculum, such as the evolution of building envelopes in Canada and commissioning issues related to building envelopes.

Most survey respondents who provide training on this core competency train more than one hundred individuals per year. Four provide training in a classroom setting. A number of these courses require specialized facilities, such as labs and workshops. Three institutions offer their training online.

[15] Training provider survey responses include existing training programs and those planned for the next calendar year (2016 to 2017).

The reach of training in this competency area spans all regions of BC except Skeena Northcoast. Northeast and Cariboo-Prince George also had low levels of access, with only one training provider reaching students from each of these areas.

Supply chain

High performance building products and materials

Ten survey respondents currently offer, or plan to offer, training on high performance building products and materials. Existing and planned curriculum covers all learning outcomes necessary to deliver Lower and Upper Steps for Part 3 and Part 9 buildings.[16]

Most respondents who provide training on this core competency reported training eleven to twenty-five individuals per year. Nine of these deliver their training in a classroom setting. Six institutions offer online training.

The reach of training on high performance building products and materials spans all regions of BC. Skeena Northcoast has the lowest levels of access.

Energy efficient building systems and equipment

Eleven survey respondents currently offer, or plan to offer, training on energy efficient building systems and equipment. Existing and planned curriculum covers all learning outcomes necessary to deliver Lower and Upper Steps for Part 3 and Part 9 buildings.[17]

Most respondents who provide training on this core competency reported training more than 100 individuals per year. Nine of these providers provide training in a classroom setting. A number of these courses require specialized facilities, such as labs and workshops. Five institutions offer training online.

The reach of training in this competency area spans all regions of BC. Skeena Northcoast has the lowest levels of access.

TRAINING GAPS

Analysis of the training provider survey suggests core competencies and learning outcomes building professionals and trades workers need to deliver BC Energy Step Code buildings are already integrated into existing training curriculum.[18] However, with no central platform for educational and training resources, the training landscape in BC is highly decentralized. There is significant duplication of training efforts on certain core competencies and training has become concentrated in regions with large urban centres.

The existing training landscape does not support efficient, province-wide diffusion of knowledge and skills. It may also result in inconsistent building practices in different regions, which must be addressed as part of a province-wide training strategy to support successful BC Energy Step Code implementation.

The only competency not adequately covered in existing or planned curriculum is airtightness testing for Part 3 buildings. However, this should not be considered a "training gap," but a reflection of the

[16] Training provider survey responses include existing training programs and those planned for the next calendar year (2016 to 2017).
[17] Ibid.
[18] Ibid.

informal training culture of Part 3 building envelope consultants, who routinely pass down knowledge and skills to staff "in-house." This is further supported by the fact that industry capacity for airtightness testing for Part 3 buildings currently exceeds market demand (see Table 5). Regardless of why this competency is not taught by educational institutions, additional curriculum does not need to be developed to address any association skills shortage. Instead, existing "in-house" training should be scaled up so it is accessible to building envelope consultants outside of leading firms. In interviews, Training Leaders from educational institutions expressed an awareness of this gap and explained that they are in the process of developing programs to address it (e.g. BCIT's Sustainable Energy Management Professional Development Series). Interviewees suggested a number of barriers to Part 3 airtightness training such as lack of funding for specialized training equipment and facilities.

There is a gap in the reach of existing training in the Skeena Northcoast and Northeast.[19] Some survey respondents reported providing minimal training in both of these regions on every core competency area. However, it is important to note these areas have very few new buildings being built relative to the rest of the province (see total building permits in North Coast, Nechako and Northeast in 2016 below). Other regions of BC that are experiencing the majority of development have reasonable access to training in each of the core competency areas.[20]

Table 3. Value of BC Building Permit by Region (2016) [21]

Value of BC Building Permits by Region (2016)		
Region	**Value ($ 000s)**	**% of BC total**
Vancouver Island/Coast	$1,841,249	13.9%
Mainland/Southwest	$9,073,135	68.5%
Thompson/Okanagan	$1,597,148	12.0%
Kootenay	$284,873	2.1%
Cariboo	$230,443	1.7%
North Coast	$28,942	0.2%
Nechako	$27,960	0.2%
Northeast	$171,274	1.3%
British Columbia total	$13,255,024	100%

POTENTIAL TO SCALE-UP EXISTING TRAINING

Given that existing and planned training curriculum covers all core competencies and learning outcomes, the Training Strategy should leverage these resources by scaling-up existing training across the province and ensuring access in all regions. The potential to scale-up existing training is high, as indicated by survey data collected from training providers.

[19] Regions referenced in the training provider survey and interviews are outlined in Appendix A.
[20] Access was deemed reasonable if two or more institutions offer training on BC Energy Step Code core competencies and some training is available in online formats.
[21] Source: BC Stats. Retrieved from http://www2.gov.bc.ca.

Forty-Four percent of survey respondents reported that they could train an additional 100 to 500+ students under current conditions, starting in the fall of 2017. If one of the barriers they currently face was removed, 26% survey respondents estimated they could train an additional 500+ students per year. Interview data suggests that these training providers' efforts could be further supplemented by additional training delivery agents located in each region (e.g. by VICA and other trades associations), to provide more specialized, hands-on training (particularly for Part 9 builders and construction trades).

Barriers to scaling-up existing and planned training programs identified by training providers include:

- Low demand for training (no regulatory requirements to meet performance standards);
- The industry is busy and does not see sufficient value;
- Lack of qualified instructors;
- Lack of funding for:
    - Staff to administer and manage additional courses and larger intake of students;
    - Classroom space to accommodate more students;
    - Specialized facilities and equipment for training;
    - Travel to provide training in remote communities.

Survey respondents reported that a lack of funding for the administration of additional courses is the most significant barrier to scaling-up existing training. Preliminary research looking at best practices to address this barrier was conducted to inform future work undertaken to fund the Training Strategy (see Appendix I).

INDUSTRY CAPACITY ASSESSMENT

Is Industry Ready for the Energy Step Code?

Evaluation of current industry capacity to implement the BC Energy Step Code requires an assessment of the knowledge and skills possessed by working professionals and trades. This was done by developing forecast models for all compliance services for Lower Steps in Part 3 and Part 9 buildings (energy modeling and airtightness testing for Part 3; and energy advising for Part 9). Building officials' roles in the inspection and permitting of all new buildings was also considered. Forecast models are based on industry and market data, growth and development forecasts, training provider survey responses and interview data.

Forecast models suggest that industry can deliver Lower Steps for all Part 3 buildings in BC today. For Part 9 buildings, there is already considerable capacity within industry to reach Lower Steps. With reasonable assumptions about training delivery (discussed in respective sections below), it is estimated that there will be sufficient capacity for 60% of new Part 9 construction to be built to the Lower Steps as of 2018, with the majority of BC Energy Step Code projects being developed in urban centres. It is estimated that the entire Part 9 industry can be expected to have the capacity to build to Lower Steps by 2020.[22]

The analysis below focuses on Lower Steps, evaluating existing industry capacity to provide compliance services, identifying capacity gaps, and matching them with appropriate training and/or training supports.

INDUSTRY CAPACITY TO DELIVER PART 3 BUILDINGS

Lower Steps

Forecast models suggest that current industry capacity is sufficient to provide compliance services for all new Part 3 buildings in BC (see Table 4 and Table 5).[23] These models are based on the estimated capacity of energy modellers and building envelope consultants across BC. Energy modellers and building consultants provide energy modeling and airtightness testing services, the two compliance services that are required for Part 3 buildings. Findings related to each of these services are presented below.

Energy modeling

There are approximately 50 energy modellers in BC that provide energy modeling services for Part 3 ICI buildings and MURBs.[24] Capacity models demonstrate that this group is capable of meeting all market demand for energy modelling for all new buildings in 2017 (see Table 4). The model uses the number of Part 3 projects completed in 2015 as an estimate of the number of projects in 2017 and assumes 50 modellers serve the market, each completing 2 projects per month.[25]

[22] Model forecasts are based on data collected through a training provider survey and stakeholder interviews, and readily available data.
[23] Source: Interview data.
[24] Source: Interview data.
[25] Source: Interview data.

Table 4. Capacity Model: Energy modeling for Part 3 buildings[26]

Capacity Model: Energy modeling for Part 3 buildings (MURBs and ICI buildings)	
Model inputs	
Number of energy modellers today [27]	50
New MURBs forecast to be completed: [28]	
5 - 50 unit buildings (assumes 75% are Part 3 or > 12 units)	443
51 - 100 unit buildings	53
>100 unit buildings	158
New Part 3 commercial buildings forecast to be completed[29]	28
Total new Part 3 buildings to be modelled	682
Number of evaluations per modeller per year [30]	24
Total building models completed	1,200
Proportion of market supplied	**176%**

Table 4 shows that there is sufficient energy modeling capacity to achieve Lower Steps of the Energy Step Code in all new Part 3 construction. With an excess of industry capacity, energy modellers are well positioned to meet additional demand for their services that may be stimulated by local government implementation of the BC Energy Step Code. It should be noted that energy modeling may also be provided remotely, should significant additional capacity be required.[31] The main difference between business-as-usual and work generated by the BC Energy Step Code will be the volume of work, not modelling techniques. The skillset required to comply with the BC Energy Step Code are no different than current practice. Additionally, the skillsets do not differ significantly between Lower and Upper Steps.

Airtightness testing

Airtightness testing for Part 3 buildings is conducted by building envelope consultants and building scientists. There are at least 21 building firms in BC that employ such professionals and provide airtightness testing services.[32] Assuming one employee at each of these firms conducts 40 evaluations per year (approximately 3.5 evaluations per month), industry is capable of providing airtightness testing for all new Part 3 buildings slated for development in 2017 (see Table 5). Based on this, there is more

[26] Commercial buildings include new office and mixed use office/retail expected to be completed in 2017. Public projects are not included. However, public projects comprise less than 6% of total construction activity and are already expected to achieve Upper Steps.
[27] Source: Interview data.
[28] Source: BC Housing (2015). Retrieved from https://www.bchousing.org
[29] Source: Colliers International (2017).
[30] Assumes each energy modelers completes 2 energy models per month.
[31] Consultants working outside of BC would require some knowledge of the BC regulatory context before providing energy modeling and airtightness testing services for Part 3 building projects.
[32] Source: RDH Engineering (2015).

capacity than needed. This leaves ample capacity to address any projects that are already underway and require air-tightness evaluation and testing services.

Table 5. Capacity Model: Airtightness testing for Part 3 buildings

Capacity Model: Airtightness testing for Part 3 buildings	
Model inputs	
Number of qualified building firms[33]	21
New MURBs forecast to be completed:[34]	
5 - 50 unit buildings (assumes 75% are Part 3 or > 12 units)	443
51 - 100 unit buildings	53
>100 unit buildings	158
New commercial buildings forecast to be completed[35]	28
Total new Part 3 buildings to be evaluated	682
Number of evaluations per person per year	40
Total buildings completed	840
Proportion of market supplied	**123%**

Table 5 shows that there is sufficient airtightness testing capacity to achieve Lower Steps. Building envelope consultants are well positioned to absorb additional demand for airtightness testing that may be created by adoption of the BC Energy Step Code by local governments. While most building scientists are located in the Lower Mainland and on Vancouver Island, they regularly travel to regions across the province to provide their services. They are easy to reach, as most are members of the British Columbia Building Envelope Council (BCBEC) and also either AIBC or Engineers and Geoscientists BC (EGBC, formally the Association of Professional Engineers and Geoscientists of the Province of British Columbia (APEGBC)).

SUGGESTED TRAINING RESOURCES

Additional Training Resources for Lower Steps

While the number of energy modellers, building envelope consultants and building scientists is sufficient to meet demand for Lower Steps in Part 3 buildings, additional training resources are needed to address the quality and consistency of these services (e.g. by training audiences on the information to be submitted to meet regulatory requirements). This will provide significant long term industry benefits. Training resources should also be introduced to make professionals who provide compliance services more accessible, increasing the likelihood of BC Energy Step Code uptake. Suggested training resources for Part 3 buildings are summarized in Table 6.

[33] Source: RDH Engineering (2015).
[34] Source: BC Housing (2015). Retrieved from https://www.bchousing.org
[35] Source: Colliers International (2017).

Table 6. Training resources to achieve Lower Steps in Part 3 buildings

Part 3 Training resources to achieve Lower Steps in Part 3 buildings			
Compliance area	**Capacity gap**	**Target audience**	**Training support**
Energy modeling	Quality and consistency of energy models	Energy modellers	Standards of practice for energy modeling
	Access to energy modellers	Developers and architects	Central inventory of energy modellers
Airtightness testing	Quality and consistency of airtightness testing	Building envelope consultants	Standards of practice for airtightness testing
	Access to building envelope specialists who provide airtightness testing	Developers and architects	Central inventory of building envelope specialists who provide airtightness testing
Regulation and enforcement	How to review and inspect energy efficient buildings How to deal with products without CSA certification	Building officials Certified Professionals (CPs)	Comprehensive training on administering and enforcing performance based codes

Additional Training Resources for Upper Steps

Achieving Upper Steps in Part 3 buildings will require additional training for many stakeholders, including:

- Developers and owners;
- Architects;
- Structural, mechanical and electrical engineers;
- Energy modellers;
- General contractors and trades;
- Building officials.

The learning outcomes required for each audience are summarized in Table 7.

While the curriculum to support these learning outcomes has already been developed, it will need to be scaled-up after priority training is delivered in the first three years of training strategy implementation.

Table 7. Training outcomes required to achieve Upper Steps in Part 3 buildings

Training outcomes required to achieve Upper Steps in Part 3 buildings		
Audience	**Core competency**	**Learning outcome**
Developers & owners	Design, construction & regulatory process	• The implications of energy efficiency goals on the building design, project cost and schedule • Construction procurement best practices for energy efficient building projects may be needed to ensure developers and owners know what to look for when hiring an effective design and construction team and how to ask for energy efficiency performance effectively.
Architects	Building science	• "Envelope first" • Impacts of energy performance on building form and massing • Application of building science to determine insulation, glazing and airtightness requirements • Reducing overall loads and simplified equipment
Structural, mechanical & electrical engineers	Design, construction & regulatory process; Building science; Mechanical systems & equipment; Electrical systems & equipment;	• Principles of energy efficient design (consider extending to include civil engineers in the context of ground source and geothermal heating/cooling systems) • How to accommodate the energy model into structural and systems design • Roles and responsibilities in the integrated design process • Accommodating additional time into energy efficient project budgets and schedules • Structural engineers need training on building science as their increased involvement in envelope design is expected • Mechanical and electrical engineers need training on the integration of an energy model into building design • Mechanical and electrical engineers need technical training on heat recovery systems
Energy modellers	Building science	• "Envelope first" energy efficiency measures • Impacts of energy performance on building form and massing • Application of building science to determine insulation, glazing and airtightness requirements • Reducing overall loads and simplified equipment
General contractors & trades	Design, construction & regulatory process; Building science; Building envelope assemblies	• Training is needed on the principles of energy efficient design and how to build an airtight building envelope • Training is needed on installing high performance windows and curtain walls – especially for MURB projects. • HVAC trades need to be specifically targeted with heat recovery systems installation training • Trades need training on how to sequence and coordinate their work on energy efficient projects
Building officials	Design, construction & regulatory process	• Innovative building products and technologies, and how to deal with lack of CSA certification on products (such as Passive House certified components)

INDUSTRY CAPACITY TO DELIVER PART 9 BUILDINGS

Lower Steps

The Part 9 industry has made significant progress in energy efficiency in recent years. There are now over 200 builders that are registered/certified with programs such as BuiltGreen™, R2000, ENERGY STAR and Passive House in BC. These firms regularly build homes to standards that are comparable to, or even exceed, Lower Steps of the BC Energy Step Code. It is important to note BuiltGreen™, R2000, ENERGY STAR and Passive House builders represent less than 4% of those licensed with BC Housing. However, there are others means by which builders have become familiar with energy efficient home building in recent years. For example, the introduction of the Vancouver Building Bylaw required all home builders to achieve higher energy performance and 845 new homes were built in the City in 2016[36].

With a reasonable effort to integrate existing BC Energy Step Code curriculum into builders associations' continuing professional development programs, it is estimated that there will be sufficient capacity for 60% of new Part 9 construction to achieve Lower Steps by 2018, with most compliant homes being built in urban centres. With a sustained training effort, it is reasonable to expect entire Part 9 industry to be capable of achieving Lower Steps by 2020. This finding is based on the estimated capacity of energy advisors, and estimates of the rate at which builders and their contractors can be trained (discussed below).

Energy advisors provide energy modeling and airtightness testing, two compliance services required for Part 9 buildings. Builders and their construction trades are involved in the integration of these services into building projects and have important roles and responsibilities to ensure airtight building envelopes. Building additional capacity to provide energy advising and training builders and contractors are addressed in the sections below.

Energy advising

The successful uptake of the BC Energy Step Code will require ensuring there are a sufficient number of energy advisors and modellers working across the province. Given the important role they play, in 2018, the Province (with the Energy Step Code Council) established a Compliance and Energy Advisor Subcommittee to address matters such as:

- Education and training of energy advisors;
- Ensuring a sufficient number of modellers to meet demand;
- Quality assurance and reliance on energy advisor reports;
- Availability of energy advisors across B.C.;
- Modelling standards and consistency of approach; and
- Other related concerns.

See Appendix F for additional information about energy advisors.

[36]Based on number of freehold starts, includes Electoral Area "A." Source: Metro Vancouver (2017). Housing Data Book [2010]. Revised Feb 2017. Retrieved from www.metrovancouver.org

BUILDERS AND TRADES

A critical factor in achieving Lower Steps in Part 9 buildings is ensuring that homebuilders know the value an energy advisor can add to their building project(s). Builders need to have easy access to an energy advisor in their area. They also need to know how to integrate energy advisors into their building process.

Builders are also central in ensuring on-site skills training for key trades (insulators, framers, roofers, and those involved with installing HVAC systems). There are over 6,500 trade contracting firms in BC. Relatively few of these are members of any industry association or union. Therefore, reaching homebuilders, whom contractor trades are accountable to, and whom are responsible for hiring an energy advisor to provide BC Energy Step Code compliance services, is essential.

There are 5,344 licensed homebuilders who are likely to build at least one home within the next 12 months. Reaching these homebuilders is critical to ensure energy efficient construction, as they are the most active in the market. They are also the easiest to reach.

Forecast models suggest it would take 1 year to reach approximately half of all active licensed homebuilders (see Table 9), assuming all Part 9 training delivery agents train 96 builders per year,[37] for a combined reach of approximately 2,000 builders per year (a list of 22 existing delivery agents for Part 9 training is provided in Appendix E). This would result in enough homebuilder capacity for leading municipalities in some regions to require Lower Steps in all new homes.

This forecast is conservative, given that some private trainers have much broader reach than the 200 builder per year assumed in the model. For example, leading industry trainer Murray Frank estimates he can train approximately 4,000 people per year, roughly 60% of which are residential builders.[38] He provides training in all regions of BC.

If the assumed level of training is sustained by delivery agents, more than 50% of all Part 9 builders could be trained to meet Lower Steps by 2019, with more than 85% trained by 2020. This finding provides support for wide spread adoption of Lower Steps across BC in the next 1 to 3 years.

[37] Source: BC Hydro. There was an average of 46 students per class in 2016. The model assumes two classes are delivered per year.
[38] Source: Interview data.

Table 9. Estimated time required to train BC home builders

Estimated time required to train BC home builders				
Model inputs	**Year**			
	2017	**2018**	**2019**	**2020**
Number of licensed builders[39]	6,765	6,900	7,038	7,179
Number of active licensed builders (build at least 1 home/year) [40]	5,344	5,451	5,560	5,671
Number of non-active licensed builders (build less than 1 home/year)[41]	1,421	1,449	1,478	1,508
Total number of trainees[42]	2,024	2,024	2,024	2,024
Number of BuiltGreen builders, R2000 builders, ENERGY STAR builders and Passive House contractors [43]	208+	208+	208+	208+
Active builders trained	2,232	4,256	5,560	5,671
Non-active licensed builders trained	-	-	720	1,508
Total number of builders trained	**2,232**	**4,256**	**6,280**	**8,304**
Proportion of active licensed builders trained	**41.7%**	**78.0%**	**100.0%**	**100.0%**
Proportion of total builders trained	**32.9%**	**61.6%**	**89.2%**	**100.0%**

SUGGESTED TRAINING RESOURCES

Additional Training Resources for Lower Steps

Training is required to increase homebuilders' awareness of the role of an energy advisor and the roles of their sub-contractors and trades in delivering energy efficient homes and small residential structures. Additional training resources that increase the quality and consistency of energy advising would also provide long-term benefits. Suggested training resources for Part 9 buildings are summarized in Table 6.

[39] Source: BC Housing. Retrieved from https://www.bchousing.org Estimated to grow at 2% per year.
[40] Source: BC Housing. Retrieved from https://www.bchousing.org
[41] Source: BC Housing. Retrieved from https://www.bchousing.org
[42] The model assumes 26 training deliver agents train 46 new students twice a year. These assumptions are based on survey and interview data collected from training providers.
[43] Source: Canada Home Builders Association for Built Green; Passive House Canada for Passive House. The model assumes these individuals do not require additional training to meet core competencies and learning outcomes to achieve Lower Steps.

Table 10. Training resources for Lower Steps in Part 9 buildings

Part 9 Lower Steps: Outstanding capacity gaps and supplementary training / training supports			
Compliance area	**Capacity gap**	**Target audience**	**Training / training support**
Energy advisors	Quality and consistency of energy models and air tightness testing	Energy advisors	Standards of practice for energy modeling and blower door tests
Energy efficient construction	Awareness of the principles of energy efficient design and technical knowledge to build an airtight envelope.	Builders and relevant trades (HVAC, framers, etc.)	Roles and responsibilities for delivering an energy efficient building.
	Access to energy advisors and an understanding of how to work with them	Builders	Central inventory of building envelope specialist who provide airtightness testing
	Quality and consistency in specification and detailing	Framers	Additional training on proper specification and detailing
	Proper installation of energy efficient equipment	Relevant trades (HVAC, etc.)	Additional training on proper installation of energy efficient equipment
	Construction sequencing to integrate newly required services into project delivery	Key Trades (HVAC, framers, insulators, roofers, etc.)	Additional training on construction sequencing
Regulation and enforcement	How to review and inspect energy efficient buildings How to deal with products without CSA certification	Building officials Builders	Comprehensive training on how to administer and enforce performance based codes

Additional Training Resources for Upper Steps

Achieving Upper Steps in Part 9 buildings will require additional training for some audiences, including:

- Architects and home designers;
- Structural, mechanical and electrical engineers;
- Energy advisors;
- General contractors and trades;
- Building officials.

These audiences play a key role in delivering Part 9 buildings. They will require additional training to fulfil their roles and responsibilities to achieve Upper Steps. The learning outcomes required for each audience are summarized in Table 11.

While the curriculum to support these learning outcomes has already been developed by Training Leaders, it will need to be scaled-up after priority training is addressed in the first three years of training.

Table 11. Training Required to Achieve Upper Steps in Part 9 buildings

Training Required to Achieve Upper Steps in Part 9 buildings		
Audience	**Core competency**	**Learning outcomes**
Architects & home designers	Design, construction & regulatory process Building science	• "Envelope first" building design • Impacts of energy performance on building form and massing • Application of building science to determine insulation, glazing and airtightness requirements • Reducing overall loads and simplified equipment • Awareness of the role of energy advisors, and accommodating them into the project budget and schedule. • Reduced reliance on mechanical design to deliver thermal comfort and performance • Additional design time required to detail the building envelope. • Detailing and installing high performance window.[44]
Structural, mechanical & electrical engineers	Design, construction & regulatory process Building science Mechanical systems & equipment Electrical systems & equipment	• Training on the principles of energy efficient design is needed for all consulting engineers. • Awareness of how to accommodate the energy model into the mechanical design. • Mechanical and electrical engineers need technical training on heat recovery systems
Energy advisors	Building science	• "Envelope first" energy efficiency measures • Impacts of energy performance on building form and massing • Application of building science to determine insulation, glazing and airtightness requirements • Reducing overall loads and simplified equipment
General contractors & trades	Design, construction & regulatory process Building science Building envelope assemblies	• Training is needed on the principles of energy efficient design and how to build an airtight building envelope • HVAC trades need to be specifically targeted with heat recovery systems installation training • Trades need training on how to sequence and coordinate their work on energy efficient projects
Building inspectors & plan checkers	Building science	• Innovative building products and technologies, and how to deal with lack of CSA certification on products (such as Passive House certified components)

[44] RDH Engineering (2014).

TRAINING STRATEGY

How Can We Support Industry?

A training strategy to support implementation of the BC Energy Step Code is needed to ensure all members of BC's building industry can participate in its delivery and benefit from the expansion of BC's market for energy efficient building design and construction, as local governments begin to adopt Steps in their communities. Given the breadth of existing industry capacity and training resources identified through the Training Analysis and Industry Capacity Assessment, the ESC Training Strategy is focused on leveraging early successes and disseminating knowledge while ensuring consistency of educational quality and reach across the province.

The training strategy is grounded in a strong understanding of defining Part 3 and Part 9 industry characteristics and market trends, which provide both opportunities and challenges to implementing a province-wide training initiative. Three groups of recommendations are put forward to support BC Energy Step Code implementation in the current context:

- **General recommendations** to ensure an effective and efficient training approach;
- **Part 3 specific recommendations** to address gaps in training and capacity required to achieve Lower Steps in the next one to three years;
- **Part 9 specific** recommendations to address gaps in training and capacity required to achieve Lower Steps in the next one to three years.

These recommendations build on the preceding analysis and findings and form the core of the Training Strategy. The focus of the strategy is on addressing overarching barriers to training, as well as the implementation of training to support industry deliver Lower Steps across the province within one to three years. A proposed timeline for training strategy implementation is provided in Figure 2.

Figure 2. Proposed Energy Step Code Training Strategy Timeline

The proposed training timeline is aligned with BC's Net Zero Energy New Construction target and anticipated BC Building Code cycles (approximately every 5 years). Priority training can be developed and delivered within 1 to 3 years, providing a strong foundation for possible integration of Lower Steps into the BC Building Code in 2022. "Additional training," outlined in the Training Analysis, can start to be delivered in 2020 (with 1.5 years for coordination [i.e. start to plan Phase 2 in mid-2018]). The Training Strategy should be updated no later than 2019, to provide direction for adaptation. Training in Phase 2 would build on existing curriculum and focus on helping industry leaders develop competencies to achieve Upper Levels of the BC Energy Step Code.

WHY INDUSTRY TRAINING IS IMPORTANT

The BC Energy Step Code Training Strategy is part of a broader effort to keep BC's building industry competitive in an increasingly aggressive global market. Implementation of Lower Steps in the next one to three years is an initial step to drive "market transformation" towards higher energy performing buildings.

The process of change in a market is often described as a "market transformation," led by "innovators" and "early adopters", with "laggards" being the last to shift.[45] The process is often described as consisting of three stages:[46]

1. **Invention** – in which techniques based on new knowledge are put into practice;
2. **Expansion** – in which a growing number of industry participants adopt the new knowledge and techniques as the status quo;
3. **Standardization** – in which most or all industry participants adopt new knowledge and techniques.

The three stages of market transformation are described in Table 12 and illustrated in figure 3.

Table 12. Description of stages of the market transformation process

Innovation	Expansion	Standardization
• New technology or practice is adopted by some industry participants • Industry is unfamiliar with new technology or practice(s) • Costly • Not commercial scale • Little industry capacity • Possible legal issues • Little / no market awareness	• New technology or practice is adopted by many industry participants • New technology or practice(s) become familiar to more and more industry participants • Costs suitable for some market segments • Commercially available • Growing industry capacity • Few / no legal issues • Acceptable to part of the market	• New technology or practice is widely adopted by most industry participants • Most industry participants are familiar with new technology or practice(s) • Cost-competitive • Widely available • Strong industry capacity • No legal issues • Widely acceptable

[45] Mensch (1979).
[46] Ibid.

The training strategy assumes that market adoption of the BC Energy Step Code will follow the three stages of market adoption. Industry leaders (or "innovators" and "early adopters") will drive the demand for training and training resources, making it easier for the rest of industry to follow suit. This approach requires less training than the province-wide implementation of a new Building Code, as industry uptake of training is staggered over time. This approach also makes it possible to efficiently train the entire industry with fewer resources, while rewarding those industry members that demonstrate leadership.

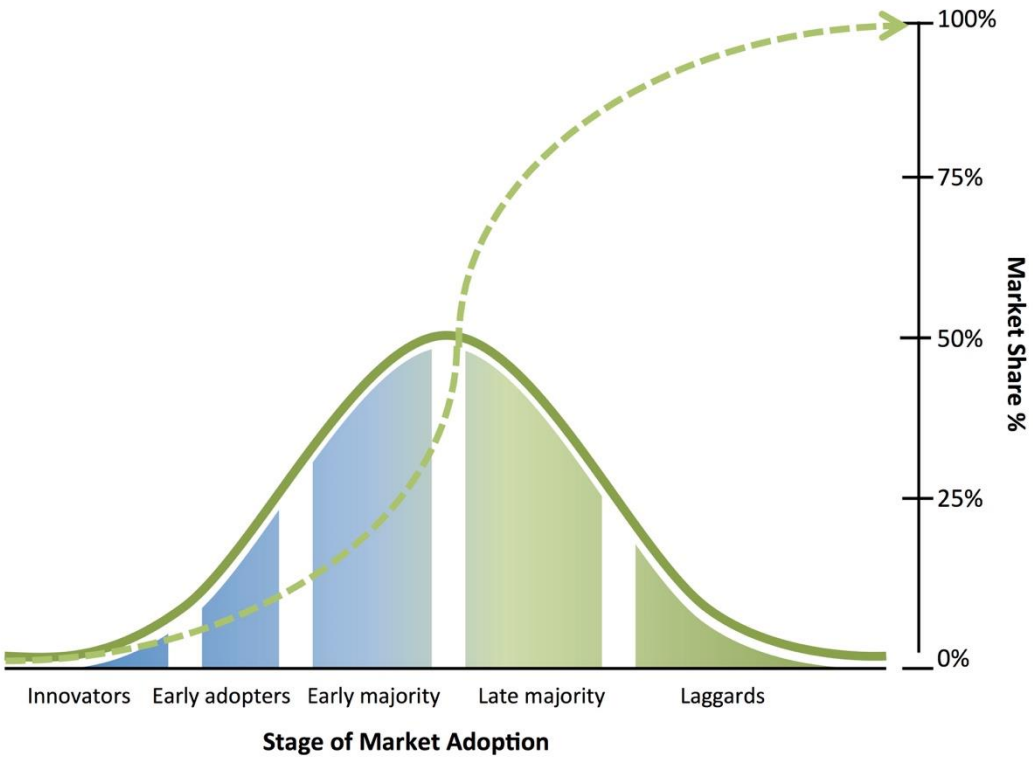

Figure 3. Market adoption curve

Compliance services for Lower Steps in Part 3 and Part 9 buildings are already in use by many industry participants, meaning that these practices are in the "expansion" stage of market transformation. Practices associated with Upper Steps are at an earlier stage, but even here, early adopters have made significant progress towards "expansion." Given the current state of BC's building and construction industry, the focus for Lower Steps is in shifting as quickly as reasonably possible to standardization. The focus for Upper Steps is on market expansion and preparation for anticipated standardization over the next five to ten years.

DEFINING INDUSTRY CHARACTERISTICS

BC's building industry is large and diverse. It is also influenced by rapidly changing market factors. An effective training strategy must take these defining characteristics into consideration, as they provide both opportunities and challenges to an industry-wide training effort. These characteristics are discussed below, providing the context for an effective training strategy.

ONE OF BC'S LARGEST INDUSTRIES

The construction industry is a key contributor to BC's economy, making up 8.2% of GDP and over $13 billion in value (Table 13). This sector is BC's largest employer, comprising a workforce of over 210,100 British Columbians.[47] As a result, keeping the construction industry competitive and productive in an increasingly competitive economy is critical.

Table 13. Value of the BC construction industry

Value of the BC construction industry					
	Type of Construction				
Timeframe:	**Residential ($ 000)**	**Industrial ($ 000)**	**Commercial ($ 000)**	**Institutional & governmental ($ 000)**	**Total ($ 000)**
Cumulative Jan. to Dec. (2016)	$9,814,001	$451,920	$2,159,910	$779,287	$13,205,118
Cumulative Jan. to Dec. (2015)	$9,445,370	$565,875	$2,301,397	$812,591	$13,125,233
Proportion of investment (2016)	74.3%	3.4%	16.4%	5.9%	

A DIVERSE INDUSTRY

The real estate, development and building industry is primarily made up of small businesses. It includes licensed architecture firms, engineering firms, building envelope consulting firms, energy advisor firms, and residential and non-residential construction firms, all of which play an important role in BC Energy Step Code implementation. There are at least 50,000 firms in this sector and over 75% of these have fewer than 10 employees (see Table 14).[48] The large proportion of small businesses in BC's building industry underscores the need for a phased training strategy, as not all firms can be trained at once.

Table 14 provides an overview of the number and types of firms in the province relevant to BC Energy Step Code implementation. This is not necessarily a comprehensive overview of all firms in BC that will have a role to play.

[47] BC Construction Association (2016).
[48] BC Construction Association (2016).

Table 14. Number of building design and construction firms.

Number of building design and construction firms	
Type of firm	**Number**
Total number of real estate firms [49]	8,270
Total number of licensed architecture firms[50]	851
Architecture firms offering building envelope services[51]	129
Architecture firms offering Part 9 building services[52]	569
Total number of engineering firms [53]	1,827
Total number of building envelope consulting firms [54]	61
Total number of drafting services firms [55]	147
Total number of energy advisor firms [56]	36
Total number of licensed residential builders in good standing with BC Housing [57]	6,765
Total number of commercial and institutional building construction firms	986
Total number of trade contracting firms with employees[58]	6,848
Framing contracting firms	496
Glass and glazing contracting firms	174
Roofing contracting firms	691
Siding contracting firms	260
Other foundation, structure and building exterior contracting firms	354
Electrical contractors and other wiring installation contracting firms	1,984
Plumbing, heating and air-conditioning contracting firms	2,128
Drywall and insulation contracting firms	761

Industry fragmentation is further reflected in the small proportion of construction companies that are affiliated with an industry association. The BC Construction Association (BCCA) and its affiliates represent approximately 15% of BC's ICI and large format residential construction companies (approximately 2,000 members). The Independent Contractors and Business Association represents a further 2,000 members and clients (some of which are also members of the BCCA). Canadian Home

[49] Source: Statistics Canada. CANSIM Table 552-0001, 2014. Retrieved from http://www5.statcan.gc.ca/
[50] AIBC (2017).
[51] Ibid.
[52] Ibid.
[53] Source: Statistics Canada. CANSIM Table 552-0001, 2014. Retrieved from http://www5.statcan.gc.ca/
[54] Source: BC Building Envelope Council.
[55] Source: Statistics Canada. CANSIM Table 552-0001, 2014. Retrieved from http://www5.statcan.gc.ca/.
[56] Sources: CACEA, NRCAN, CHBA BC, interview data and consultants' knowledge.
[57] BC Housing, 2015. Retrieved from https://www.bchousing.org
[58] Source: Statistics Canada. CANSIM Table 552-0001, 2014. Retrieved from http://www5.statcan.gc.ca/

Builders Association membership is similarly about 20% of the total industry segment.[59] The total number of existing associations, unions and professional institutes is estimated to be over 80.[60] At present, there is currently no central organization that convenes all building industry audiences, making it a challenge to reach all firms and ensure consistency in training and educational quality across the entire workforce.

The Part 3 industry is generally more proactive when it comes to training, as suggested by its existing capacity to provide energy efficient building services. However, the Part 3 market is busy with $77 billion worth of projects underway, with a further $328 billion in the pipeline.[61]

The slower pace of development within the Part 9 industry may help manage the roll out of province-wide training for Part 9 audiences. For example, only 79% of licenced homebuilders built a home in the last 12 months and the average number of homes completed in 2014 was only 3.9 per builder.[62] Further, the relatively few volume homebuilders, who may complete over 100 homes a year, tend to be well organized and proactive when it comes to training and education. By integrating BC Energy Step Code training into the business as usual training for these Part 9 builders, a phased approach that provides opportunities to "learn by doing" can be accommodated. This approach will establish active building industry firms as leaders in the dissemination of BC Energy Step Code building practices, while less active firms follow suit according to their natural business cycles.

AN AGING INDUSTRY

Members of the building industry are aging across Canada and BC is no exception. The 2011 Canadian Architectural Practices Benchmark Study found that 47% of the architects it surveyed were 50 years or older.[63] According to BCCA, two-thirds of skilled construction workers are over the age of 45. The aging labour market is forecasted to result in 15,000 unfilled construction jobs in BC by 2025.[64]

The need for workforce attraction and retention imperatives will likely increase between now and 2025. This may result in companies in the building industry placing greater emphasis on training and professional development over the next few years, given the volumes of construction business expected throughout the province (see Table 15). This would provide a significant opportunity to support market transformation through the wide-spread dissemination of BC Energy Step Code training just as the building industry enters a period of significant workforce turnover, with retiring professionals making way for new workers.

[59] Globe Advisors and Brantwood Consulting (2013).
[60] Source: Interview data.
[61] BC Construction Association (2016).
[62] BC Housing (2015).
[63] MacLeod, Douglas (2015).
[64] BC Construction Association (2016).

Table 15. Expected volume of construction business anticipated in 2016 and 2017

Expected volume of construction business anticipated in 2016 and 2017				
Consideration	**Year**			
	2016		2017	
Total value of proposed construction projects, incl. infrastructure / civil (BCCA, 2015 & 2016)	$270bn		$329bn	
Total value of projects underway	N/A		$77bn	
Total value of building construction projects delivered	$13.2bn		N/A	
Forecast housing starts[65]	Low	High	Low	High
Single-Detached	11,000	11,400	10,200	10,800
Multiples	24,200	25,400	21,200	22,800
Total housing starts	35,300	36,700	31,400	33,600

HOW DOES INDUSTRY CURRENTLY KEEP UP WITH TRAINING?

There are significant differences in educational cultures and professional development practices between Part 3 and Part 9 building professionals and construction trades. For example, Part 3 professionals have professional development requirements, which have resulted in a greater commitment to ongoing training. The BC Energy Step Code training strategy must acknowledge these differences, working within them to move all industry audiences toward high performance building practices.

Part 3 industry training characteristics

The Part 3 industry is driven to keep up with best practices by risk of liability and owner sophistication. Qualified architects and engineers in good standing with their professional institutes are required to take responsibility for the design of Part 3 buildings. They are mandated to complete continuing professional development credits as a condition of their license to practice. Local governments rely on these "professionals of record" to provide assurance that the building construction will 1) conform to applicable laws and bylaws, and 2) will be constructed in accordance with the building permit which describes the approved design.

Commercial building and MURB clients tend to be professional companies and many of their employees are also trained as architects or engineers. While non-residential general contractors are not required to be formally trained or maintain continuing professional development credits, the complex nature of the work and demands of commercial building clients mean that companies recruit workers out of construction management or skilled trade programs and then turn to programs such as Gold Seal (which require continuing professional development credits) as an ongoing qualification requirement.[66] Some insurance companies take training into consideration when setting insurance and bonding premiums.

[65] Source: Canada Mortgage and Housing Corporation (2017).
[66] Construction Institute of Canada (n.d.). Retrieved from http://www.tcic.ca

Part 9 industry training characteristics

The Part 9 construction industry is generally slower to adopt new building practices relative to the Part 3 community. Some attribute this to the lack of requirements to maintain knowledge and skills that are tied to a performance standard. For example, any building with a gross area of less than 470 m^2, and any building containing 5 or less dwelling units, does not require an architect.[67] The design of Part 9 buildings is mostly undertaken by home design firms or in-house by the homebuilder. Although residential builders licensed with BC Housing are required to complete Continuous Professional Development (CPD), the extent, and means by which, home designers continue to train is less clear.

Residential builders are a key audience in the Part 9 industry. They generally learn best through the application of knowledge on projects. It is important to acknowledge that it takes one project cycle to learn a new building practice or technique. Additionally, the first time a new building practice is applied to a project it may cost more than usual, due to inevitable errors made during the learning process. Given that 70% of builders complete between 1 and 5 buildings per year, it is fair to assume that the BC Energy Step Code may take a year or more to become well established in the industry (in line with previous experience regarding updates to the BCBC). [68]

MARKET TRENDS

The BC Energy Step Code marks a fundamental shift in the building industry from a regulatory system based on prescriptive measures, to one based on performance outcomes. This shift puts a greater emphasis on the need for research and development, investment in new technologies, and stronger working relationships between regulators, technology developers and entrepreneurs. These areas provide numerous opportunities to grow our local economy. For example, the built environment currently accounts for approximately 24% of GHG emissions in BC.[69] With over $400 billion in projects either proposed or in progress in 2017, making BC's building industry more energy efficient offers a tremendous opportunity for BC's $15 billion clean-tech sector. [70]

Firms in the building industry that foster a culture of innovation will have a significant competitive advantage in the future. A number of enabling technologies play a key role in improving building quality, efficiency and performance. Providing training on the following systems will help the industry to not only achieve more demanding energy standards but also attract a technically savvy workforce and be more productive.

- Virtual design and construction tools (such as building information modelling);
- Pre-fabrication and pre-assembly;
- Business processes to manage innovation and the quality of construction documents.

Encouraging market adoption of these tools will be a win-win for both policy makers seeking greater quality control and reliability from construction projects, as well as construction companies that are looking for ways to improve productivity in the context of an increasing squeeze on margins and a tight labour market.

[67] Architectural Institute of BC (2007).
[68] BC Housing (2015).
[69] BC Climate Leadership Plan (2016).
[70] Source: BC Construction Association.

British Columbians working in the building industry will also benefit from BC Energy Step Code training that "greens" their skills by making them more competitive in the future economy, which is increasingly moving towards sustainable and efficient practices. For example, the City of Vancouver has experienced a 50% increase in employment in the "green" jobs sector between 2010 and 2013 as a result of updates to the Vancouver Building Bylaw (VBBL) in 2010 and 2013.[71] This includes both increases in the value of existing jobs, as well as the creation of 1500 new jobs.[72] With the adoption of the 2020 Zero Emissions Building Plan, a further 64% increase in highly qualified personnel (HQP) in green building design and technology is expected in the City of Vancouver, amounting to a total of 7,350 "green" jobs in the City by 2020. The BC Energy Step Code could bring similar benefits to other communities across the province.

OPPORTUNITIES AND CHALLENGES

OPPORTUNITIES

Now is a strategic time to implement a province-wide training effort for BC's building industry, as it leverages a larger trend towards modernization and reform. Opportunities for advancing the BC Energy Step Code include:

- **Trend towards professionalization of the industry:** Until recently, the industry has been slow to adopt formal energy efficiency credentials, but the demand for these in recent years has increased dramatically. BC has 208 BuiltGreen, R2000 and ENERGY STAR certified builders. While the number of BuiltGreen and R2000 builders has remained reasonably static at around 70,[73] Passive House Canada and the Canadian Passive House Institute (CANPHI) have together certified 71 consultants, designers and contractors since their launch in 2013.[74] Last year, 1,300 people received Passive House training.[75] BCIT ran 12 Passive House courses in BC in 2016 and is bumping up against a shortage of trainers. This suggests that there is a national and provincial shift in momentum towards buildings with higher energy efficiency.
- **Entry of international players into the BC market**: The first multi-family project to be built using modular units made in China is under way in Tofino,[76] and a Quebec based company recently built a prefabricated home in Whistler.[77] Globally, there is also incursion into the construction industry from non-traditional players, such as Ikea and Google. The reality of the growing field of competition is making an impression on local firms and motivating them to improve both productivity and performance. For example, Chandos has restructured as a technology firm and only delivers projects using Lean principles and Integrated Project Delivery. Britco is now producing Passive House certified modular units that can be assembled into multi-family buildings, hotels, commercial structures, etc.
- **Cost of construction continues to rise:** the prices of land, natural resources, materials and labour have gone up over 10% during the past 5 years, forcing builders to do more with less. Efficiency is the key to market success and the philosophy of eliminating waste through Lean

[71] Delphi Group (2014).
[72] Delphi Group (2014).
[73] Source: BuiltGreen Canada.
[74] Source: Passive House Canada.
[75] Source: Interview data.
[76] By Stack Modular (www.stackmodular.com)
[77] By Bone Structure (https://bonestructure.ca)

construction practices includes efforts to reduce energy consumption and to build as economically as possible.

- **Workforce attraction and retention**: companies are responding to the "retirement cliff" by embracing technology to entice millennials into the industry. Younger workers are predisposed towards companies that foster strong corporate social values, central to which is a commitment to sustainability.

CHALLENGES TO IMPLEMENTING THE TRAINING STRATEGY

Despite the optimistic market trends, there are significant barriers to training key industry audiences to deliver high performance buildings. It is worth noting where the challenges lie for the purpose of developing effective recommendations that anticipate and respond to challenges. The following barriers to industry training were identified through our primary research. We also accessed a study completed for CHBA-BC in 2013 on the state of residential construction.[78] Barriers to high performance building include:

- **Hard to reach:** a large proportion of the industry is not affiliated with any organization/association. This is especially true of the construction industry which plays a key role in the delivery of buildings. There is no single organization that represents the construction industry as a whole. Builders rely heavily on self-employed piece-workers who are paid hourly and are not considered employees (e.g. carpenters). The motivation to train contract workers is low. Further, workers are reluctant to take unpaid time off work.
- **Affordability**: many small and medium business owners feel that incentives (e.g., tax breaks) are necessary for employers to be able to support workers' training. As a result, the building industry relies heavily on workplace training and mentorship to provide workers with training. This requires an investment of valuable time from both the trainee and the mentor.
- **Lack of trust:** when it comes to project design and construction there is a long-standing and pervasive attitude of "each man for himself," leading to a tendency to over-compensate in the design and/or over-size equipment. In particular, the benefits of passive design and shading can be undervalued.
- **Green building "fatigue":** for those markets that have been working with LEED for the past 15 years, there is a strong perception that industry is either delivering energy efficient buildings already or green buildings do not work (the predicted v. actual performance gap).
- **Lack of qualified trainers**: because the demand for training tends to be highly cyclical with building code updates, trainers find it difficult to develop and sustain their programs and teaching staff. Builder licensing may ease this issue and stabilize the historically cyclical demand for trainers.
- **Lack of Passive House trainers**: Passive House Canada has played an important role in developing energy efficient building practices in the industry. The organization has acknowledged that their lack of qualified trainers is hindering them from meeting the demand for training, particularly given the need to train builders and trades. Further, the application of Passive House to Part 3 buildings is in the early stages of development and more knowledge is needed before Passive House can be applied to towers and commercial buildings.
- **Lack of established pathways to continuous learning**: the current trades training system focuses on getting workers ready for their first job, without much consideration of the need for continuous learning or on pathways to career development. Energy efficiency relies on a range of design and

[78] Globe Advisors and Brantwood Consulting (2013).

construction best practices which could be translated into a valuable credential, particularly for business owners and senior staff.

- **Limited workshop capacity for training providers (institutions**): training takes place in classrooms and specialized facilities, such as workshops and labs with access to equipment. Although there is plenty of classroom space, trades training institutions are running their specialized facilities at capacity to provide for apprenticeship training. Some training institutions may not be able to accommodate additional trades training (e.g. airtightness construction techniques, wall assembly training, window installation, HVAC training), and there may be a mismatch between classroom training facilities and a need for hands-on training, either on-site or in a specialized facility.
- **Structural funding issues**: many training providers will not run programs unless they have a certain minimum number of participants registered. The more specialized a program or the more rural the location, the harder it might be to get the required minimum enrolment. Travel costs for trainees in rural areas can also be significant, especially when forfeited income is factored in.
- **Lack of consistency of knowledge**: the experiences and qualifications that consultants and builders possess can vary widely. The problem of quality is particularly acute in emerging skills, such as energy modelling and building science. Despite requiring CPD training, professional institutes cannot mandate which courses their members take.

RECOMMENDATIONS

Building on the current context of the BC building industry, the Training Strategy provides general and Part 3 and Part 9 specific recommendations to ensure successful implementation of Lower Steps of the BC Energy Step Code across BC in the next one to three years:

- **General recommendations** will ensure a training approach that responds to the present industry context, leveraging existing opportunities and addressing potential challenges.
- **Part 3 specific recommendations** will fill training and capacity gaps needed to achieve Lower Steps in ICI and MURB buildings.
- **Part 9 specific recommendations** will fill specific training and capacity gaps needed to achieve Lower Steps in homes and residential structures.

Recommendations are presented as actions in three corresponding tables below. Each table also includes objectives and outcomes, and suggests a potential coordinator and delivery agent(s) to support implementation.[79]

GENERAL RECOMMENDATIONS

The general recommendations focus on disseminating knowledge, while ensuring consistency of educational quality and reach across the province. The objectives of the general recommendations are:

- Improved coordination of training delivery across BC
- Increased efficiency of program delivery
- Continuous learning
- Raise the profile of the BC Energy Step Code and awareness of its benefits
- Drive demand for training in each region

[79] Potential coordinators and delivery agents are included as suggestions for the Energy Step Code Council's review.

- Reduce duplication, and increase efficiency and reach of training
- Streamline access to information and funding to encourage training

Recommendations are presented as actions in Table 16 below.

Table 16. General Recommendations

General Recommendations Objective	Action	Potential Coordinator	Potential Delivery agents	Outcome
A. Improved coordination of training delivery across BC	1. Establish Regional Coordinators to work directly with local industry and local governments to encourage training by connecting audiences to appropriate training.[80]	BC Housing BC Hydro	BC Housing BC Hydro Local industry associations	A province-wide Regional Coordinator program that is supported for at least 3 years.
B. Increased efficiency of program delivery	2. Establish a data collection program to gather data on completed training and industry capacity by region.	Energy Step Code Council	BC Hydro BC Housing	Centralized database of training programs and qualified professionals that is searchable by region.
C. Continuous learning	3. Track success and lessons learned from incentives and regulations, and share via Energy Step Code Regional Coordinators.	Energy Step Code Council	Local governments Regional coordinators (see A1 above)	Local governments and industry players are engaged in a rapid innovation / continuous learning process.
D. Raise the profile of the BC Energy Step Code and awareness of its benefits	4. Develop and implement and awareness and marketing campaign. Target builders and buyers (developers, owners, realtors, leasing agents, homebuyers) to increase industry support and demand for training.	Energy Step Code Council	BC Housing VRCA, ICBA, CHBA and other trades' associations NAIOP & UDI UBCM	Coordinated marketing and communications campaign directed at builders, commercial tenants and homebuyers. Focus on countering myths, and communicate the co-benefits of energy efficient buildings.
E. Drive demand for training in each region	5. Identify and work with at least one leading local government in each region to pilot incentives and regulations early, creating friendly competition and serving as a model for nearby communities.	Energy Step Code Council	Local governments BOABC PIBC	An "early adopter" community that can stimulate demand for training and serve as a role-model for other regions.
F. Reduce duplication, and increase efficiency and reach of training	6. Encourage training leaders to use a mentorship training model, where individuals who manage workers and/or crews receive direct training and are	Energy Step Code Council	BC Housing, VRCA, ICBA, CHBA and other builders' & trades associations	The targeted number of industry stakeholders are trained within the desired time frame.

[80] In regions where established industry associations have working relationships with local audiences, some funding should be directed to these associations to deliver training. For example, in areas well served by builders' associations, some funds should be directed to these associations to provide training directly to builders. A Regional Coordinators will work with associations to coordinate curriculum to ensure consistency across the province.

General Recommendations Objective	Action	Potential Coordinator	Potential Delivery agents	Outcome
	expected or required to pass on their knowledge.			
	7. Encourage or require building science firms and energy advisors to provide informal training during mid-construction air tightness testing to provide hands-on training on site for builders and trades contractors, and for building inspectors.	Energy Step Code Council	BC Housing VRCA, ICBA & CHBA BOABC AIBC & APEGBC BCBEC City Green	Consistent understanding of constructability implications of energy efficient buildings across all industry stakeholders.
	8. Incorporate building energy efficiency training into core requirements of professional education accreditation, CPD and builder licensing.	Energy Step Code Council	BC Housing VRCA, ICBA, CHBA, & trades' associations BOABC AIBC & APEGBC	Energy efficiency training contributes to continuing professional development programs such as core AIBC LCUs, Gold Seal, etc.
	9. Identify existing building science and other energy efficiency modules to be included in builders' CPD programs.	Energy Step Code Council	BCIT BOABC	Maintain an up-to-date centralized training database (see A2)
G. Streamline access to information and funding to encourage training	10. Provide a central platform for Energy Step Code information and resources.	Energy Step Code Council	Regional coordinators (see A1 above)	It is easy for all industry participants to access training and related resources, and understand the Step Code-related capacity building efforts.
	11. Track trades training accomplishments	BC Housing	CHBA Trades associations	A database for tracking qualified trades contractors so builders can hire qualified trades contractors to work on energy efficient projects. RCABC does this already for their RoofStar guarantee program.
	12. Ensure that feedback from training leaders and industry advocates in terms of potential issues and challenges (curriculum updates, introduction of new technologies, marketing issues, etc.) is captured and	Energy Step Code Council	Regional coordinators (see A1 above)	A strong feedback loop exists, linking on-the-ground experience to the Energy Step Code Council, supporting highly relevant training and systems that meet industry needs.

General Recommendations Objective	Action	Potential Coordinator	Potential Delivery agents	Outcome
	addressed in a timely manner.			
	13. Develop a funding strategy or alternative incentive programs (e.g. expedited permitting process or other incentives often found municipal program offers) to address key funding barriers. These would address: • HR resources needed to coordinate and implement priority training; • Paying for trades training; • Paying for trainers to deliver training in remote communities; • Specialized training equipment.	Energy Step Code Council	BC Hydro MEM CSCD	Funding program(s) are in place to address key needs on a consistent basis.

RECOMMENDATIONS SPECIFIC TO PART 3 BUILDINGS

Although industry may be ready to deliver Upper Steps for Part 3 buildings, training to create greater consistency amongst energy modellers and building envelope consultants should still be established. Improving consistency of Lower Step compliance services will create a strong foundation on which to build Upper Step competencies. The objectives of the Part 3 recommendations are:

- Increase the consistency of airtightness testing
- Improve the consistency of energy modeling

Recommendations specific to Part 3 buildings are presented as actions in Table 17 below.

Table 17. Recommendations specific to Part 3 buildings

Recommendations Specific to Part 3 Buildings Objective	Action	Potential Coordinator	Potential Delivery agents	Outcome
Building envelope consultants				
H. Increase the consistency of airtightness testing	14. Work with APEGBC and leading building envelope experts to develop a best practices guide on airtightness testing (also applicable to Part 9 buildings).	BCBEC	BCBEC, APEGBC, CHBA, leading building science firms local governments	Best Practices Guide on airtightness testing for Part 3 and part 9 buildings (note RDH Engineering has already developed relevant materials). Organize information into a "Standard for Practice".
	15. Work with members of organizations who helped support the development of the guide to train airtightness testers, using the guide.	BCBEC	BCBEC APEGBC Leading building science firms	Educational curriculum and training program based on the Best Practices Guide (see F12).
	16. Liaise with leading building science firms to encourage (fund?) the expansion of their in-house airtightness training programs to supplement the work of other (potentially out-of-province) private trainers.	BCBEC	Leading building science firms	Incentive program (including travel budget) for leading building science firms to ramp up established training programs to ensure all regions of the province are reached.
Energy modellers				
I. Improve the consistency of energy modeling	17. Develop and maintain a list of qualified energy modellers in BC. The evaluation of modellers should be based on their compliance with BC Hydro's Energy Modeling Guidelines.	IBPSA CaGBC (could provide their previous list)	BPSA, BC Hydro New Construction Program Local governments	Up-to-date list of qualified energy modellers hosted on the IBPSA website and/or the BC Hydro New Construction Program online portal (launching in April 2017).
	18. Develop an energy modeling reporting tool for Part 3 buildings based on best practices outlined in the BC Hydro New Construction Program's Energy Modeling Guidelines.	BC Hydro New Construction Program	BC Hydro New Construction Program, IBPSA Local governments	Energy modeling reporting tool Create a "Standard for Practice" or energy modeling.

RECOMMENDATIONS SPECIFIC TO PART 9 BUILDINGS

While there is currently a sufficient number of energy advisors to support implementation, the Part 9 industry needs more training for Part 9 builders so they know the value of working with an energy advisor and where to find one. Construction trades need to understand how this may affect construction sequencing and have the technical skills to deliver an airtight building envelope. The objectives of the Part 9 recommendations are:

- Ensure there remains a sufficient number of qualified energy advisors in BC to meet demand which is anticipated to grow over time
- Streamline training for builders and trades on proper specification, installation of energy efficient equipment and construction sequencing
- Make training for builders and trades readily accessible, project based and in a format that is familiar

Recommendations specific to Part 9 buildings are presented as actions in Table 18 below.

Table 18. Recommendations specific to Part 9 buildings

Recommendations Specific to Part 9 Buildings Objective	Action	Potential Coordinator	Potential Delivery agents	Outcome
Energy advisors				
J. Ensure a sufficient number of qualified energy advisors in BC	19. Develop and maintain a central inventory of energy advisors in BC, ensuring that only EAs in good standing with NRCan are included on the list. The inventory should be searchable by region.	BC Housing	CHBA BC Housing City Green CaGBC	Up-to-date list of qualified energy advisors
	20. Work with NRCan to establish a program to fast track licensing of previously licensed energy advisors in good standing; encourage previously licensed EAs to renew their license through the program in anticipation of increased demand.	City Green CEA CHBA NRCan	Service organizations	Energy advisor prior learning and assessment program (PLAR)
	21. Work with NRCan to increase the speed of audits of the work of EAs on BC projects, keeping pace with the increase in the amount of building energy models produced by EAs.	City Green CHBA NRCan	Service organizations	Certainty of energy audit processing timeline, irrespective of number audits submitted from BC. Published KPIs on audit turnaround time.
Residential builders and trades contractors				
K. Streamline training for builders and trades on proper specification, installation of energy efficient equipment and construction sequencing	22. Ensure that builder training focuses on quality and consistency in specification and detailing, installation of energy efficient products and equipment as well as how to work with energy advisors.	BC Housing HPO CHBA BC and regional chapters	Training providers	A consistent and transferable curriculum that can be customized for builders and targeted trades (e.g. framers, HVAC, etc.)
L. Make training for builders and trades readily accessible,	23. Prioritize training for active licensed builders, as they are most likely to apply the training quickly.	BC Housing HPO CHBA	Training providers	A database for tracking qualified builders. Active licensed builders are trained first

Recommendations Specific to Part 9 Buildings Objective	Action	Potential Coordinator	Potential Delivery agents	Outcome
project based and in a format that is familiar				
	24. Encourage BCIT and regional technical colleges to scale up the relevant professional development series for builders and regular trades (the module teaches crews to sequence and coordinate trades for high performance building construction).	BC Housing and/or BC Hydro	BCIT, other institutions via through DoTT (deans of trade and technology)	Regular engagement program with deans of trade and technology schools (DoTT) across BC. Coordinated marketing program for builder training programs
	25. Encourage homebuilders to use suppliers as on-site trainers for their crews on proper installation of high performance equipment, products and materials.	BC Housing CHBA	CHBA, AIBC & APEGBC Trade associations	Supplier-delivered training is accepted for CPD training credits
	26. Encourage plumbing/HVAC trades to enrol in the CAGBC's G-PRO green building training program, which focuses on installation of energy efficient mechanical and HVAC systems.	Energy Step Code Council	CaGBC	Marketing support is provided to CAGBC as it rolls out the G-Pro program (anticipated fall 2017)
	27. Develop and deliver training for MURB builders on installing high performance windows and curtain walls.	BCIT BC Housing	BCIT other training providers FEN-BC and other trades association CHBA	Window installation training program to be created based on RDH Engineering's Guide to High Performance Windows.

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MODUS

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APPENDICES

APPENDIX A

REGIONS OF BC

The map below illustrates the regions of British Columbia referenced throughout the Energy Step Code Training and Capacity Project.

APPENDIX B

CORE COMPETENCIES & LEARNING OUTCOMES FOR PART 3 AND PART 9 BUILDINGS

The table below presents the core competencies and learning outcomes required to deliver Lower and Upper Steps for Part 3 and Part 9 buildings.[81] The learning outcomes are cumulative (all learning outcomes required for Lower Steps are fundamental to reaching Upper Steps).

	Lower Steps	Upper Steps
Part 3	Step 1, 2	Step 3, 4
Part 9	Step 1, 2, 3	Step 4, 5
Core competency	**Learning outcomes**	
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 (IES, WUFI, PHPP, etc.)
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	• Envelope quality control and assurance	All lower step learning outcomes, and: • Minimizing thermal bridging • Advanced framing, alternative envelope solutions (SIPs, box truss walls, etc.)

[81] Core competencies were identified in consultation with the Energy Step Code Training & Education Sub Committee, technical experts, and interview data collected from a cross section of industry stakeholders.

	Lower Steps	Upper Steps
Part 3	Step 1, 2	Step 3, 4
Part 9	Step 1, 2, 3	Step 4, 5
Core competency	**Learning outcomes**	
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. • Fatter walls, smaller windows, passive design and shading
Windows, skylights & doors	• Role of fenestration in heat loss calculations • Labels, standards, shading co-efficients and U-values	All lower step learning outcomes, and: • Smaller 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 • 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
Electrical systems & equipment	• Controls, meters, ventilation, lighting, appliances, fans, pumps, etc. • Metering, monitoring and controls • Commissioning, M&V	All lower step learning, and: • Renewable energy solutions • Whole building commissioning, M&V

APPENDIX C

TRAINING LEADERS

Training leaders listed on the following page have existing or planned curriculum that aligns with the BC Energy Step Code core competencies and learning outcomes. The inventory provides information on existing and planned training, the core competencies covered, program format, location, reach and target audience.

Provider	Provider organization						Role		Physical location								Courses	Part 3 ICI			Part 3 MURB				Part 9					Key competency						Reach								Format				Audience							
Leaders	University	College	Government	Private trainer	NGO	Industry Association/Union	Coordinator (prov.-wide)	Delivery Agents (regional)	Lower Mainland - Southwest	Vancouver Island - Coast	Thompson-Okanagan	Kootenay	Cariboo-Prince George	Northeast	Skeena-North Coast	Outside BC	Existing & Planned Curriculum	Step 1	Step 2	Step 3	Step 1	Step 2	Step 3	Step 4	Step 1	Step 2	Step 3	Step 4	Step 5	Building design, construction and regulatory process	Energy modelling, energy advising & building	Building envelope - Optimal thermal performance	Building envelope - Airtight envelope	High performance building products and materials	M&E building systems and equipment	Lower Mainland - Southwest	Vancouver Island - Coast	Thompson-Okanagan	Kootenay	Cariboo-Prince George	Northeast	Skeena-North Coast	Trainer may travel	Online	Workshop / practical	Stand-alone resource (e.g., guidebook)	Classroom	Local governments	Developers & owners	Architects & building scientists	Energy modellers, CEAs	M&E engineers & commissioning agents	Builders	Trade contractors
AIBC						Y	Y		Y								Building Envelope Education Program - Module I - Building Science & the Building Envelope	Y			Y				Y							Y	Y				Y										Y									
AIBC						Y	Y		Y								Building Envelope Education Program - Module II - Applications of Building Science: Design and Practice	Y			Y				Y							Y	Y				Y										Y									
AIBC						Y	Y		Y								Building Envelope Education Program - Module III - Building Envelope Field Services	Y			Y				Y							Y	Y				Y										Y									
AIBC						Y	Y		Y								Building Envelope Education Program - Module VI - Role & Responsibilities	Y			Y				Y							Y	Y				Y										Y									
AIBC						Y	Y		Y								Building Envelope Education Program - Module VII - Extreme Environments	Y			Y				Y							Y	Y				Y										Y									
AIBC						Y	Y		Y								Building Envelope Principles (BEP)	Y			Y				Y							Y	Y				Y										Y									
APEGBC						Y	Y		Y								Heat Pump Applications: Centralized Heat Pump Systems and Key Considerations for Successful HP Systems Applications	Y	Y	Y	Y	Y	Y	Y										Y											Y										Y			
APEGBC						Y	Y		Y								Geothermal Energy (Resource, Technology, and Economy)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y						Y											Y										Y			
APEGBC						Y	Y		Y								New product development workshop	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y						Y											Y										Y			
Athabasca University RAIC Centre for Architecture	Y															Y	APST 470 - Building Envelope and Assemblies	Y			Y				Y							Y	Y				Y										Y	Y	Y	Y	Y	Y	Y		Y					Y							
Athabasca University RAIC Centre for Architecture	Y															Y	APST 480 - Mechanical Equipment of Buildings	Y			Y				Y										Y										Y	Y	Y	Y	Y	Y	Y		Y					Y							
BC Housing			Y				Y		Y								Illustrated Guide for Achieving Airtight Buildings (for both Part 3 and 9 buildings)				P	P			P	P	P	P	P			P				P	P	P	P	P	P	P	P				P			Y				Y	Y			Y	Y
BC Housing			Y				Y		Y								Regular airtightness seminar offered as webinar also				Y	Y			Y	Y						Y	Y	Y	Y										Y	Y									Y	Y			Y	Y
BC Housing			Y				Y		Y								Webinar on "Air & Vapour Barrier				P	P			P	P	P	P	P			P				P	P	P	P	P	P	P	P	P			P			Y				Y	Y			Y	Y
BC Housing			Y				Y		Y								Illustrated Builder Guide to Meeting Energy Step Code Step 1 & 2, then 3 &4 (Pt 9) in CZ 4-8				P	P	P	P	P	P	P	P	P			P	P	P	P	P	P	P	P	P	P	P	P	P			P		P	P	Y		Y	Y	Y	Y	Y	Y

Provider	Provider organization						Role		Physical location								Courses	Part 3 ICI			Part 3 MURB				Part 9					Key competency					Reach								Format				Audience							
Leaders	University	College	Government	Private trainer	NGO	Industry Association/Union	Coordinator (prov.-wide)	Delivery Agents (regional)	Lower Mainland - Southwest	Vancouver Island - Coast	Thompson-Okanagan	Kootenay	Cariboo-Prince George	Northeast	Skeena-North Coast	Outside BC	Existing & Planned Curriculum	Step 1	Step 2	Step 3	Step 1	Step 2	Step 3	Step 4	Step 1	Step 2	Step 3	Step 4	Step 5	Building design, construction and regulatory process	Energy modelling, energy advising & building	Building envelope - Optimal thermal performance	Building envelope - Airtight envelope	High performance building products and materials	M&E building systems and equipment	Lower Mainland - Southwest	Vancouver Island - Coast	Thompson-Okanagan	Kootenay	Cariboo-Prince George	Northeast	Skeena-North Coast	Trainer may travel	Online	Workshop / practical	Stand-alone resource (e.g., guidebook)	Classroom	Local governments	Developers & owners	Architects & building scientists	Energy modellers, CEAs	M&E engineers & commissioning agents	Builders	Trade contractors
BC Housing			Y				Y		Y								Builder Guide on Cost Effective Tips and Optimization for high Performance Homes and Buildings				P	P	P	P	P	P	P	P	P			P	P	P	P	P	P	P	P	P	P				P						Y	Y
BC Housing			Y				Y		Y								Best Practices for Windows and Doors								Y	Y						Y				Y	Y	Y	Y	Y	Y	Y	Y			Y		Y		Y	Y	Y	Y
BC Housing			Y				Y		Y								Residential Construction Performance Guide								Y							Y	Y		Y	Y	Y	Y	Y	Y	Y	Y	Y			Y		Y		Y	Y	Y	Y
BC Housing			Y				Y		Y								Building Envelope Guide for Houses								Y	Y						Y	Y			Y	Y	Y	Y	Y	Y	Y	Y			Y		Y		Y	Y	Y	Y
BC Housing			Y				Y		Y								Building Enclosure Design Guide				Y											Y																						
BC Housing			Y				Y		Y								Building Envelope Thermal Bridge Guide				Y	Y			Y	Y						Y																						
BC Housing			Y				Y		Y								CPD course database				Y				Y							Y																						
BCIT		Y						Y	Y								High Performance Building Lab			Y			Y	Y				Y	Y	Y	Y	Y	Y	Y	Y	Y									Y		Y	Y		Y	Y	Y	Y	Y
BCIT		Y						Y	Y								CESA 1500 - Passive House Tradesperson Course - Building Envelope Specialization (Four new course on high performance building, including: mechanical systems, barriers, envelope, trades integration, and net zero building)			P			P	P				Y	Y	Y	Y	Y	Y	Y	Y	Y									Y		Y						Y	Y
BCIT		Y						Y	Y								CESA 5300 - Energy Systems / Sustainable Energy Management Program	Y	Y	Y	Y	Y	Y	Y									Y	Y												Y								Y		
BCIT		Y						Y	Y								CESA 7100 - Energy Modelling for Building Professional, CESA 0198 Residential Energy Efficiency	Y	Y	Y	Y	Y	Y	Y						Y					Y																		Y				
BCIT		Y						Y	Y								Graduate Certificate in Building Energy Modelling	Y	Y	Y	Y	Y	Y	Y						Y					Y																		Y				
BCIT		Y						Y	Y								BLDG 3100 - Building Science 1 , BLDG 4100 - Building Science 2	Y	Y		Y	Y			Y	Y						Y	Y	Y		Y											Y				Y				
BCIT		Y						Y	Y								BLDC 1500 - BC Building Code Part 9 (SFD)								Y							Y	Y			Y															Y	Y				
BCIT		Y						Y	Y								BLDG 1825 - BC Building Code - Multi Unit & Small Buildings				Y				Y							Y	Y			Y															Y	Y				
BCIT		Y						Y	Y								BLDG 1830 - BC Building Code: Part 3	Y			Y				Y							Y	Y			Y															Y	Y				
BCIT		Y						Y	Y								BLDG 1835 - BC Building Code: Part 3 Advanced	Y			Y				Y							Y	Y			Y															Y	Y				
BCIT		Y						Y	Y								BLDG 1845 - Vancouver Building Bylaw	Y			Y				Y							Y	Y			Y															Y	Y				

Provider	Provider organization						Role		Physical location								Courses	Part 3 ICI			Part 3 MURB				Part 9					Key competency						Reach								Format				Audience							
Leaders	University	College	Government	Private trainer	NGO	Industry Association/Union	Coordinator (prov.-wide)	Delivery Agents (regional)	Lower Mainland - Southwest	Vancouver Island - Coast	Thompson-Okanagan	Kootenay	Cariboo-Prince George	Northeast	Skeena-North Coast	Outside BC	Existing & Planned Curriculum	Step 1	Step 2	Step 3	Step 1	Step 2	Step 3	Step 4	Step 1	Step 2	Step 3	Step 4	Step 5	Building design, construction and regulatory process	Energy modelling, energy advising & building	Building envelope - Optimal thermal performance	Building envelope - Airtight envelope	High performance building products and materials	M&E building systems and equipment	Lower Mainland - Southwest	Vancouver Island - Coast	Thompson-Okanagan	Kootenay	Cariboo-Prince George	Northeast	Skeena-North Coast	Trainer may travel	Online	Workshop / practical	Stand-alone resource (e.g., guidebook)	Classroom	Local governments	Developers & owners	Architects & building scientists	Energy modellers, CEAs	M&E engineers & commissioning agents	Builders	Trade contractors
BCIT		Y						Y	Y								BLDG 2100 - Introduction to Building Science, BLDG 4105 - Computer Applications for Building Science	Y	Y		Y	Y			Y	Y						Y	Y	Y			Y										Y									Y				
BCIT		Y						Y	Y								CESA 5620 - Commissioning and Optimization, CESA 5500 - Codes and Standards/Building Controls and Energy Management	Y	Y	Y	Y	Y	Y	Y											Y	Y												Y									Y				
BCIT		Y						Y	Y								BLDC 3050 and 3060 - Building Envelope Performance and Laboratory	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		Y	Y	Y	Y		Y												Y									Y				
BCIT		Y						Y	Y								CESA 0198 - Residential Energy Efficiency								Y							Y	Y			Y												Y									Y				Y	
BCIT		Y						Y	Y								CESA 0199 - Residential Renewable Energy			Y			Y	Y			Y	Y	Y						Y	Y												Y									Y			Y		Y	Y	Y
BCIT		Y						Y	Y								CESA 0158 - Introduction to Solar Electricity			Y			Y	Y			Y	Y	Y						Y	Y												Y									Y				Y		Y
BCIT		Y						Y	Y								CESA 0159 - Solar Electric Design			Y			Y	Y			Y	Y	Y						Y	Y												Y									Y				Y		Y
BCIT		Y						Y	Y								CESA 0178 - Introduction to Solar Water Heating			Y			Y	Y			Y	Y	Y						Y	Y												Y									Y				Y		Y
BCIT		Y						Y	Y								CESA 0179 - Solar Water Heating Design			Y			Y	Y			Y	Y	Y						Y	Y												Y									Y				Y		Y
BCIT		Y						Y	Y								CESA 7100 - Energy Modelling for Building Professionals	Y	Y	Y	Y	Y	Y	Y								Y						Y												Y									Y				
BCIT		Y						Y	Y								EENG 8221 - Introduction to Green Buildings & Infrastructure	Y			Y				Y					Y		Y	Y	Y	Y			Y									Y		Y	Y	Y	Y		Y	Y							
BCIT		Y						Y	Y								EENG 8224 - Optimizing & Specifying Geo-Exchange Systems	Y	Y	Y	Y	Y	Y	Y											Y	Y												Y											Y	Y
BCIT		Y						Y	Y								EENG 8226 - Thermal Energy Systems	Y			Y				Y	Y										Y	Y												Y											Y	Y
BCIT		Y						Y	Y								EENG 8223 - Solar & Wind Power	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y						Y	Y												Y											Y	Y
BCIT		Y						Y	Y								EENG 8220 - Foundations of Sustainable Energy	Y			Y				Y	Y	Y	Y	Y						Y	Y														Y	Y		Y		Y	Y						
BCIT		Y						Y	Y								BSCI 9000 - Building Science	Y			Y	Y			Y	Y	Y	Y	Y			Y	Y			Y												Y		Y			Y							
BCIT		Y						Y	Y								BSCI 9100 - Building Science 2	Y			Y	Y			Y	Y	Y	Y	Y			Y	Y			Y												Y		Y			Y							
BCIT		Y						Y	Y								BSCI 9150 - Building Mechanical Systems and Controls (HVAC)	Y			Y				Y											Y	Y												Y									Y				
BCIT		Y						Y	Y								BSCI 9110 - Building Envelope 1	Y			Y	Y			Y							Y	Y			Y												Y									Y				
BCIT		Y						Y	Y								BSCI 9130 - Building Energy Performance	Y			Y											Y	Y			Y												Y									Y			Y	Y	Y			

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BCIT		Y						Y	Y								BSCI 9170 - Ventilation Indoor Air Quality	Y			Y				Y								Y	Y	Y									Y		Y					Y		
BCIT		Y						Y	Y								BSCI 9210 - Building Envelope 2	Y			Y	Y			Y	Y						Y	Y										Y		Y							
BCIT		Y						Y	Y								BSCI 9250 - Advanced Energy Simulation	Y	Y	Y	Y	Y	Y	Y						Y				Y									Y		Y							
BCIT		Y						Y	Y								HVAC 3104 - Explain Heat Recovery / Energy Management	Y			Y												Y	Y											Y	Y	Y					Y	Y	Y
BCIT		Y						Y	Y								MSYS 2020 - HVAC Load Analysis	Y			Y												Y	Y											Y	Y	Y					Y	Y	Y
BCIT		Y						Y	Y								MSYS 2040 - Mechanical Systems for Buildings	Y			Y	Y											Y	Y										Y		Y					Y	Y	Y
BCIT		Y						Y	Y								MSYS 3025 - Heating Systems 1	Y			Y												Y	Y										Y		Y					Y	Y	Y
BCIT		Y						Y	Y								MSYS 4025 - Heating Systems 2	Y			Y												Y	Y										Y		Y					Y	Y	Y
BCIT		Y						Y	Y								MSYS 3020 - Air Conditioning Systems 1	Y			Y												Y	Y										Y		Y					Y	Y	Y
BCIT		Y						Y	Y								MSYS 4020 - Air Conditioning Systems 2	Y			Y												Y	Y										Y		Y					Y	Y	Y
BCIT		Y						Y	Y								MSYS 3060 - Renewable Energy Systems 1		Y	Y			Y	Y			Y	Y	Y					Y	Y										Y		Y					Y	Y	Y
BCIT		Y						Y	Y								MSYS 4062 - Renewable Energy Systems 2		Y	Y			Y	Y			Y	Y	Y					Y	Y										Y		Y					Y	Y	Y
BCIT		Y						Y	Y								MSYS 3065 - LEED Standards and Applications	Y			Y	Y								Y		Y	Y	Y	Y	Y										Y					Y	Y	Y
BCIT		Y						Y	Y								Master of Engineering in Building Science	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		Y	Y	Y	Y		Y									Y		Y					Y	Y	Y
BCIT		Y						Y	Y								Master of Applied Science in Building Engineering / Building Science	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		Y	Y	Y	Y		Y									Y		Y					Y	Y	Y
BCIT		Y						Y	Y								Renewable Energy Electrical Systems Installation and Maintenance (REESIM)		Y	Y			Y	Y			Y	Y	Y					Y	Y										Y		Y								Y	Y	Y
BuiltGreen Canada						Y	Y	Y								Y	BuiltGreen Builder Training								Y	Y						Y	Y	Y	Y		Y							Y								Y	Y
Building It Right (Murray Frank)				Y				Y	Y								The Building Science of a Home - Part 1: Condensation and Mechanism of Moisture								Y						Y				Y	Y	Y	Y	Y	Y	Y		Y								Y	Y
Building It Right (Murray Frank)				Y				Y	Y								The Building Science of a Home - Part 2: Ventilation and Controlling Interior Comfort and Air Quality								Y							Y	Y	Y	Y	Y	Y	Y	Y		Y								Y	Y
Building It Right (Murray Frank)				Y				Y	Y								Putting Windows in Their Place - Part 1: Overview of Window Installation Requirements								Y						Y		Y		Y	Y	Y	Y	Y	Y	Y		Y								Y	Y

Provider	Provider organization						Role		Physical location								Courses	Part 3 ICI			Part 3 MURB				Part 9					Key competency						Reach								Format				Audience							
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Building It Right (Murray Frank)				Y				Y	Y								Putting Windows in Their Place - Part 2: The Basics About Window and Door Installation								Y							Y			Y			Y	Y	Y	Y	Y	Y	Y									Y	Y
Building It Right (Murray Frank)				Y				Y	Y								Putting Windows in Their Place - Part 3: Alternate Installation Details								Y							Y			Y			Y	Y	Y	Y	Y	Y	Y									Y	Y
Building It Right (Murray Frank)				Y				Y	Y								"An Introduction to the New BC Step Code for Houses"								Y	Y	Y				Y	Y	Y	Y	Y								Y										Y	Y
Camosun Trades Education & Innovation Complex		Y						Y		Y							Solar Heating Associate (NABCEP)			Y				Y				Y	Y					Y			Y								Y										Y	Y
Camosun Trades Education & Innovation Complex		Y						Y		Y							Photovoltaics: An Intro to Solar Electric			Y				Y				Y	Y					Y			Y								Y										Y	Y
Camosun Trades Education & Innovation Complex		Y						Y		Y							Alternative energy in the fourth year curriculum			Y				Y				Y	Y					Y			Y								Y										Y	Y
Camosun Trades Education & Innovation Complex		Y						Y		Y							Introduction of Vapour Proof Boxes/Potlights			Y				Y				Y	Y					Y			Y								Y										Y	Y
Canada Green Building Council					Y		Y	Y	Y								Construction of the Building Envelope for a LEED V4 Homes Platinum Project											Y	Y			Y	Y	Y		Y	Y	Y	Y	Y	Y	Y		Y						Y			Y	
Canada Green Building Council					Y		Y	Y	Y								LEED V4: Secrets to a Well-Commissioned Envelope	Y	Y	Y	Y	Y	Y	Y								Y	Y			Y	Y	Y	Y	Y	Y	Y		Y						Y				
Canada Green Building Council					Y		Y	Y	Y								Energy Efficiency Strategies for a LEED V4 Homes Platinum Project											Y	Y			Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		Y						Y		Y	Y	
Canada Green Building Council					Y		Y	Y	Y								Solar PV Analysis with RETScreen						Y	Y				Y	Y					Y	Y	Y	Y	Y	Y	Y		Y						Y	Y			
Canada Green Building Council					Y		Y	Y	Y								G-Pro training for trades	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P								P							Y	Y
Canadian Institute for Energy Training					Y		Y	Y								Y	Efficient Building Envelope															Y														Y	Y	Y	Y	Y	Y	Y	Y
Canadian Institute for Energy Training					Y		Y	Y								Y	Achieving Low Energy Performance and Satisfactory Indoor Air Quality															Y	Y		Y								Y						Y					
Canadian Institute for Energy Training					Y		Y	Y								Y	Certified Building Commissioning Professional (CBPC)	Y			Y	Y										Y														Y				Y					

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Leaders	University	College	Government	Private trainer	NGO	Industry Association/Union	Coordinator (prov.-wide)	Delivery Agents (regional)	Lower Mainland - Southwest	Vancouver Island - Coast	Thompson-Okanagan	Kootenay	Cariboo-Prince George	Northeast	Skeena-North Coast	Outside BC	Existing & Planned Curriculum	Step 1	Step 2	Step 3	Step 1	Step 2	Step 3	Step 4	Step 1	Step 2	Step 3	Step 4	Step 5	Building design, construction and regulatory process	Energy modelling, energy advising & building	Building envelope - Optimal thermal performance	Building envelope - Airtight envelope	High performance building products and materials	M&E building systems and equipment	Lower Mainland - Southwest	Vancouver Island - Coast	Thompson-Okanagan	Kootenay	Cariboo-Prince George	Northeast	Skeena-North Coast	Trainer may travel	Online	Workshop / practical	Stand-alone resource (e.g., guidebook)	Classroom	Local governments	Developers & owners	Architects & building scientists	Energy modellers, CEAs	M&E engineers & commissioning agents	Builders	Trade contractors
Canadian Institute for Energy Training					Y		Y	Y								Y	Efficient Lighting	Y			Y	Y											Y												Y					Y	Y	Y
Canadian Institute for Energy Training					Y		Y	Y								Y	Introduction to Combined Heat and Power	Y			Y	Y											Y												Y					Y		
Canadian Institute for Energy Training					Y		Y	Y								Y	CanQUEST training	Y	Y	Y	Y	Y	Y	Y						Y														Y				Y			
CHBA BC						Y	Y		Y								CHBA energy advisor training								Y	Y	Y	Y	Y		Y				Y	Y	Y	Y	Y	Y	Y					Y				Y			
CHBA BC						Y	Y		Y								Net Zero Energy train the trainer											Y	Y		Y				Y	Y	Y	Y	Y	Y	Y					Y				Y		Y	
CHBA BC						Y	Y		Y								R-2000 and Net Zero training											Y	Y			Y	Y	Y	Y	Y	Y	Y	Y	Y	Y					Y					Y	Y
CHBA BC						Y	Y		Y								Building Science for New Homes								Y	Y	Y	Y	Y			Y	Y	Y	Y	Y	Y	Y	Y	Y	Y					Y					Y	Y
Greater Vancouver HBA						Y	Y		Y								CHBA energy advisor training								Y	Y	Y	Y	Y		Y				Y												Y				Y			
Greater Vancouver HBA						Y	Y		Y								R-2000 and Net Zero training											Y	Y			Y	Y	Y	Y	Y											Y					Y	Y
Greater Vancouver HBA						Y	Y		Y								Building Science for New Homes								Y	Y	Y	Y	Y			Y	Y	Y	Y	Y											Y					Y	Y
Greater Vancouver HBA						Y	Y		Y								Building Science Day								Y	Y	Y	Y	Y			Y	Y	Y		Y											Y					Y	Y
CHBA - Central Interior						Y	Y				Y						CHBA energy advisor training								Y	Y	Y	Y	Y		Y						Y											Y				Y		
CHBA - Central Interior						Y	Y				Y						R-2000 and Net Zero training											Y	Y			Y	Y	Y	Y			Y										Y					Y	Y
CHBA - Central Interior						Y	Y				Y						Building Science for New Homes								Y	Y	Y	Y	Y			Y	Y	Y	Y			Y										Y					Y	Y
CHBA - Central Okanagan						Y	Y				Y						CHBA energy advisor training								Y	Y	Y	Y	Y		Y						Y											Y				Y		
CHBA - Central Okanagan						Y	Y				Y						R-2000 and Net Zero training											Y	Y			Y	Y	Y	Y			Y										Y					Y	Y
CHBA - Central Okanagan						Y	Y				Y						Building Science for New Homes								Y	Y	Y	Y	Y			Y	Y	Y	Y			Y										Y					Y	Y
CHBA - Fraser Valley						Y	Y		Y								CHBA energy advisor training								Y	Y	Y	Y	Y		Y				Y												Y				Y			
CHBA - Fraser Valley						Y	Y		Y								R-2000 and Net Zero training											Y	Y			Y	Y	Y	Y	Y											Y					Y	Y
CHBA - Fraser Valley						Y	Y		Y								Building Science for New Homes								Y	Y	Y	Y	Y			Y	Y	Y	Y	Y											Y					Y	Y
CHBA - Northern BC						Y	Y						Y				CHBA energy advisor training								Y	Y	Y	Y	Y		Y								Y	Y	Y	Y					Y				Y			
CHBA - Northern						Y	Y						Y				R-2000 and Net Zero training											Y	Y			Y	Y	Y	Y					Y	Y	Y	Y					Y					Y	Y

Provider	Provider organization						Role		Physical location								Courses	Part 3 ICI			Part 3 MURB				Part 9					Key competency						Reach								Format				Audience							
Leaders	University	College	Government	Private trainer	NGO	Industry Association/Union	Coordinator (prov.-wide)	Delivery Agents (regional)	Lower Mainland - Southwest	Vancouver Island - Coast	Thompson-Okanagan	Kootenay	Cariboo-Prince George	Northeast	Skeena-North Coast	Outside BC	Existing & Planned Curriculum	Step 1	Step 2	Step 3	Step 1	Step 2	Step 3	Step 4	Step 1	Step 2	Step 3	Step 4	Step 5	Building design, construction and regulatory process	Energy modelling, energy advising & building	Building envelope - Optimal thermal performance	Building envelope - Airtight envelope	High performance building products and materials	M&E building systems and equipment	Lower Mainland - Southwest	Vancouver Island - Coast	Thompson-Okanagan	Kootenay	Cariboo-Prince George	Northeast	Skeena-North Coast	Trainer may travel	Online	Workshop / practical	Stand-alone resource (e.g., guidebook)	Classroom	Local governments	Developers & owners	Architects & building scientists	Energy modellers, CEAs	M&E engineers & commissioning agents	Builders	Trade contractors
BC																																																				
CHBA - Northern BC						Y	Y						Y				Building Science for New Homes								Y	Y	Y	Y	Y			Y	Y	Y	Y				Y	Y	Y	Y				Y					Y	Y
CHBA - Rocky Mountain						Y	Y					Y					CHBA energy advisor training								Y	Y	Y	Y	Y		Y							Y					Y					Y				
CHBA - Rocky Mountain						Y	Y					Y					R-2000 and Net Zero training											Y	Y			Y	Y	Y	Y				Y					Y						Y	Y
CHBA - Rocky Mountain						Y	Y					Y					Building Science for New Homes								Y	Y	Y	Y	Y			Y	Y	Y	Y				Y					Y						Y	Y
CHBA - Sea to Sky						Y	Y		Y								CHBA energy advisor training								Y	Y	Y	Y	Y		Y					Y								Y					Y				
CHBA - Sea to Sky						Y	Y		Y								R-2000 and Net Zero training											Y	Y			Y	Y	Y	Y	Y								Y						Y	Y
CHBA - Sea to Sky						Y	Y		Y								Building Science for New Homes								Y	Y	Y	Y	Y			Y	Y	Y	Y	Y								Y						Y	Y
CHBA - South Okanagan						Y	Y				Y						CHBA energy advisor training								Y	Y	Y	Y	Y		Y						Y							Y				Y				
CHBA - South Okanagan						Y	Y				Y						R-2000 and Net Zero training											Y	Y			Y	Y	Y	Y		Y							Y						Y	Y
CHBA - South Okanagan						Y	Y				Y						Building Science for New Homes								Y	Y	Y	Y	Y			Y	Y	Y	Y		Y							Y						Y	Y
CHBA - Vancouver Island						Y	Y			Y							CHBA energy advisor training								Y	Y	Y	Y	Y		Y							Y							Y				Y				
CHBA - Vancouver Island						Y	Y			Y							R-2000 and Net Zero training											Y	Y			Y	Y	Y	Y			Y							Y						Y	Y
CHBA - Vancouver Island						Y	Y			Y							Building Science for New Homes								Y	Y	Y	Y	Y			Y	Y	Y	Y			Y							Y						Y	Y
City Green Solutions					Y			Y		Y							EnerGuide Ratings System (Step) Code Verification Report and Software - for energy advisors								Y	Y				Y	Y	Y	Y	Y	Y	Y	Y	Y	Y					Y	Y		Y					Y				
City Green Solutions					Y			Y		Y							EnerGuide Ratings System (Step) Code Verification Report and Software - for local governments								Y	Y					Y	Y				Y	Y	Y	Y				Y					Y	Y							
City Green Solutions					Y			Y		Y							New Home Energy advisor qualification training								Y	Y					Y	Y				Y	Y	Y	Y				Y		Y		Y				Y				
City Green Solutions					Y			Y		Y							Mid-construction blower door test training (energy advisors and builders)								Y	Y					Y	Y				Y	Y	Y	Y				Y		Y		Y				Y		Y		
City Green Solutions					Y			Y		Y							Introduction to the Energy Star for New Homes Technical and Best Practices Guide								Y	Y					Y	Y				Y	Y	Y	Y				Y			Y		Y	Y	Y	Y	Y	Y	Y

Provider	Provider organization						Role		Physical location								Courses	Part 3 ICI			Part 3 MURB				Part 9					Key competency						Reach								Format				Audience							
Leaders	University	College	Government	Private trainer	NGO	Industry Association/Union	Coordinator (prov.-wide)	Delivery Agents (regional)	Lower Mainland - Southwest	Vancouver Island - Coast	Thompson-Okanagan	Kootenay	Cariboo-Prince George	Northeast	Skeena-North Coast	Outside BC	Existing & Planned Curriculum	Step 1	Step 2	Step 3	Step 1	Step 2	Step 3	Step 4	Step 1	Step 2	Step 3	Step 4	Step 5	Building design, construction and regulatory process	Energy modelling, energy advising & building	Building envelope - Optimal thermal performance	Building envelope - Airtight envelope	High performance building products and materials	M&E building systems and equipment	Lower Mainland - Southwest	Vancouver Island - Coast	Thompson-Okanagan	Kootenay	Cariboo-Prince George	Northeast	Skeena-North Coast	Trainer may travel	Online	Workshop / practical	Stand-alone resource (e.g., guidebook)	Classroom	Local governments	Developers & owners	Architects & building scientists	Energy modellers, CEAs	M&E engineers & commissioning agents	Builders	Trade contractors
City Green Solutions					Y			Y		Y							Introduction to RateOurHome.ca (for builders, realtors, energy advisors, local governments)								Y	Y					Y	Y				Y	Y	Y	Y				Y				Y			Y		Y	
City Green Solutions					Y			Y		Y							Meeting the BC Energy Step Code (for builders)								P	P					P	P				P	P	P	P				P							P	Y	Y
City Green Solutions					Y			Y		Y							Program Qualified Energy Advisor Training								Y	Y					Y	Y				Y	Y	Y	Y				Y		Y		Y					
City Green Solutions					Y			Y		Y							Modelling for the BC Energy Step Code (for energy advisors)								P	P					P					P	P	P	P				P				Y					
City Green Solutions					Y			Y		Y							Ongoing builder training (webinars)								Y	Y				Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		Y			Y				Y	Y
Community Energy Association					Y		Y	Y	Y								ENERGY STAR for New Homes Builder Workshop								Y	Y	Y				Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		Y			Y	Y		Y		Y	Y
Heatspring				Y			Y										A wide range of energy efficiency, principles of passive design and green building webinars and online courses	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		Y					Y	Y	Y	Y	
Insightful Healthy Homes Inc.				Y				Y	Y								Introduction of CHBA net zero housing label											Y	Y	Y					Y										Y	Y		Y			Y	Y
Insightful Healthy Homes Inc.				Y				Y	Y								How to achieve net zero and net zero ready											Y	Y		Y	Y	Y	Y	Y										Y			Y			Y	Y
Insightful Healthy Homes Inc.				Y				Y	Y								The Sweet Spot of Passive and Active Measures for High Performance Homes											Y	Y		Y	Y	Y	Y	Y										Y			Y			Y	Y
Insightful Healthy Homes Inc.				Y				Y	Y								The Sweet Spot of Conservation Measures and on Site Renewable Generation											Y	Y		Y	Y	Y	Y	Y										Y			Y			Y	
Morrison Hershfield				Y				Y	Y								Visualizing the Pathway to Low Energy Buildings - The Real Impact of the Building Envelope	Y	Y	Y	Y	Y	Y	Y							Y	Y	Y		Y	Y	Y	Y	Y	Y	Y	Y			Y			Y				
Morrison Hershfield				Y				Y	Y								Holistic Approach to Achieving Low Energy High-Rise Residential Buildings				Y	Y	Y	Y							Y	Y	Y		Y	Y	Y	Y	Y	Y	Y	Y			Y		Y		Y		Y		
Morrison Hershfield				Y				Y	Y								The Importance of Structural Thermal Breaks in Meeting Future Energy Building Codes and Improving Building Envelope efficiency	Y	Y	Y	Y	Y	Y	Y							Y				Y				Y						Y	Y		Y		Y			

Provider	Provider organization						Role		Physical location								Courses	Part 3 ICI			Part 3 MURB				Part 9					Key competency						Reach								Format				Audience							
Leaders	University	College	Government	Private trainer	NGO	Industry Association/Union	Coordinator (prov.-wide)	Delivery Agents (regional)	Lower Mainland - Southwest	Vancouver Island - Coast	Thompson-Okanagan	Kootenay	Cariboo-Prince George	Northeast	Skeena-North Coast	Outside BC	Existing & Planned Curriculum	Step 1	Step 2	Step 3	Step 1	Step 2	Step 3	Step 4	Step 1	Step 2	Step 3	Step 4	Step 5	Building design, construction and regulatory process	Energy modelling, energy advising & building	Building envelope - Optimal thermal performance	Building envelope - Airtight envelope	High performance building products and materials	M&E building systems and equipment	Lower Mainland - Southwest	Vancouver Island - Coast	Thompson-Okanagan	Kootenay	Cariboo-Prince George	Northeast	Skeena-North Coast	Trainer may travel	Online	Workshop / practical	Stand-alone resource (e.g., guidebook)	Classroom	Local governments	Developers & owners	Architects & building scientists	Energy modellers, CEAs	M&E engineers & commissioning agents	Builders	Trade contractors
Passive House Canada					Y		Y	Y	Y	Y							One Day Intro to Passive House Design & Construction			P			Y	Y			Y	Y	Y	Y	Y	Y	Y	Y	Y	Y					Y			Y	Y	Y		Y	Y	Y
Passive House Canada					Y		Y	Y	Y	Y							Passive House Trades Course			P			P	P			Y	Y		Y	Y	Y	Y	Y	Y	Y	Y					Y							Y	Y
Passive House Canada					Y		Y	Y	Y	Y							Certified Passive House Designer/Consultant Exam Preparation Course			P			Y	Y			Y	Y		Y	Y	Y	Y	Y	Y	Y	Y					Y			Y		Y			
Passive House Canada					Y		Y	Y	Y	Y							Masterclass: PHPP v9			P			Y	Y			Y	Y		Y	Y	Y	Y	Y	Y	Y	Y					Y			Y	Y				
Passive House Canada					Y		Y	Y	Y	Y							Masterclass: Passive House for Multi-family Buildings						Y	Y						Y	Y	Y	Y	Y	Y	Y	Y	Y					Y			Y		Y			
Passive House Canada					Y		Y	Y	Y	Y							Masterclass: Building Enclosures for High Performance Buildings						Y	Y								Y	Y	Y		Y	Y	Y					Y			Y					
Passive House Canada					Y		Y	Y	Y	Y							Masterclass: Thermal Bridging Calculation			Y			Y	Y				Y	Y		Y	Y	Y			Y	Y	Y					Y			Y	Y				
Passive House Canada					Y		Y	Y	Y	Y							Passive House Design Construction Course			P			Y	Y				Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y					Y			Y		Y	Y	Y
RDH Engineering				Y				Y	Y	Y							Study of Part 3 Building Airtightness	Y	Y	Y	Y	Y	Y	Y								Y			Y	Y	Y	Y	Y	Y	Y	Y			Y	Y			Y	Y		Y	
RDH Engineering				Y				Y	Y	Y							Guide on High-Performance Windows	Y	Y	Y	Y	Y	Y	Y								Y		Y		Y	Y	Y	Y	Y	Y	Y			Y				Y			
RDH Engineering				Y				Y	Y	Y							Passive House Training for Designers and Consultants	Y	Y	Y	Y	Y	Y	Y							Y	Y	Y	Y	Y	Y	Y	Y								Y			Y	Y	Y		
RDH Engineering				Y				Y	Y	Y							Energy Efficient Envelope Design for Part 3	Y	Y	Y	Y	Y	Y	Y								Y	Y			Y	Y								Y			Y					
RDH Engineering				Y				Y	Y	Y							Optimal Northern Wall Assembly Guidelines	Y	Y		Y	Y										Y		Y		Y	Y	Y	Y	Y	Y	Y			Y				Y		Y	
RDH Engineering				Y				Y	Y	Y							Window Design for Canada's North	Y	Y		Y	Y										Y		Y		Y	Y	Y	Y	Y	Y	Y			Y				Y			
RDH Engineering				Y				Y	Y	Y							Balcony and Slab Edge Study	Y	Y	Y	Y	Y	Y	Y								Y				Y	Y	Y	Y	Y	Y	Y			Y				Y			
RDH Engineering				Y				Y	Y	Y							Thermal Performance of Buildings Seminar - Meeting and Exceeding Current and Future Energy Efficiency Requirements	Y	Y	Y	Y	Y	Y	Y								Y	Y	Y											Y				Y		Y	Y	
RDH Engineering				Y				Y	Y	Y							Passive House 2.0: Lessons Learned from the First Cohort of West Coast Passive House Buildings						Y	Y				Y	Y		Y	Y	Y	Y	Y	Y								Y	Y		Y	Y	Y	Y	Y
RDH Engineering				Y				Y	Y	Y							Airtightness Testing of Large Buildings: Current and Future Conditions and Outcomes	Y	Y	Y	Y	Y	Y	Y								Y				Y											Y	Y		Y		Y	
TECA						Y	Y		Y								Certified Heating Technician Program				Y	Y			Y	Y							Y	Y											Y							Y
TECA						Y	Y		Y								Hydronic Systems Design Course	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y																									

Provider	Provider organization						Role		Physical location								Courses	Part 3 ICI			Part 3 MURB				Part 9					Key competency						Reach								Format				Audience							
Leaders	University	College	Government	Private trainer	NGO	Industry Association/Union	Coordinator (prov.-wide)	Delivery Agents (regional)	Lower Mainland - Southwest	Vancouver Island - Coast	Thompson-Okanagan	Kootenay	Cariboo-Prince George	Northeast	Skeena-North Coast	Outside BC	Existing & Planned Curriculum	Step 1	Step 2	Step 3	Step 1	Step 2	Step 3	Step 4	Step 1	Step 2	Step 3	Step 4	Step 5	Building design, construction and regulatory process	Energy modelling, energy advising & building	Building envelope - Optimal thermal performance	Building envelope - Airtight envelope	High performance building products and materials	M&E building systems and equipment	Lower Mainland - Southwest	Vancouver Island - Coast	Thompson-Okanagan	Kootenay	Cariboo-Prince George	Northeast	Skeena-North Coast	Trainer may travel	Online	Workshop / practical	Stand-alone resource (e.g., guidebook)	Classroom	Local governments	Developers & owners	Architects & building scientists	Energy modellers, CEAs	M&E engineers & commissioning agents	Builders	Trade contractors
TECA						Y	Y		Y								HRV Installation and Balancing				P	P	P	P	P	P	P	P	P						P											P						
Richard Kadulski				Y				Y	Y								CBHA Energy Advisor Training								Y	Y	Y	Y	Y		Y				Y	Y	Y	Y	Y	Y	Y	Y				Y				Y			Y
Richard Kadulski				Y				Y	Y								R-2000 and Net Zero training											Y	Y			Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y				Y				Y			Y
Richard Kadulski				Y				Y	Y								Building Science for New Homes								Y	Y	Y	Y	Y			Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y				Y				Y			Y

Note: Information and course offerings are subject to change. Data was collected in spring 2017. Curriculum offerings denoted with a “Y” were currently being offered; “P” indicates that curriculum was in the planning stage. Consult training providers for additional information.

APPENDIX D

TRAINING DELIVERY AGENTS BY REGION (PART 3 AND PART 9)

Delivery agents are organizations that provide training to building industry professionals in their respective regions.[82] They have established relationships with target audiences in the regions in which they are active and may be well suited to provide BC Energy Step Code training.

[82] Delivery agents' regions were determined by physical location of offices, as well as areas in which organizations have worked in the last two years.

LOWER MAINLAND – SOUTHWEST

Aboriginal Skills Group

Academy of Learning

Association of Professional Engineers & Geoscientists of BC (APEG BC)

Architectural Institute of BC (AIBC)

BC Housing/Home Protection Office (HPO)

BC Building Envelope Council (BCBEC)

BC Construction Association (BCCA)

British Columbia Insulation Contractors Association (BCICA)

BC Institute of Technology (BCIT)

Brenda Martens (industry trainer)

British Columbia Wall and Ceiling Association (BCWCA)

Building Officials' Association of BC (BOABC)

Brighton College

Canada Green Building Council (CaGBC)

Cascadia Windows

CDI College

Canadian Home Builders' Association of BC, Fraser Valley

Canadian Home Builders' Association of BC, Sea to Sky

City Green Solutions

CIQS

Curt Hepting (industry trainer)

Discovery Community College

Douglas College

E3 EcoGroup

Embers

Fenestration Association of BC (FEN-BC)

Finishing Trades Institute of BC

Fortis BC Contractor Program

Greater Vancouver Home Builders' Association (GVHBA)

Integral Group Inc.

International Brotherhood of Electrical Workers (IBEW)

Insightful Healthy Homes Inc.

Joint Apprenticeship Refrigeration Training School

Kane Consulting

Kwantlen University College

Langara College

Manufactured Housing Association of BC (MHABC)

Mitsubishi Electric

Murray Frank (industry Trainer)

National Association of Industrial and Office Properties (NAIOP)

Pacific Vocational College

Passive House Canada

Roofing Contractors Association of BC (RCABC)

Richard Kadulski (industry trainer)

Riverside College

RDH Engineering

Terrazzo, Tile and Marble Association of Canada (TTMAC)

Sheet Metal Workers Training Centre Society (SMWTCS)

Sprott Shaw College

Squamish Nation Trades Centre

Trane

Trowel Trades Training Association (TTTA)

Turner & Townsend

UA-Piping Industry College of BC

UBC

Urban Development Institute (UDI)

Vancouver Career College

Vancouver Community College (VCC)

Vancouver Regional Construction Association (VRCA)

Wood WORKS! BC

VANCOUVER ISLAND – COAST

Academy of Learning

Association of Professional Engineers & Geoscientists of BC (APEG BC)

BC Construction Association (BCCA)

Brenda Martens (industry trainer)

Camosun College

Canadian Home Builders' Association of BC, Vancouver Island

CDI College

CIQS

City Green Solutions

Curt Hepting (Industry trainer)

Discovery Community College

Electrical Industry Training Institute

Electrical Joint Training Committee (EJTC)

Electricity Association of BC (EABC)

Fortis BC Contractor Program

Integral Group Inc.

Manufactured Housing Association of BC (MHABC)

Passive House Canada

RDH Engineering

Richard Kadulski (industry trainer)

Sirewall

Sprott Shaw College

Thermal Environment Comfort Association (TECA)

Trade Works Training Society

Urban Development Institute (UDI)

Vancouver Island Construction Association

Vancouver Island University

Victoria Residential Builders Association (VRBA)

Viessmann Academy

THOMPSON-OKANAGAN

Academy of Learning

BC Construction Association (BCCA)

Brenda Martens (industry trainer)

Canadian Home Builders' Association of BC, Central Interior

Canadian Home Builders' Association of BC, Central Okanagan

CIQS

Curt Hepting (industry trainer)

Delta Geothermal

Fortis BC contractor Program

Integral Group Inc.

Okanagan College

Richard Kadulski (industry trainer)

Secwepemc Cultural Education Centre

Sprott Shaw College

Thompson Rivers University (TRU)

Trane

Urban Development Institute (UDI)

Vancouver Career College

KOOTENAY

Brenda Martens (industry trainer)

Canadian Home Builders' Association of BC, South Okanagan

Curt Hepting (industry trainer)

Fortis BC Contractor Program

Integral Group Inc.

Manufactured Housing Association of BC (MHABC)

Southern Interior Construction Association (SICA)

CARIBOO-PRINCE GEORGE

Academy of Learning

BC Construction Association, North (BCCAN)

Brenda Martens (industry trainer)

Canadian Home Builders' Association, Northern BC

College of New Caledonia

Curt Hepting (industry trainer)

Fortis BC Contractor Program

Integral Group Inc.

Manufactured Housing Association of BC (MHABC)

Northern Regional Construction Association

Richard Kadulski (industry trainer)

University of Northern British Columbia (UNBC)

NORTHEAST

Brenda Martens (industry trainer)

Curt Hepting (industry trainer)

Fortis BC Contractor Program

Integral Group Inc.

International Brotherhood of Electrical Workers (IBEW)

North West Community College

Northern Lights College of Electrical Workers

Richard Kadulski (industry trainer)

SKEENA-NORTH COAST

Brenda Martens (industry trainer)

Construction & Specialized Workers

Curt Hepting (industry trainer)

Fortis BC Contractor Program

Integral Group Inc.

Richard Kadulski (industry trainer)

Trade Works Training Society

UA-Piping Industry College of BC

APPENDIX E

TRAINING DELIVERY AGENTS (PART 9)

Training delivery agents listed below are well suited to provide training to Part 9 audiences.

Part 9 delivery agents	
Provider type	**Organization**
Government	BC Housing
College	BC Institute of Technology
	Thompson Rivers University
	Langara College
	Vancouver Island University
	Camosun College
	College of New Caledonia
	Okanagan College
	Northern Lights College
NGO	Canadian Home Builders' Association of BC
	City Green Solutions
	Built Green
	Canada Green Building Council (CaGBC)
	Passive House Canada (PHC) (formerly Canadian Passive House Institute(CanPHI))
Private Trainers	Richard Kadulski
	Murray Frank
	Torsten Ely
	Joe Ltsiburek
	Rob Pope
	Arthur Lo
	Einar Halbig
	Andy Oding

APPENDIX F

ENERGY ADVISORS IN BC: PART 9 BUILDINGS

The BC Energy Step Code requires Part 9 builders work with an Energy Advisor (EA) to review plans, model energy consumption, conduct air tightness testing, and verify the plans and as-built homes will meet the energy performance requirements of a given Step of the BC Energy Step Code.

EnerGuide Rating System (ERS) EAs are third-party consultants who have been registered by Service Organizations that are licensed by Natural Resources Canada (NRCan) to deliver NRCan's EnerGuide Rating System, ENERGY STAR® for New Homes and R-2000 initiatives promoting energy-efficient homes. Service Organisations are responsible for training ERS EAs, providing field supervision, ensuring quality control and that procedures established by NRCan are followed, and collating data collected from the house evaluations and submitting energy models to NRCan. ERS EAs are trained to use NRCan's energy simulation software HOT2000. Energy modellers not affiliated with a Service Organization and ERS may use other energy simulation software that meets the BC Energy Step Code's requirements.

An energy model calculates how much energy a proposed building is expected to use. Modelled energy consumption in a building can relate to the thermal envelope, air leakage, space heating, ventilation, lighting, appliance and plug loads. The EA (or other energy modeller) understands the modelling software, construction details and code requirements. The energy model accounts for the size and geometry of the building, the climate location, the effective insulation values of assemblies such as walls, ceilings, windows and the mechanical systems that heat and ventilate the house. EAs can provide advice to homebuilders who want to improve energy efficiency in their homes and achieve any of the Part 9 Steps.

To meet the requirements of the BC Energy Step Code, builders and developers will need to work with an EA to check that their plans will meet the energy performance requirements of a given Step of the Energy Step Code. An EA will use software to complete a whole-building energy model to analyze construction plans and determine the energy efficiency of the building and whether the design will meet the target performance requirements. If it does not, the EA will work with the builder or developer to provide upgrade options to increase the energy efficiency of the building until it meets its targets. After construction, the EA will test the building by conducting a blower door test to determine how well it performs. Data collected from evaluations performed by EAs is submitted to NRCan through their Service Organization to enable quality checks, and to populate a national database on energy consumption patterns and potential energy savings in the housing sector.

As of April 2018, there were 13 NRCan-licensed Service Organizations providing services across British Columbia. Energy modelling can be provided remotely during the pre-construction phase; however air leakage testing must be conducted on site by a registered Energy Advisor. A searchable database of Service Organizations is accessible on NRCan's website, and listings of active ERS Energy Advisors can be found through the various Service Organizations as well as other third-party websites. The BC Energy Step Code website maintains EA information as well.

While ERS EAs and Service Organizations use NRCan's official marks, trademarks and software under a licensing agreement, they operate as independent businesses, and are not agents, partners, or employees of NRCan. NRCan does not endorse any builder or services of any energy advisor/service organization, or any specific product and accepts no liability in the selection of builders, materials, products, or performance or workmanship.

Note: The above information is adapted from Natural Resources Canada's website. Additional information about Energy Advisors and their qualifications and contact information for Service Organizations licensed by NRCan and participating in energy-efficiency initiatives can be found at www.nrcan.gc.ca.

APPENDIX G

TRAINING PROVIDER SURVEY RESPONDENTS

The organizations who responded to the Training Provider Survey are listed below. All organizations provide training to working industry professionals on BC Energy Step Code competencies. Data from other training providers was collected via interviews, as listed in Appendix G.

- A.O. Smith Enterprises Ltd.
- Association of Professional Engineers and Geoscientists of BC
- BCIT, Sustainable Energy Management Program
- Building Officials Association of BC
- Camosun College
- Canada Green Building Council
- Canadian Home Builders' Association of BC
- Canadian Institute for Energy Training
- Canadian Wood Council
- Certified Energy Advisors
- City Green Solutions
- College of New Caledonia
- Independent Contractors and Businesses Association of BC
- Insightful Healthy Homes Inc.
- Northern Lights College
- RDH Building Science Inc.
- Thermal Environmental Comfort Association
- Thompson Rivers University
- Turner & Townsend Inc.
- Vancouver Island Construction Association
- Vancouver Island University
- Victoria Residential Builders Association

APPENDIX H

PRELIMINARY RESEARCH ON FUNDING MODELS

The research below provides a starting point for considering potential funding models to support implementation of the Training Strategy by:

- Identifying significant funding barriers
- Suggesting appropriate programs/initiatives to address the funding barriers, and
- Providing a summary of funding models used to support similar programs/initiatives in leading jurisdictions.

Significant Funding Barriers

Industry can be trained quickly and efficiently by scaling-up existing training programs and deploying them through established delivery agents in regions across British Columbia. This approach requires marginal investment while providing consistency in the quality and reach of training. It requires: (1) provincial coordination to identify which curricula should be disseminated to support implementation of the BC Energy Step Code, and (2) regional coordination to identify appropriate delivery agents in each region, liaise between Training Leaders and delivery agents, and work with local industry stakeholders to promote the BC Energy Step Code and drive demand for training.

Training providers, who will need to authorize and oversee the integration of their curricula into delivery agents' training offering, have a key role to play in scaling up existing training. Data collected through the Training Provider survey shows that the greatest barrier they face to scaling-up training is a lack of administrative resources. Supporting the province-wide deployment of existing programs may require greater administrative effort. Human resources are needed to take some of the administrative burden off of training providers and ensure the maximum training potential is reached across the province.

Human resources at the regional scale are also needed to foster relationships between local government and industry stakeholders that can mutually benefit from the BC Energy Step Code to drive training in each region. For example, stronger relationships between local homebuilders and energy efficiency equipment suppliers could support increased levels of on-site training for local construction trades on proper installation of equipment.

Addressing Funding Barriers

"Energy Step Code Coordinators" could provide the administrative and community engagement support needed by liaising with a BC Energy Step Code training and education lead at the provincial level,[1] delivery agents in the region, and local industry stakeholders, to coordinate training and foster stakeholder synergies. This role will be especially important in regions that do not currently have institutions to organize training and facilitate relationship building between stakeholders.[2]

[1] This role may be filled by the Energy Step Code Training and Education subcommittee and/or the Energy Step Code Council.

[2] Regions with strong local chapters of the Canadian Home Builders' Association may not need a Regional Energy Step Code Coordinator. The Provincial Energy Step Code Coordinator may provide sufficient capacity to ensure the CHBA in the region has the information and resources to support BC Energy Step Code training.

Funding a single part-time Coordinator would cost approximately $29,500 per year, for a total of approximately $20,000 to staff a Coordinator in each region of BC.[3] This cost is negligible when compared with the $800,000 allocated to the Community Energy Leadership Program and the Post-Secondary Clean Energy Partnership Program in 2017/2018 through the Innovative Clean Energy (ICE) Fund. The BC Energy Step Code Coordinator program would be a short-term investment resulting in long-term self-sustaining partnerships that support provincial energy efficiency plans, policies and targets while creating opportunities for local industry.

Experiences in Leading Jurisdictions

Funding models used to support similar initiatives should be considered when developing an appropriate funding model to the BC Energy Step Code Coordinator program.

Interviews were conducted with energy efficiency policy and planning experts with knowledge and experience of implementing high performance building standards in five leading jurisdictions in the United States. These jurisdictions are—Washington, California, New York, and Vermont—each of which has attempted to coordinate state-wide training programs/initiatives.

Interviews focused on the approach to state-wide coordination of training in each jurisdiction and the funding models used to support each approach.

Table 1 below summarizes the interview findings relevant to the proposed BC Energy Step Code Coordinator program, including the training coordination program/initiative, the funding model used,[4] and the dedicated funding source.[5]

[3] Source: Estimated median employment income based on 2015 Job Bank median hourly wage rate (median annual salary = hourly wage rate x 40 (hours/week) x 52.14 (weeks/year)) for an annual salary of $45,883.

[4] Funding models refer to the system in which programming is sustained over time.

[5] Primary source of funds refers of the initial investment to support a funding model.

Table 1. Summary of funding models for training initiatives/programs similar to the BC Energy Step Code Coordinators program			
Jurisdiction	**Dedicated funding source**	**Training coordination initiative/program**	**Funding model description**
Washington	Utility fee	Northwest Energy Efficiency Council (NEEC)	Funds collected through utility fees are distributed to NEEC to manage competitive bids for energy efficiency services, including the development and/or delivery of industry training programs.
California	Utility fee	Local Government Energy Efficiency Best Practices Coordinator (x1)	Funds collected through utility fees are used to support a full time Local Government Energy Efficiency Best Practices Coordinator, who directs Regional Energy Networks and local governments to state-wide training resources.
Massachusetts	Regional Greenhouse Gas Initiative alternative compliance payments	Green Communities Program Regional Coordinators (x4)	Funds collected through the Regional Greenhouse Gas Initiative are used to support four full time Green Communities Program Regional Coordinators who administer stretch code training for building officials and direct builders to training resources.
Vermont	Utility fee	Efficiency Vermont Energy Consultants (x6)	Funds collected through utility fees are used to fund six full time Energy Consultants at Efficiency Vermont who act as a point of contact for industry stakeholders and direct them to training resources.

APPENDIX I

RELATED INITIATIVES

In the process of researching relevant education and training programs for this project, we came across numerous initiatives that are being planned or in early stages of development. The market is moving fast and it may make sense to revisit these activities at a later stage of BC Energy Step Code implementation.

- **Passive House Canada** reports that it is involves with the United Nations to develop a global standard. The growth projections in terms of rate of uptake and geographic spread suggest that this standardization may be achieved faster than 2032. Passive House Canada also reports that they are working to establish regional centres for training and education that will help to ensure consistency and certainty.
- **CHBA Net Zero Home Labelling Program**, officially launched in May 2017, provides the industry and consumers with a clearly defined and rigorous two-tiered technical requirement that recognizes Net Zero and Net Zero Ready Homes and identifies the builders and renovators who provide them. Net Zero training has been developed by for CHAB members who want to participate in this program.
- **The Roofing Contractors Association of BC** has a sizeable training facility in Langley and many of their members are air barrier suppliers and applicators. They offer their Red Star qualification program and warranties for roofing. They are interested in evolving their mandate to represent air barrier suppliers and trades.
- **The Concrete Council of Canada** continues to develop technical information and training on insulated concrete forms (ICFs) as a means to achieve high performance taller buildings. There are numerous ICF suppliers in BC.
- **The City of Vancouver** is developing a Centre of Excellence for Zero Emission (ZE) Buildings "to facilitate the compilation and dissemination of the knowledge and skills required to design, permit, build and operate zero emission buildings in BC." Aiming to open in 2017, the Centre will serve as a space for learning and sharing where stakeholders in the architecture, engineering and construction (AEC) industry can convene to learn, network and identify barriers to ZE buildings and hear about best practices. The Centre will facilitate, influence and empower AEC firms to deliver ZE buildings in both the public and private sectors in the short/medium term. The Centre is an important component in reaching Vancouver City Council's recently adopted (July 2016) target "to reduce emissions from new buildings by 90% as compared to 2007 by 2025 and to achieve zero emissions for all new buildings by 2030."[1]
- **VRCA and other regional construction associations** are embarking on multi-year strategic planning processes in 2017. Following the 2016 launch of the Construction Innovation Strategy for BC,[2] innovation which includes energy efficiency, is a key theme along with commitment to modernizing the industry, encouraging the adoption of enabling technologies such as virtual design and construction (VDC) collaboration and pre-fabrication, and resolving longstanding procurement issues.

[1] Source: "Vancouver takes next step to advance Renewable City Strategy." http://vancouver.ca/news-calendar/vancouver-takes-next-step-to-advance-renewable-city-strategy.aspx

[2] See: http://www.bccassn.com/resources/innovation.