BOABC BCESC – Competency Framework Outline

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Acronyms used:

AIBC = Architectural Institute of British Columbia
BCESC = British Columbia Energy Step Code
CEA = Certified Energy Advisor
CPD = Continuing Professional Development
EFP= Energy Foundation Program
EGBC = Engineers and Geoscientists of BC
TEDI = Thermal Energy Demand Intensity
TEUI = Total Energy Use Intensity
MEUI = Mechanical Energy Use Intensity
PTL = Peak Thermal Load
ERS = EnerGuide Rating System
VFAR = Vertical Surface area to Floor area Ratio
SVR = Surface to Volume Ration

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Purpose of the Competency Framework

BOABC leadership has expressed a need to increase professional development opportunities beginning with the design of a competency framework outlining the technical and functional skills, knowledge, and abilities for effective application of the BCESC within the duties of building officials. A review of related professions' competency frameworks[i] identified some common features, namely:

1. Use of measurable action verbs[ii] to specify learning objectives (some competency frameworks refer to Bloom's Taxonomy to identify the lower order and higher order thinking involved in achieving each competency[iii]
2. Identification of responsibility level. For BOABC, the three levels of certification are used[iv] [v]
3. Use of Learning Competency Categories. For BOABC, six competency categories have been used, based on major divisions of BCESC knowledge required for implementation.
4. Validation of training curriculum and training providers. For further professionalization, some system of vetting training providers and curriculum is recommended. This validation can be applied to existing courses, workshops, sessions, and recordings, for the purpose of evaluating the fit with identified competencies to be gained. See additional comments in the Training recommendations (for developers and facilitators) section.
5. Recognition of individual achievement. Currently, CPD points are awarded on participation in a workshop or session. For further professionalization, a means of assessing the individual's new knowledge level is recommended. (See the Assessment Recommendations section for further discussion).

The Competency Framework provides a means of identifying and organizing the knowledge needed by building officials to successfully implement the BCESC. This includes reference to existing and developing training opportunities, and reference to means of assessing learning.

The Competency Framework is not a replacement for existing or developing courses, programs, webinars, and other means of acquiring the knowledge.

The following BCESC competencies for Building Official are identified from BOABC membership surveys, consultation with BOABC Steering Committee and leadership, BC Hydro and other BCESC specialists, review of existing BCESC resources (workshops, documents, webinars, and recordings), individual

consultations with building officials, BCBC Part 3 and 9 BCESC specialists, energy modellers and CEAs. This framework is a living document, and open to ongoing feedback from stakeholders.

The Competency Framework can be used for several purposes, including: providing a basis for, and informing a need for training; developing new curriculum; assigning CPDs to training programs; revising job descriptions; improving performance; professional development; and adding competencies to the certification exams.

Training Needs because of the BCESC

The framework is built on six key aspects of the BCESC and resulting changes of standard practices of construction for Part 9 and Part 3 buildings in British Columbia. Following the BCESC from the lower to upper steps will result in gradual changes in construction of all BC buildings which will primarily impact building enclosures and mechanical heating, ventilation and cooling systems. This has a direct impact on the current and future versions of the BC Building Code, Plumbing Code, Fire Code and various other building standards with respect to life safety, health and safety, energy efficiency.

Table 1 outlines the 6 key aspects where training is needed for and directly resulting from the BCESC, specifically tailored for BC Building Officials of all levels. The table breaks down the key components of the training program into Part 3 and Part 9 buildings given differences in the types of construction, involvement of registered Architects/Engineers and energy modeling methods.

Learning Competency Category	**Part 3**	**Part 9**
	Key Elements (basis of Learning Objectives)	
1. BCESC Basics	Background & function Performance based instead of prescriptive The steps Costing Attributes of higher performance buildings	
2. BCESC Metrics & Definitions	TEDI TEUI Airtightness targets Climate Zones	
	Articulation, VFAR Overheating Limit Climate data	MEUI PTL ERS Articulation, SVR Cooling allowance Small home allowance Step 1 airtightness
3. Implementing the BCESC: Process, Roles & Responsibilities	Implementation Plan Checking Submittals & Forms New Process Liability	

	Site inspections Roles & responsibilities	Site inspections Roles & responsibilities Working with EAs
4. High Performance Mechanical Systems	New systems/ technology Heating Ventilation Cooling & Overheating Control Domestic Hot Water	
	Ventilation impact Energy sub-metering	System changes with higher steps Cooling
5. High Performance Building Enclosures	Effective R-values & Thermal Bridging Insulation Placement Moisture management, vapour control New air barrier systems & detailing Issues with BCBC & New Systems/Materials Low energy design principles	
	Non-combustible concrete & steel Construction Mid-rise wood-frame Whole building airtightness tests	Wood frame construction Airtightness testing
6. Energy Modelling	Performance instead of Prescriptive Timing of the model	
	Professional Practice Guidelines Part 3 Tools Thermal Bridging Guide	Energy Advisors Part 9 Tools

The framework and 6 high-level categories are expressed as measurable outcomes in terms of incorporating the following knowledge into building official duties:

1. BCESC Basics
2. BCESC Metrics & Definitions
3. Implementing the BCESC
4. High Performance Mechanical Systems
5. High Performance Building Enclosures
6. Energy Modelling

Each high-level goal has several specific and measurable learning objectives that upon successful completion represent achievement of the goal. The learning objectives may be met through a variety of learning experiences and activities, including existing or new sessions, courses, online modules, experiential learning opportunities, and other means.

The Competency Framework is used to evaluate existing and new courses for alignment with learning goals and learning objectives. It is also used to identify training gaps and indicate the need for new training opportunities.

Training recommendations (for developers and facilitators)

Note: The "Need" comments are to be reviewed by BOABC management and staff. They are provided here as suggestions and recommendations.

- **General comment:** Much of the existing training follows an information transfer model. Information is presented in the format of a webinar, workshop, or recording.
- **Need for profile descriptions** – Some means of establishing a profile of the respective AHJ and of the individual building official regarding adoption and knowledge of the BCESC will be helpful in further training recommendations. Some of this information has been collected from the 2018 survey and analysis work. A profile tool may be helpful. (See the Assessment Recommendations for more detail)
- **Need for assessment of learning** - recommended as part of an awarding of CPD points
    - BCESC assessment instruments added to Level 1, 2, and 3 BOABC Exams
    - Assessment methods used in of training sessions
- **Need for verification strategies**[vi]
    - For each competency, learning objective, or task: provide detail of the primary evaluation method and alternative evaluation method
    - Evaluation methods include:
        - Completion of acceptable course of study
        - Testing, evidence, body of work
        - Practical experience
        - Pass code courses
        - Combinations of the above
- **Need for an analysis procedure**[vii]**.** This involves an analysis of existing training programs to determine the extent to which they conform with learning objectives detailed in the Competency Framework. The results of this analysis can be used to determine if a training course or program the specific learning, methods of assessment, and levels of competencies acquired. Some features to include:
    - Objectives not covered in a training program (curriculum gaps)
    - Objectives which are theoretically covered, and require additional skills/knowledge to be developed on the job (training gaps)
    - Material that may be provided in a training program, and is not part of the duties of building officials (training relevancy)
- **Need for a list of accredited courses.** This involves an evaluation based on the Competency Framework by BOABC Education and Exam staff. Include the information about the provider, the course name and outline, and specific Competency Framework objectives addressed.
- **Need for a process to apply for education provider status, or request curriculum review for approval by BOABC-** see Appendix D: Sample Forms for Training Provider, Course Information Sheet, and Course Review/Mapping [viii]
- **Need for outsourcing -** see Appendix H: Outsourcing Guidance in the National Certification and Accreditation Model for Professional Building Officials[ix]

Assessment recommendations

Assessment *for learning* strategies can be used. Here are some examples:

- Pre-assessment to determine what the learners already know, to avoid duplication, correct misunderstandings, prime for acquisition of new knowledge
- Use of various questioning techniques during a workshop to increase learning opportunities. See Using Questions Effectively

Assessments to match measurable, action-verb learning objectives. The objectives can be compared to the corresponding learning objectives in this Competency Framework, as part of the assessment of the number of CPD points to be awarded, the level of competency targeted, and the fit with an existing or new training curriculum with BOABC educational needs.

Three areas where it is advantageous to assess learning are identified:

Pre-assessment

Purpose: to identify and focus on specific training needs and level of training indicated. This can be accomplished by developing a training needs profile (a few simple questions will suffice) for the AHJ and the individuals taking the training.

Here are some examples of profile questions for an AHJ:

- AHJ not considering adopting BCESC currently
- BCESC adoption by my AHJ is pending approval. Some training and capacity building have occurred.
- AHJ has adopted one or more lower steps and has a process in place for implementation. More development of implementation training, tools, and procedures is needed
- AHJ has a strong BCESC program and has enough support in place for building community and building official training and CPD

Here are some examples of profile questions for an individual Building Official (use a Likert Scale for answers):

- I have an immediate need to learn the basics of the BCESC
- I am confident in my basic knowledge of the BCESC, and need more in-depth training
- I have specific implementation questions that I would like to resolve

Formative assessment

There are many opportunities during a workshop, session, or class for supporting learning through questioning strategies, short check-ins for comprehension of new concepts, and immediate feedback techniques. Workshop facilitators, Trainers, and other Education Providers can be supported in the development of these techniques and strategies, and the curriculum overview for courses can be reviewed to ensure that formative assessments are included.

Summative Assessment

Summative assessment provides assurance that individual learning has occurred. Methods to accomplish this include:

1. Reliance on curriculum from a validated provider that has been carefully reviewed and includes a valid means of assessment.
2. Self-assessment, for example, the use of a simple self-assessment form that asks for level of comfort with key BCESC topics, and identification of areas for further development further.
3. BCESC assessment questions added to Level 1, 2, and 3 BOABC Exams

Examples from related disciplines to consider for further development of the Competency Framework[x]

Assessing KNOWLEDGE:
The knowledge taxonomy developed by Dr Benjamin Bloom recognizes six different levels of processing thought. These levels relate directly to rigor and complexity in thinking and learning. "Knowledge" is the simplest level while "evaluation" is the most complex. Knowledge level is assessed by analyzing the verbs used in the performance objectives for a particular course, as shown in the table below:

	Level	*Description*	*Action Verbs*
1	Knowledge	Recall information	define, describe, list
2	Comprehension	Understand information - Grasp its meaning.	explain, convert, rewrite
3	Application	Use ideas in particular situations	demonstrate, uses, compute
4	Analysis	Break down information into its parts	distinguish, discriminate
5	Synthesis	Put parts together to form a new whole	combine, design, rearrange
6	Evaluation	Make judgements about the value of methods or materials for a given purpose.	appraise, criticize, conclude, defend

[from page 56 of **chibo-pboreportoctober05**- National Certification and Accreditation Model for Professional Building Officials.]

Possible learning objectives with action verbs for plan checking:

- Prepare (a document)
- Evaluate (a plan)
- Propose solutions
- Define schematic design elements
- Analyze (proposed) solutions
- Evaluate solutions
- Utilize conceptual skills to communicate design solutions
- Assess technical aspects of schematic design solutions
- Explain active and passive mechanical system impact on design
- Explain electrical system impact on design

- Analyze the choice of system options
- Apply BCESC requirements to design-development documents
- Apply BCESC requirements to construction documents
- Demonstrate awareness of alternative solution provisions in BCESC
- Describe construction materials properties and influence on design and documentation
- Describe material assemblies' materials properties and influence on design and documentation

BC-Housing-Core-Competency-Requirements[xi]

Note: the language used below has been modified from BC Housing's Core Competency Requirements document to reflect where BCESC training might fit in.

Relevant Enactments

- Describe the role of the BCESC
- Describe how the BCESC is developed and what it accomplishes
- Identify who enforces it and the general permit process
- Understand how the BCESC relates to other codes, such as electrical regulations, the British Columbia Fire Code and others
- Describe what the BCESC governs and identify the location of all key aspects of Division B, Part 9, relating to residential construction

Construction Technology

- Explain the "house-as-a-system" concept.
- Explain how to control heat flow through heat flow mechanisms, such as conduction, convection and radiation
- Explain how to control moisture flow through moisture movement mechanisms, such as bulk moisture movement, capillary action, airborne moisture and vapour diffusion
- Categorize indoor air quality through contributors and detractors, such as pollutants, moisture or mould, and material selection.
- Classify air barriers (materials and details)
- Classify vapour barriers (materials and details)
- Distinguish foundation design: types of foundations, heat loss control, and moisture control
- Distinguish floor designs: details for heat-flow control, moisture management, details at critical locations and vibration telegraphing sub-floors
- Distinguish wall design: heat loss and moisture control, and alternate details
- Distinguish roof construction and attics: air leakage into attics, details at critical locations, heat loss control, and details to deal with specific problems, such as truss uplift and ice damming
- Distinguish windows and doors installations: guidelines to control heat loss and gains and moisture
- Distinguish heating, cooling and ventilation principles
- Distinguish heating systems
- Distinguish heat distribution systems

- Distinguish ventilation systems: benchmarks, alternate systems, heat recovery ventilation and energy recovery ventilation, and design and installation considerations
- Distinguish integrated mechanical systems.

Legal Issues

- Describe how provincial legislation and local bylaws may affect residential construction:
    - Zoning and easements
    - Development permits
    - Building permits
    - Inspection requirements
    - Occupancy permits
- Describe how the BCESC may affect residential construction.

Outcomes-based competencies and indicators for newly registered/licensed Architect-canadian_standards_of_practice[xii]-

- Note the use of Blooms levels (No Knowledge, Remember, Apply, Analyze, Evaluate, Create) to categorize the level of competency targeted
- Evaluate the BCESC implications for schematic design
- Explain code requirements relevant to active and passive mechanical systems
- Explain the use of referenced standards included within the code
- Assess issues related to indoor air quality and energy conservation strategies

National Certification and Accreditation Model for Professional Building Officials - **chibo-pboreportoctober05** [xiii] [xiv] - This 2005 document from The Construction Sector Council in partnership with The Alliance of Canadian Building Officials Association contains an extensive amount of information and potentially useful framework for consideration in further developments of this Competency Framework.

Some examples from the document are provided below:

Note: The higher the ranking, the more important the task is considered.

NOS Task #	NOS Task Description	Danger	Criticality	Complexity	Frequency	Overall Rating	Ranked Importance of this Task
9	Conducts on-site inspections	4.0	3.7	4.2	4.7	16.59	**1**
4	Reviews technical documents	2.0	3.8	4.1	4.3	14.24	**2**
6	Issues special approvals	2.0	3.9	4.0	3.3	13.19	**3**
13	Administers municipal law	2.0	3.3	3.4	4.3	13.02	**4**
2	Communicates verbally	1.0	3.6	3.7	4.6	12.94	**5**
14	Recognizes legal responsibility	2.0	3.6	3.2	4.1	12.89	**6**
12	Administers provincial law	2.0	3.3	3.7	3.4	12.32	**7**
3	Resolves Conflicts	2.0	3.0	3.7	3.6	12.31	**8**
1	Communicates in writing	1.0	3.8	3.5	4.1	12.26	**9**
10	Conducts research	2.0	2.7	3.7	3.7	12.12	**10**
8	Requests tests	2.0	3.3	3.6	3.0	11.86	**11**
5	Obtains Clearance Certificates from other authorities.	2.0	3.0	2.9	4.0	11.84	**12**
7	Issues permits.	1.0	3.1	2.8	4.2	11.10	**13**
15	Maintains documentation.	1.0	3.0	2.33	4.4	10.69	**14**
17	Administers office	1.0	2.2	2.73	4.6	10.51	**15**
11	Administers federal law.	1.0	2.4	3.42	2.3	9.14	**16**
16	Maintains resource library.	1.0	2.0	2.51	3.0	8.43	**17**

- definitions for Inspection and for Plan Reviews (pages 27-28)
- Accreditation (pages 32-37)
- Glossary of Terms (pages 44-53)

National-Certification-Process-for-Building-Officials (Construction Sector Council)- information about the process for certification.

Flexibility of the Competency Framework

As stated above, this is a living document, intended to provide a means to identify professional development opportunities, and acknowledge BCESC learning for building officials. It can be used to assign CPD points. An additional column can be added to the Competencies and Learning Objectives table to identify the learning level (to match the National Occupational & Training Standard: Professional Building Official). The competencies and learning objectives can compared to and mapped onto corresponding industry frameworks if needful (AIBC, EGBC, BC Housing). The version presented in Table 2 corresponds to the BOABC Level 1 Exam Guideline (BOABC Exam resources, n.d.).

Note: Developing learning objectives is an iterative process, and we expect changes to the action verbs used below. Learning objectives, to be useful, are to be stated as *measurable* actions that the learner will be able to do after completing a course of study or training. *Understand* is commonly provided, but it is not a measurable learning outcome. We have therefore provided lower-level cognitive verbs (e.g. Explain, Describe) which can be changed as needed in future applications of this competency framework. It may also become apparent that additional learning objectives are needed to accurately represent the learning steps involved (for example, see the last item in the Implementation section: "Explain the design and construction process for single family homes from pre-permit to occupancy – Part 9".

The Alignment column in the following tables refers to specific subtasks in the National Occupational & Training Standard—Professional Building Official document. At the time of the preparation of this framework, the document can be found on the BOABC website: http://boabc.org/wp-content/uploads/2015/10/Professional-Building-Official-NOS-Revised-2007.pdf. Examples have been provided for most of the competencies and learning objectives, and may be further refined or added to as needed.

Table 2. Competencies and Related Learning Objectives

Competencies and Learning Objectives		M = Mandatory S = Supplementary (Note: designations can be changed as appropriate)		
1. BCESC Basics	**L1**	**L2**	**L3[xv]**	**Alignment[xvi] (examples)**
General				
Describe the Background and History of the Step Code	M			
Explain how the BCESC can be adopted by jurisdictions or voluntarily complied with by individual projects	M			1.01.05
Describe how the BCESC works within the regulatory framework of BC	M			1.01.02
Differentiate the types of buildings covered, or not covered by the BCESC				10.01.04
Compare the performance-based nature and use of metrics to prescriptive requirements	M			9.01.01
Describe impacts on construction practices		M		10.02.02

Explain the Passive House path and how it fits into the BCESC	M			11.04
Explain building as a system concept as it relates to energy efficiency, air-tightness, building enclosure performance and mechanical systems	S			4.03
Review case studies	S			15.03.06
Review costing examples	S			
Part 3				
Explain the 4 steps for Part 3 Buildings			M	1.05
Describe the basic changes necessary for buildings to meet the lower to upper steps for Part 3 buildings in Climate Zones across BC			S	6.01
Review new documentation requirements for Part 3 buildings			M	1.05
Part 9				
Describe the role of Energy Advisors for Part 9 buildings	M			7.03.03
Explain the 5 Steps for Part 9 Buildings	M			5.01
Review new documentation for Part 9 submissions	M			4.06
Describe the basic changes necessary for buildings to meet the lower to upper steps for Part 9 buildings in Climate Zones across BC	M			1.05
Describe in high level the new design and build process for Part 9 and Part 3 buildings	M			1.01.01
2. BCESC Metrics and Definitions	**L1**	**L2**	**L3**	
General				
Explain energy efficiency and energy use metrics and targets within the BCESC (TEDI, TEUI, MEUI etc.)	M	M		8.01.01
Describe BC Climate Zones and different metrics for each	M			
Part 3				
Explain what step code limits and does not limit in Part 3			S	3.01.05
Define Part 3 terminology (TEUI, TEDI and overheating hours)	M			3.03.02
Describe how Part 3 energy metrics are calculated		S	M	
Describe overall energy consumption (TEUI) for a building and comment on whether it is within a normal range			M	11.05.04
Evaluate overall energy consumption (TEUI) for a building and comment on whether it is within a normal range			M	11.05.04
Explain airtightness metrics for Part 3 and how modeling is impacted		S	M	11.04.01
Part 9				
Explain what step code limits and does not limit in Part 9	M			13.01.02
Define Part 9 terminology (ACH at 50 Pa, TEUI, MEUI, PTL (for now) and TEDI)	M			
Describe how Part 9 energy metrics are calculated	M			
Define TEUI, TEDI and overheating hours and how they are calculated.	M			
Answer general administrative questions about the application and interpretation of the BCESC, and about inspections, plans, specifications, and professional design and review.	M			12.09.03
Explain airtightness metrics for Part 9 and nuances of Step 1	M			

3. Implementing the BCESC	L1	L2	L3	
General				
Explain the role of building official within their mandate as it relates to the BCESC	M			2.08.01
Explain process and timing for the submissions to and review by the AHJ, (e.g. When should model be anticipated? When does testing occur?)	M			4.01.03
Explain the role of a building official to evaluate or enforce building science issues or when to refer to industry guidance.	M			12.09.04
Given building design and construction details, identify the responsibility of the building official, the energy advisor, and the Energy Modeller to verify compliance with the BCESC.	M			1.01.03
Given scenarios, provide rationales for accepting or rejecting an application.	M			4.03.10
Given sample submissions, differentiate between required submissions and non-required submissions.	M			5.02.02
Part 3				
Explain the roles and responsibilities for energy modellers for Part 3 Buildings	M			1.01.03
Describe the process of verifying credentials or qualifications of an energy modeller for Part 3 buildings.			M	7.03.01
Given sample energy modeller certifications, distinguish between acceptable and non-acceptable credentials.[xvii]			M	7.03.01
Given sample application forms for Part 3 buildings, determine if the application has appropriate information for the targeted step.			M	
Describe role of coordinating professional in demonstrating compliance with BCESC	M			1.01.03
Describe the role of the Coordinating Registered Professional is providing assurances for energy modelling and BCESC compliance.	S		M	1.01.03
Describe the pre-design, design and construction process for large building developments from rezoning to occupancy – Part 3	S		M	6.01.01
Describe the process and timing of energy modelling at rezoning and building-permit submission (as applicable)	S		M	
Describe a process of denying occupancy for a non-compliant project.	M			
Given scenarios, provide a rationale for approving or denying occupancy.	M			4.07.05
Part 9				
Describe the role of an Energy Advisor (Part 9)	M			2.08.01
Explain the difference between a correctly performed energy model, and actual energy performance.				9.02.02
Describe the requirements of the BCESC and who is responsible for what and when during a typical Part 9 project	M			14.02.03
Explain the design and construction process for single family homes from pre-permit to occupancy and final inspection – Part 9	M			1.01.05

Describe the process of labeling and closing / recording of the BCESC level achieved	M			12.05.08
Describe the process of collecting the Post-Construction Compliance Forms and other requirements to complete and close a file.	M			12.09.08
5. High Performance Mechanical Systems	**L1**	**L2**	**L3**	
	General			
Explain the role of a building official to evaluate or enforce mechanical equipment or systems selection issues.	M			12.05.01
Explain alternate mechanical systems for heating, ventilation and cooling as well as domestic hot-water.	S			6.03.02
Describe distribution for alternate mechanical systems for heating, ventilation, and cooling and requirements within building and plumbing code for air-sealing, sealing, insulation etc.		S		6.03.02
Explain pros/cons and benefits/limitations for various mechanical systems and equipment.		S		4.03.02
Describe heat recovery ventilation concepts along with differences between HRV and ERV equipment		S		4.03.05
Identify safe use of natural gas, electricity or other fuels for mechanical equipment	M			12.02.05
	Part 3			
Explain role of mechanical equipment on TEUI metric			M	
Explain the important of ventilation on the TEDI metric	S		M	
Describe where the minimum outdoor air rates are established		S	M	
Provide examples of ventilation system technologies that are anticipated in step code buildings (H/ERV, DOAS)		S		
	Part 9			
Explain role of mechanical equipment on MEUI and TEUI metrics	S			
Recognize correct placement of various equipment within a home.	M			
6. High Performance Building Enclosures	**L1**	**L2**	**L3**	
	General			
Describe building enclosure systems and components (walls, roofs, foundations, windows, doors, balconies/decks) change with higher levels of insulation and airtightness	M			12.05.03
Describe the impact of placement within assemblies/detail the building science of building enclosure assemblies and components and be able to identify control layers and critical barriers (air, vapour, water, heat etc.)		M		12.05.03
Describe design and material selection differences for more highly insulated walls, roofs, and foundation assemblies. Specifically describe how alternate insulation placement and various air/vapour/thermal material properties of different materials impact the long-term durability and performance of wall and roof assemblies		M		12.05.04

Explain the role of ventilation within roof assemblies and alternate approaches which are acceptable in performance		M		12.07.07
Identify a thermal bridge on an envelope detail.		M		2.03.03
Describe alternate wall assemblies, exterior insulation, deep walls, vapour barrier placement, types of insulation, insulation impacts		M		12.08.03
Evaluate alternate materials/approaches for building enclosure designs		M		4.05.01
Explain the role of new modern materials (i.e. insulation, tapes, membranes glazing, windows etc.) and how they fit into current code requirements		M		4.05.09
	Part 3			
Describe the airtightness testing process, when and how.	S			11.01.01
Describe the impact of building enclosure performance on TEDI, MEUI and EUI	S			11.01.02
Describe how the Thermal Building Guide can be used in practice.	S			11.01.01
Review and comment on values that have been calculated through the Thermal Building Guide process	S			2.03.01
Identify alternate air barrier system strategies and the importance of design, detailing and commissioning to achieve whole building airtightness.	S			2.03.02
	Part 9			
Describe the blower door testing process, when and how.		M		11.04.01
Explain how alternate building enclosure assemblies perform beyond prescriptive strategies outlined within the current Part 9 of the BCBC		M		9.01.01
Describe new building enclosure and material technologies including new insulation, glazing, window frames, doors, air-sealing membranes, tapes, sealants, liquids etc. can be integrated into homes		M		4.05.04
Identify and evaluate new and alternative building enclosure materials and methods outside of Part 9 of the BCBC		M		4.05.09
6. Energy Modelling	**L1**	**L2**	**L3**	
	General			
Describe how calculated and modeled energy use breakdown compares to measured/ in-service use			S	2.03.01
Given typical building energy end uses, provide examples of design features that would impact them	S		M	2.03.02
Describe the benefits of energy modelling analysis beyond prescriptive requirements.		S		2.03.04
	Part 3			
Explain the basics of energy modeling for Part 3 (Hourly Modeling)	S		M	2.03.04
Explain the requirements for modellers (e.g. what the process entails and what qualifications are accepted, not how to do the modeling)	S		M	7.03.03
Describe the implications of the Professional Practice Guidelines issued by AIBC and Engineers and Geoscientists BC	M			7.03.03

Identify the relevant energy modelling guidelines	S	M		7.03.04
Compare and contrast specific areas of the Energy Modelling Guidelines with other energy modelling standards (airtightness, inputs and schedules)	S		M	7.03.04
Describe the application of the BC Housing Thermal Building Guide	S		M	7.03.04
Review and comment on step code energy modelling results for a project and whether they are within range and follow the standard process			M	1.04.07
	Part 9			
Explain the basics of energy modeling for Part 9 (Hot 2000)	S			2.03.04
Identify role of Energy Advisors (EAs) within the new construction process for Part 9 and Energy Modellers for Part 3	M			7.03.03

Examples of how the Competency Framework can be used

The framework can be used to identify areas within existing BOABC competencies that can be enhanced to include step code material. For example, Table 3 summarizes some areas within the existing BOABC Level 1 Exam Guideline Document where it would be relevant to include step code material.

Table 3: Example: Areas of change to current BOABC Level 1 Exam Guideline document

Areas of change to regular work implied (Level 1 example)
Inspection and verification of Framing
Inspection and verification of Foundations
Inspection and verification of Thermal Insulation, Ventilation, and Heating
Inspection and verification of Masonry and Insulating Concrete Form Walls
General Administrative Requirements
Rooms, Spaces, Doors, and Windows

Similarly, the Competency Framework can be used to identify strengths of training materials and courses. Table 3 provides an example of how some existing information can be reviewed and evaluated (please note that the "X" marks are fictitious for this example).

While only the Core Competencies are represented here; the same process can be used for the more detailed learning objectives within each competency category.

Table 3: Core Competency Example

Core Competency Example	**Provider A**	**Provider B**	**Provider C**	**Provider D**	**Provider E**	**Provider F**
1. BCESC Basics	X	X	X	X		
2. BCESC Metrics and Definitions	X		X			X
3. Implementing the BCESC	X		X			X

4. High Performance Mechanical Equipment						X
5. High Performance Building Enclosures				X	X	
6. Energy Modelling				X	X	

Types of training opportunities – existing and possible

Webinars – live and recorded (note: the recorded webinars could be improved by some simple editing, and potentially adding an online quiz)

Live training sessions – Conference sessions, workshops, presentations. BOABC, BC Housing, Community Energy Association, Canadian Home Builders' Association BC, EGBC, Independent Contractors and Businesses Association BC, Placemakers Institute, BUILDEX Vancouver, Board of Change, BC Building Envelope Council, AIBC, Urban Development Institute, Vancouver Island Construction Association, Building Safety and Standards Branch BC, Fortis BC, Fenestration Canada, Interior BC Residential Construction Institute, Planning Institute of BC, Canadian Institute of Plumbing and Heating, Passive House Canada, Pacific Energy Innovation Association, and many AHJs have hosted and are hosting events (Note: this is a partial list, visit the energystepcode.ca event calendar for upcoming events.

Courses – Energy Step Code Training – At BCIT is a good place to start for courses "tailored to busy construction professionals". The Lab-in-a-box course is portable and includes hands-on practice activities.

Site visits and Simulations – Some training sessions include site visits to BCESC projects to demonstrate a blower door test, and other strategies to ensure compliance. Simulations can also serve in place of an actual project. Lab-in-a-box (see above) and the shared wall-section mock-ups used in Kootenays training sessions[xviii] are two examples. Retrotec, manufacturer of blower doors, has a House Simulator that can be used to demonstrate the airtightness testing process[xix].

Building Official BCESC training – The best source currently is the energystepcode.ca Resources for Local Governments webpage which has a wealth of documents and some recorded webinars.

Recordings were made of the BCESC Basics and Implementation sessions from the November 30, 2018 BOABC Conference that specifically address building official needs. These will need some editing to optimize their learning potential.

BOABC has expressed intentions to develop in-house training for implementing the BCESC.

Builder's breakfasts – The City of New Westminster (and other jurisdictions) have conducted a series of Builder & Designer Breakfast events that include BCESC topics. Building officials have participated in these as well.[xx]

Online training and courses- This idea has been discussed with BOABC members and BCESC experts, to deliver training to remote jurisdictions, and to deliver training on a flexible, asynchronous mode. A well-designed course in modules can be effective, advantageous, and is worth exploring. Much of the content (recordings, documents, images, handbooks and guides), is readily available. With some experienced help, a Learning Management System could be used to facilitate the dissemination of BCESC knowledge.

Virtual Reality building inspection tour – This idea has been discussed with BOABC members and BCESC experts, to deliver training to remote jurisdictions. Develop costs may not be prohibitive for a simple site-visit recording with a 360^{o} camera in the hands of an experienced operator and editor[xxi]

Note: for a list of British Columbia organizations and training institutions offering BCESC training, and an upcoming events calendar, see https://energystepcode.ca/training/

Short session examples

Two course outlines are presented below as examples of short (1-1/2 hour) BCESC training sessions.

What learning can be accomplished in short sessions?

A short session can spark interest in a topic, build awareness, and help participants get started on a path to learn more. An effective strategy to initiate learning is to respectfully challenge pre-conceived assumptions. Like most subjects, a sustained interest, focused attention, time, and experiential factors combine to affect a change in thinking from novice to expert.

Advantages of short sessions:

- Lower time barrier to participation
- Manageable chunks of new information
- Can be recorded relatively easily

Can serve as modules of a longer connected program

Assessment opportunities

- We can pre-assess the level of knowledge participants have at the start of, or before the session begins (through introductions, profile questions, mini-quizzes).
  We can use formative assessment techniques (e.g. questioning, polling) during the session to prompt learning.
- We can request feedback during and at the end of the session to inform mid-session shift of focus, or improvements for subsequent sessions.
- Assessment is best seen as an iterative, community process: the learning designers, subject-matter experts, facilitators, guest presenters, participants, and learners, are all partners in discovering the best ways to teach and learn the topics. Assessment is the proof of learning. The ultimate

assessment is accomplished when the building official can administer the BCESC with skill and ease, thereby playing an essential role in the delivery of modern, worthwhile buildings. Training sessions, courses, webinars, and supporting resources are important contributions to learning; the learning itself is an internal process and relies on dedication of attention by the individual. Exposures to the subject, in theory and practice (on the job or simulated application of the principles), can ready the individual for a summative assessment (e.g. a certificate exam, or other recognition of achievement).

Example outlines (from the November 30, 2018 BOABC BCESC Sessions)

Given the 6 core competencies for Building Officials related to the BCESC covered above include:

1. The BCESC Basics
2. BCESC Metrics and Definitions
3. Implementing the BCESC
4. The basics of new high-performance mechanical systems
5. How new high-performance building enclosures work
6. Energy Modelling

Two sessions were delivered at the November BOABC Conference. The first session addressed BCESC Basics and introduced Metrics and Definitions. The second session focussed on Implementing the BCESC and the role of the building official. Core Competencies 4 through 6 are much more in-depth and require longer full-day/week long length courses.[xxii]

The implementation session format provided an opportunity to hear from multiple building officials experienced in administering the BCESC. Peer-to-peer learning, facilitated by experts with comprehensive theoretical knowledge, is especially valuable as it addresses the practical concerns and issues uppermost in the minds of the participants.

In both sessions, participants left with an overview of the BCESC framework, with an invitation to connect to learn more, and with resources for self-study.

Session 1: BC Energy Step Code – Essentials for Building Officials

1.5-hour total, 1.25 presentation, 0.25 questions

Focus on Competencies #1 & 2

- BCESC Basics
  - Archetypes, what's not included
  - Part 9 vs 3
  - BC Climate zones examples
- BCESC Metrics and Definitions
  - Part 9 vs 3
  - Where does this focus the design
  - Overheating
- Touch on High Performance Mechanical
  - Part 3 changes (ventilation)
  - Part 9 changes (cooling)
- Touch on High Performance Building enclosures
  - Air Barrier strategies and airtightness testing
- Resources
- Goal: Teaser for other things to know- overheating, costing, part 3 airtightness, process (presentation #2)

Session 2: BC Energy Step Code – Implementing the BCESC: Key Changes to Roles and Process

1.5-hour total, 1.25 presentation, 0.25 questions

Focus on Competency #3

- The role of the Building Official and other parties in the BCESC
    - Part 9
        - Current Roles: Building Official, Energy Advisor
        - Changes in roles
        - Need for mechanical design
    - Part 3
        - Current Roles: Building Official, Energy Modeller, Coordinating professional
        - New Roles & Changes to current: Airtightness tester
- Part 9 process
    - Current Process: Drawings, Submit report
    - What may be different in design?
        - Process
        - Envelope
            - Insulation
            - Airtightness
        - Mechanical
            - Designed system
            - Cooling
    - What may be different in construction?
        - Who does reviews? - discussion
        - Blower door test results (not required in progress but recommended)
    - Post construction
        - Check that airtightness value matches design intent
- Part 3 Process
    - Current Process: Submit compliance report at BP
    - What may be different in design?
        - Development permit (for rezoning)
            - Declare step and how
        - Envelope
            - Insulation
            - Airtightness
        - Mechanical
            - Designed system
            - Cooling
        - Building permit
            - Energy statement on drawings
            - Professional practice guidelines
    - What may be different in construction?
        - Whole building airtightness test & model update

    - Occupancy permit
- Guest presentation – Megan Lohmann – specific challenges, opportunities that building officials in the Kootenays see, importance of training. 15 minutes

Key Resources for Building Officials

Local Government Best Practices Guide

(Building and Safety Standards Branch of the Government of British Columbia., 2019)

Building Officials Handbook

BC Energy Step Code Builder Guide (BC Housing, 2018)

Action verbs

(Table from https://www.mdpi.com/2227-7102/6/4/37/pdf)

Table 1. Sample of 176 unique words identified for a level of Bloom's taxonomy by 4 or more lists in a sample of 30 published lists (*f* = number of lists that nominate the word for a level of Bloom's taxonomy).

Knowledge	*f*	Understand	*f*	Apply	*f*	Analyze	*f*	Evaluate	*f*	Create	*f*
arrange	6	articulate	4	act	19	analyze	24	appraise	22	arrange	22
choose	4	associate	4	adapt	4	appraise	11	argue	12	assemble	14
cite	17	characterize	4	apply	22	break	8	arrange	5	categorize	7
copy	4	cite	4	back/back up	5	break down	7	assess	17	choose	7
define	21	clarify	5	calculate	10	calculate	9	attach	4	collect	9
describe	14	classify	18	change	9	categorize	19	choose	10	combine	14
draw	5	compare	11	choose	11	classify	10	compare	18	compile	7
duplicate	7	contrast	7	classify	6	compare	24	conclude	13	compose	19
identify	20	convert	13	complete	5	conclude	6	contrast	8	construct	29
indicate	4	defend	12	compute	10	contrast	19	core	6	create	19
label	21	demonstrate	6	construct	13	correlate	5	counsel	4	design	24
list	27	describe	22	demonstrate	20	criticize	11	create	4	develop	18
locate	10	differentiate	8	develop	4	debate	8	criticize	11	devise	13
match	14	discuss	21	discover	8	deduce	6	critique	14	estimate	5
memorize	10	distinguish	12	dramatize	16	detect	7	decide	4	evaluate	4
name	22	estimate	11	employ	16	diagnose	4	defend	15	explain	8
order	5	explain	28	experiment	6	diagram	12	describe	4	facilitate	4
outline	11	express	17	explain	5	differentiate	20	design	4	formulate	18
quote	7	extend	11	generalize	5	discover	4	determine	6	generalize	7
read	4	extrapolate	5	identify	4	discriminate	11	discriminate	9	generate	11
recall	24	generalize	11	illustrate	18	dissect	6	estimate	15	hypothesize	8
recite	12	give	4	implement	4	distinguish	21	evaluate	16	improve	5
recognize	14	give examples	8	interpret	15	divide	12	explain	9	integrate	4
record	13	identify	14	interview	6	evaluate	4	grade	4	invent	10
relate	11	illustrate	9	manipulate	10	examine	18	invent	8	make	6
repeat	20	indicate	8	modify	12	experiment	9	judge	25	manage	8
reproduce	11	infer	15	operate	17	figure	4	manage	15	modify	10
review	4	interpolate	5	organize	4	group	4	mediate	9	organize	21
select	16	interpret	17	paint	4	identify	7	prepare	12	originate	9
state	23	locate	10	practice	15	illustrate	8	probe	4	plan	21
tabulate	4	match	7	predict	9	infer	14	rate	5	predict	8
tell	4	observe	5	prepare	11	inspect	8	rearrange	19	prepare	12
underline	7	organize	5	produce	13	inventory	9	reconcile	12	produce	13

Works referenced

BC Energy Step Code website https://energystepcode.ca/all-resources/

BC Energy Compliance Report Training Webinar
https://na01.safelinks.protection.outlook.com/?url=https%3A%2F%2Fwww.youtube.com%2Fwatch%3Fv%3Dyd5KHcRu0DY&data=01%7C01%7Cbishops%40douglascollege.ca%7C395e8fa8a1ac477d2d1208d6022d841d%7C3af48838cd5345079e7ffc6dac355e33%7C1&sdata=TnF%2BqrEFujHVj11GovxWSF1

BC Energy Compliance Report: As-Built v1.1 https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/construction-industry/building-codes-and-standards/forms/bcbc_part9_compliancereport_asbuilt.pdf

BC Energy Compliance Report: Pre-Construction v1.1. https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/construction-industry/building-codes-and-standards/forms/bcbc_part9_compliancereport_preconstruction.pdf

BC Energy Compliance Reports https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/construction-industry/building-codes-and-standards/bulletins/b18-03_july2018_energy_compliance_reports.pdf

BCESC Design Guide, BCESC Local Govt Survey, ESC Convenience Copy https://energystepcode.ca/for-local-governments/

Bldg-Officials-Round-Table- presentation Presented to BOABC Steering Committee Oct 9, 2018.

BOABC Exam resources https://boabc.org/wp-content/uploads/2018/02/2018-Level-1-Exam-1-Prioritized-Content-Outline.pdf and https://boabc.org/wp-content/uploads/2015/10/6.4-Exam-Committee-Report-May-2016.pdf)

BC Energy Step Code Builder Guide https://www.bchousing.org/research-centre/library/residential-design-construction/bc-energy-step-code-builder-guide&sortType=sortByDate

Common Core Competencies – Professional Building Officials http://boabc.org/wp-content/uploads/2015/10/education_occ_cmncre.pdf

Compliance Report Instruction Manual for Energy Advisors Version 1.1
https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/construction-industry/building-codes-and-standards/guides/bcenergy_compliancereport_manual.pdf

BOABC Survey Results and Analysis by the Energy Foundations Program Working Group

BC Energy Step Code Training Program for Building Officials Township of Langley
https://www.dropbox.com/s/x2x72lwpsobie7h/ToL%20Step%20Code%20Training%20for%20Building%20Officials%20-%20Distribution%20Copy.pptx?dl=0#

Local Government Implementation of the BC Energy Step Code
https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/construction-industry/building-codes-and-standards/guides/baguide_c2_sc_april2017.pdf

Energy Step Code Training and Capacity Project Report - MODUS, Brantwood, and Community Energy Association http://energystepcode.ca/app/uploads/sites/257/2018/07/BC-Energy-Step-Code-Training-and-Capacity-Report-Final.pdf

National Occupational & Training Standard for Building Officials http://boabc.org/wp-content/uploads/2015/10/Professional-Building-Official-NOS-Revised-2007.pdf

Steering Committee mtg. notes – July 2018 to present

Energy Code Training Framework Trevor Welsh, RBO, City of Port Moody

What Building and Plumbing Officials Need to Know about the Building Act
https://www2.gov.bc.ca/gov/content/industry/construction-industry/building-codes-standards/building-act/building-act-guide

For copies of this standard, information on their development or to provide feedback and suggest changes, please contact: ***Marc Ouimet, National Education Program Manager Gestionnaire du programme d'éducation national, Passive House Canada*** *marc.ouimet@passivehousecanada.com*

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[i] BC Housing, AIBC, EGBC, CHIBO and other frameworks were reviewed – CHIBO Other useful sections include:

- Appendix A: Taxonomic Analysis Procedure (pages 54-56)
- Appendix C: Partial List of Accredited Courses (pages 58-60)
- Appendix D: Sample Forms (pages 61-64)
- Appendix F: Verification Strategies (pages 75-81) Appendix H: Outsourcing Guidance (pages 90-96)

[ii] see "**12 architectural subject areas_competencies_BEA candidates"**
[iii] Bloom's Taxonomy
[iv] See BOABC Certification Program Information
[v] See What Building Officials Need to Know About the Building Act for descriptions of the three levels
[vi] Cf. Appendix F – p. 75
chibo-pboreportoctober05- National Certification and Accreditation Model for Professional Building Officials.
[vii] Cf. Appendix A: Taxonomic Analysis Procedure of the 2005 National Certification and Accreditation Models for Professional Building Officials
[viii] See Appendix D: Sample Forms p. 61
chibo-pboreportoctober05- National Certification and Accreditation Model for Professional Building Officials.
[ix] See Appendix H: Outsourcing Guidance (pages 90-96) **chibo-pboreportoctober05**- National Certification and Accreditation Model for Professional Building Officials.

[x] see BOABCWorkingFolder > Competency Framework > Frameworks-and-examples folder
[xi] https://www.bchousing.org/publications/Core-Competency-Requirements.pdfThis document is helpful when replacing "understand" verbs in curriculum with active verbs (where applicable).

[xii] Outcomes-based competencies and indicators for a newly registered/licensed Architect. Note the use of Blooms levels. This document can be helpful when replacing "understand" verbs in curriculum with active verbs (where applicable).

[xiii] Also see the related document **Common-Core-Competencies-inspectors-building-officials-gov-Canada-2001 –** refer to for detailed descriptions of the blocks, tasks, subtasks and supporting knowledge and abilities

[xiv] Other useful sections include:

- Appendix A: Taxonomic Analysis Procedure (pages 54-56)
- Appendix C: Partial List of Accredited Courses (pages 58-60)
- Appendix D: Sample Forms (pages 61-64)
- Appendix F: Verification Strategies (pages 75-81)
- Appendix H: Outsourcing Guidance (pages 90-96)

[xv] See http://boabc.org/wp-content/uploads/2015/10/Building-Officials-Building-Act-Guide-Feb.2017-.pdf for descriptions of the three BOABC Levels

[xvi] See National Occupational & Training Standard—Professional Building Official document for alignment to Alliance of Canadian Building Officials Associations "Supporting Knowledge and Abilities" objectives

[xvii] Refer to Compliance Checklist, Building Officials Act, local AHJ policies and directions, and the BC Building Code

[xviii] Contact Megan Lohmann, Community Energy Association, for details

[xix] See https://retrotec.com/cloth-simulator-tent.html

[xx] Contact Norm Connolly, Community Energy Manager for the City of New Westminster for details

[xxi] Contact Steven Bishop bishops@douglascollege.ca for more information on this possibility.

[xxii] There is substantial material developed by Passive House Canada, RDH, and other sources that can be adapted for competencies 4-6 and for the higher steps of the BCESC.