Passive House for Campus

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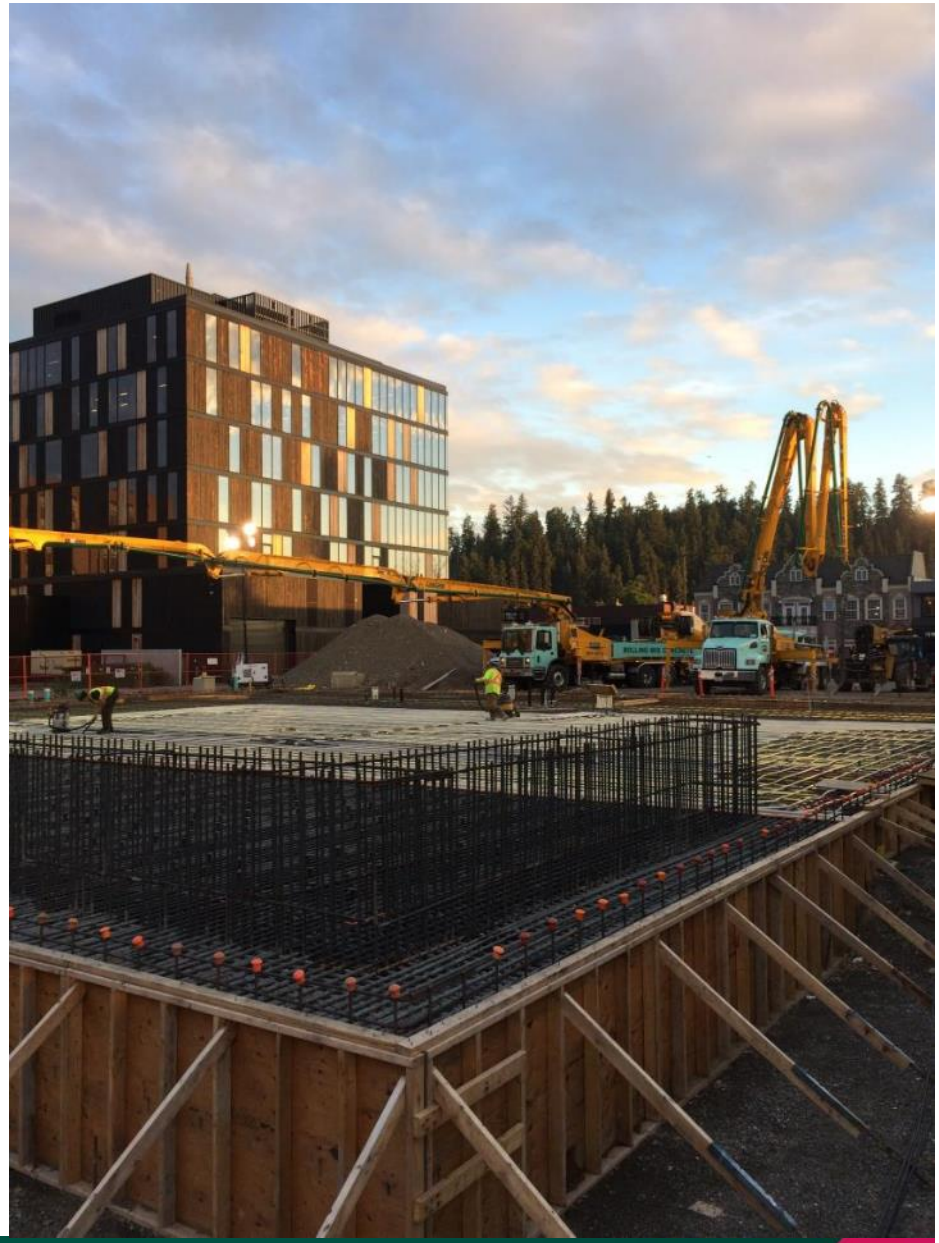
Outline

- Context
- Project History
- Areas of Success
- Barriers Overcome
- Lessons Learned
- Heating with plug loads
- Life Cycle Costing



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CANADA'S GREEN UNIVERSITY™

A History of Innovation

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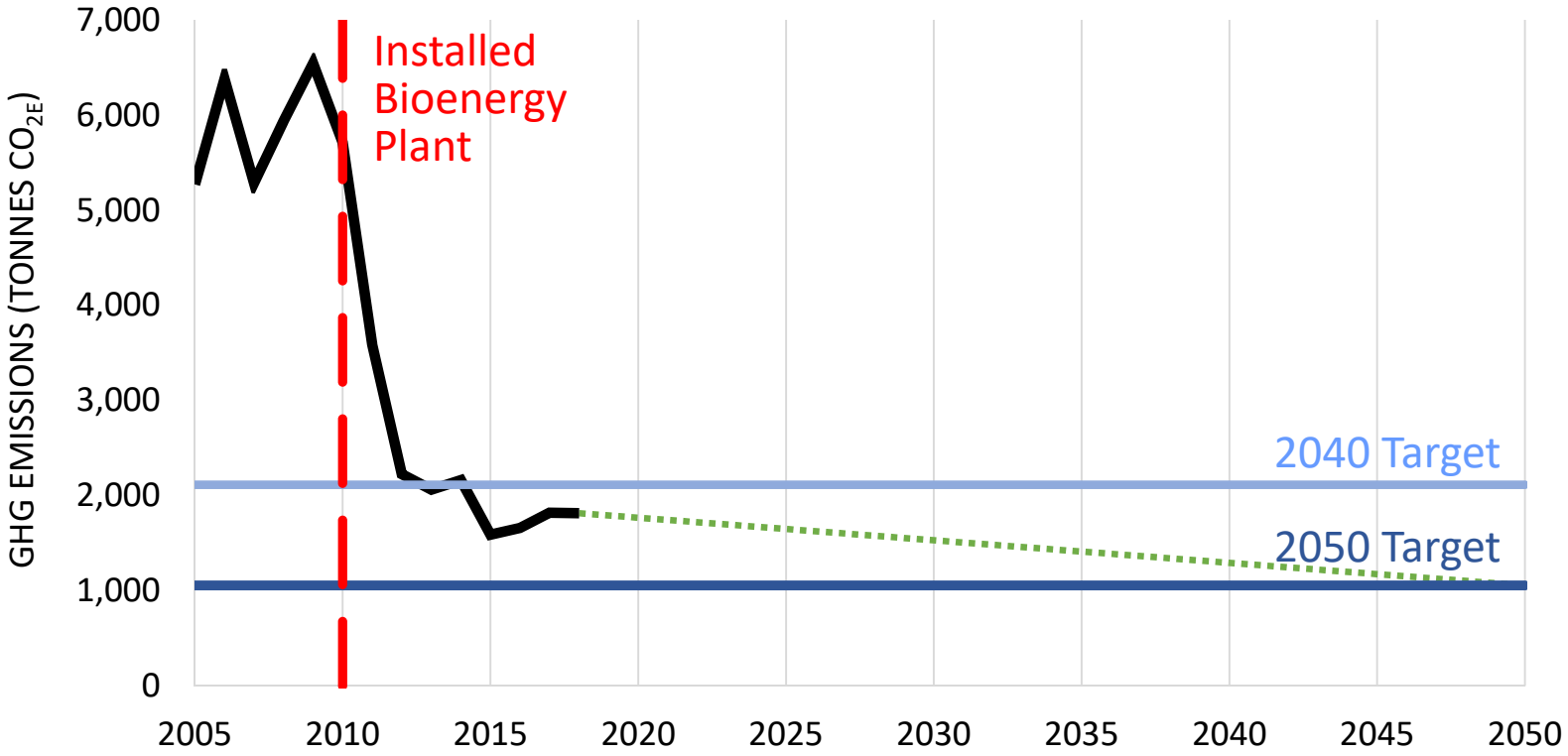
UNBC CO_{2e} Reductions



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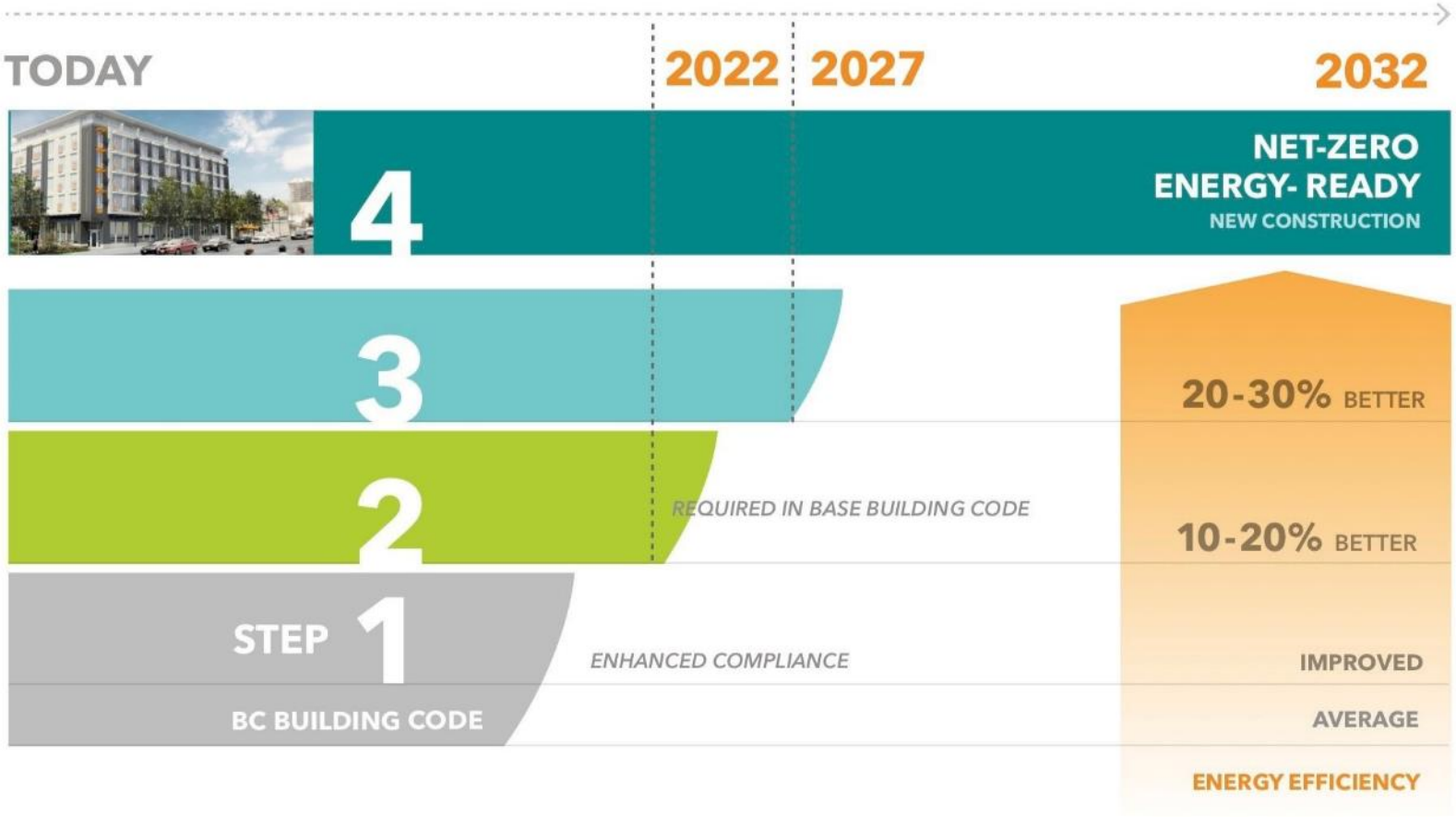
Masters of Engineering in Integrated Wood Design

Passive House

- 1991 – Wolfgang Feist, Austrian physicist
- Insulation
- Air tightness
- Heat Recovery Ventilation
- Proper windows
- Thermal bridges

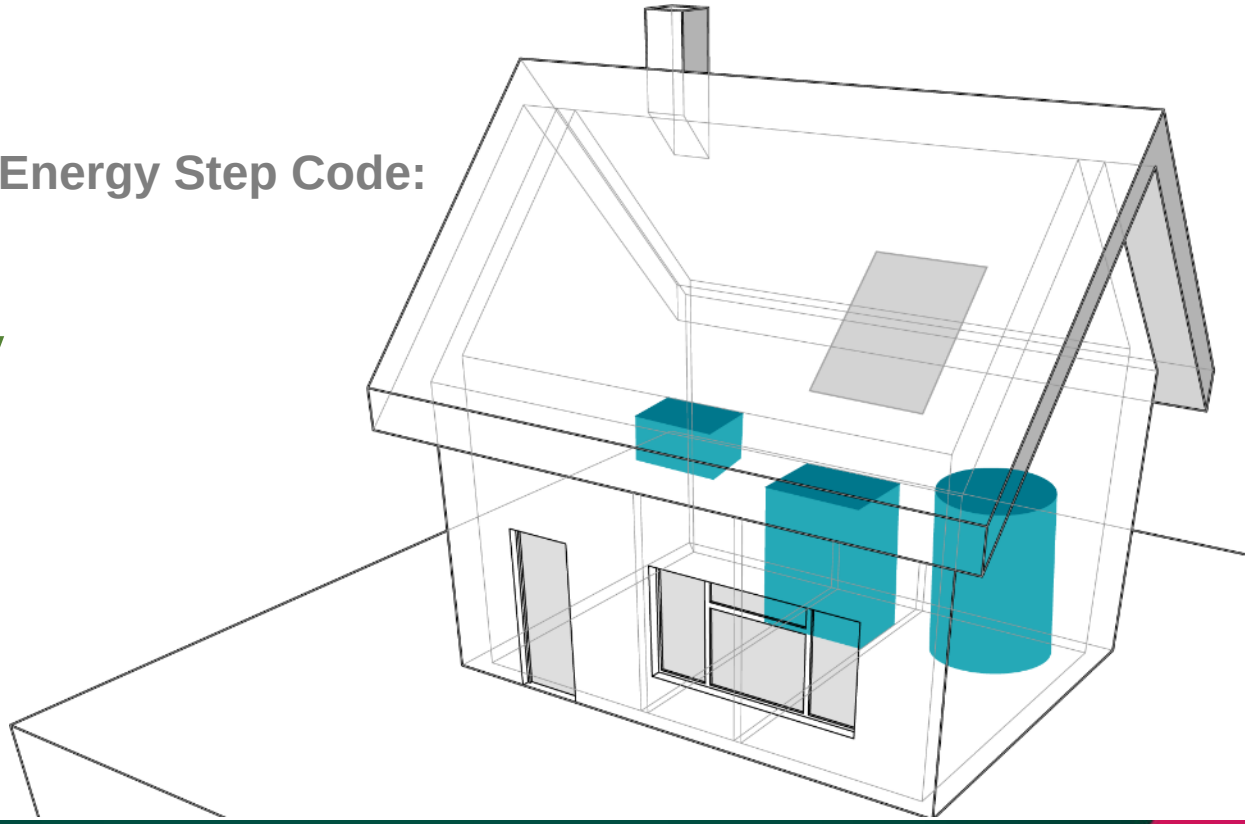
Energy Step Code: Part 3 Buildings



What does the Energy Step Code Measure?

'Energy Efficiency' in the Energy Step Code:

- ✓ **Envelope Efficiency**
- ✓ **Equipment Efficiency**
- ✓ **Performance based**



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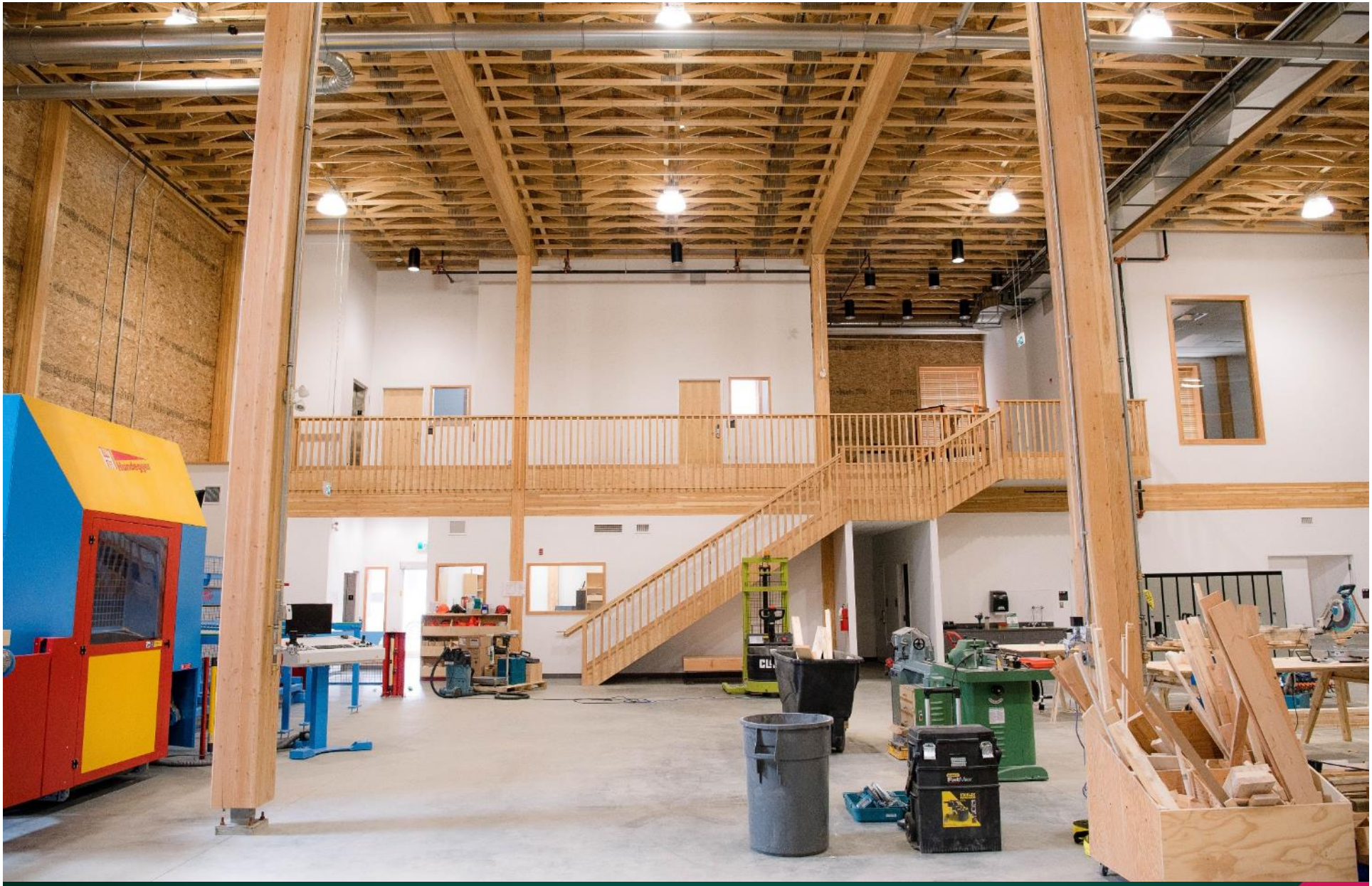
By the numbers

- 1,042 m^2
- Single story, with a mezzanine
- High head lab with overhead crane
- Three offices
- Seminar room for 30 people
- Wood conditioning room
- Dust extraction
- Passive House


JCB


STERLING



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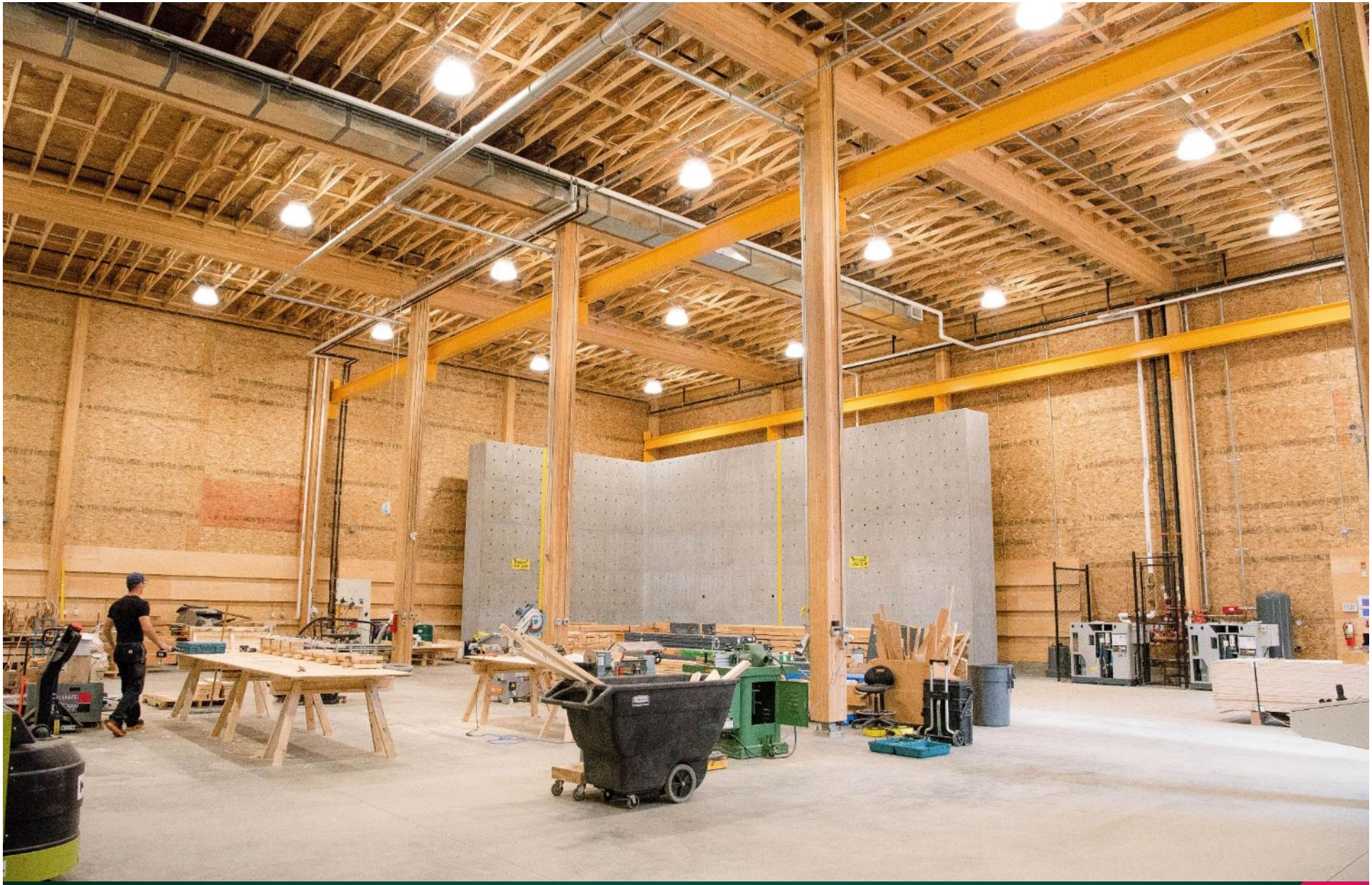

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Areas of Success

- Completed on time and budget
  (SIF project, no extension)
- Tight envelope
- “Textbook” detailing
- Certified by the International Passive House Institute
- It works, minimal call backs

Tight Envelope

Standard:
<0.6 ACH

Tested:
0.075 ACH

Barriers Overcome

- Timeline - design build
- Passive what? - fully committed from the start
- Inexperience - relationships based on trust, and dialogue
- Lack of internal floors
- Dust extraction
- Roof warranty
- Wall insulation

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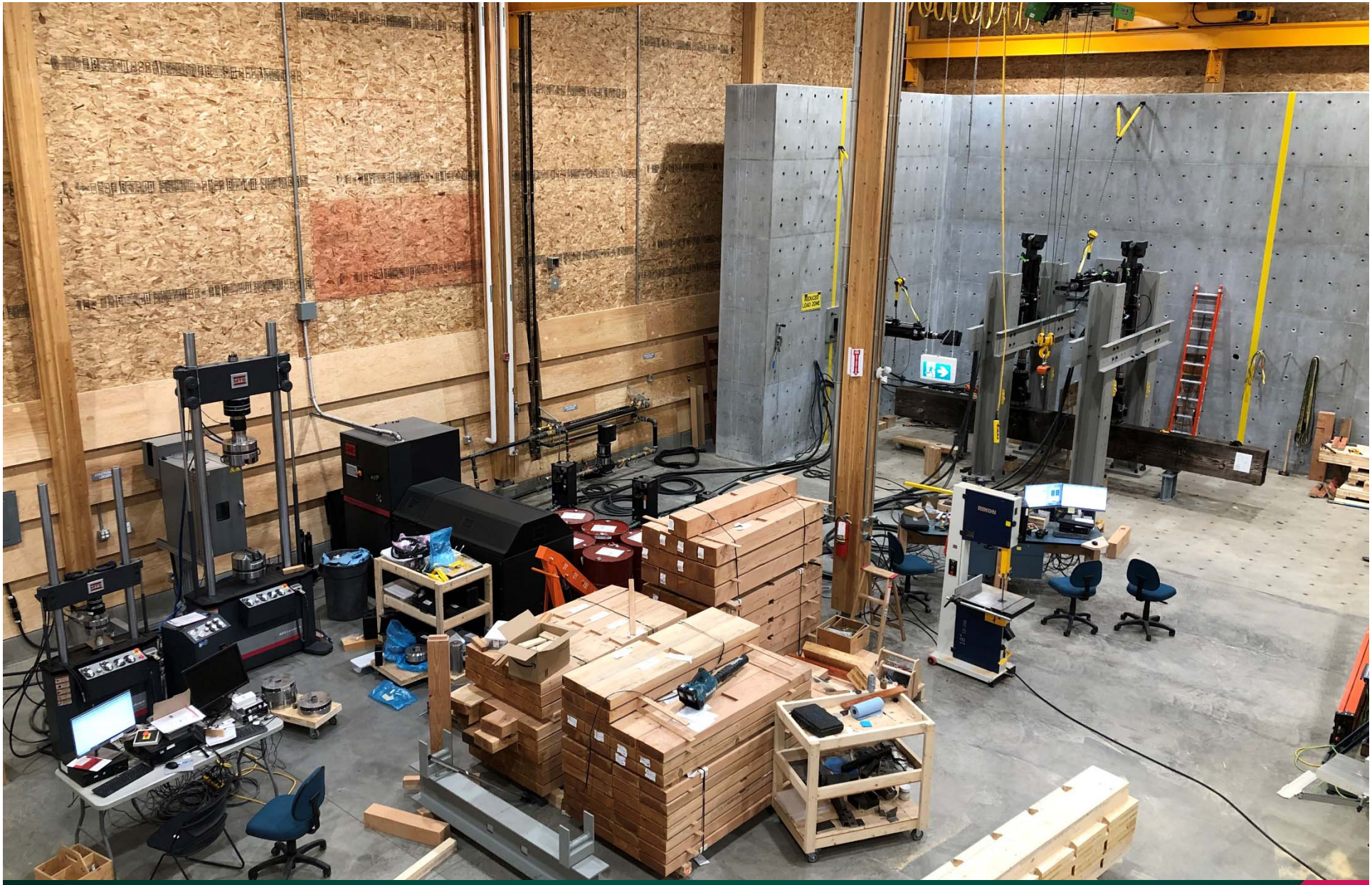
Lessons Learned

- Need unwavering commitment:
  - Owner – Passive House certification isn't negotiable
  - Designer - willing to explore all options
  - Builder - attention to detail, procurement
- Prefabrication in its infancy in BC
- Internal Heat Gain matters
  - Building heated by computers and people



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Heating with Plug Loads

2.5 kW one office
10 kW peak overall

Life Cycle Costing

- Construction decisions have a huge impact on operational realities

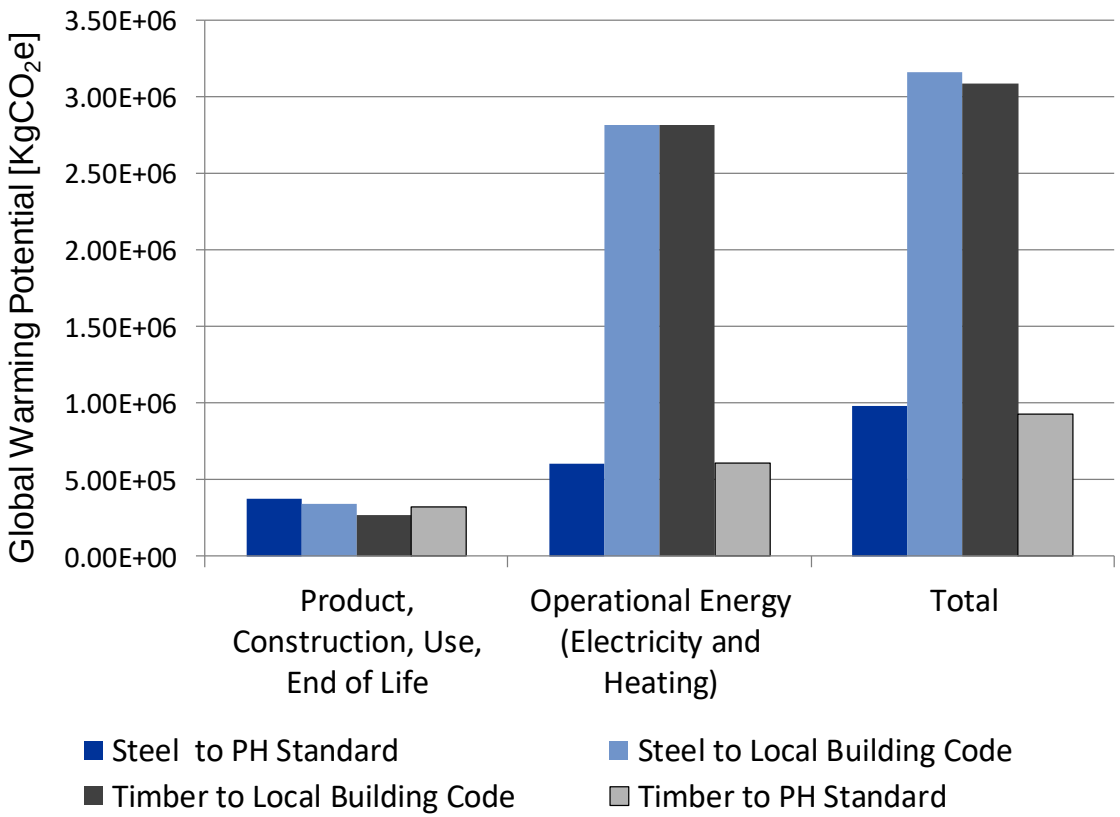
- Building lifespan
- Determine metric(s) of interest
  - Dollars
  - Greenhouse gasses
- Modelling is the first step (Energy Step Code)
- How to incorporate results into capital decisions?

LCA Impact Indicator Categories

- Global Warming Potential (CO_2e)
- Acidification Potential (SO_2e)
- HH Particulate ($PM_{2.5}e$)
- Eutrophication Potential (Ne)
- Ozone Depletion Potential (CFC 11e)
- Smog Potential (O_3e)
- Total Primary Energy (MJ)
  - Non Renewable Energy (MJ)
  - Fossil Fuel Consumption (MJ)

Material by:
Stephanie Wall and
Guido Wimmers

LCA Results



- 70% GWP reduction when designed to PH Standard
- For PH buildings material selection of increasing importance:
  - Code building material ~10% GWP
  - PH building material ~38% GWP
- Designing with wood rather than steel reduced embodied energy by 22%

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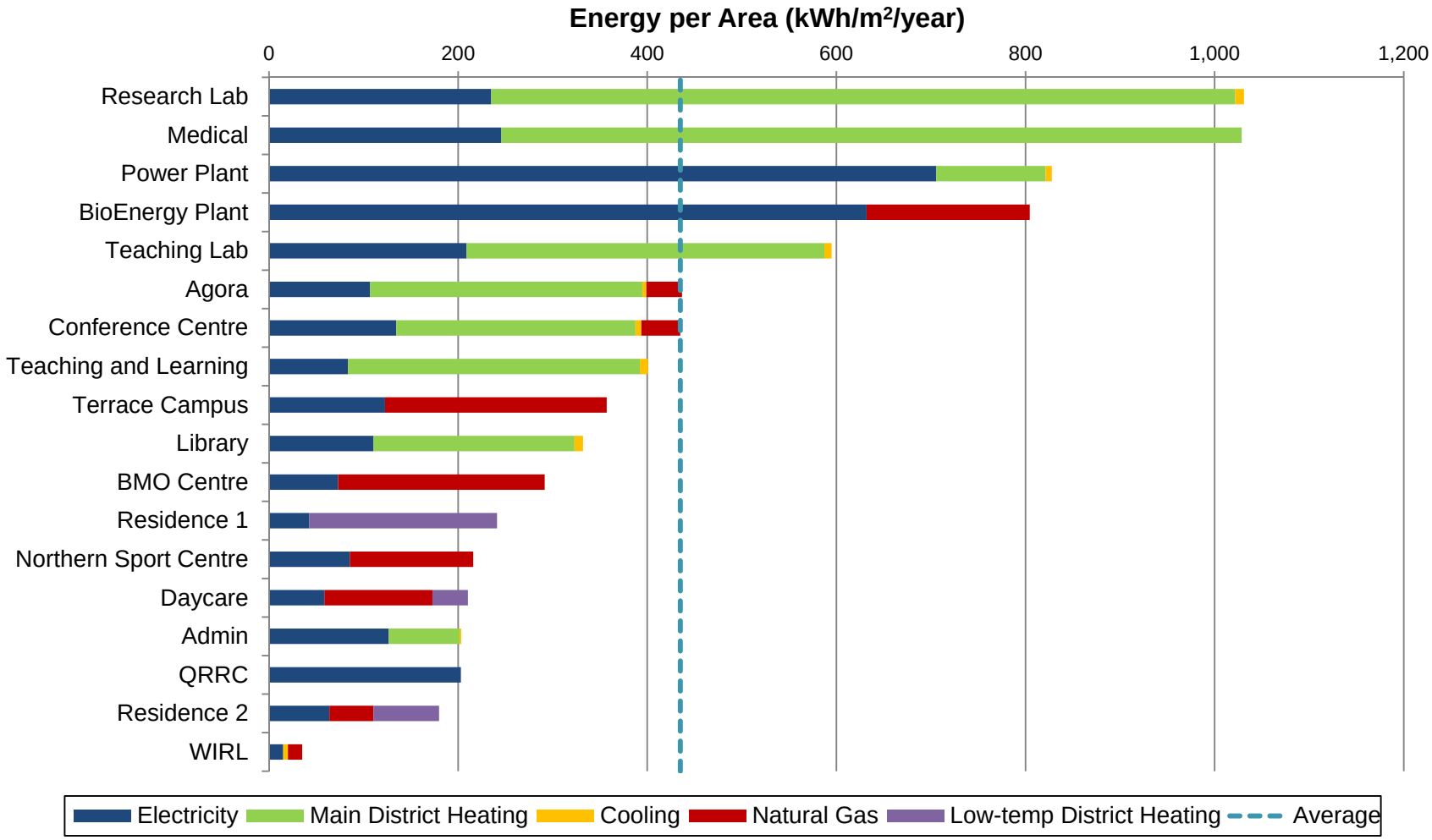
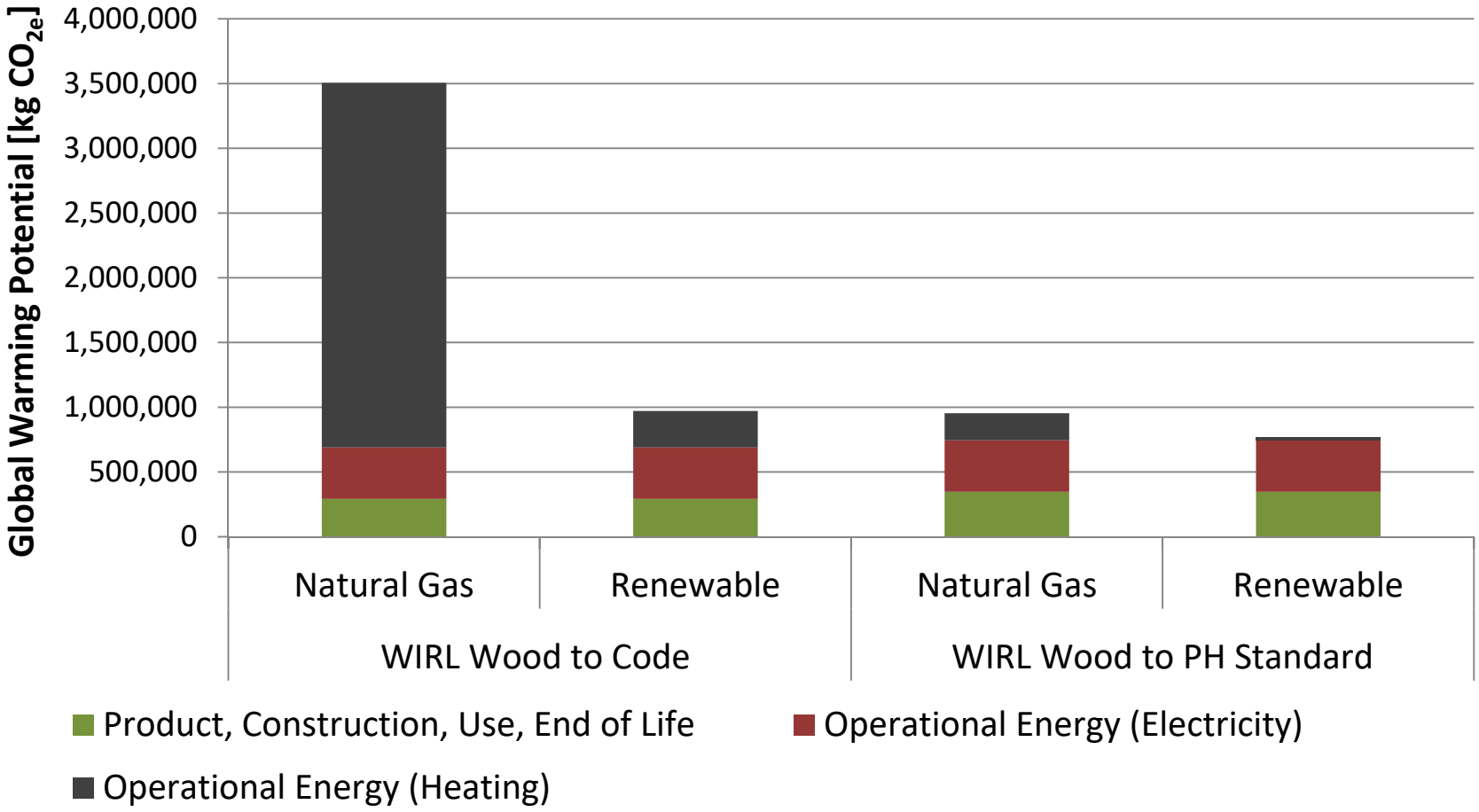
UNBC Building Energy Consumption



WIRL LCA Results:
Embodied Energy vs. Building Operation



Questions?