BCLTBIA Energy / Caron Policy Workshop

The BC LTBIA board has been working with the BC government to recognize the environmental and low-carbon benefits surrounding predominantly log homes and structures.

Currently log homes are lumped in with all other types of structures with regards to energy efficiency in building codes, as there isn't a lifecycle or low embodied carbon requirement.

We will be discussing what "low carbon" actually is and how it impacts the lifecycle of buildings and our members' products, as well as discussing the different metrics for the BC Energy Step Code – air tightness (ACH), mechanical energy use intensity (MEUI), and thermal energy demand intensity (TEDI).

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BC Energy Step Code Process

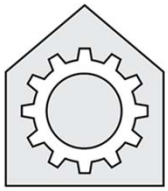
Modelling

Reports

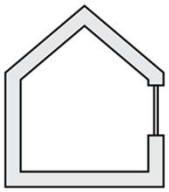
Inspections

Air Tightness Testing

Airtightness



Equipment & Systems



Envelope

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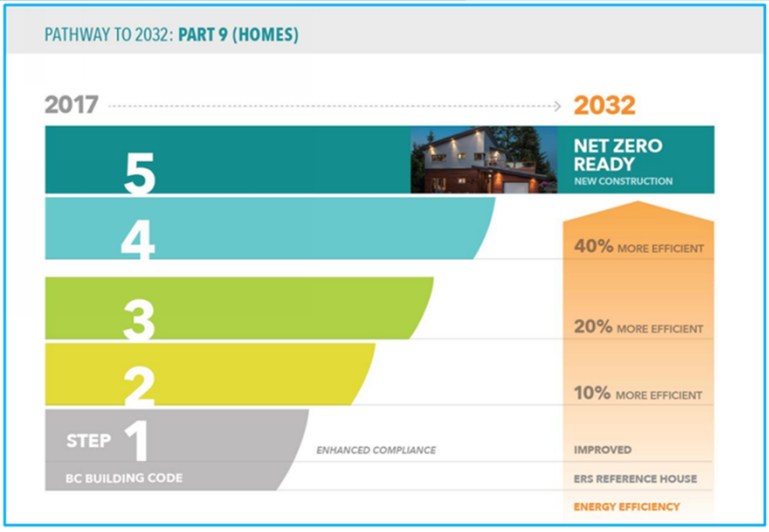
Part 9: The Steps



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Example Metrics (check local zone)

STEP CODE METRICS FOR ENERGY EFFICIENCY: CLIMATE ZONE 5

Step level	ENERGY MODELLING	AIRTIGHTNESS (AIR CHANGES PER HOUR AT 50 PA PRESSURE DIFFERENTIAL)	PERFORMANCE REQUIREMENT OF BUILDING EQUIPMENT AND SYSTEMS	PERFORMANCE REQUIREMENT OF BUILDING ENVELOPE
Step 1	Required	N/A	EnerGuide Rating % lower than EnerGuide Reference House: not less than 0% lower energy consumption OR Conform to Subsection 9.36.5	
Step 2 10% Beyond Code	Required	3.0 ACH_{50}	10% lower than ERS v15 ref. house OR MEUI ≤ 90kWh/m^2.year	TEDI ≤ 60 kWh/m^2.year OR PTL ≤ 55 W/m^2
Step 3 20% Beyond Code	Required	2.5 ACH_{50} +	20% lower than ERS v15 ref. house or OR MEUI ≤ 75kWh/m^2.year +	TEDI ≤ 50 kWh/m^2.year OR PTL ≤ 45 W/m^2
Step 4 40% Beyond Code	Required	1.5 ACH_{50}	40% lower than ERS v15 ref. house OR MEUI ≤ 45kWh/m^2.year	TEDI ≤ 40 kWh/m^2.year OR PTL ≤ 40 W/m^2
Step 5	Required	1.0 ACH_{50}	MEUI ≤ 25kWh/m^2.year	TEDI ≤ 15 kWh/m^2.year OR PTL ≤ 10 W/m^2

EITHER/OR

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03.5 Summary of Key Strategies

While certain design strategies will help meet a single BC Energy Step Code performance target (e.g. TEDI), others will help accomplish all three. Practitioners should consider these core strategies — addressing building shape, orientation, and envelope, as well as mechanical and ventilation systems — early in the design process. Proponents must retain the services of an energy modeler at the design and permitting stages. To ensure overall compliance, designers should rely on hourly energy modelling tools.

Diagram Description

The figure to the right shows the importance of each design strategy in relation to the three key metrics of the BC Energy Step Code (TEDI, TEUI, and airtightness). To explore the impact of different design decisions interactively, visit the **Building Pathfinder website**.

LEGEND

- TEDI
- TEUI
- Airtightness
- Architecture
- Building Envelope
- Mechanical

More info: https://www.bchousing.org/research-centre/library/residential-design-construction/bc-energy-step-code-design-guide

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New Research

Utilizing new research on R-values of log walls

Licensing

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ICC 400 - R-Values of Common Logs

- The current NBCC (9.36.2.2) values for log walls are based on ICC400 published results.
- These values are based on average log wall diameter, minimum wall thickness, species properties and several other material properties.
- For example, a log wall built with 16" logs, is turned into a 13.25" thick timber wall.
- Results for ICC 400 on Western Red Cedar would give this wall an R-value of 19.2. A 16" average Douglas Fir log wall, shows an R-value of 13.4.

Table 4.3 ICC 400-2012 R-value per inch and R_S-value per mm of wood species.

Log Species	R-Value per inch (wood property)	R_{SI}-Value per mm (wood property)
Western Red Cedar	1.51	0.0105
Red Spruce, White Fir, W. Spruce-Pine-Fir	1.27	0.0088
Black Spruce, E. Spruce-Pine-Fir, Eastern Softwoods, Eastern Spruce, Sitka Spruce, Western Softwoods	1.21	0.0084
Hem-Fir, Lodgepole Pine, Ponderosa Pine, Red-Canadian Pine	1.21	0.0084
Douglas Fir-Larch	1.06	0.0074

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New Tests → Higher R-Values

- Every percentage of the building envelope counts towards energy efficiency
- BCLTBIA has conducted *ASTM C1363 – Guarded Hot Box testing* with the National Research Council (NRCan) in Ottawa on five log wall assemblies
- C1363 measures a real assembly insulation value based on our northern freezing temperatures

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Results

- Results from C1363 testing have proven
  - The 16" Western Red Cedar wall is actually R22.8, which is a 19% increase over ICC400.
  - The 16" Douglas Fir wall is actually R16.2, which is a 21% increase.
  - In smaller log sizes 8-12", the **results are 20-40% better than ICC400**.
- Using the C1363 results shows a **2-6% point overall home model energy savings** in several log home types.
- The percentage changes based on the design, climatic zone and other home properties.
- Shows an improvement in the building envelope without further cost of construction.

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Licensing for Your Use

- In order to use the NRC results in home modelling, the BCLTBIA member is to sign the testing Licensing Agreement. As well, their chosen Energy Advisor, needs to sign a non-disclosure agreement.
- The cost of using the NRC results is based on the following fee schedule:
  - Lifetime Membership/Founding Member - $5000
  - One year access to report - $1500
  - Per project use of report - $500
- Funds collected will be used to recoup the cost of initial testing and to provide future testing of additional species.

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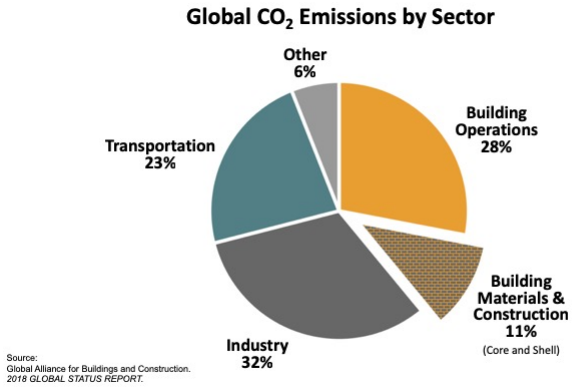
Carbon

What is it?
Why it matters?
Life Cycle Assessment



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What is "carbon"?

- One of the most abundant elements on earth – in everything from wood to diamonds
- In the form of CO_2, input for plants as part of photosynthesis and a waste breathed out from animals
- It is good, unless we have too much or in the wrong places, then it can be pollution and poison
- Scale matters – by time, by volume, by layer (product, building, community, nation, globe)
- Sometimes used as short hand for all of the greenhouse gases or for various other terms like carbon equivalent (CO_{2e}), global warming potential (GWP), embodied energy, embodied carbon and carbon footprint
- Not the only thing that matters – biodiversity loss, over population, water and soil degradation, habitat loss / deforestation, waste and pollutants

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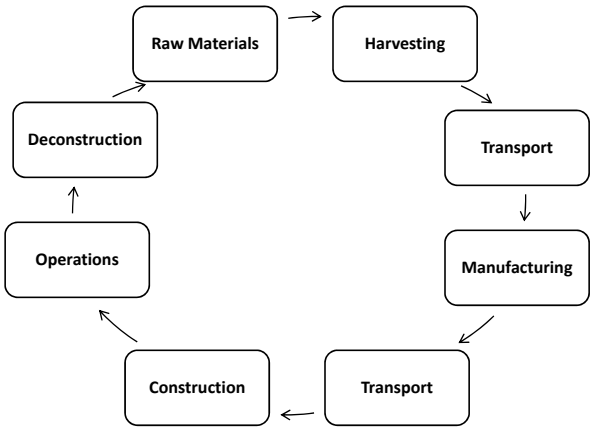
Sequestered, Embodied and Operating Carbon



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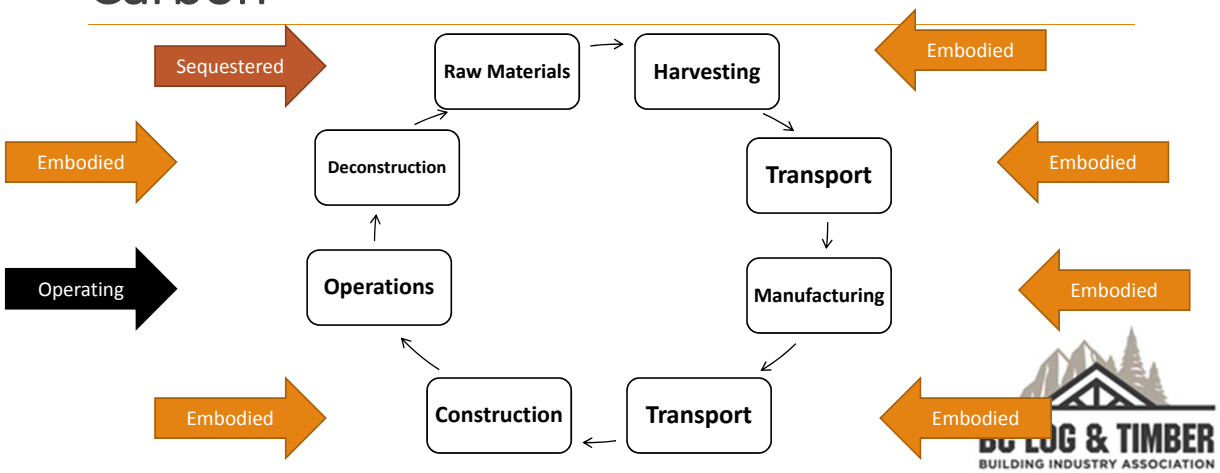
Sequestered, Embodied and Operating Carbon



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Sequestered Carbon

- Natural sequestered carbon is the long-term storage of carbon in leaves, branches, roots and other plant parts
- Sequestered when plants absorb CO_2 from the atmosphere and used in growth
- Carbon is still sequestered in wood until it burns or composts
- Importance of long-life products like buildings, furniture and infrastructure

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Embodied Carbon

- Embodied carbon is the CO2 emitted throughout the supply chain leading to a finished product
- Includes transport, manufacturing and construction and then deconstruction / demolition of buildings

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Operating Carbon

- Operating carbon is the carbon and other Green House Gas (GHG) emissions created while running and maintaining the building
- Includes heat/cooling, ventilation, lighting, appliances, etc
- Focus of "netzero ready", BC Energy Step Code and Zero Carbon Building Standard

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Carbon Calculator

Canadian Wood Council / Conseil canadien du bois

Results

Volume of wood products used:
37 cubic meters (1,301 cubic feet)

U.S. and Canadian forests grow this much wood in:
6 seconds

Carbon stored in the wood:
27 metric tons of carbon dioxide

Sequestered

Avoided greenhouse gas emissions:
54 metric tons of carbon dioxide

Embodied

Total potential carbon benefit:
81 metric tons of carbon dioxide


997 sq ft Modified "Saltspring"

Equivalent to:

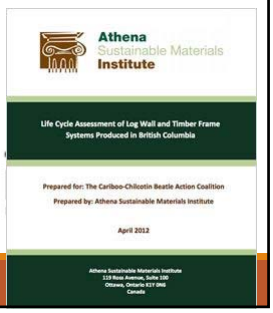
17 cars off the road for a year

Energy to operate 9 homes for a year

Access Canadian Wood Council's Carbon Calculator: https://cwc.ca/design-tools/carbon-calculator/

Life Cycle Analysis

- BCLTBIA commissioned a Life Cycle Analysis of different hand crafted log, machine milled log and timber frame home methods
  - https://bclogandtimberbuilders.com/resources/environmental-sustainability
- The impacts of the three products are generally driven by the manufacturing portion of the life cycle, the stain is also a significant driver of impacts, and the results are highly sensitive to the transportation distance and mode of transportation
- The logging, construction, steel and gasket use, and end of life processing are less significant in terms of overall impacts.
- Athena has other free tools available to model buildings (and some wood/log components):
  - http://www.athenasmi.org/our-software-data/ecocalculator/
  - http://www.athenasmi.org/our-software-data/impact-estimator/



Best Practices

Ways to improve energy efficiency for log and timber projects

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Considerations for Log Structures

- Windows and Doorways
  - Attachments and sealing given need for movement

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Considerations for Log Structures

- Log Corners
  - Proper gasketing and sealing

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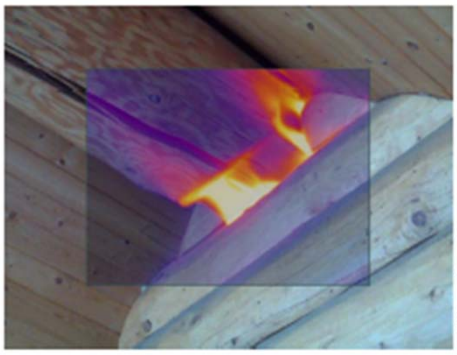
Considerations for Log Structures

- Wall to Roof
  - Attachments and sealing given need for settling



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Break-out Session

What defines or makes a home a "log home"?

While still showing increased energy efficiency gains between steps, what adjusted metrics / targets are reasonable?

Thermal Energy Demand Intensity

Air Changes per Hour

Mechanical Energy Use Intensity

By components?

To final output?

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What issues do you foresee or have experienced, particularly with blower tests? Have you had them done, and if so, what are your tips and tricks?

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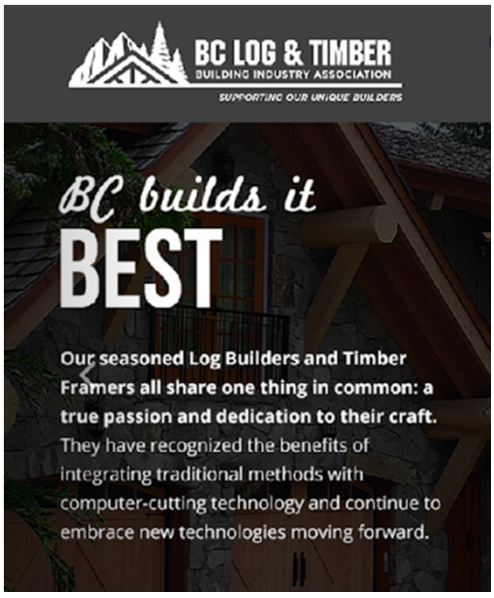

https://bclogandtimberbuilders.com

Contact us for:

- Licensing of improved R-Values for WRC and Douglas Fir Logs
- Copies of *Illustrated Guide to Log Home Construction*
- Environmental Sustainability Resources
- Finding a Hand Crafted, Machine Profiled or Timber Frame builder to work with
- Finding consultants, engineers, drafters and other log and timber specialists
- To join as a Member!

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Resources

Overview of Environmental Sustainability of Log Homes including Life Cycle Analysis report: https://bclogandtimberbuilders.com/resources/environmental-sustainability

Licensing of Enhanced Energy Performance Modelling for Log Structures: https://bclogandtimberbuilders.com/resources/license-new-log-wall-insulation-values

Illustrated Guide to Log Home Construction: https://bclogandtimberbuilders.com/news/2020/the-illustrated-guide-to-log-home-construction-from-log-shell-to-finished-home

ICC 400 Standard on the Design and Construction of Log Structures: www.iccsafe.org/wp-content/uploads/ICC-400-2017-ANSI-PC-Draft-pdf.pdf

BC Energy Step Code (BCBC 9.36.6): https://free.bcpublications.ca/civix/document/id/public/bcbc2018/bcbc_2018dbp9s936r2

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