Decarb Lunch Series

zebx

BC Hydro
Power smart

CITY OF VANCOUVER

Overheating: Will the need for cooling accelerate decarbonization?

Thu May 19, 2022,
from 12- 1pm PDT
Free Webinar
zebx.org


ZERO
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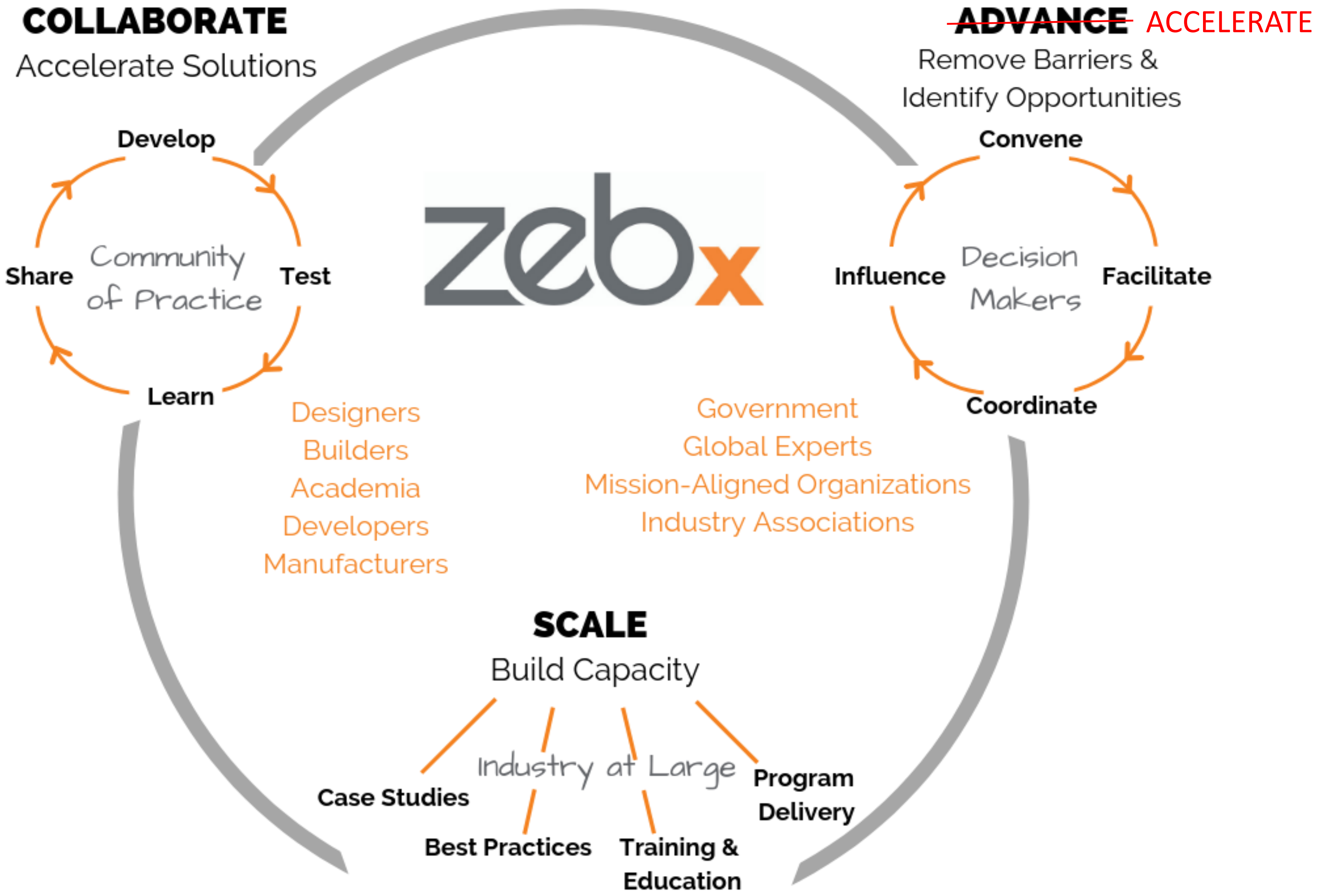
INNOVATION
CENTRE
Energy efficiency
in buildings
Urban
renewable energy
Transportation
solutions
ZEBx is proud to be part of the Metro Vancouver Zero Emissions Innovation Centre
Visit ZEIC.ca to find out more


COLLABORATE
Accelerate Solutions
~~ADVANCE~~ ACCELERATE
Remove Barriers & Identify Opportunities
Develop
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Learn
Share
Community of Practice
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Convene
Facilitate
Coordinate
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SCALE
Build Capacity
Industry at Large
Case Studies
Best Practices
Training & Education
Program Delivery

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.

B2electrification.org

CLF Carbon Leadership Forum Vancouver joins zebx

ZEBx is proud to announce the **Carbon Leadership Forum, Vancouver** has joined our organization.

clfvancouver.com

bcgreeneventcalendar.ca

The BC Green Building Calendar

Welcome to the BC Green Building Calendar.

Here you will find all of the latest events and training related to green building subject matter, including: emissions, energy efficiency, resiliency, high-performance design, and more.

If you would like to submit an event or for more details on submission guidelines, see the bottom of this page.

Filters

February 2022

Webinar | **Presented by: ZEBx**

Feb
17
Thursday
10:00am - 12:00pm

Deep Emissions Retrofit Dialogue - Ready to Roll: Simple Solutions for Going Electric

Webinar | **Presented by: ZEBx**

Feb
25
Friday
12:00 - 1:00pm

ZEBx Decarb Lunch - Be Prepared! The BC Energy Step Code Capacity Study.

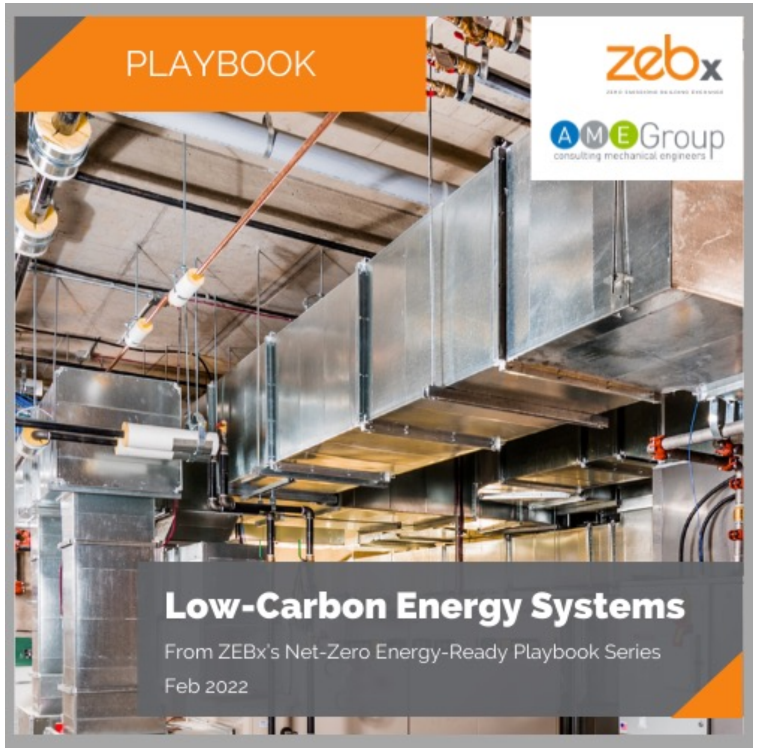
February 2022

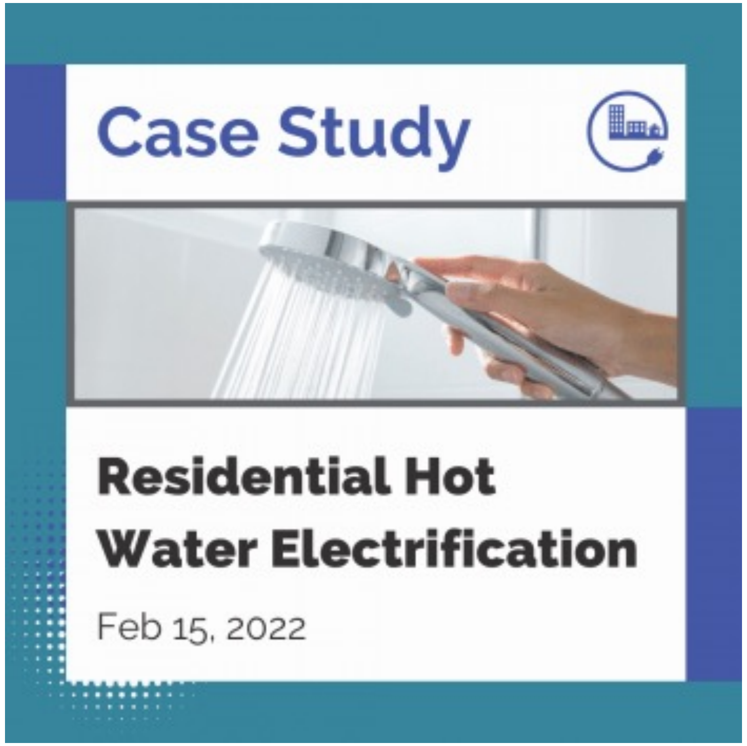
Sun	Mon	Tue	Wed	Thu	Fri	Sat
30	31	1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	1	2	3	4	5
6	7	8	9	10	11	12

To submit events for your organization:

Join our community

b2electrification.org





zebx.org

POLL

Tell us about yourself!

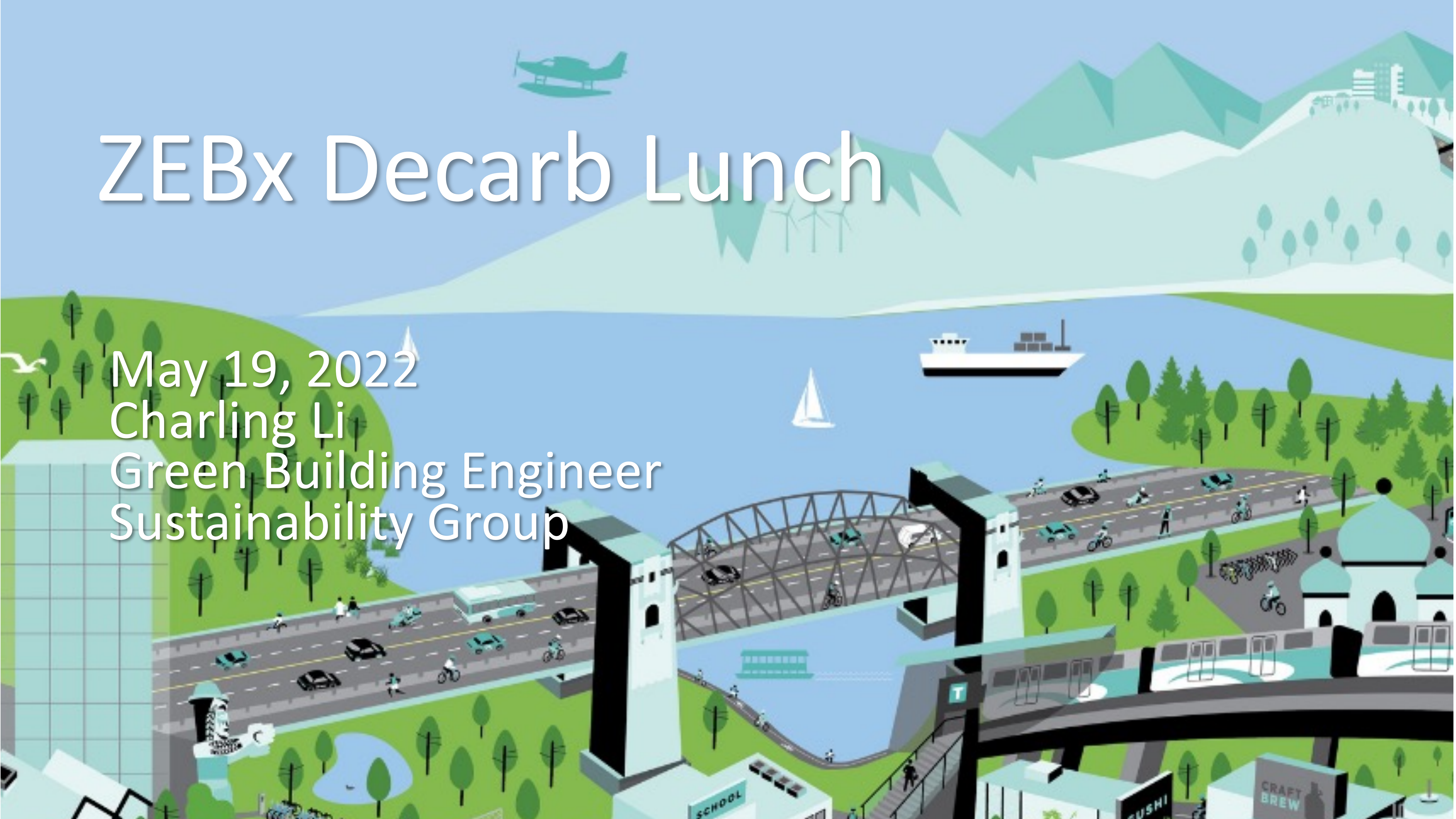
Three-part anonymous poll

B2E
Building to Electrification

CITY OF VANCOUVER

ZEBx Decarb Lunch

May 19, 2022
Charling Li
Green Building Engineer
Sustainability Group



May 17 council decisions

1: New buildings update to VBBL and Rezoning Policy

2: Benchmarking & carbon limits for existing large buildings

3: Requirements for existing detached homes

4: $2M grant for non-market housing to accelerate heat pump adoption

Council direction

- prioritize electrification over renewable gas wherever possible in new and existing buildings

- explore options to remove gas cooking, fire places and others uses in all new residential buildings

New Part 3 buildings updates

BIG MOVES
4+5
NEW BUILDINGS

#1 ENERGY + CARBON

VBBL

GHGI = 3
2023
4-6 story residential
2025
high rise + commercial

#2 RESILIENCE

VBBL

2023
MERV 13 filtered air
2025
require cooling in dwellings

#3 EMBODIED CARBON

VBBL

2023
reporting only
2025
10-20% reductions + sustainable sourcing

#4 STREAM-LINING

REZONINGS

IMMEDIATELY
remove requirements except rainwater, enhanced commissioning and energy system sub-metering

Intake reports for energy & emissions, embodied carbon and resilient buildings

POLL

What did you tell us about yourself?

B2E
Building to Electrification

CITY OF VANCOUVER

Key Takeaway

Heat pumps are a key strategy to address climate mitigation AND resilience to future climate needs

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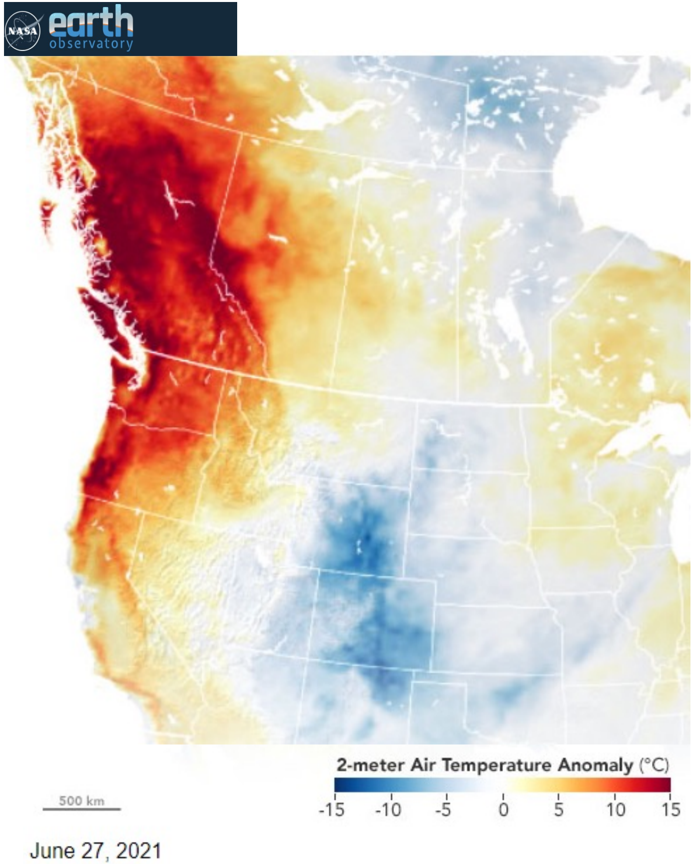
May 19, 2022

Ralph Wells
Community Energy Manager
Campus and Community Planning – Sustainability and Engineering
University of British Columbia

CANADA'S TOP WEATHER STORIES IN 2021

BRITISH COLUMBIA HEAT DOME EVENT



Science Advances

RESEARCH ARTICLE | CLIMATOLOGY

The 2021 western North America heat wave among the most extreme events ever recorded globally

BRITISH COLUMBIA | Coroners Service

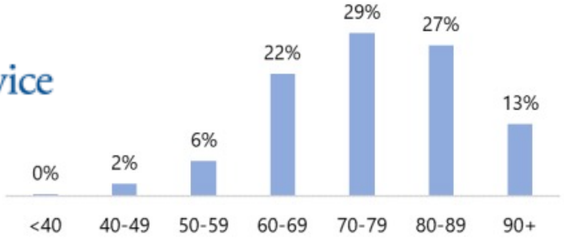
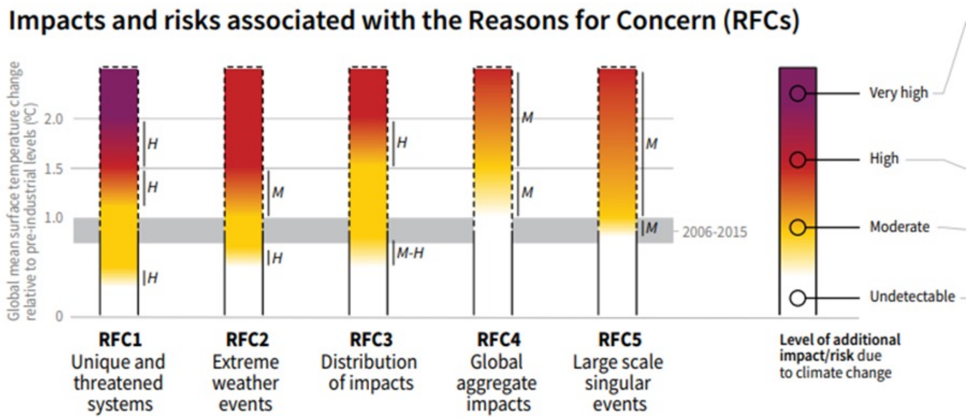


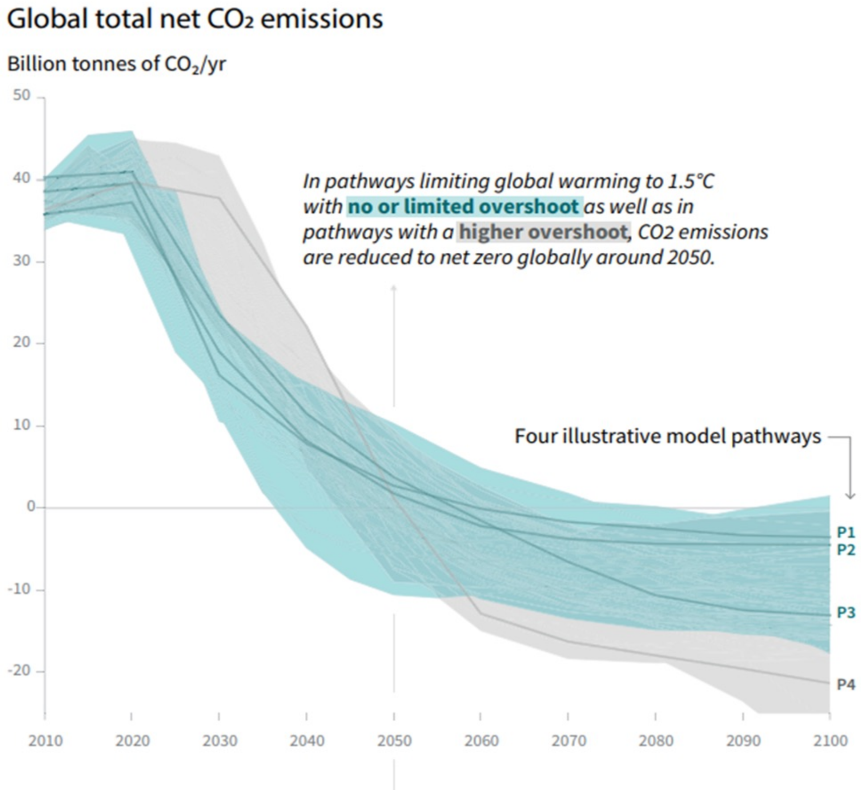
Fig. 3. Heat-Related Deaths by Age Group as % of Total, Jun 25 – Jul 1, 2021

Table 7. Heat-Related Deaths by Injury Location and Health Authority of Injury, Jun 25 – Jul 1, 2021[1]

	Interior	Fraser	Vancouver Coastal	Island	Northern	Total
Inside Residence	57	265	118	46	20	506
Outside	3	2	1	1	1	8
Public Building[2]	1	1	0	0	0	2
Unknown	3	5	1	1	0	10
Total	64	273	120	48	21	526

IPCC SPECIAL REPORT GLOBAL WARMING 1.5C





Implications for Buildings in Metro Vancouver

Cooling Degree Days: Recent Past

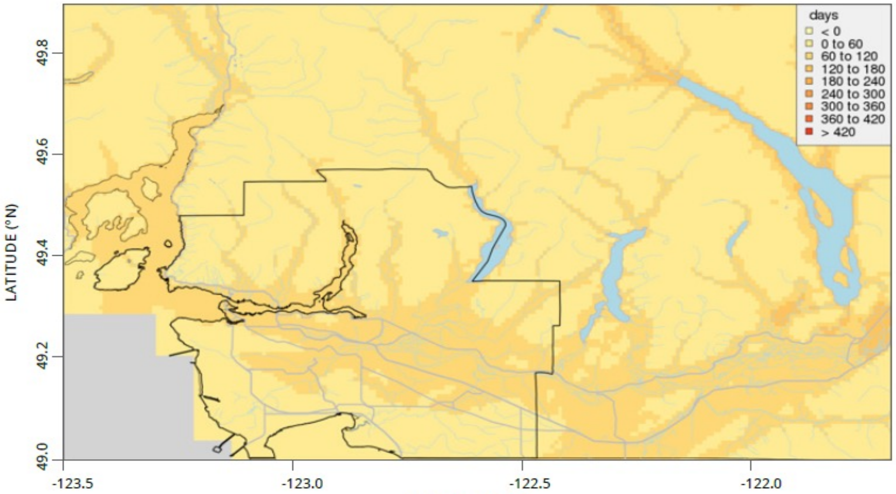


FIGURE 15: COOLING DEGREE DAYS – PAST

Cooling Degree Days: 2050s

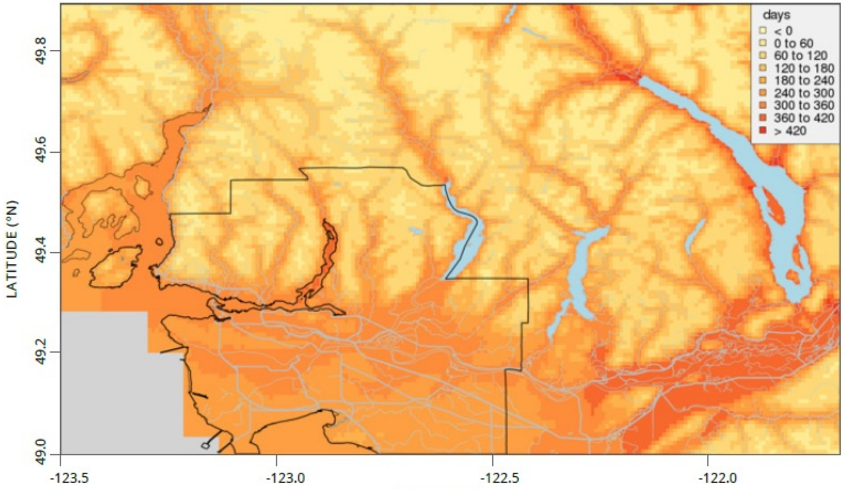
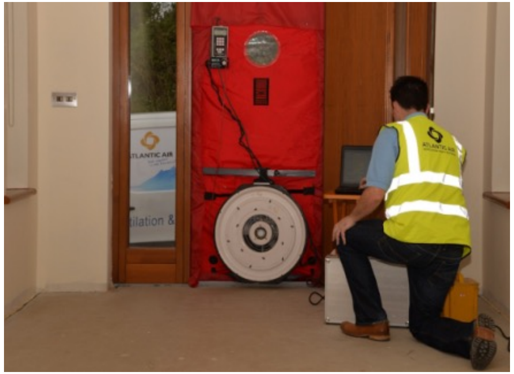


FIGURE 16: COOLING DEGREE DAYS – FUTURE (2050s)

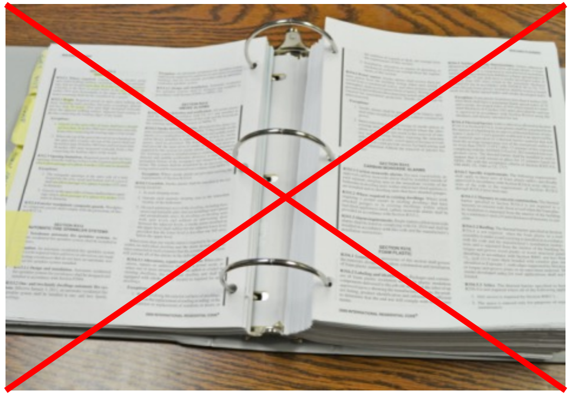
Source: PCIC for Metro Vancouver (2016)

Energy Step Code Performance Compliance

Energy Modeling



Air-Tightness Testing

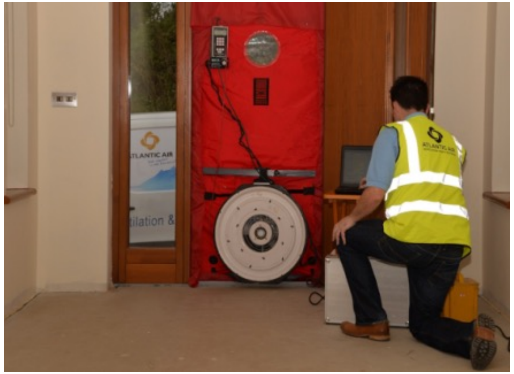


No Prescriptive Energy Requirements

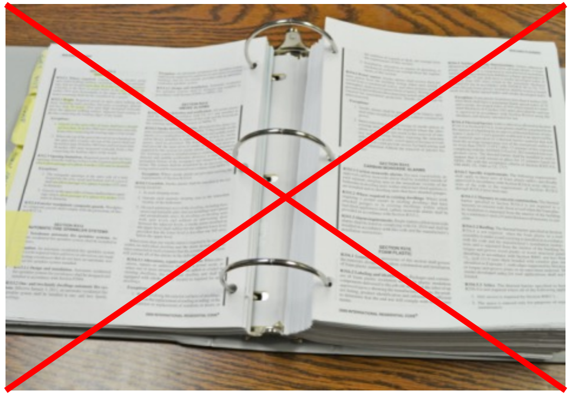
Energy Step Code Performance Compliance

Energy Modeling

* requires weather file



Air-Tightness Testing



No Prescriptive Energy Requirements

Energy Step Code Performance Compliance

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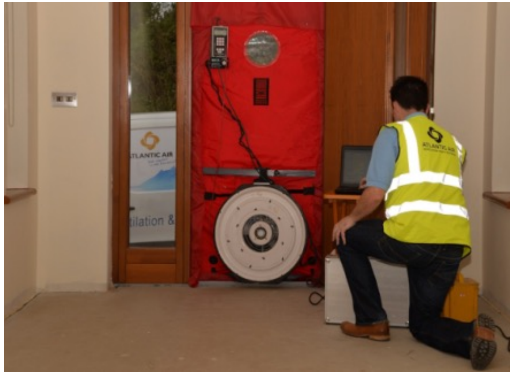
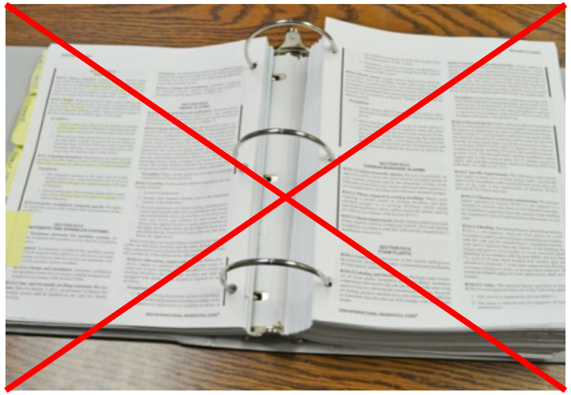


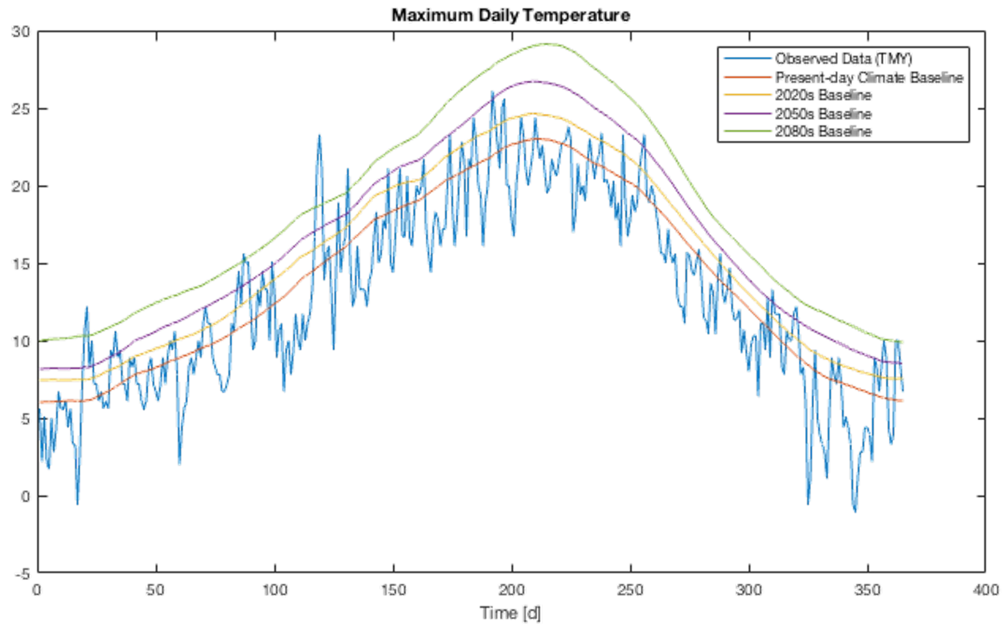
Air-Tightness Testing



No Prescriptive Energy Requirements

* requires weather file
* current weather file represents past climate (CWEC 2016)

Generating “Future Climate Weather Files” For Building Energy Modelling



Malin Ek

Trevor Murdock (PCIC)

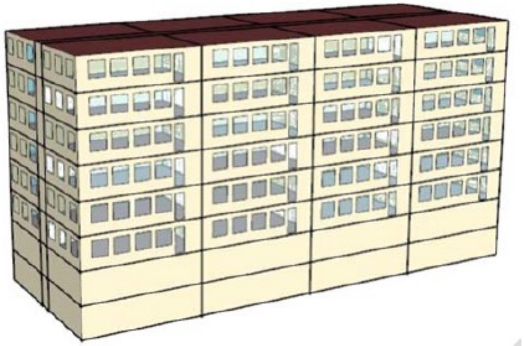
- TMY – Typical Meteorological Year for building modelling
- “Morphing” future daily temperature to hourly TMY

UBC SEEDS Project: Future weather files to support climate resilient building design in Vancouver. Ek *et al*. 2018

Designing Climate Resilient MURBs – Partnership Project

Innovative Clean Energy (ICE) Fund

Unmet Cooling Hours – New Low Rise Archetype



Building Archetype
Low Rise New
(No Mechanical Cooling)

NW	N1	N2	NE
CORRIDOR			
SW	S1	S2	SE

≤ 200 hrs	201-500 hrs	501-800 hrs	> 800 hrs	# of hrs pear year above the upper temperature limit
< 2%	2-6%	2-9%	>9%	% of hrs per year above the upper temperature limit

Top Floor

Suite	CWEC 2016 (Hottest Suite: SW - Top Floor)	RCP-8.5 2020s (Hottest Suite: SW - Top Floor)	RCP-8.5 2050s (Hottest Suite: SW - Top Floor)	RCP-8.5 2080s (Hottest Suite: SW - Top Floor)
NW	63	110	370	453
N1	11	30	222	312
N2	11	30	216	306
NE	16	44	234	318
Corridor	57	120	560	695
SW	160	246	589	702
S1	95	160	536	667
S2	93	160	531	665
SE	87	161	503	601

Mid Floor

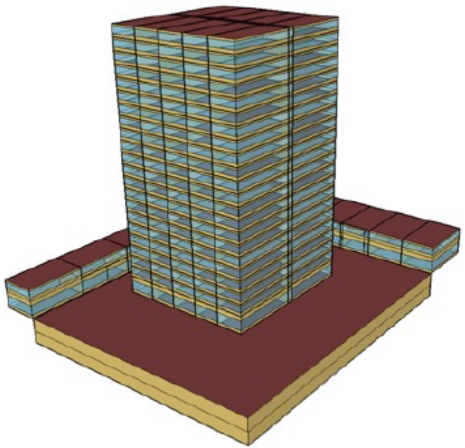
Suite	CWEC 2016	RCP-8.5 2020s	RCP-8.5 2050s	RCP-8.5 2080s
NW	24	45	236	301
N1	2	5	117	164
N2	2	5	114	154
NE	6	13	148	194
Corridor	23	48	402	532
SW	101	149	463	549
S1	69	99	425	536
S2	68	100	428	525
SE	62	97	375	476

First Floor

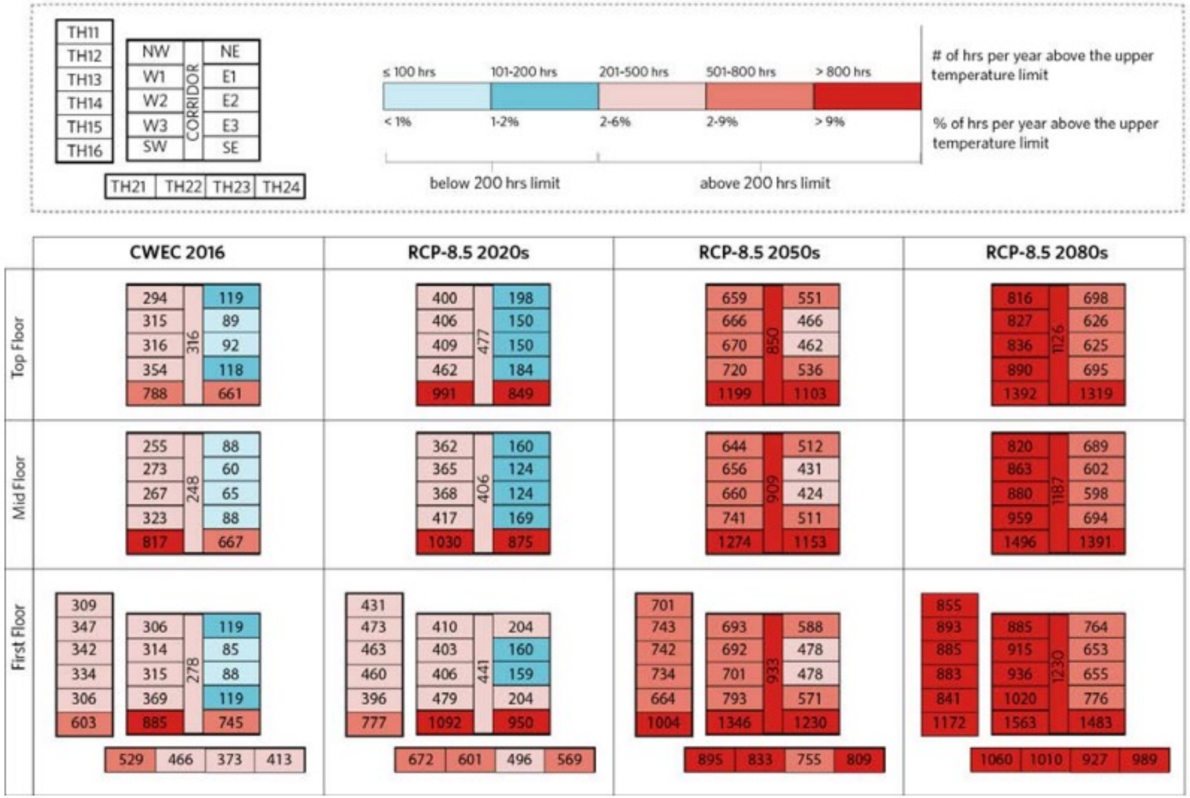
Suite	CWEC 2016	RCP-8.5 2020s	RCP-8.5 2050s	RCP-8.5 2080s
NW	7	27	142	179
N1	0	2	44	77
N2	0	1	42	73
NE	1	5	76	104
Corridor	7	23	208	291
SW	57	105	352	429
S1	49	74	295	377
S2	49	76	290	373
SE	40	67	249	322

Making Buildings Better™

Unmet Cooling Hours – Existing High-Rise Archetype

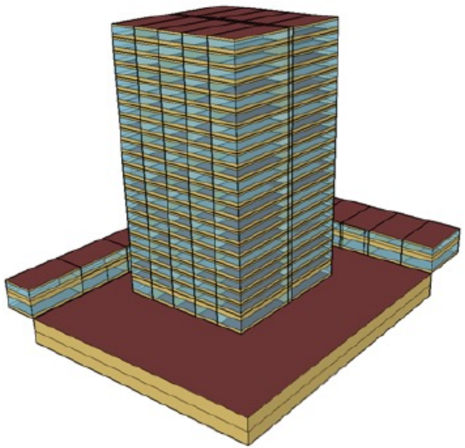


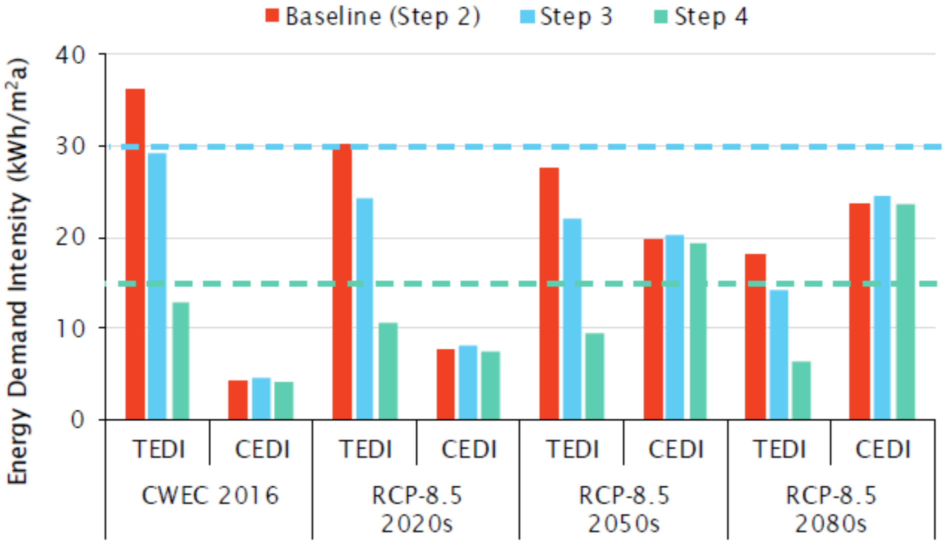
Building Archetype
High Rise Existing
(No Mechanical Cooling)



RDH
Making Buildings Better™

Cooling Energy Demand Intensity (CEDI) – New High Rise Archetype





Building Archetype

High Rise New

(Mechanical Cooling)

TEDI – Thermal Energy Demand Intensity (space heating)

CEDI – Cooling Energy Demand Intensity (space cooling)

UBC NEW CONSTRUCTION POLICY

Requirements for Residential Buildings

Mandatory – 2050 Climate Ready Thermal Comfort Modelling

The building design should meet thermal comfort requirements for 2020s and have a design strategy to meet 2050 requirements. Passively cooled buildings must meet City of Vancouver Energy Modelling Guideline requirements for passively cooled buildings using 2020s weather files and have design strategies for meeting these requirements using 2050 weather files.

Optional – 2050 Climate Ready Energy Efficient Design

Using 2050 RCP 8.5 weather files, achieve a reduction in Cooling Energy Demand Intensity (CEDI) over a base case 2050 ready design that meets REAP E&E and CA preconditions, with passive design measures. (Credits received for 5%, 10% or 15% reduction)

Technical Guidelines for Institutional Buildings

2.3 Design Criteria of Passively Cooled Spaces

Thermal comfort modeling shall be conducted using the 2050s weather file for YVR obtained from the PCIC website (https://www.pacificclimate.org/data/weather-files). Models shall simulate indoor thermal conditions for the months of May to September inclusive.

2.4 Design Criteria of Mechanically Cooled Spaces

Active cooling systems, where required, shall be sized to prevent overheating (see section 2.2 for thermal comfort criteria) based on 31C DB / 23C WB (the expected 2.5% summer design condition in the 2050s climate) and an indoor temperature of 25° C.


UBC
THE UNIVERSITY OF BRITISH COLUMBIA
THE UNIVERSITY OF BRITISH

RESOURCES

Designing Climate Resilient MURBS (Summary Report)
https://sustain.ubc.ca/sites/default/files/Designing%20Future%20Climate_Nov%202020-small.pdf

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

PCIC Future shifted water files
https://www.pacificclimate.org/data/weather-files

Future weather files to support climate resilient building design in Vancouver. Ek *et al*. 2018
https://www.pacificclimate.org/sites/default/files/Eketal_2018_Proceedings_22_Feb_2019.pdf

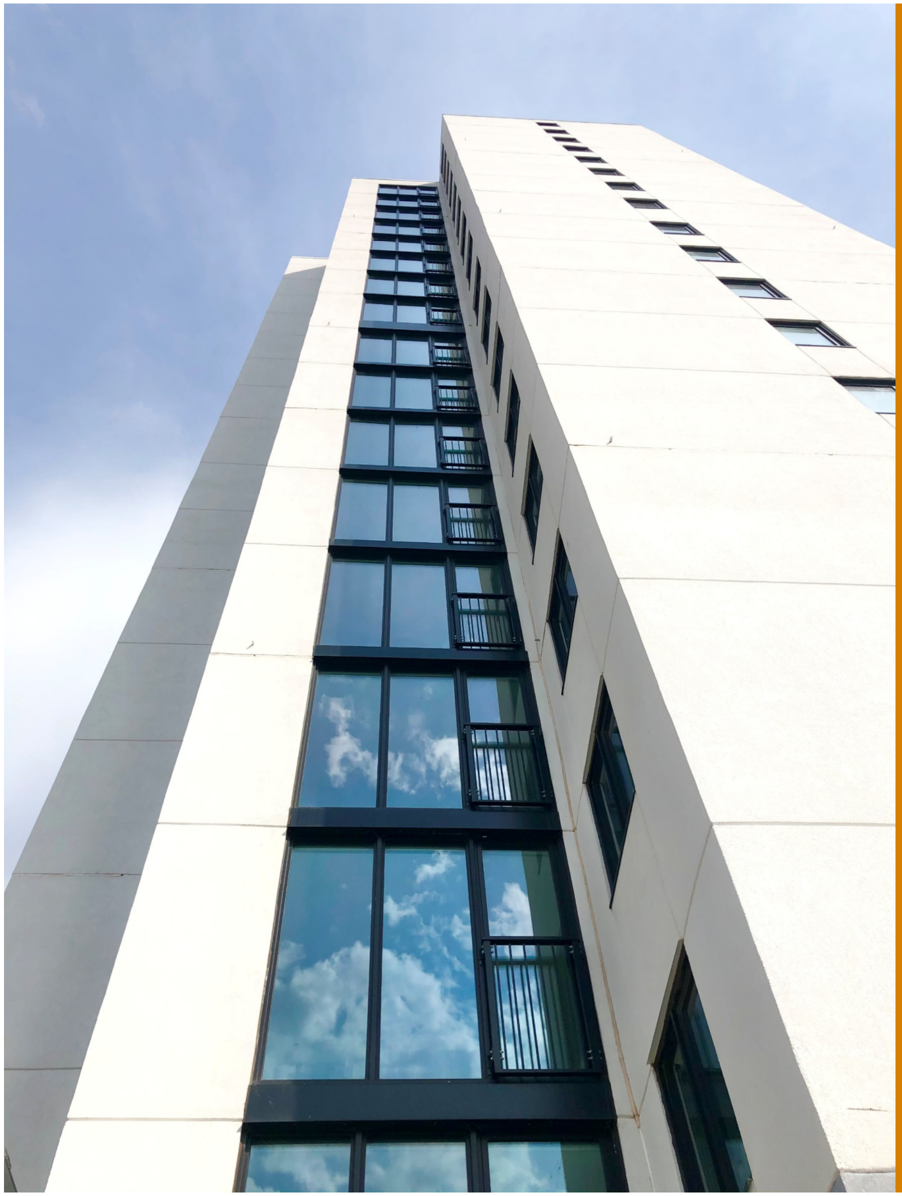
DECARB LUNCH
May 19, 2022

Overheating

- Strategies
- Will the need for cooling accelerate decarbonization?

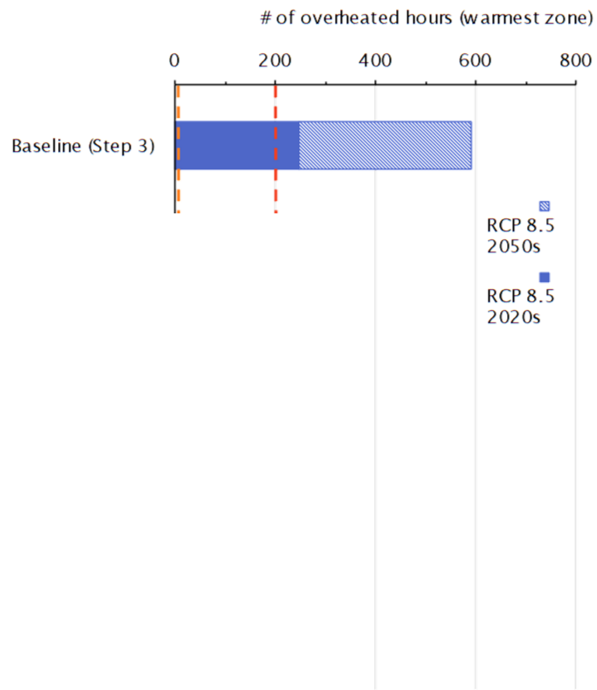
Christy Love, P.Eng., CPHD
Principal, RDH Building Science

RDH



Key Solutions – from UBC Study

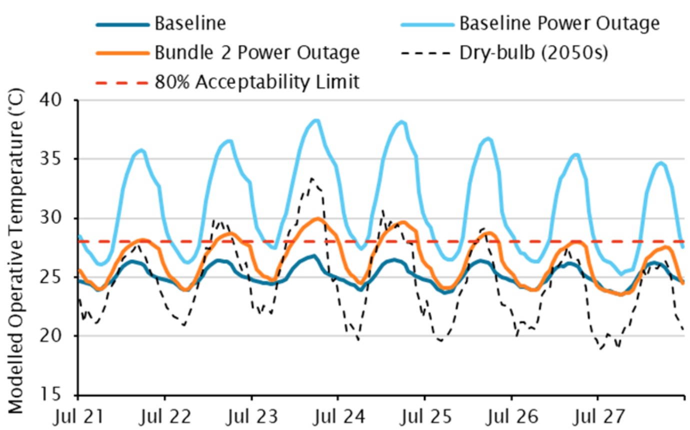
Results : Low Rise New Building



Climate Adaptation and Mitigation Bundles: Overheated hours for New Low Rise **Step-3**

Benefits of Passive Solar Control

→ Power outage (high rise new)



2050s scenario: one bundle was analyzed for the high-rise new building:

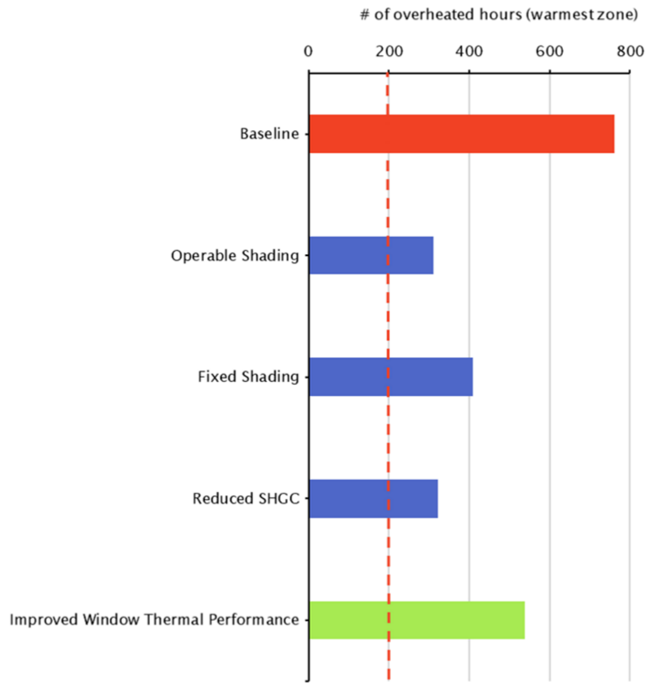
- Bundle 2: operable exterior shading + reduced SHGC

Source: UBC Designing Climate Resilient Buildings Study

New Building Take-aways

- Consider future climate for multifamily buildings to avoid overheating
- Low rise buildings benefit from a combination of passive and active cooling measures
- High rise buildings that are designed with cooling systems can reduce loads and improve resiliency by incorporating passive cooling measures
- Passive systems = increased resiliency

Existing Buildings: Reduce the Need for Cooling



- Source: UBC Designing Climate Resilient Buildings Study

Existing Building Take-aways

- Given the typically poor performance of windows in this building type, any passive measures that reduce direct solar heat gain will lead to a significant reduction of overheated hours.
  - Low SHGC glazing
  - Exterior shading (fixed or operable)
  - Dynamic glazing
  - Plant trees
- Not a great idea to add cooling to a building with high SHGC/poor performing glazing.
  - Add shading and/or upgrade windows to limit excessive cooling energy and peak cooling loads
  - Enclosure thermal performance improvements (where renewals are planned)
- Consider options for simultaneously improving cooling, heating, and ventilation
  - Heat pumps, heat pump HRVs

Design Implications Matrix

- Considers:
  - Overheating
  - Energy & GHG Impacts
  - Capital & Operating Impacts
  - Design Implications
  - Resiliency (Passive Survivability)

General Information		Overheating Mitigation	Climate Change Mitigation	Capital and Operational Impacts			Design Implications			Impacts on Resilience
Measure	Description	Overheating mitigation	Energy impacts	Capital cost considerations	Cost ($)	Maintenance & replacement	Architectural	Mechanical	Electrical	Passive survivability
Exterior shading - operable (automated)	Exterior shades with motors that minimize solar gain based on automated control strategies.	4 - Excellent	May reduce cooling load and potentially the required cooling equipment. Can be modeled according to	Increased cost with motors and controls in automated system. Similar to manually operated exterior	$$+	Periodic cleaning required to maintain the design intent. Maintenance/repairs on moving parts,	Early design integration is recommended. Considerations with automated shading system options include:	Same implications as fixed exterior shading, except that optimization is automated and as such requires	Power for motors and controls. System will need to be integrated	Power outage will render motor-driven blinds inoperable. May need to prioritize failure state (e.g. 'normally closed' in case of power
Dynamic glazing	Electrochromatic coating on windows to adjust SHGC with electrical controls (either manually or automatically)	4 - Excellent	Reduced cooling load and potentially the required cooling equipment. Energy requirement to operate is minimal.	Expensive product compared to conventional glazing. Costs may reduce as the market matures.	$$	Uncertain life-time durability and maintainance requirements given relative newness of product.	Dynamic glazing can appear dark from exterior and blue tinted from interior.	Must consider how the system responds to interior/exterior temperatures, heating or cooling system	Dynamic glazing units require additional electrical panel within unit for controls and	Power outage will controls inoperable (or make part of emergency power system if there is one). May need to prioritize failure state (e.g. 'fully
Full mechanical cooling via radiant distribution	Providing mechanical cooling via radiant system (e.g. ceiling, wall panels) to meet the full design cooling load.	4 - Excellent	Will increase cooling energy consumption over a case with no mechanical cooling.	Will add capital cost over a building with no cooling. If combined with passive measures, the sizing of the cooling system may	$$$	Central equipment and system maintenance (whether chiller or heat pump); adds complexity to building systems	The distribution of the system to be considered through the design; e.g. if the radiant system is in the ceiling, it	Radiant cooling, with thermal mass based systems such as radiant floors/ceilings, is not as responsive	Electrical requirements for central equipment and controls.	Non-functional during power outage unless on emergency power/generator
Full mechanical cooling via air distribution	Providing mechanical cooling via air delivery systems (e.g. mini-split heat pumps, or centralized air handling or heat pump units with fan driven terminal units)	4 - Excellent	Will increase cooling energy consumption over a case with no mechanical cooling.	Will add capital cost over a building with no cooling. If combined with passive measures, the sizing of the cooling system may	$$$	Central equipment and system maintenance in the case of centralized system; adds complexity to building systems	Location of terminal units wihtin the space to be coordianted with disciplines. Terminal units	Air cooling is typically how space cooling is provided, as the cooling coil can control both space air	Electrical requirements for equipment and controls.	Non-functional during power outage unless on emergency power/generator
Passive fixed exterior shading is bundled with full mechanical cooling.	Fixed exterior shading is bundled with full mechanical cooling, such as through a radiant system or a air delivery system. This reflects the realistic scenario of	4 - Excellent	Less energy consumption than full mechanical cooling without passive measures.	Reducing cooling demand via passive measures can enable downsizing of mechanical cooling equipment, resulting in	$$$	(see full mechanical cooling & passive solar shading row items)	(see fixed shading row)	exterior shading helps to offset the cooling load of the mechanical equipment and reduce the cooling energy	(see full mechanical cooling row)	The addition of passive demand reduction (solar shading) to mechanical cooling helps the passive survivability of having

Future Climate Design for Multi-Family Buildings Study:
https://planning.ubc.ca/sites/default/files/2021-11/R-21007_001%202021%2009%2027%20UBC%20Climate%20Resilience%20Final%20Report_ISSUED.pdf

General Information		Overheating Mitigation	Climate Change Mitigation	Capital and Operational Impacts			Design Implications			Impacts on Resilience
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Exterior shading - operable (automated)	Exterior shades with motors that minimize solar gain based on automated control strategies.	4 - Excellent	May reduce cooling load and potentially the required cooling equipment. Can be modeled according to operating strategy	Increased cost with motors and controls in automated system. Similar to manually operated exterior shades, local	$$+	Periodic cleaning required to maintain the design intent. Maintenance/repairs on moving parts, including motors	Early design integration is recommended. Considerations with automated shading system options include: material	Same implications as fixed exterior shading, except that optimization is automated and as such requires implementation as	Power for motors and controls. System will need to be integrated within overall	Power outage will render motor-driven blinds inoperable. May need to prioritize failure state (e.g. 'normally closed' in case of power disruption in
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Full mechanical cooling via radiant distribution	Providing mechanical cooling via radiant system (e.g. ceiling, wall panels) to meet the full design cooling load.	4 - Excellent	Will increase cooling energy consumption over a case with no mechanical cooling.	Will add capital cost over a building with no cooling. If combined with passive measures, the sizing of the cooling system may be reduced	$$$	Central equipment and system maintenance (whether chiller or heat pump); adds complexity to building systems and controls	The distribution of the system to be considered through the design; e.g. if the radiant system is in the ceiling, it will need to be	Radiant cooling, with thermal mass based systems such as radiant floors/ceilings, is not as responsive as air cooling	Electrical requirements for central equipment and controls.	Non-functional during power outage unless on emergency power/generator
Full mechanical cooling via air distribution	Providing mechanical cooling via air delivery systems (e.g. mini-split heat pumps, or centralized air handling or heat pump units with fan driven terminal units) to meet the full design	4 - Excellent	Will increase cooling energy consumption over a case with no mechanical cooling.	Will add capital cost over a building with no cooling. If combined with passive measures, the sizing of the cooling system may be reduced	$$$	Central equipment and system maintenance in the case of centralized system; adds complexity to building systems and controls	Location of terminal units wihtin the space to be coordianted with disciplines. Terminal units require physical	Air cooling is typically how space cooling is provided, as the cooling coil can control both space air temperature and	Electrical requirements for equipment and controls.	Non-functional during power outage unless on emergency power/generator
Passive fixed exterior shading is bundled with full mechanical cooling.	Fixed exterior shading is bundled with full mechanical cooling, such as through a radiant system or a air delivery system. This reflects the realistic scenario of several measures being	4 - Excellent	Less energy consumption than full mechanical cooling without passive measures.	Reducing cooling demand via passive measures can enable downsizing of mechanical cooling equipment, resulting in potential cost	$$$	(see full mechanical cooling & passive solar shading row items)	(see fixed shading row)	exterior shading helps to offset the cooling load of the mechanical equipment and reduce the cooling energy impact	(see full mechanical cooling row)	The addition of passive demand reduction (solar shading) to mechanical cooling helps the passive survivability of having full mechanical

General Information		Overheating Mitigation	Climate Change Mitigation	Capital and Operational Impacts			Design Implications			Impacts on Resilience
Measure	Description	Overheating mitigation	Energy impacts	Capital cost considerations	Cost ($)	Maintenance & replacement	Architectural	Mechanical	Electrical	Passive survivability
Exterior shading - operable (automated)	Exterior shades with motors that minimize solar gain based on automated control strategies.	4 - Excellent	May reduce cooling load and potentially the required cooling equipment. Can be modeled according to	Increased cost with motors and controls in automated system. Similar to manually operated exterior	$$+	Periodic cleaning required to maintain the design intent. Maintenance/repairs on moving parts,	Early design integration is recommended. Considerations with automated shading system options include:	Same implications as fixed exterior shading, except that optimization is automated and as such requires	Power for motors and controls. System will need to be integrated	Power outage will render motor-driven blinds inoperable. May need to prioritize failure state (e.g. 'normally closed' in case of power
Dynamic glazing	Electrochromatic coating on windows to adjust SHGC with electrical controls (either manually or automatically)	4 - Excellent	Reduced cooling load and potentially the required cooling equipment. Energy requirement to operate is minimal.	Expensive product compared to conventional glazing. Costs may reduce as the market matures.	$$	Uncertain life-time durability and maintainance requirements given relative newness of product.	Dynamic glazing can appear dark from exterior and blue tinted from interior.	Must consider how the system responds to interior/exterior temperatures, heating or cooling system	Dynamic glazing units require additional electrical panel within unit for controls and	Power outage will controls inoperable (or make part of emergency power system if there is one). May need to prioritize failure state (e.g. 'fully
Full mechanical cooling via radiant distribution	Providing mechanical cooling via radiant system (e.g. ceiling, wall panels) to meet the full design cooling load.	4 - Excellent	Will increase cooling energy consumption over a case with no mechanical cooling.	Will add capital cost over a building with no cooling. If combined with passive measures, the sizing of the cooling system may	$$$	Central equipment and system maintenance (whether chiller or heat pump); adds complexity to building systems	The distribution of the system to be considered through the design; e.g. if the radiant system is in the ceiling, it	Radiant cooling, with thermal mass based systems such as radiant floors/ceilings, is not as responsive	Electrical requirements for central equipment and controls.	Non-functional during power outage unless on emergency power/generator
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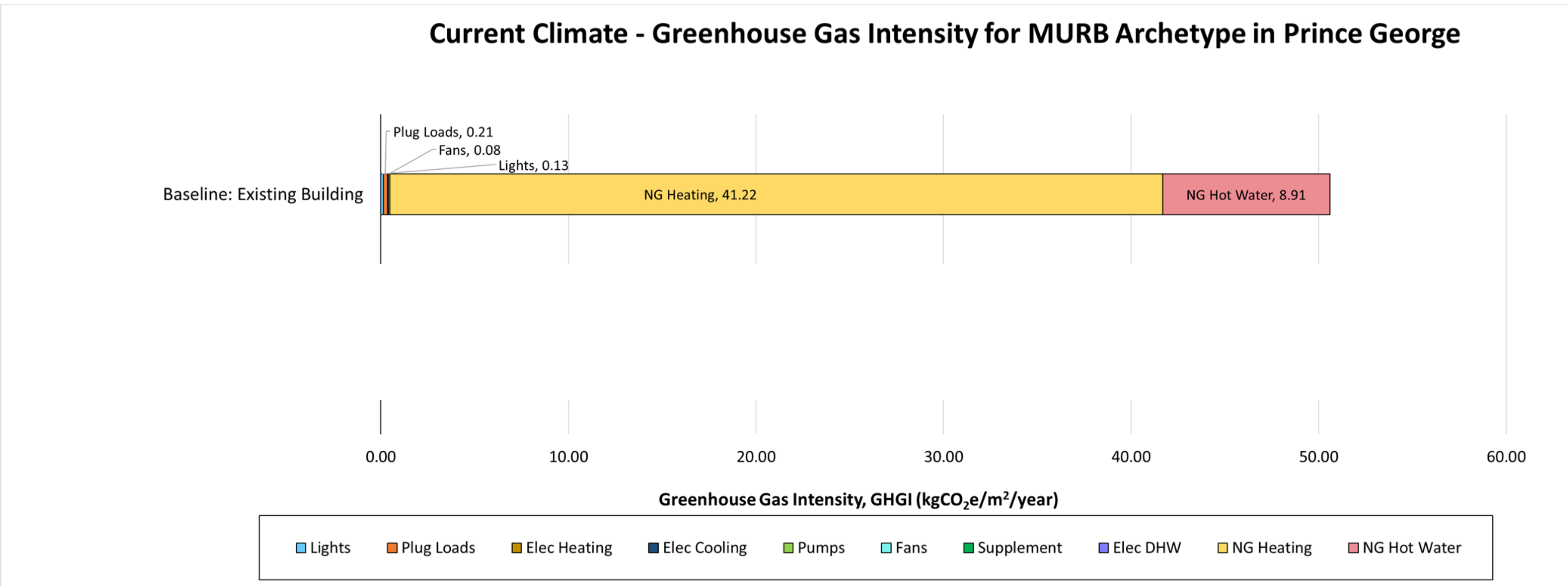
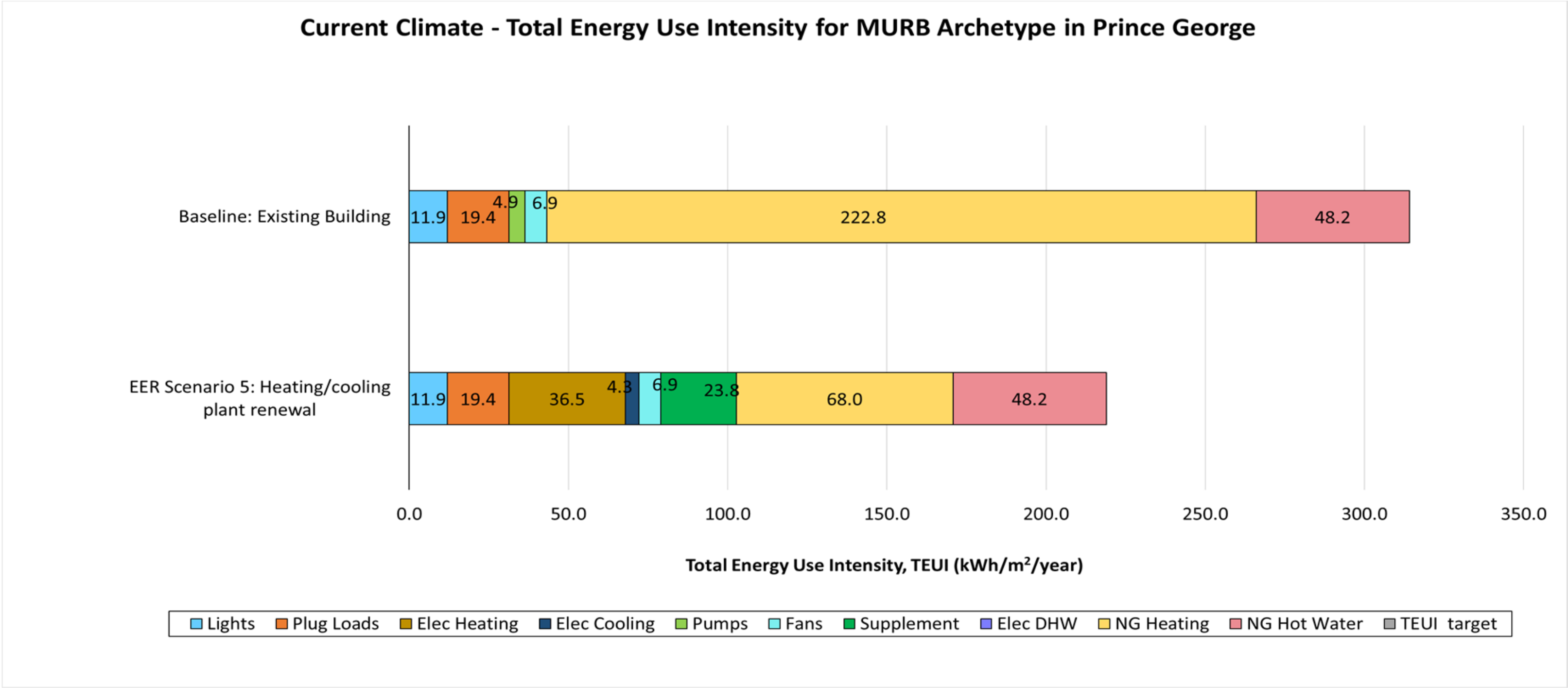
Can we just add heat pumps?

Can we just add heat pumps?
GHGI – great!

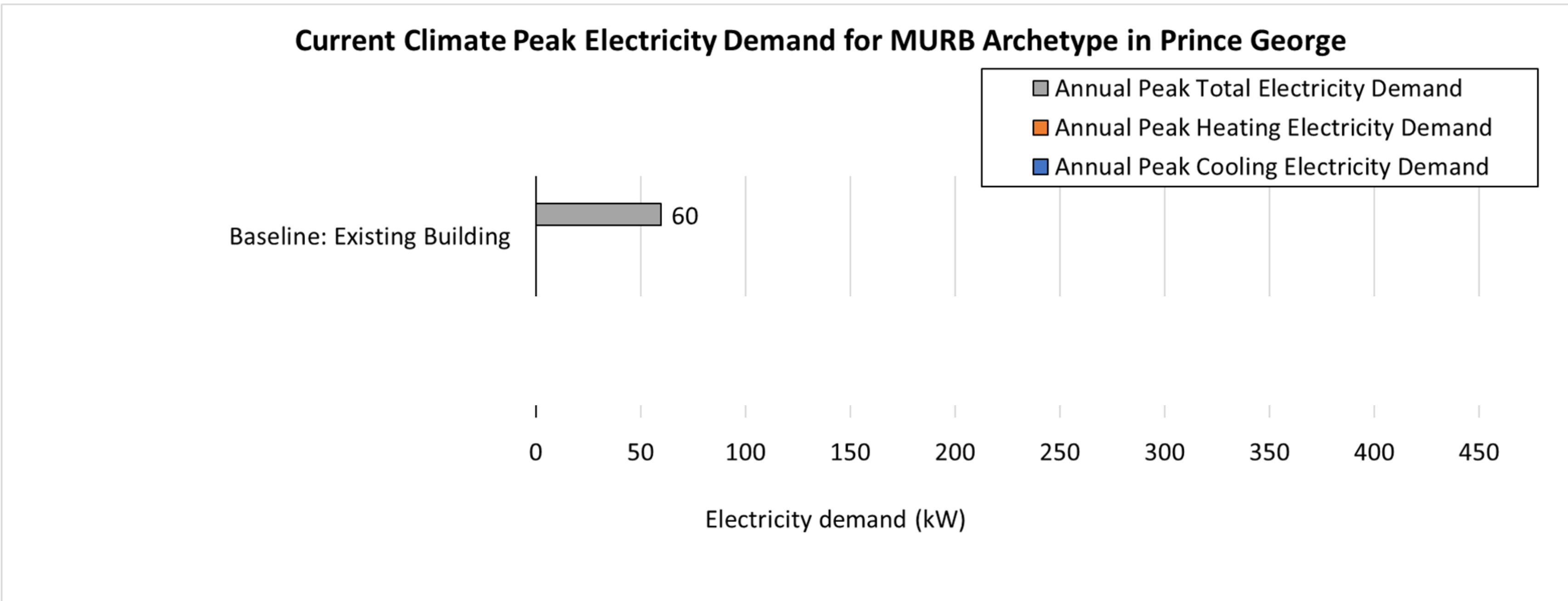


Can we just add heat pumps?
TEUI – pretty good!

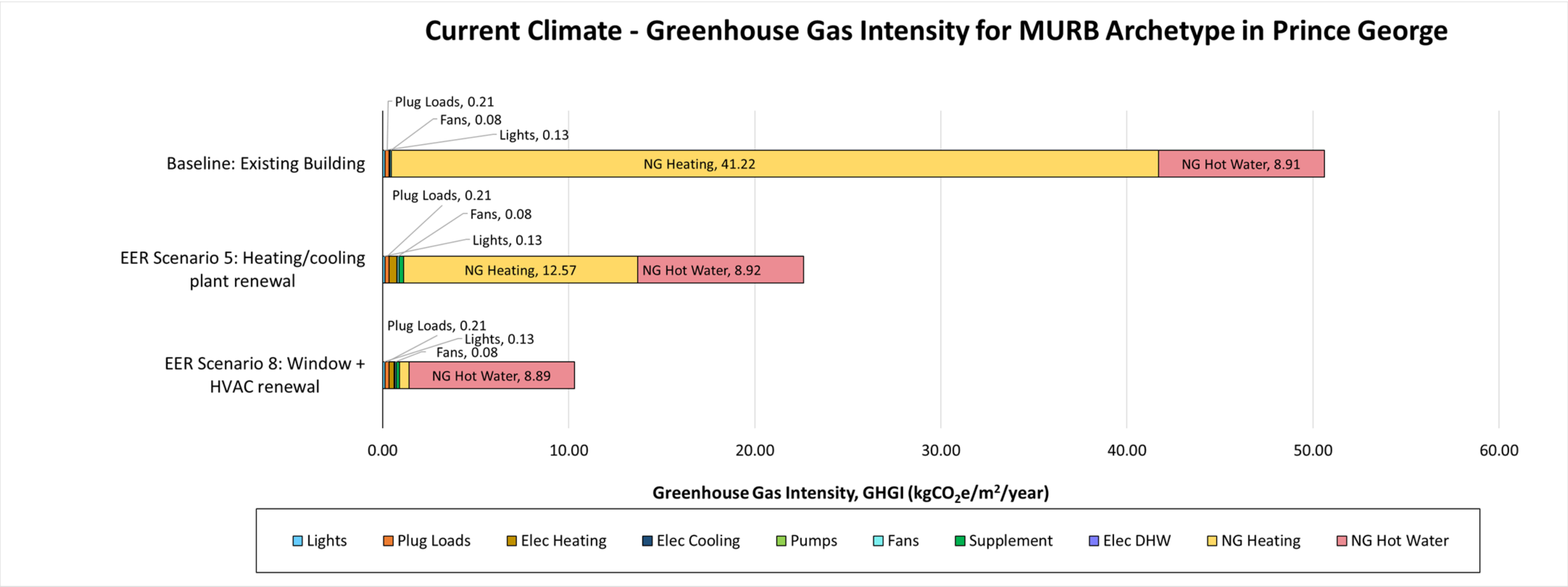


RDH

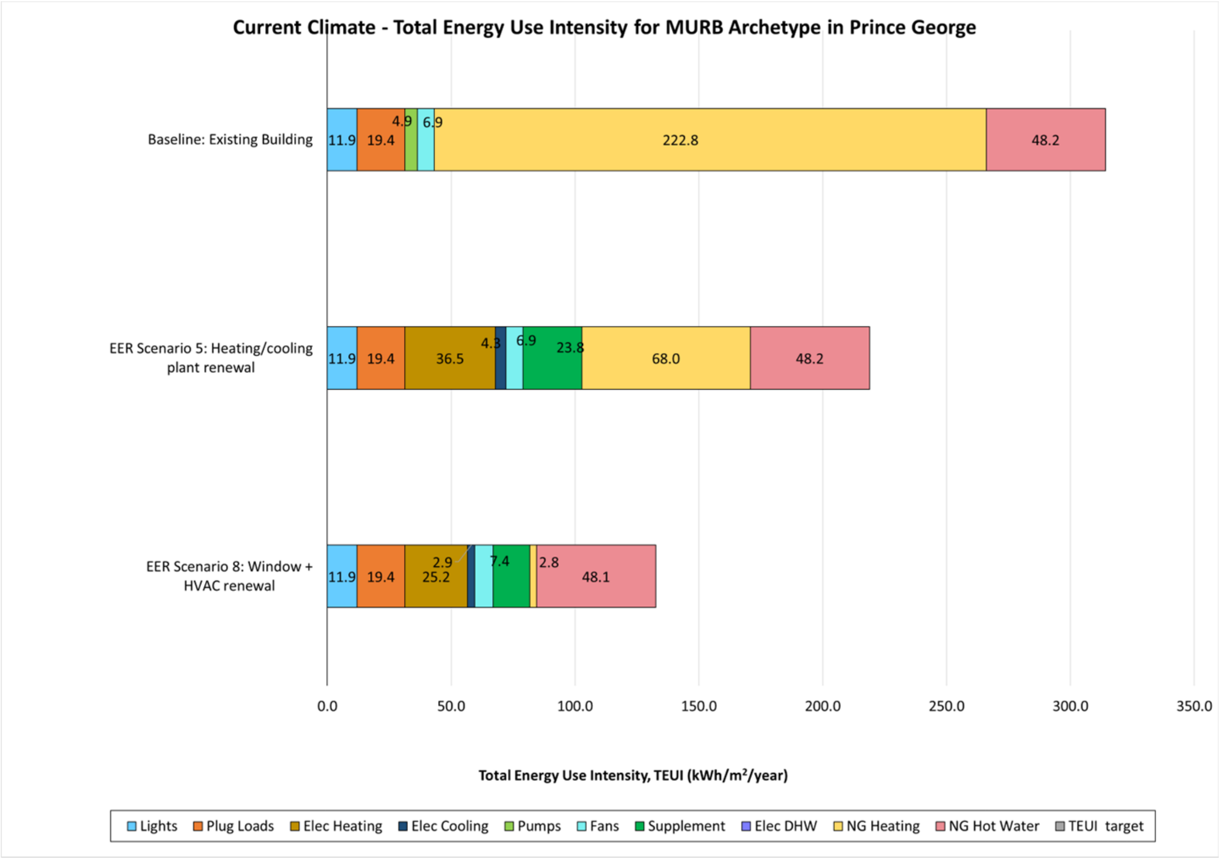
Can we just add heat pumps?
Peak loads – not good…



What about heat pumps and better windows? GHGI – even better!



What about heat pumps and better windows? TEUI – even better!



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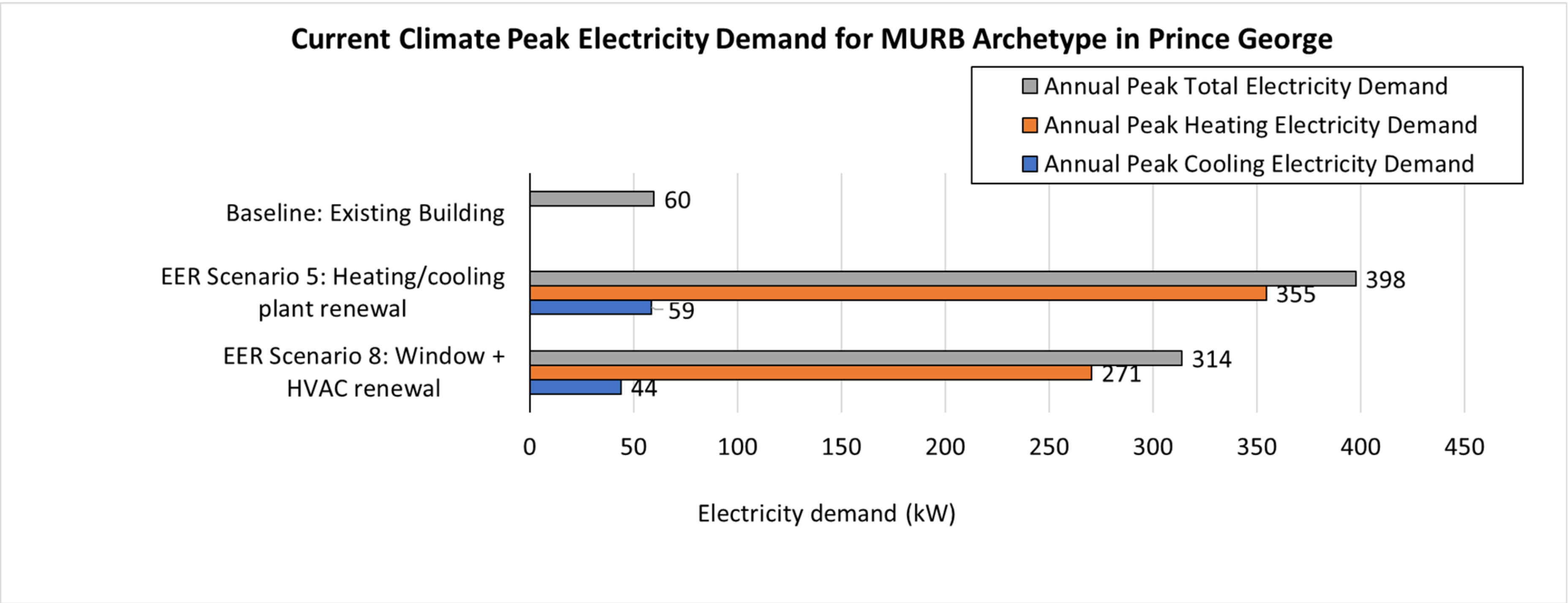
What about heat pumps and better windows? Peak demand – better…



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TAKEAWAYS: Addressing Overheating

Design + Policy

- High eff heat pumps = good as a standalone solution if you are also offsetting less efficient heating
- Look for opportunities to incorporate passive solar management and demand reduction
- Considering future climate in today's designs (the future is now)
- CEDI coming soon to a policy near you?
- Must consider multiple objectives

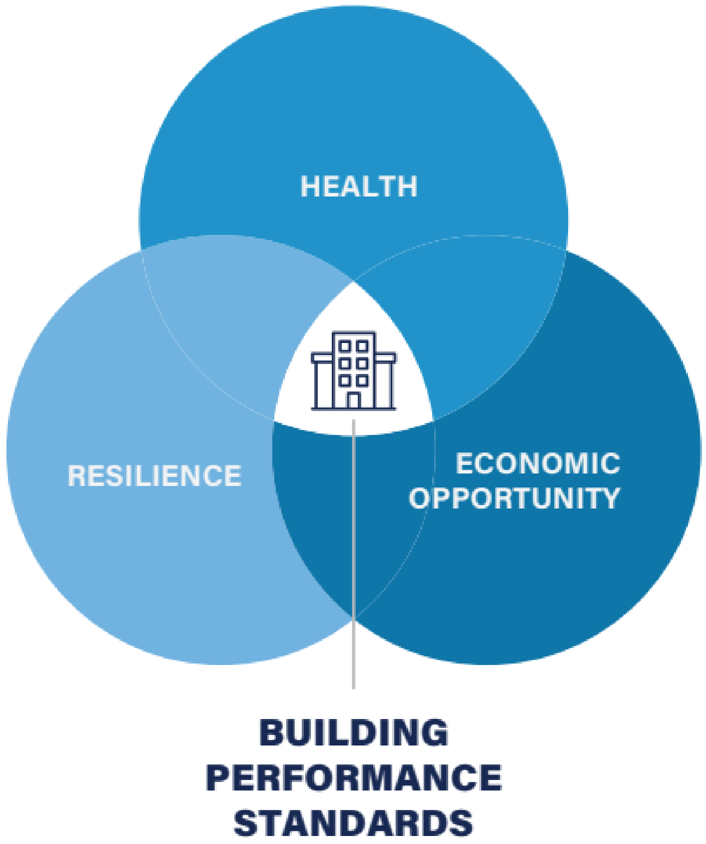

Image: IMT

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UBC NEW CONSTRUCTION POLICY

Requirements for Residential Buildings

Mandatory – 2050 Climate Ready Thermal Comfort Modelling

The building design should meet thermal comfort requirements for 2020s and have a design strategy to meet 2050 requirements. Passively cooled buildings must meet City of Vancouver Energy Modelling Guideline requirements for passively cooled buildings using 2020s weather files and have design strategies for meeting these requirements using 2050 weather files.

Optional – 2050 Climate Ready Energy Efficient Design

Using 2050 RCP 8.5 weather files, achieve a reduction in Cooling Energy Demand Intensity (CEDI) over a base case 2050 ready design that meets REAP E&E and CA preconditions, with passive design measures. (Credits received for 5%, 10% or 15% reduction)

Technical Guidelines for Institutional Buildings

2.3 Design Criteria of Passively Cooled Spaces
Thermal comfort modeling shall be conducted using the 2050s weather file for YVR obtained from the PCIC website (https://www.pacificclimate.org/data/weather-files). Models shall simulate indoor thermal conditions for the months of May to September inclusive.

2.4 Design Criteria of Mechanically Cooled Spaces
Active cooling systems, where required, shall be sized to prevent overheating (see section 2.2 for thermal comfort criteria) based on 31C DB / 23C WB (the expected 2.5% summer design condition in the 2050s climate) and an indoor temperature of 25° C.

Discussion + Questions

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