mood provided by: Fuzzy Donut
song: Responsible Emotions

RESOURCES

SORTING:

Categories:

- [ ] Articles
- [ ] Case Studies
- [ ] Past Events
- [x] Podcasts
- [ ] Reports
- [ ] Videos & Slides

Series:

- [ ] Decarb Lunch
- [ ] Deep Emissions Retrofit Dialogue
- [ ] NZER Challenge Playbook Series
- [ ] NZER Challenge Winners Series
- [ ] Tech Demonstration

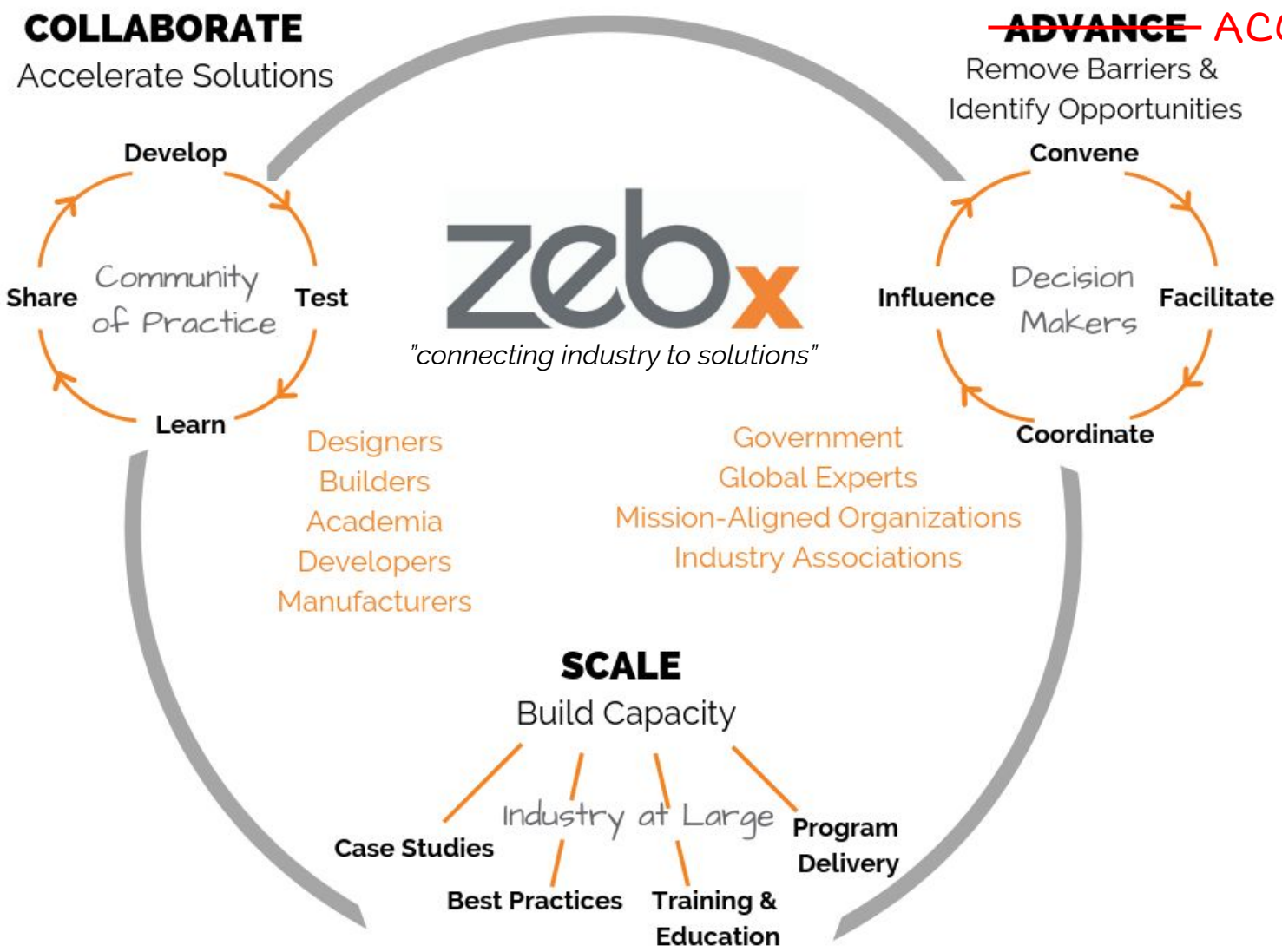
Systems:

- [ ] Building Enclosure
- [ ] Domestic Hot Water Heat Pump
- [ ] Geothermal
- [ ] Mechanical

The ZEBx Podcast Decarb Lunch Jan 2022: Reducing Embodied Carbon for Step Code Homes

The ZEBx Podcast Decarb Lunch Oct 2021: From Net-Zero Energy to Near-Zero Emissions

The ZEBx Podcast Decarb Lunch Jul 2021: Developer/Builder Recipes for Low-Cost, All-Electric, Step 4 Residential Construction


COLLABORATE
Accelerate Solutions
Develop
Test
Learn
Share
Community of Practice
~~ADVANCE~~ ACCELERATE
Remove Barriers & Identify Opportunities
Convene
Facilitate
Coordinate
Influence
Decision Makers
zebx
"connecting industry to solutions"
Designers
Builders
Academia
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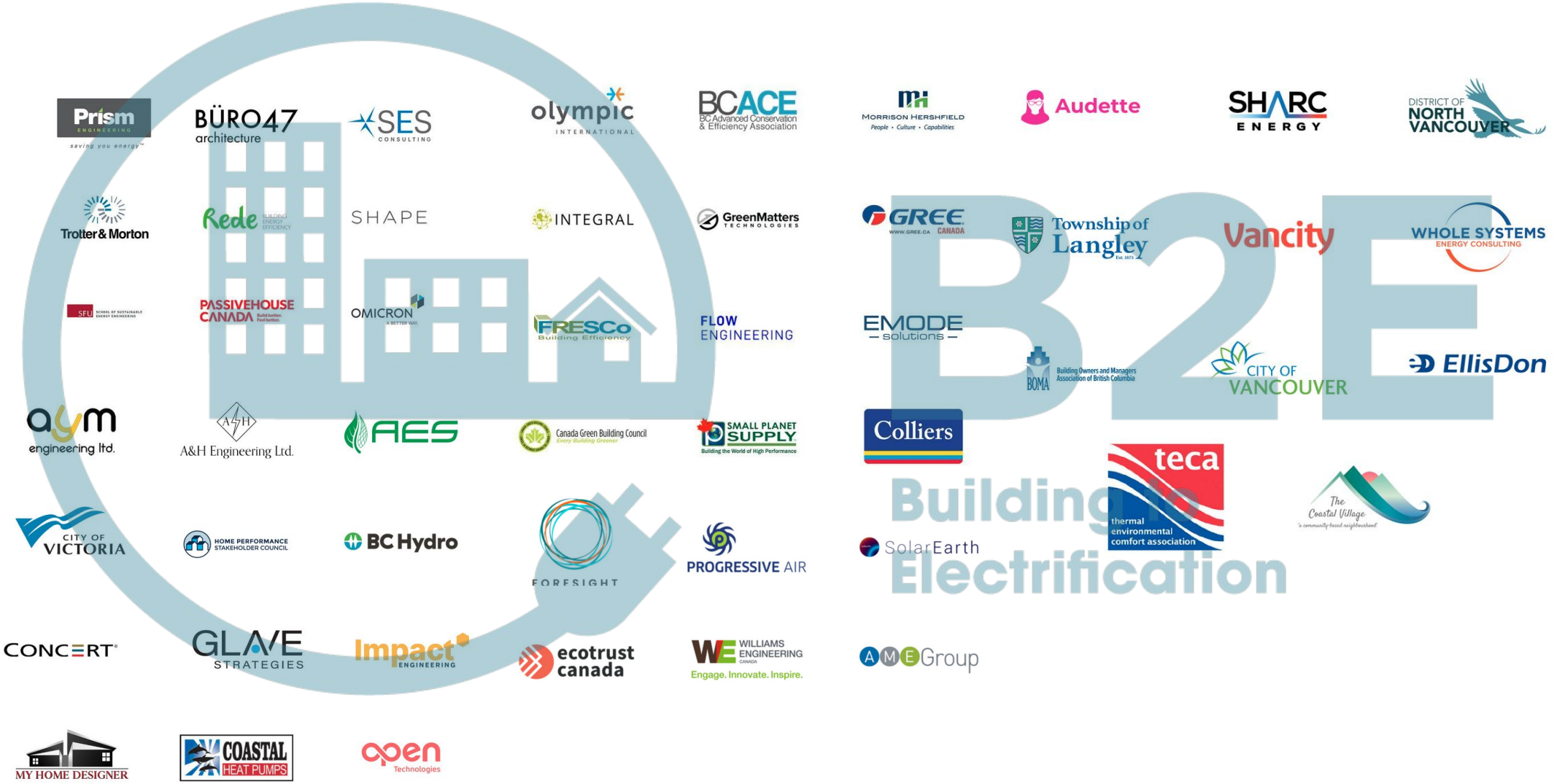
Government
Global Experts
Mission-Aligned Organizations
Industry Associations
SCALE
Build Capacity
Industry at Large
Case Studies
Best Practices
Training & Education
Program Delivery

zebx.org

We are a broad coalition working together to electrify buildings in British Columbia in order to reduce their climate impacts and reliance on fossil fuels.



B2E

Events Resources FAQ About ZEBx Contact **Get Involved**

Become a Member

Becoming a member of B2E is simple and free. As a member you will enjoy the following benefits:

- Numerous collaboration opportunities with industry leaders through working groups, subcommittees, B2E events, case study development, and publishing online articles;
- Early access to building electrification news, updates and events;
- Recognition on B2E website and acknowledgement that your organization is fully engaged in the decarbonization of the building sector.

Join B2E

What is Building Electrification?

Building electrification is about making the shift away from fossil-fuels and using low-carbon electricity for space heating, hot water and cooking.

Instead of using natural gas or propane to run appliances like furnaces, kitchen stoves, washers and dryers, everything is electric.

Read more about building electrification on our FAQ page.

View FAQ

b2electrification.org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ZERO EMISSIONS BUILDING EXCHANGE

TOP 3

Intel International Science and Engineering Fair, the world's largest high school science research competition.

CASE STUDY

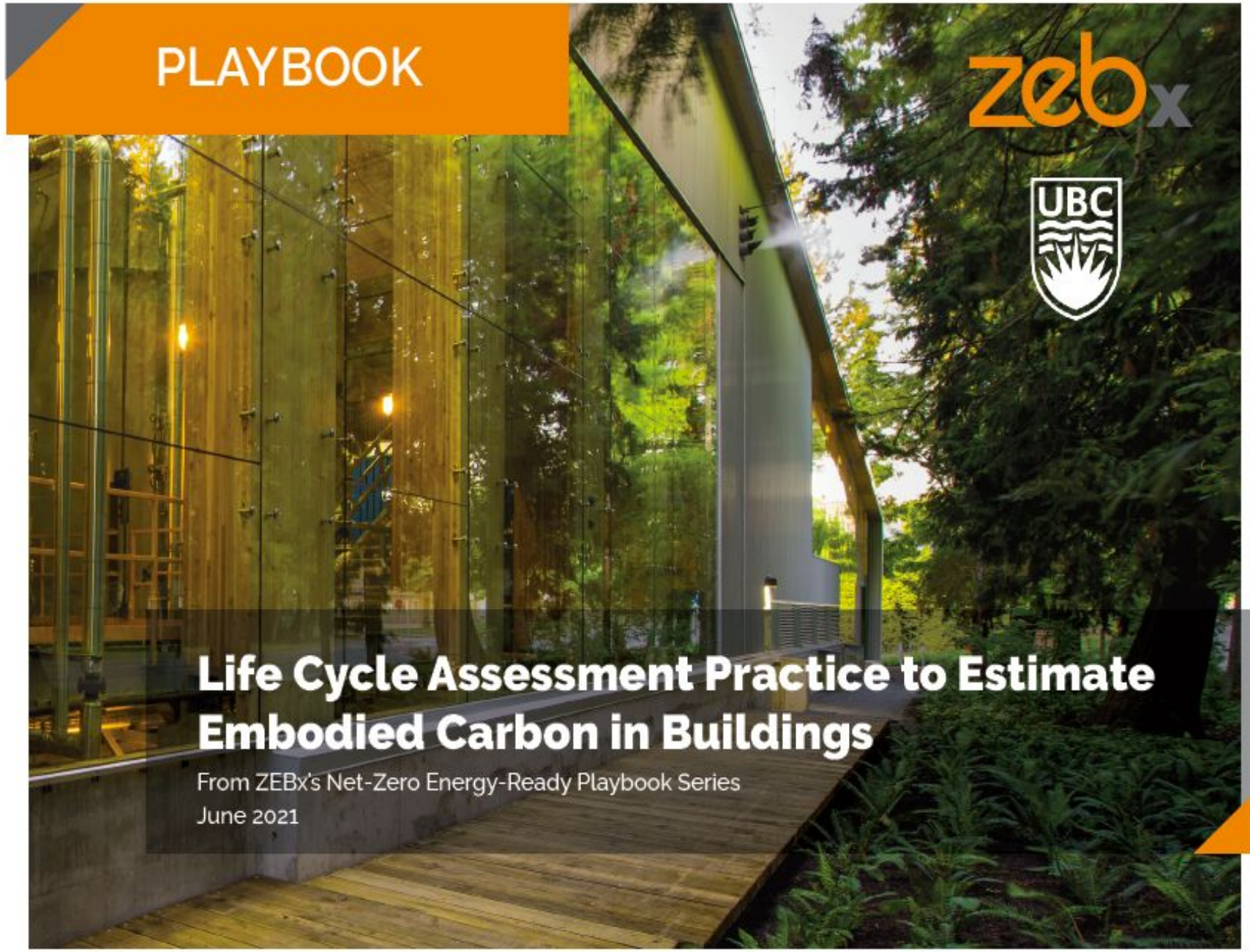
SFU Parcel 21

Net-Zero Energy-Ready Challenge Winner Series

Feb 2022

www.zebx.org/resources

cleanBC BETTER BUILDINGS



cleanBC
BETTER BUILDINGS

NET-ZERO ENERGY-READY CHALLENGE PLAYBOOK SERIES

- Ventilation Strategies for High-Performance MURBs
- Planning Airtight Buildings
- LCA Practice to Estimate Embodied Carbon
- Thermal Bridging
- Low-Carbon Energy Systems
- Planning for High-Performance Buildings

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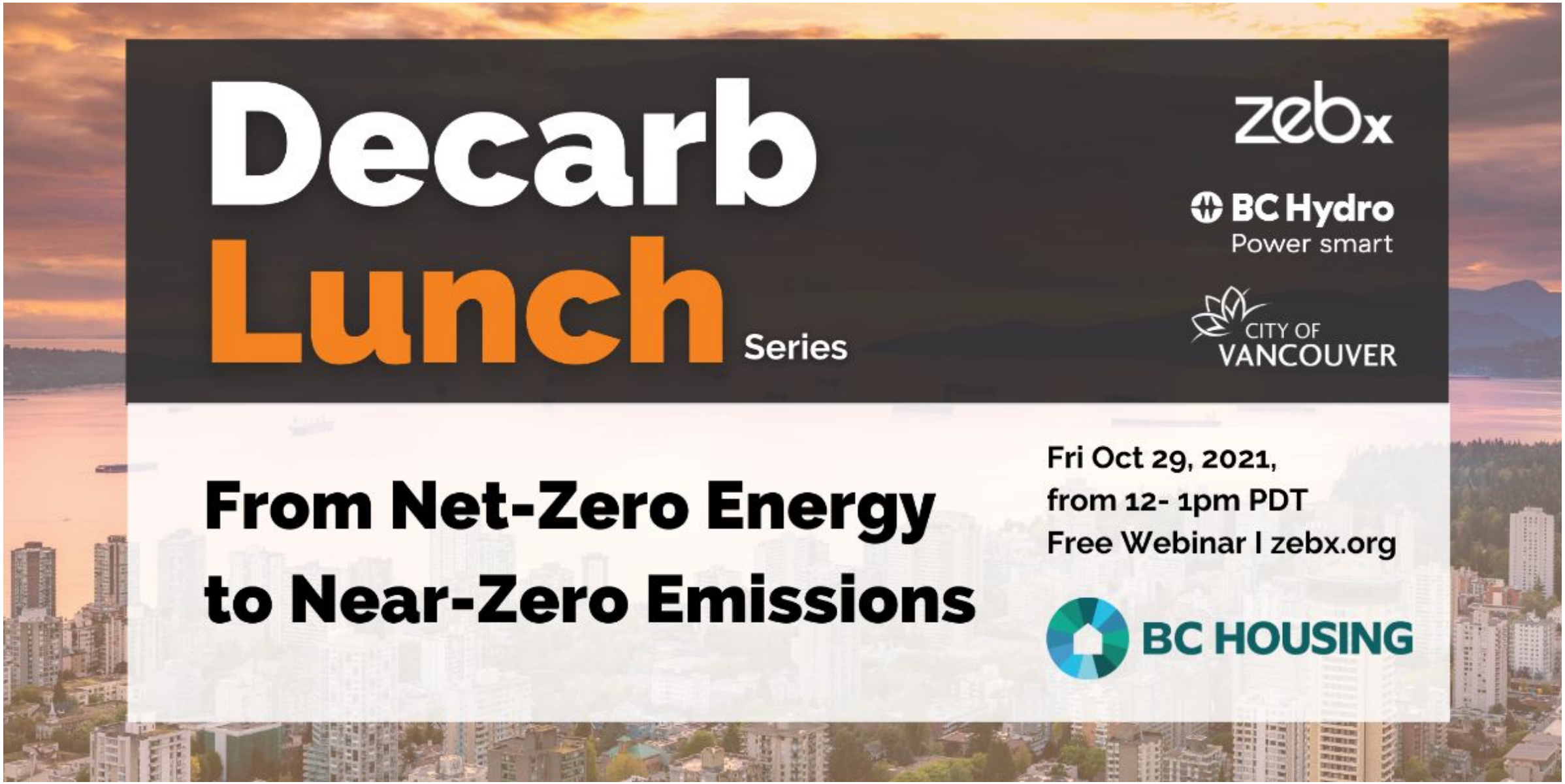

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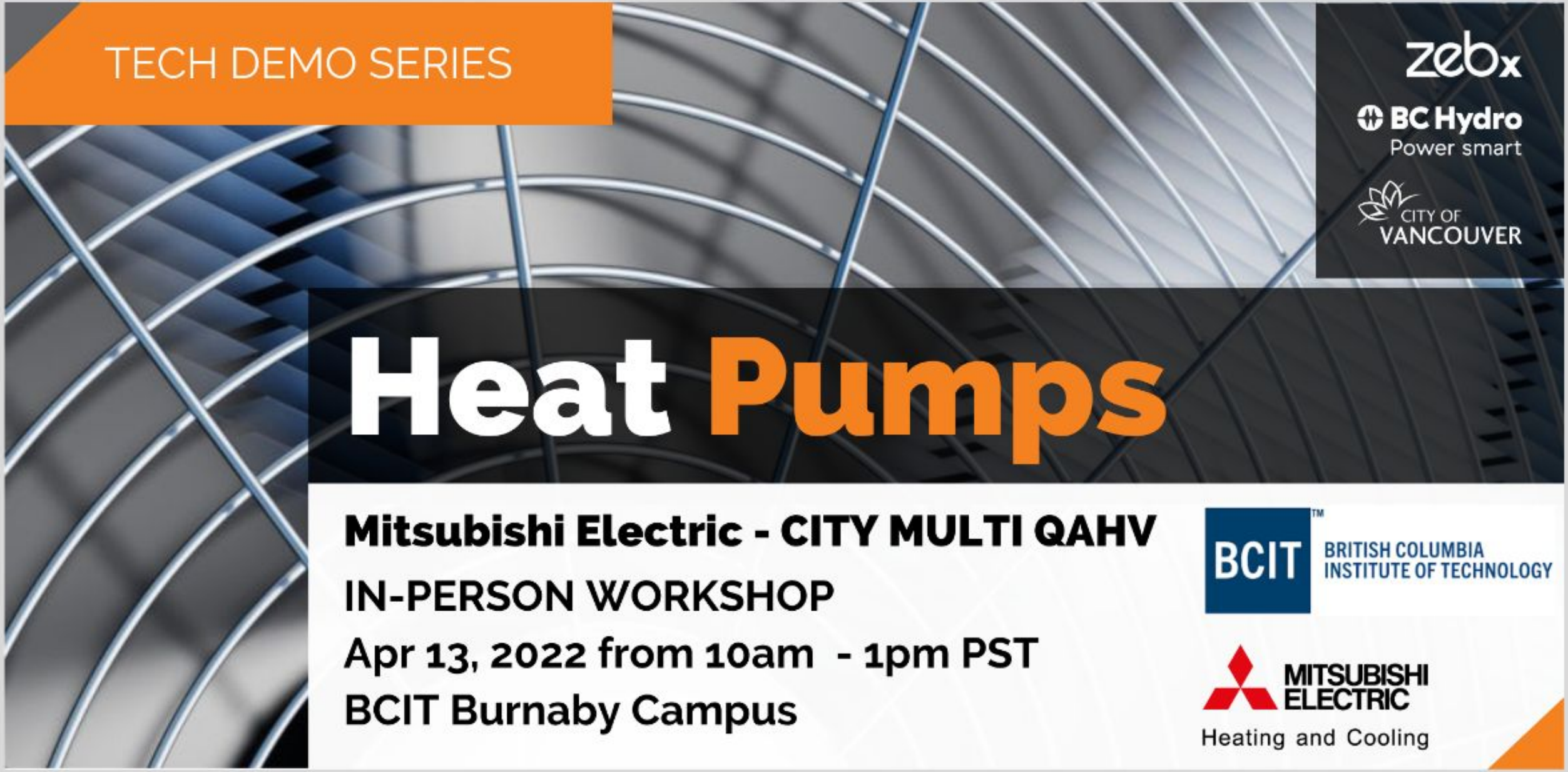
The ZEBx Podcast


TECH DEMO SERIES
zebx
BC Hydro
Power smart
CITY OF VANCOUVER
Heat Pumps
Mitsubishi Electric - CITY MULTI QAHV
IN-PERSON WORKSHOP
Apr 13, 2022 from 10am - 1pm PST
BCIT Burnaby Campus
BCIT
BRITISH COLUMBIA INSTITUTE OF TECHNOLOGY
MITSUBISHI ELECTRIC
Heating and Cooling

POLL 1

Tell us about yourself!

Three-part anonymous poll

SFU SCHOOL OF SUSTAINABLE ENERGY ENGINEERING

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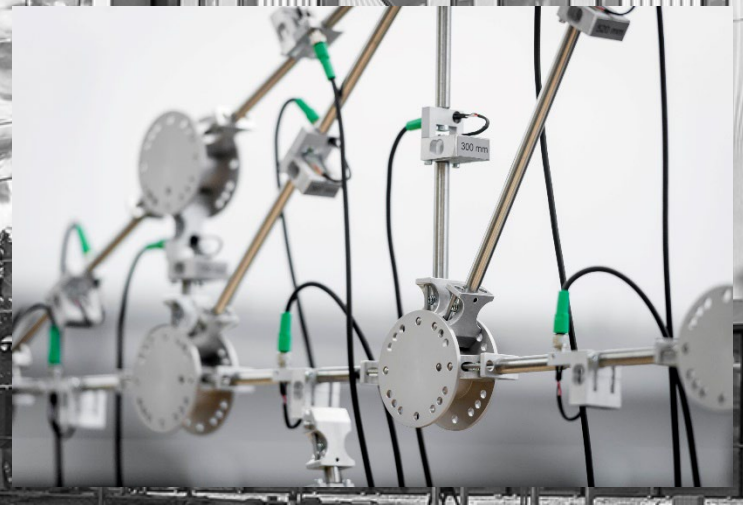
SFU

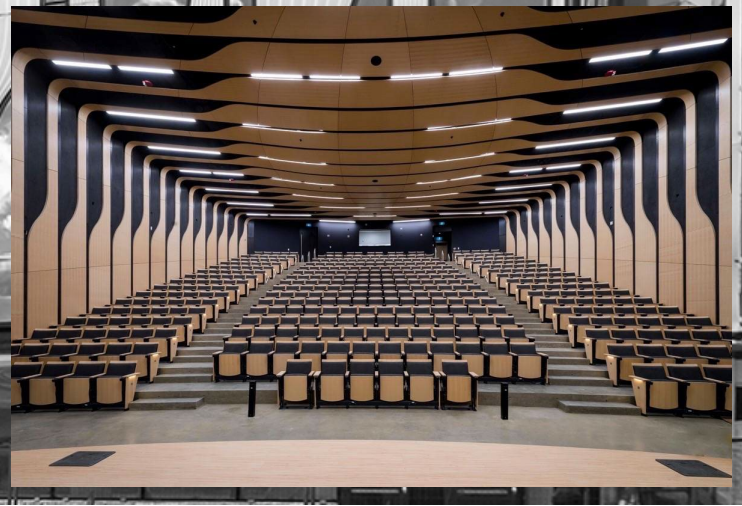
SIMON FRASER UNIVERSITY

SFU SCHOOL OF SUSTAINABLE ENERGY ENGINEERING

SFU

SCHOOL OF SUSTAINABLE
ENERGY ENGINEERING





SFU

SCHOOL OF SUSTAINABLE
ENERGY ENGINEERING

SUSTAINABLE ENERGY ENGINEERING (SEE)

Program design: The first of its kind in Western Canada

INTERDISCIPLINARY DESIGN

Faculty of Science
Foundational courses in Physics, Chemistry and Math

Beedie School of Business
Introduction to Entrepreneurship

Faculty of Environment
Ecological Economics
Geography of Urban Built Environments
Geography of Transportation
Industrial Location

IMMERSIVE EXPERIENCES

Capstone project
Design and implement sustainable energy solutions for real-world problem

Mandatory co-op educations
Options for community-engaged sustainability Projects and non-traditional placements

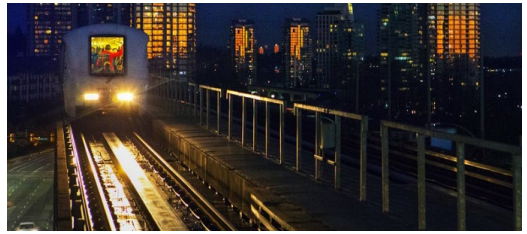
Teamwork
Project-based and problem-based learning
Team projects with peer teaching/assessment
Engagement with multi-disciplinary perspectives

SUSTAINABLE ENERGY ENGINEERING (SEE)

Focus

Sustainable Energy Engineering (SEE) involves the development of solutions for the **harvesting**, **storage**, **transmission** and **use** of energy, with an emphasis on sustainability (e.g. economic, environmental, societal and cultural) and the interdisciplinary perspectives that this requires.






SUSTAINABLE ENERGY ENGINEERING (SEE)

Collaboration and engagement opportunities

Co-op/internship

Hire our brilliant students as co-op to help them get real-world, hand-on experience.

Research

Get our experienced faculty members and top notch graduated students engaged with you R&D projects.

Consultation

Our faculty members are professional engineers with decades of cumulative industrial experience.

Mehran Ahmadi, Ph.D., P.Eng.

Lecturer & Associate Director

Sustainable Energy Engineering (SEE)

Office # 5145 - 10285 University Drive
Surrey

mahmadi@sfu.ca | (778) 782-7182

POLL 1

What did you tell us about yourself?

SFU SCHOOL OF SUSTAINABLE ENERGY ENGINEERING

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SFU Parcel 21

Achieving Step 4 at Conventional Construction Budgets

Local Practice Architecture + Design

ZEBx Decarb Lunch Series | March 31, 2022

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UniverCity ON BURNABY MOUNTAIN

PEAK CONSTRUCTION GROUP

zebx

Context and Goals

SFU Parcel 21 is the story of high-performance affordable housing that promotes connection — people to one another, students to university, residents to the neighborhood, and everyone to nature.

Project Brief

- Location:
  - Simon Fraser University, Burnaby, BC
- Major Occupancy:
  - Group C - Rental Apartments
- Number of Suites:
  - 90 with a mix of studios, 1 bed, and 2 bed
- Code Minimum:
  - 2012 B.C. Building Code (ASHRAE 90.1)
- Performance Target:
  - “Pursuing Passive House”
  - BC Energy Step Code - Step 4

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Size and Cost

- Two apartment buildings and an amenity pavilion on top of a single level parkade
- Gross Floor Areas:
  - East Building: 3,210 m^2
  - West Building: 2,570 m^2
  - Amenity Pavilion: 120 m^2
  - Parkade: 1,705 m^2
- Construction Cost:
  - $22.9M
  - $3,880/$m^2$ ($360/sqft) (conditioned interior space)

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Simon Fraser University's Goals

- Provide rental housing for students to respond to a housing emergency on campus
- Strengthen the local community at *UniverCity*
- Achieve a high performance building within a conventional construction budget
- Champion underserved communities with accessible-, adaptable-, and family-oriented housing
- Make the simple elegant

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Who are we in service to?

- Client
- Future residents
- Society
- Construction Industry
- Larger ecological systems

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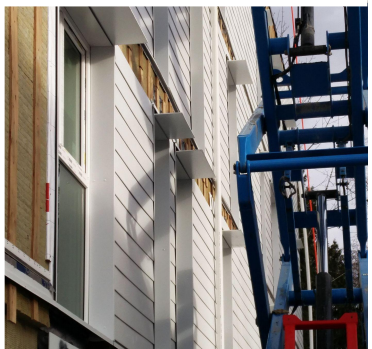

What was the reality in 2014?

- Passive House was relatively new in the market
- There were not yet any completed projects of this scale in BC
- There was good momentum for training by Passive House Canada
- Desire to test what was possible and help advance the industry's ability to deliver high-performance projects

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Why not Passive House?

- PH Institute wanted to certify only whole projects
- Overcoming primary energy constraints wasn't consistent with the University's other goals
- Solving these would lead to disproportionate cost premiums for marginal performance benefits for the University and Community

However, the Passive House Standard provided tremendous value as a direction and guide:

"We aimed for Passive House and achieved Step 4"

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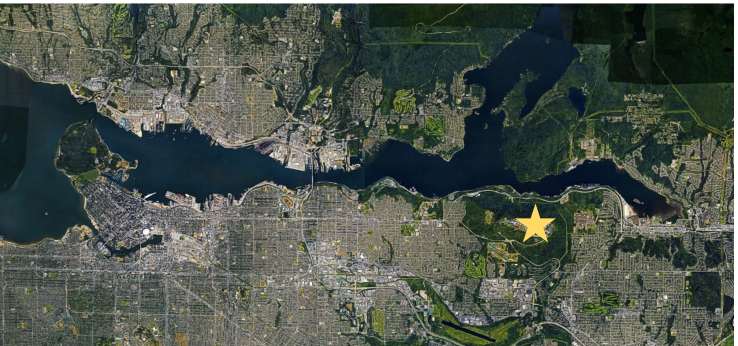

Location & Context

- Burnaby, British Columbia
- Last parcel in the *UniverCity* neighbourhood at Simon Fraser University
- Serves as a threshold between the academic campus and the residential community

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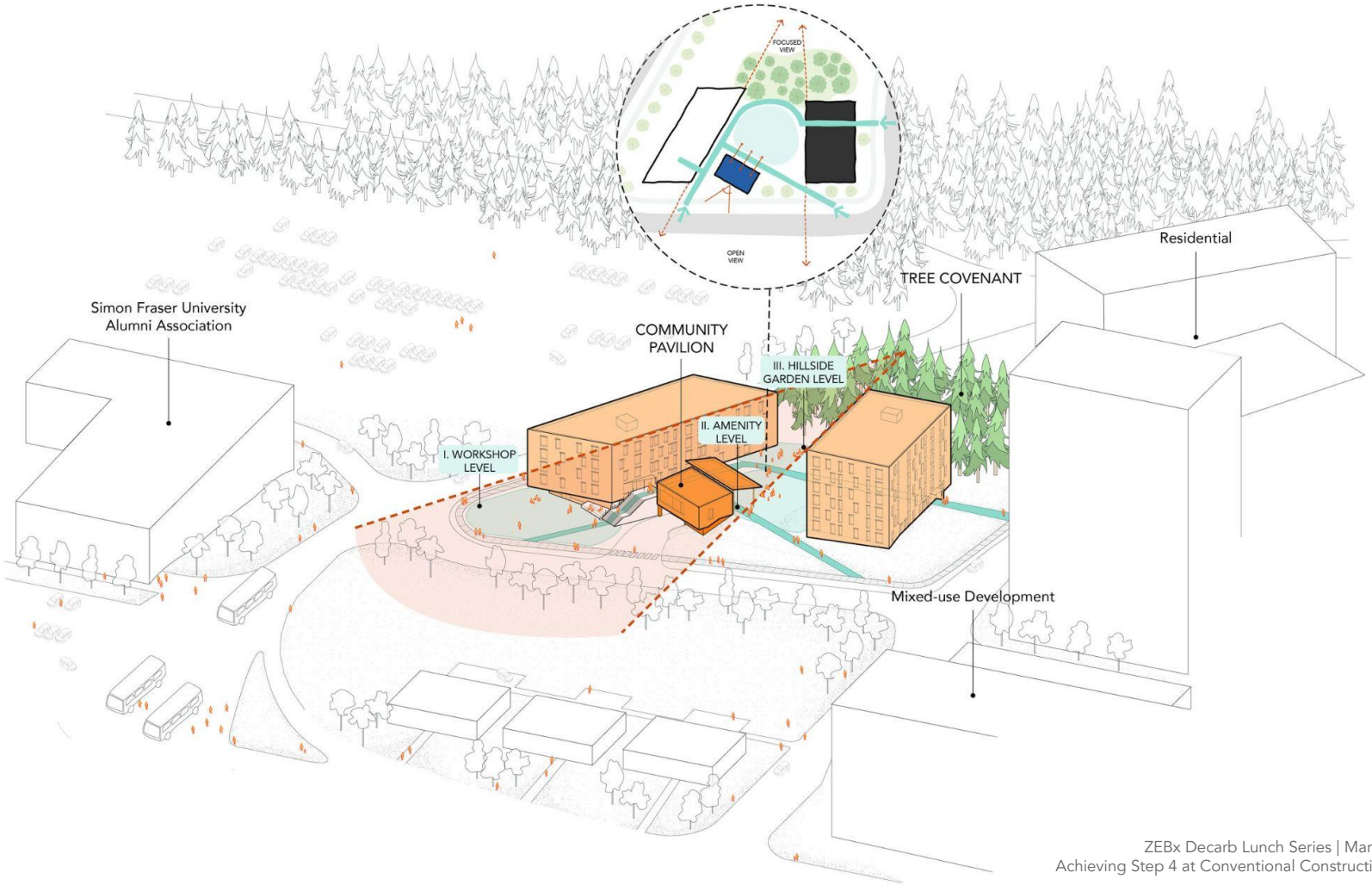
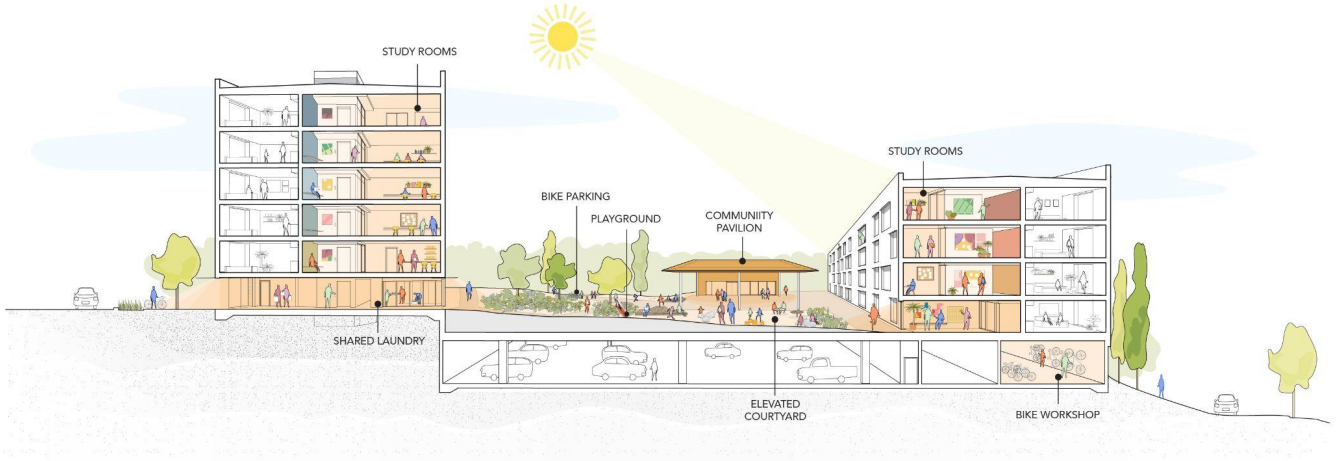
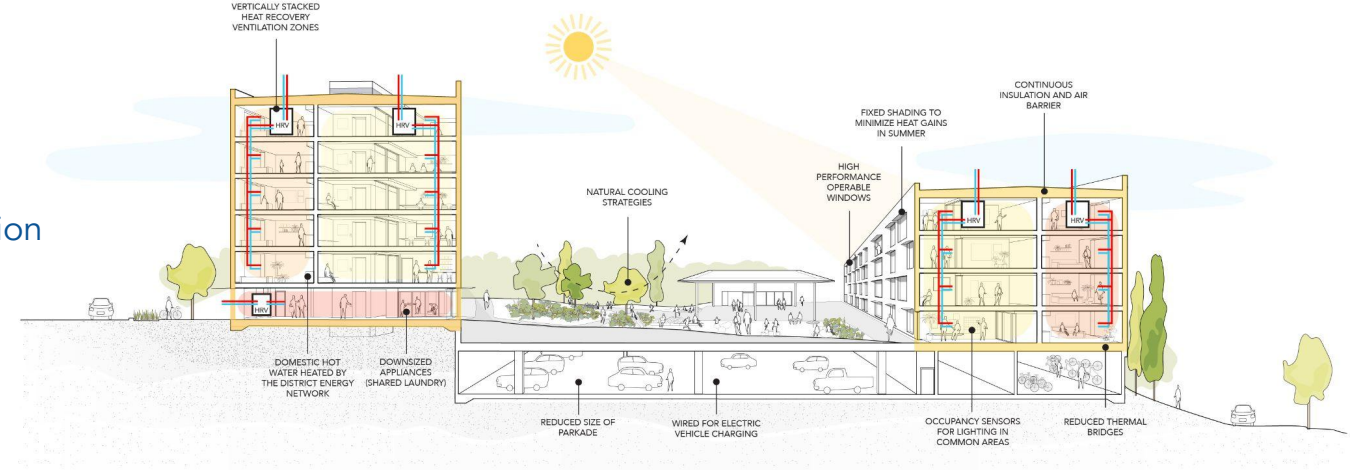

FOCUSED VIEW
OPEN VIEW
Residential
TREE COVENANT
Simon Fraser University Alumni Association
COMMUNITY PAVILION
III. HILLSIDE GARDEN LEVEL
II. AMENITY LEVEL
I. WORKSHOP LEVEL
Mixed-use Development

Community Nurturing



Decarbonization



Site Plan

1. Lobby
2. Social Stairs
3. Shared Laundry
4. Community Pavilion
5. Picnic Tables
6. Natural Playground
7. Forest Covenant
8. Hill slide
9. Benches
10. Bike Parking

What did we do?

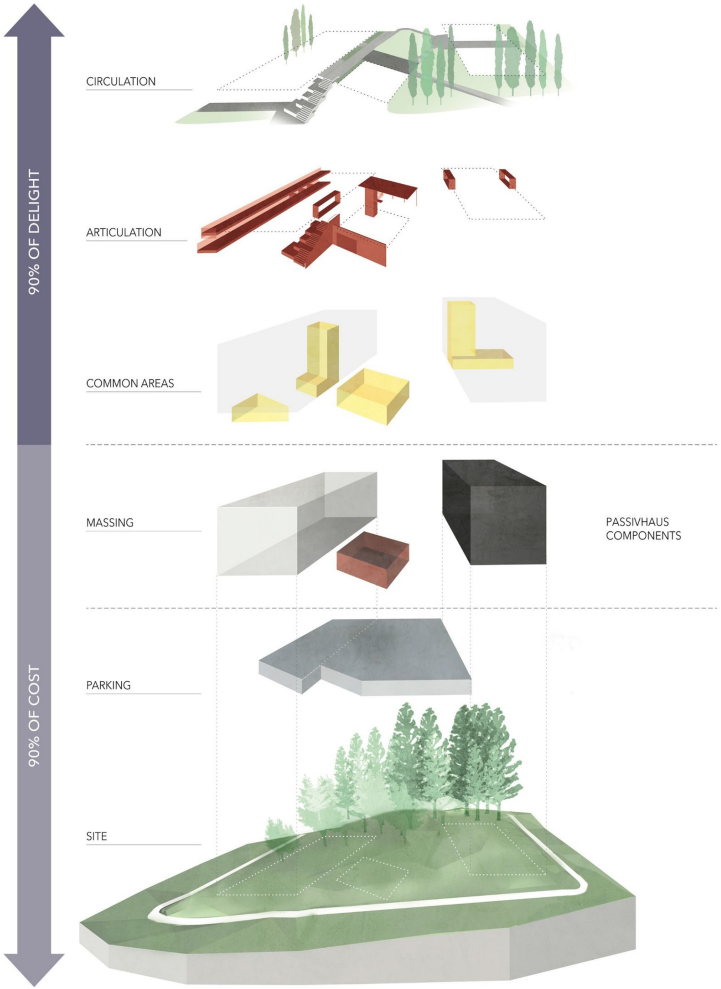
"Upon completion, this project should be one of the most energy efficient buildings in British Columbia on an entirely conventional construction budget."

— DALE MIKKELSEN, CHIEF OPERATING OFFICER, SFU COMMUNITY TRUST

Performance Metrics

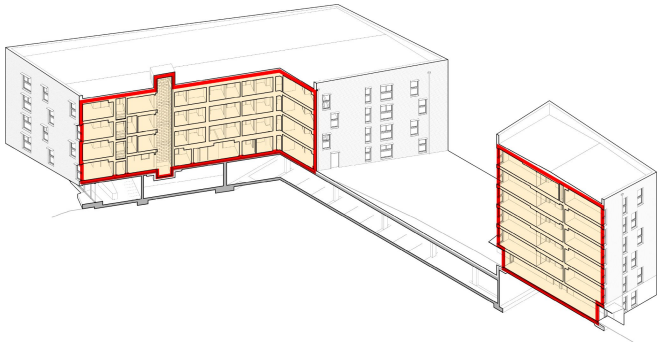
	Target	West	East	Avg
• Air Tightness:				
○ ACH_{50}	<0.60[1]	0.31	1.37[5]	0.48[6]
○ $EALR_{N75}$ (L/sm^2)	<2.00[2]	0.21	1.15[2]	
○ $IPALR_{N75}$ (L/sm^2)	<1.20[2]	<1.20[7]	<1.20[7]	
• TEDI (kWh/m^2yr)	15[3]	16.92[4]	12.84[4]	12.29[4]
• TEUI (kWh/m^2yr)	100[3]	69.26[4]	61.34[4]	65.30[4]
• GHGI ($kgCO_2e/m^2yr$)		2.38[4]	2.04[4]	2.21[4]

1. Passive House Requirement (project target)
2. SFU requirement
3. 2012 BC Energy Step Code Level 4 requirements for less than 3000 degree-days below 18 °C and based on GFA. SFU degree-days below 18° C are 3100. 2018 Step Code L4 requirements in this zone are 22 and 110.
4. Adjusted to GFA from TFA from updated PHPP model based on airtightness test results.
5. East Building combined value including ground floor suites with exterior exit only.
6. East Building L1 Lobby + L2-L6 only, more representative of the actual building performance.
7. IPALR tested in 5 suites in each building (11% of all suites).



1. Simplify the Thermal Envelope

- Keep building forms compact to minimize envelope area
  - Exclude the parkade
  - Roof access by hatch instead of stairs & penthouse
  - Eliminate balconies and setbacks
- Form Factor (Envelope Area / GFA):
  - East Building: 0.88
  - West Building: 0.83



2. Provide Articulation using Stairs, Canopies, and Cladding

- Reframe performance targets as an opportunity instead of a constraint to design
- Obtained the aesthetic we were after using texture and external elements:
  - Sunshades over south-facing windows
  - Bold yellow canopies pull you into lobbies
  - Feature entry stair and guard
  - Courtyard patio canopy
  - Distinctive Pavilion cladding
  - Varied cladding textures
- Design for simplicity — dial up complexity as the industry evolves and becomes familiar with high-performance assemblies and details

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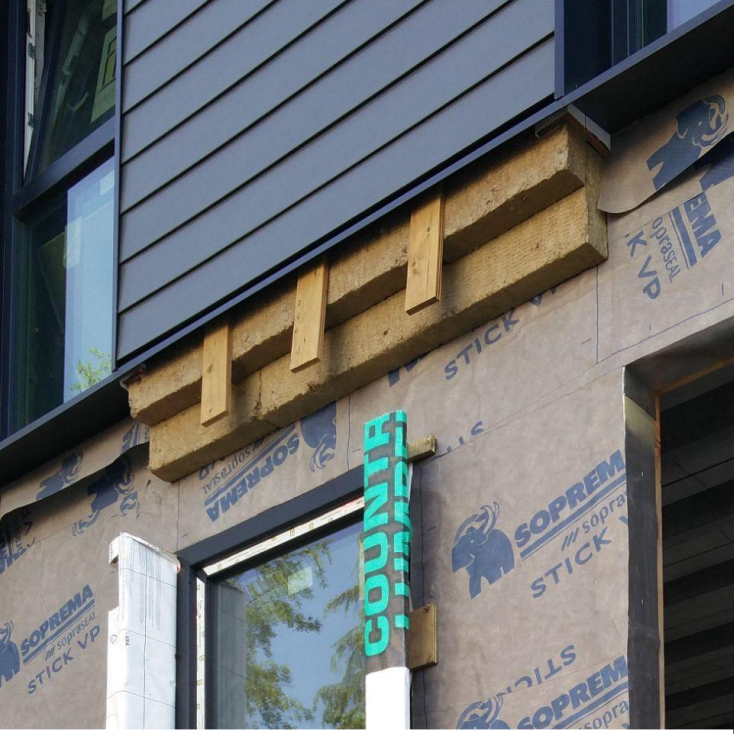

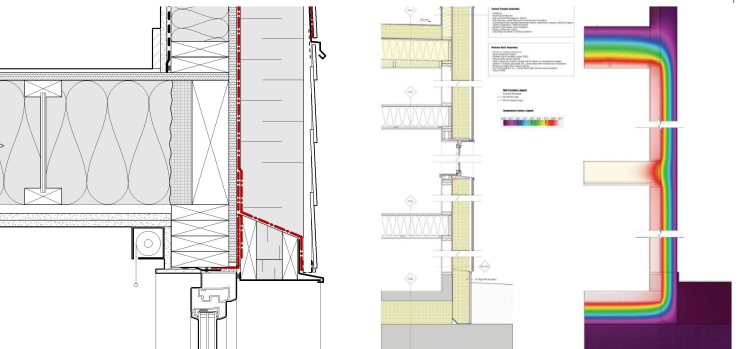

3. Design Thick Walls and Fine-Tune Envelope Detailing

- Refine and repeat typical details
- Reduce thermal bridging
  - Membrane for through wall flashing
  - Wood blocking for sunshades
  - Long screws in lieu of thermal brackets
- High Effective RSI values ($m^2 \cdot K/W$)
  - Roof: 14.3 (R-81)
  - Walls: 7.2 (R-41)
  - East Slab-on-Grade: 4.8 (R-27)
  - West Suspended Slab: 4.9 (R-28)
- Evaluate options with energy models + software
  - PHPP 9.6a
  - THERM 2D

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4. Prioritize Airtightness

- Use high-performance, multipoint locking windows.
  - Dialed-up membrane airtightness in energy models is risky to rely on alone - too many variables in field.
- Careful review of membrane installation and deficiencies
  - Pinholes and fishmouths
  - Positive membrane lapping and adhesion
  - Seals at penetrations
- High-performance doors
  - lesson learned from the East Building exterior suite doors and airtightness results
- Simplify detailing for ease of installation
- Repeat what works

local.

5. Provide Passive Daylighting

- Tall windows to maximize light penetration depth
- Daylight the corridors through common areas
- Oversize spaces near windows to encourage people to linger and interact with neighbours
- High-performance tilt-turn windows:
  - Triple-glazed with low-e coating and argon
  - Overall U-value (W/m^2K) 0.91
  - SHGC: 0.17
  - VT: 0.34
- Balance Window-to-Wall Ratio and energy performance:
  - East: 27%
  - West: 24%

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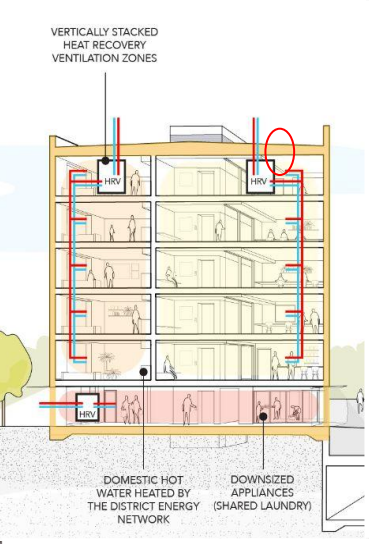

6. Coordinate Mechanical Early

- Heat Recovery Ventilators (HRVs) serve stacks of units
  - 84% efficient units in Semi-Centralized configuration
- Locate HRVs in corridors
  - Save prime real estate at exterior walls for residents
  - Easy access for maintenance without entering suites
- Minimize roof vents and penetrations
  - Fewer HRV inlet/exhaust vents
  - Combine plumbing stacks into a single roof penetration for each building
  - Exterior roof drainage through scuppers
- Insulate service penetrations inside the thermal envelope
  - Plumbing vents 3m into building
  - HRV ducts between units and the envelope

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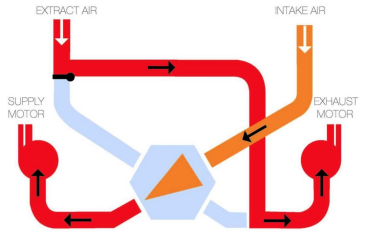

Zehnder HRV Bypass Mode

7. Utilize Passive Cooling Strategies

- Open tilt-turn windows at night to dump hot air
- Cross ventilation possible for corner units
  - South units at highest risk of overheating
- Inset windows and sunshades to minimize solar gains
- HRV's with a bypass mode to dump heat on cool nights
- Future challenges
  - Increase in number of hot days and overheating risk
  - Smoke from forest fires prevents opening windows during hottest season

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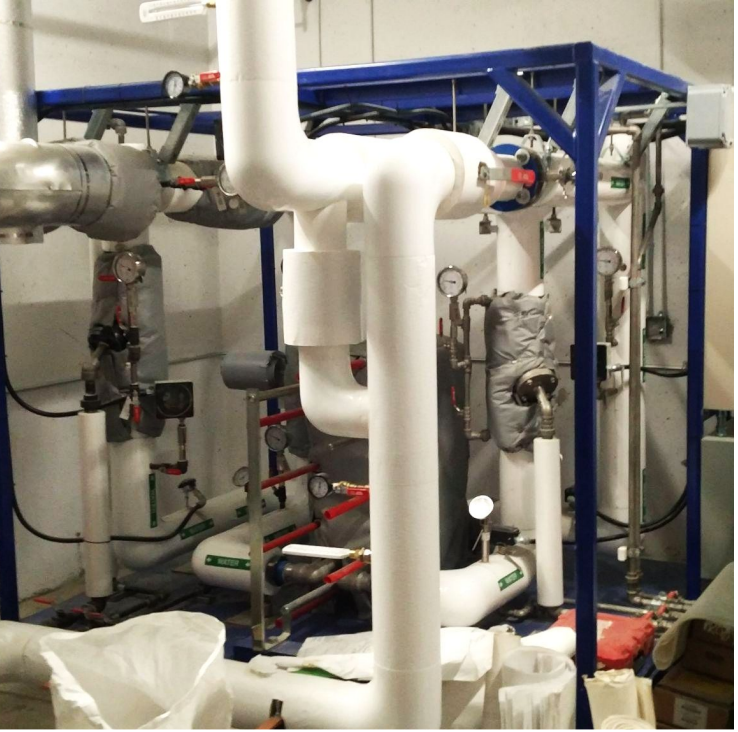


8. Reduce Greenhouse Gas Intensity

- No active cooling — utilize operable windows
- Shift expectations of interior comfort +/- a few degrees
- HRVs with electric boost
- Hot water heating by District Energy Utility (biomass)
- All electric building — no natural gas
- UPS in lieu of backup generator
- Smaller parkade by offsetting vehicle parking with Class A bike parking

local.

Project Team

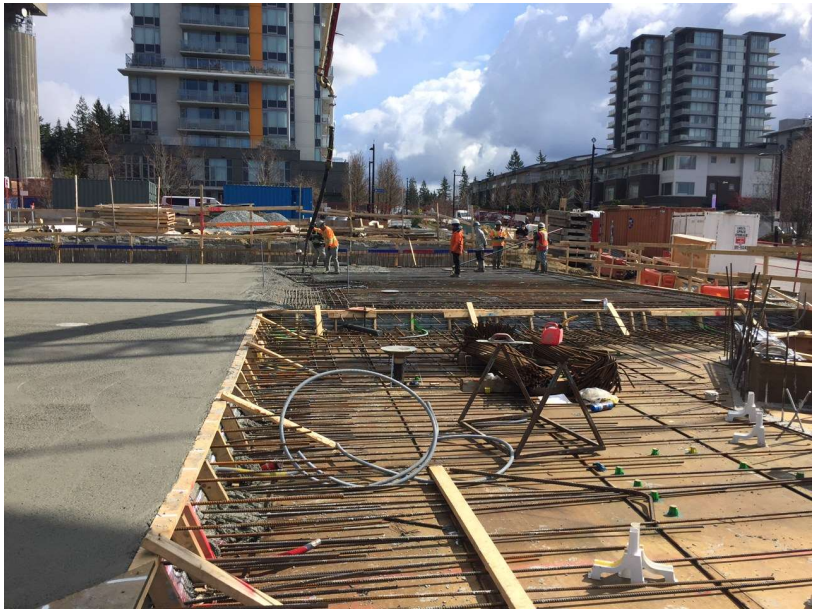
Architect	Local Practice
Landscape	Space2place
Structural & Electrical	Associated Engineering
Mechanical	Rocky Point Engineering
Fire Protection	Mfpe Engineering
Civil	H.Y. Engineering
Envelope	RDH Building Science
Energy Modeling	Tandem Architecture Écologique
Building Code	Jensen Hughes
Acoustics	RWDI
Cost & Constructability	Heatherbrae Builders
Project Manager	JLL
General Contractor	Peak Construction
Client	SFU Community Trust

local.

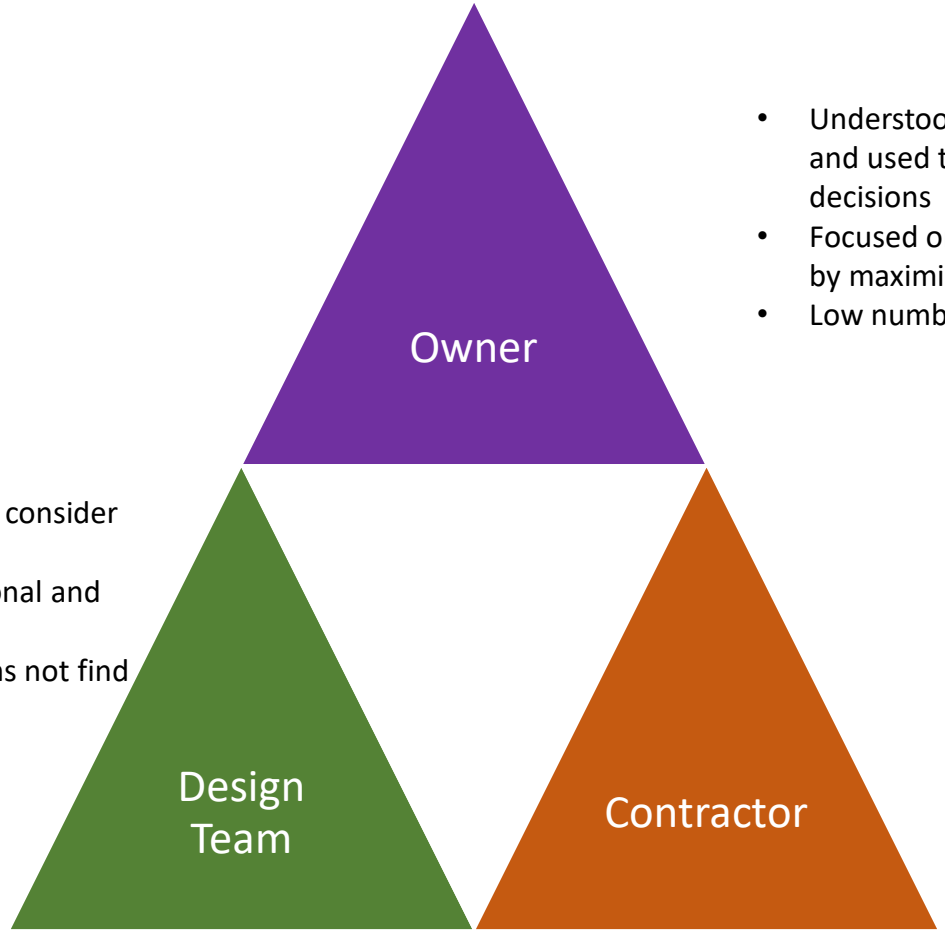

Thank you!

SFU Parcel 21

Challenges and Lessons Learned



The Team



- Understood core value of PH principles and used them to guide smart decisions
- Focused on a budget, but motivated by maximizing value, not profit
- Low number of Owner driven changes

- Collaborative and willing to consider alternate points of view
- Focused on creating functional and beautiful spaces
- Motivated to solve problems not find fault

- SMT was involved, aware and provided leadership
- Willing to teach and take some risks ($$) from the trades
- Empowered the team to make decisions (value of time)

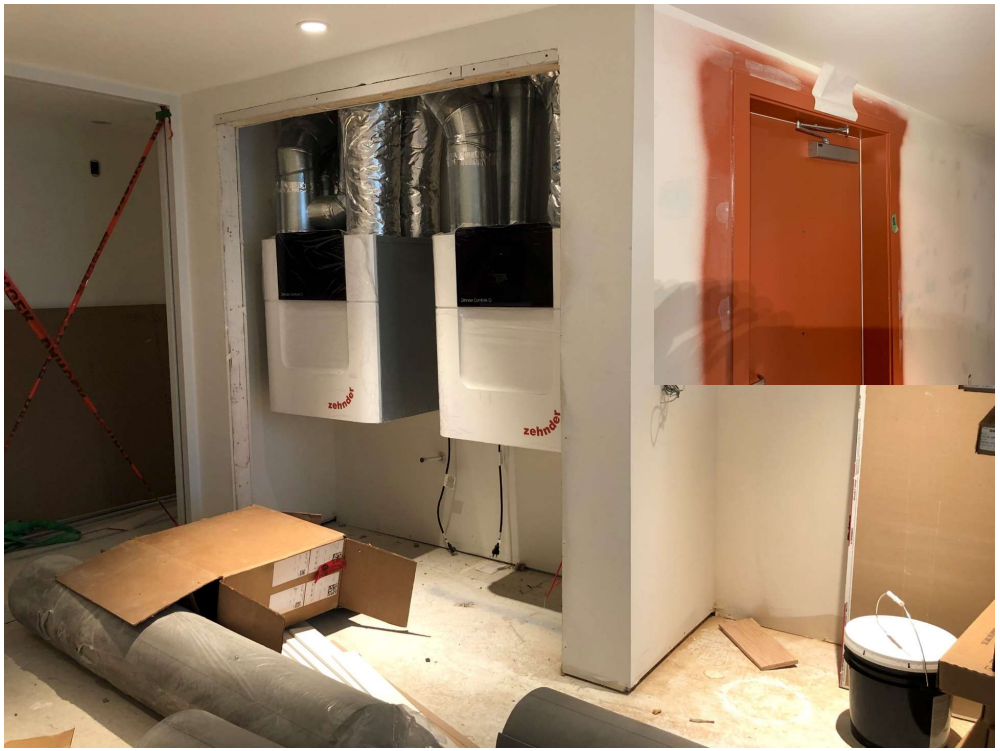
What worked and where we were challenged

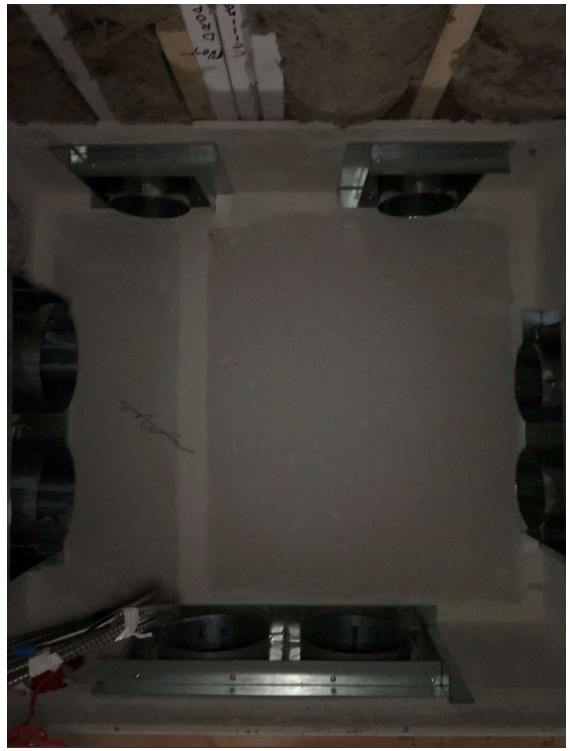
- What worked well…
  - Success with trades that understood the why and were willing to do things differently
  - Simple building form that set construction team up for success
  - Design team that tried to think of the “person” doing the work
  - Lead by example. Provided training/encouragement/took over where needed
  - Use good products

- What we were challenged by and how we overcame
  - Trades are motivated by making money on this job. Not normally future or big picture oriented
  - Trades want to do things the way they’ve always done them
  - Material and skilled labour shortages at the same time
  - Working in tight spaces during Covid

Some Specific Challenges

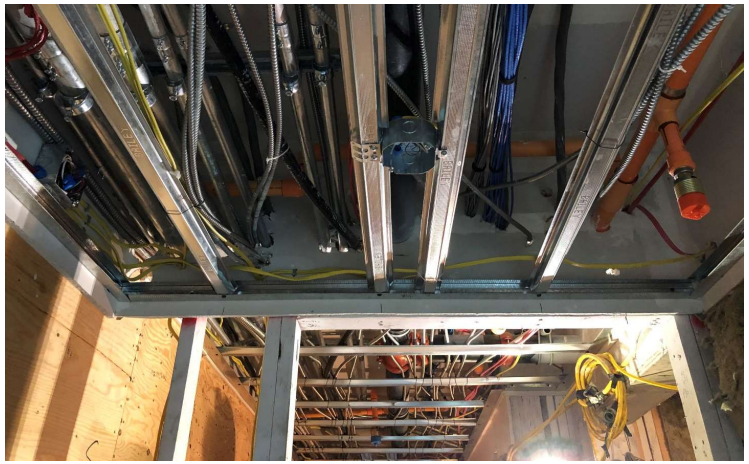
- Very small HRV closets (ducting config, door hardware)

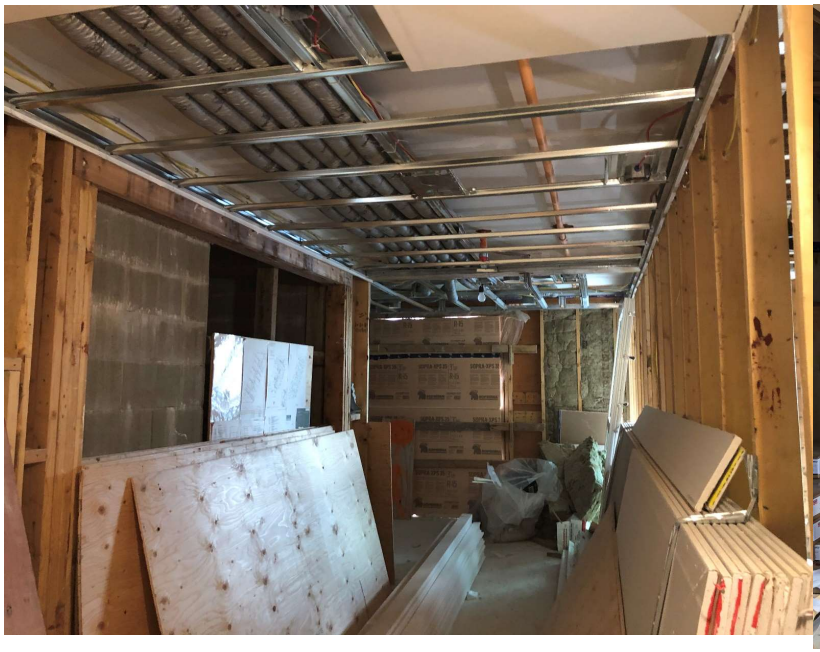




Specific Challenges

Low ceiling heights and a lot of structure





Specific Challenges

- No decks
- Small parking lot and the elevator doesn't access parkade

TVVV0

Lessons Learned

- Teamwork makes the dreamwork (owner, design team, contractor)
- Understand the why
- Make it simple
- Create enthusiasm for Passive House (tell your friends)
- Invest in training the right people at the right time
- Keep talking (even near the end when it gets hard)