Partners in Project Green

A Program of Toronto and Region Conservation Authority

Energy Leaders Consortium

Site Visit to TRCA's new Head Office

November 7th, 2023

We respectfully acknowledge that we are situated on the Traditional Territories and Treaty Lands, in particular those of the Mississaugas of the Credit First Nation, as well as the Anishinaabe of the Williams Treaty First Nations, the Huron Wendat, the Haudenosaunee, and the Metis Nation.

As stewards of land and water resources within the Greater Toronto Region, Toronto and Region Conservation Authority appreciates and respects the history and diversity of the land and is grateful to have the opportunity to work and meet on this territory.

Additional Resources

- yrnature.ca/acknowledging_land
- edgeofthebush.ca
- native-land.ca
- Text 1-855-917-5263 with your City and Province to learn whose traditional territory you're on
(standard text messaging rates may apply)

A Collaborative Space for All

Proposed Operative Values for ELC meetings:

1. Balance airtime to hear from as many voices as possible
2. Be curious and challenge our own assumptions and biases
3. Be open to building on each other's suggestions or taking the conversation in another direction

Agenda

Time	Activity
8:30am – 9:00am	Arrival and Networking
9:00am – 9:10am	Welcoming Remarks, Introduction, & Updates from PPG
9:10am – 9:35am	Presentation 1 (ZAS Architects)
9:35am – 9:45am	Q&A Presentation 1
9:45am – 10:25am	Presentations 2 (CaBGC) and Presentation 3 (Region of Peel)
10:25am – 10:35am	Q&A Presentations 1 and 2
10:35am – 10:45am	Break and Depart for Tour (walk to building)
10:45am – 12:00pm	TRCA Head Office Tour (live construction site)
12:00pm – 12:15pm	Closing Remarks from PPG/Return from tour (walk from building)
12:15pm – 12:30pm	Networking and session end

Introduction

Upcoming ELC Sessions & PPG Events

Date	Topic
Wed, Nov 22nd 7:30am-10:00am	**GreenBiz Caledon Climate Partnership** - Workshop 1 Identifying GHG Reduction Opportunities at Your Facility (for businesses with facilities located in the municipality of Caledon)
Tues, Nov 28th 8:00am-11:30am	**Mississauga Climate Leaders Program** - Workshop 1: Identifying GHG Reduction Opportunities (for businesses with facilities located in the municipality of Mississauga)
Thurs, Dec 7th 1:00pm-2:30pm	**Roundtable Discussion and year-end reporting**

Please contact Julia Kole if you are interested in hosting an ELC Site Visits, presenting at a Member Roundtable, or have suggestions for future learning sessions.

Updates and Reminders

- **ELC Member Reporting for 2023**
  - 2023 savings for electricity, natural gas, and water projects/ upgrades
  - Tracking helps us celebrate our impact as a consortium of energy leaders!
  - Complete and return spreadsheet by Dec 31, 2023*

Example of tracking form:

Energy Conservation Measure Description	Utility	Annual Consumption Savings		Monetary Savings ($)
			kWh	
			m3	
			L	
			kW	

*If more time needed to collect information, please let Matt know as soon as possible.

Today's Speakers

Marek Zawadzaki, Owner & Principal Architect, ZAS Architects + Interiors

Marek has been practicing architecture since 1975 and co-founded the firm in 1984. Since then, he has managed many exceptional projects that have contributed to the firm's growing expertise. The firm continues to consistently deliver high quality projects of varied scales with an unwavering commitment to respecting client input and design excellence, as well as exceeding schedule and budget expectations.

Andrzej Gortat, Principal, ZAS Architects + Interiors

Andrzej (Andrew) is a Principal with ZAS Architects and helps lead the design and management facets of the Toronto studio's operations. He joined the firm in 1996 after interning at several notable design practices and turned his attention to working on community based cultural and educational projects in the Greater Toronto Area. Andrew leads the ZAS team supporting TRCA Headquarters project.

Today’s Speakers

Michael Sugar, Director of Zero Carbon Building, CaGBC
Michael is charting the course to decarbonizing Canada’s building sector. By ensuring the Zero Carbon Building Standard remains progressive and accessible, Michael supports CAGBC, its members, and customer project teams to advance decarbonization strategies across the value chain of green buildings. The role is pivotal to laying the foundation for new and existing large buildings across the country towards their net zero targets.

Today’s Speakers

Alex Bogun, Advisor – Climate Change & Energy Management, Region of Peel

Alex is a professional engineer with 15+ years of experience in sustainability and energy management fields. He has climate change advisory, energy management, and building systems commissioning experience in public and private sectors. He has experience and knowledge in sustainability actions planning, implementation of climate change mitigation projects, and energy management areas.

Adam Vaiya, Advisor, Office of Climate Change and Energy Management, Region of Peel

For the past 6 years, Adam has helped develop the decarbonization strategy within the Region's Corporate Climate Change Master Plan. He is currently guiding the Region's approach to fleet electrification and required charging infrastructure for their emergency services, public works and accessible bus vehicles, and advising on several new zero-carbon construction projects.

ZAS Architects + Interiors

Toronto & Region Conservation Authority
New Administrative Headquarters

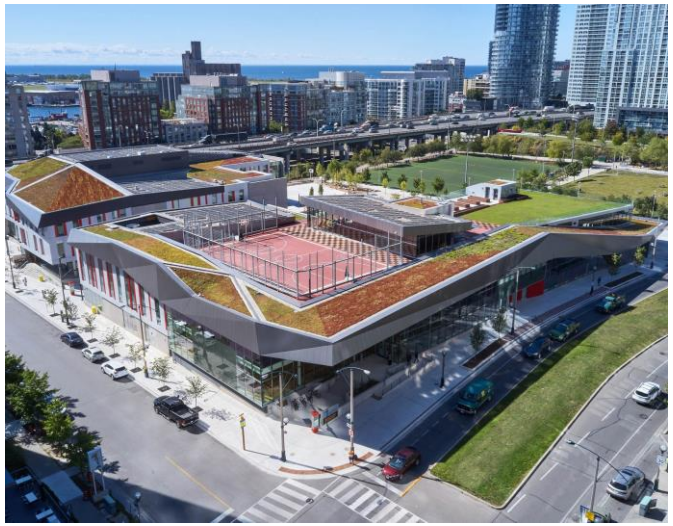
A Plant-Based Building for Human Habitat | Toronto, Ontario

ZAS ARCHITECTS + INTERIORS

bucholzmcevoy ARCHITECTS

ZAS
ARCHITECTS + INTERIORS

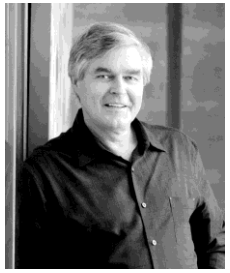
Established in 1984, ZAS Architects Inc. is a multidisciplinary design team of architects, interior designers, technologists, and environmental specialists. Our team brings the talents of an internationally recognized and reputable design firm, and an impressive record of successful achievement in the design and completion of facilities around the world. Our work is notable for solving complex programmatic and operational challenges, with designs that are innovative, technical, user - friendly and enduring. Our work spans from large multi-use facilities, university and college buildings, libraries and community centres to corporate and residential campuses, transportation facilities and planning projects.



Canoe Landing Community Campus & Schools

Bergeron Centre School of Engineering, York University

River City



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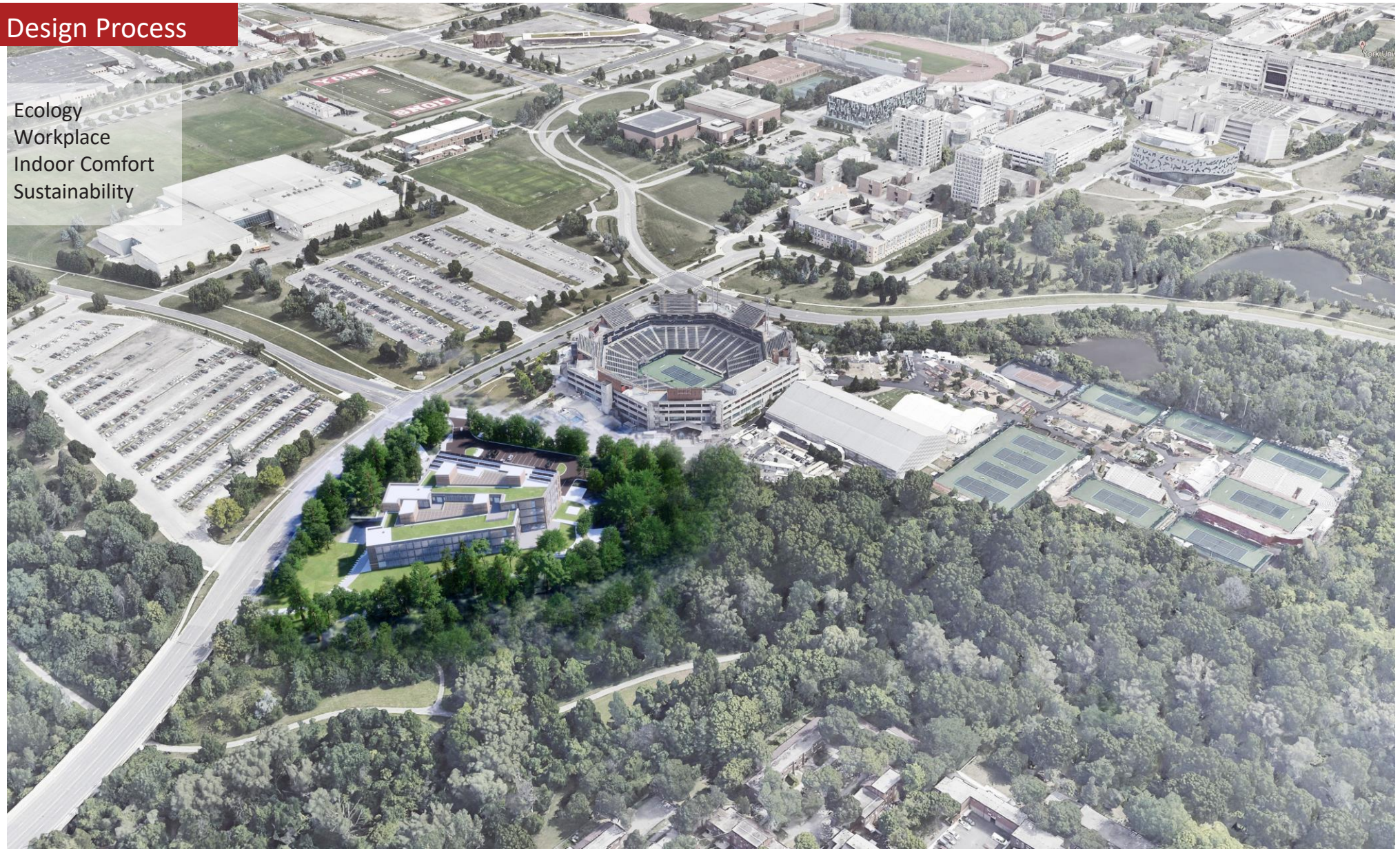
Andrzej (Andrew) Gortat is a Principal with ZAS Architects and helps lead the design and management facets of the Toronto studio's operations. He joined the firm in 1996 after interning at several notable design practices and turned his attention to working on community based cultural and educational projects in the Greater Toronto Area. Andrew leads the ZAS team supporting TRCA Headquarters project.

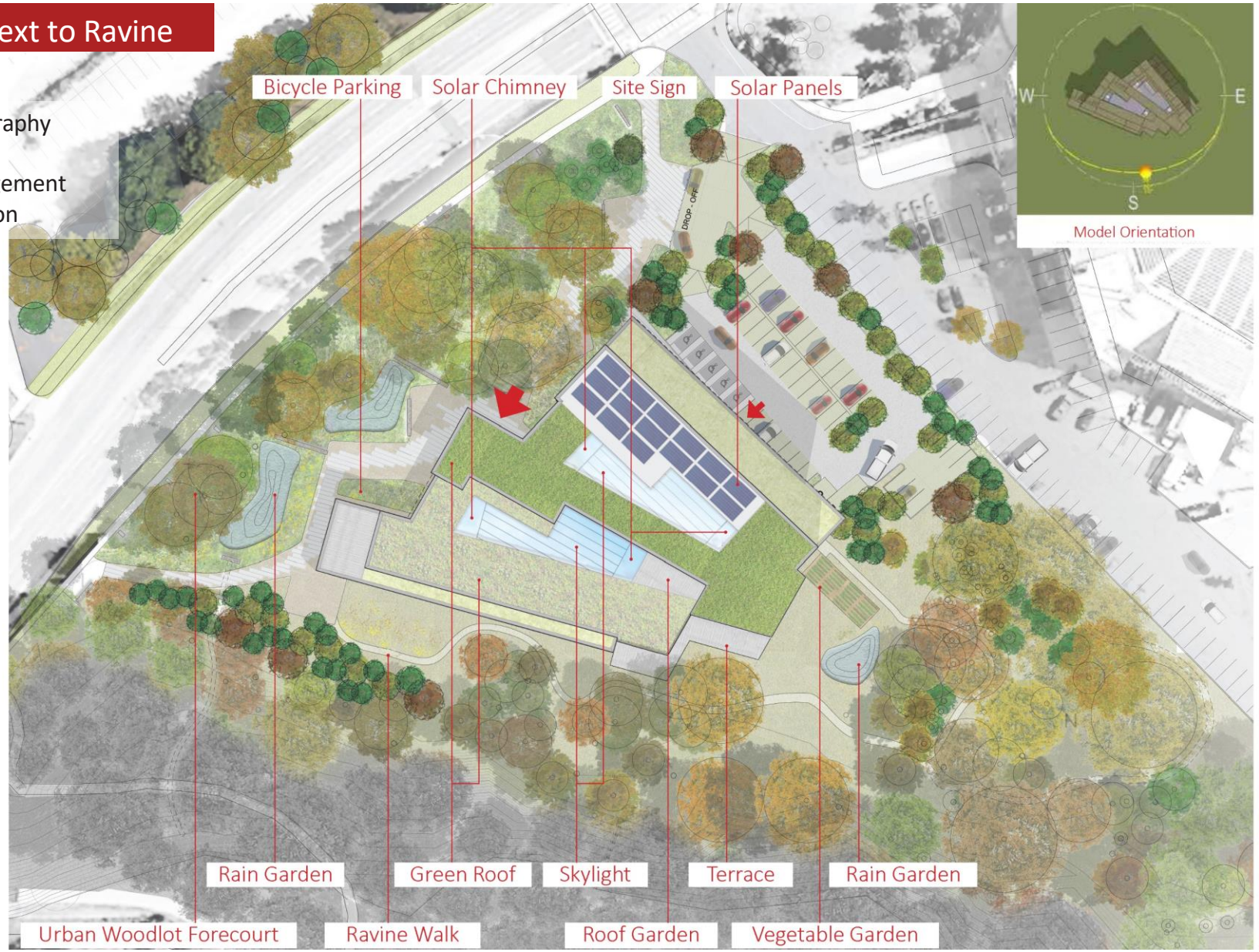
Design Process

Ecology
Workplace
Indoor Comfort
Sustainability



Ecology - Building Next to Ravine

Integrating Building / Topography
Trees / Ecological Systems
Water / Storm Water Management
Natural Heritage Conservation



Workplace - Great Place to Work and Visit

Supporting TRCA Work Culture and Flows
Collaborative Work Environment Fulfilling Programmatic Requirements Showcase of Examplary Development

View of Atrium from Ground Floor Lobby

Ground Floor

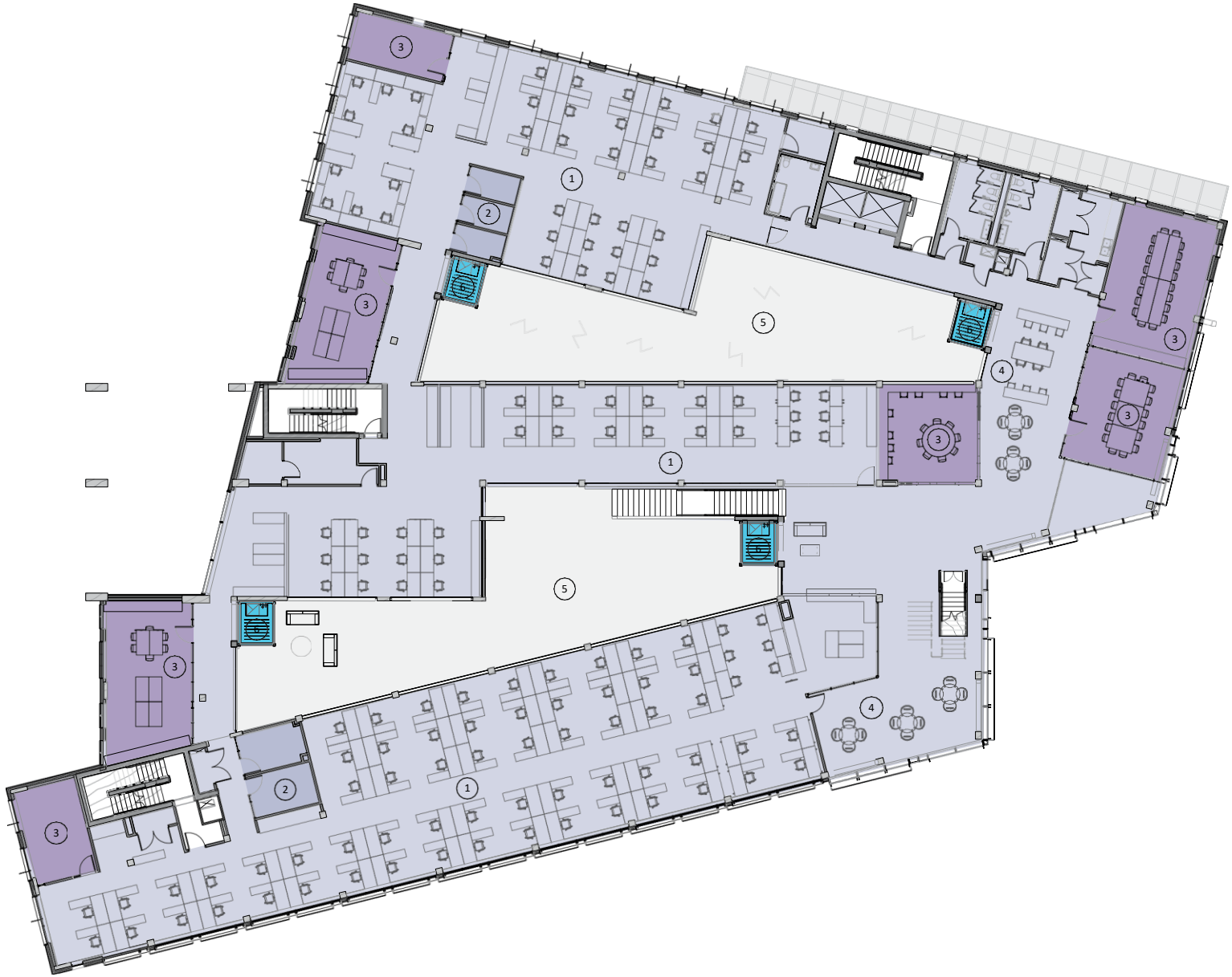
Legend

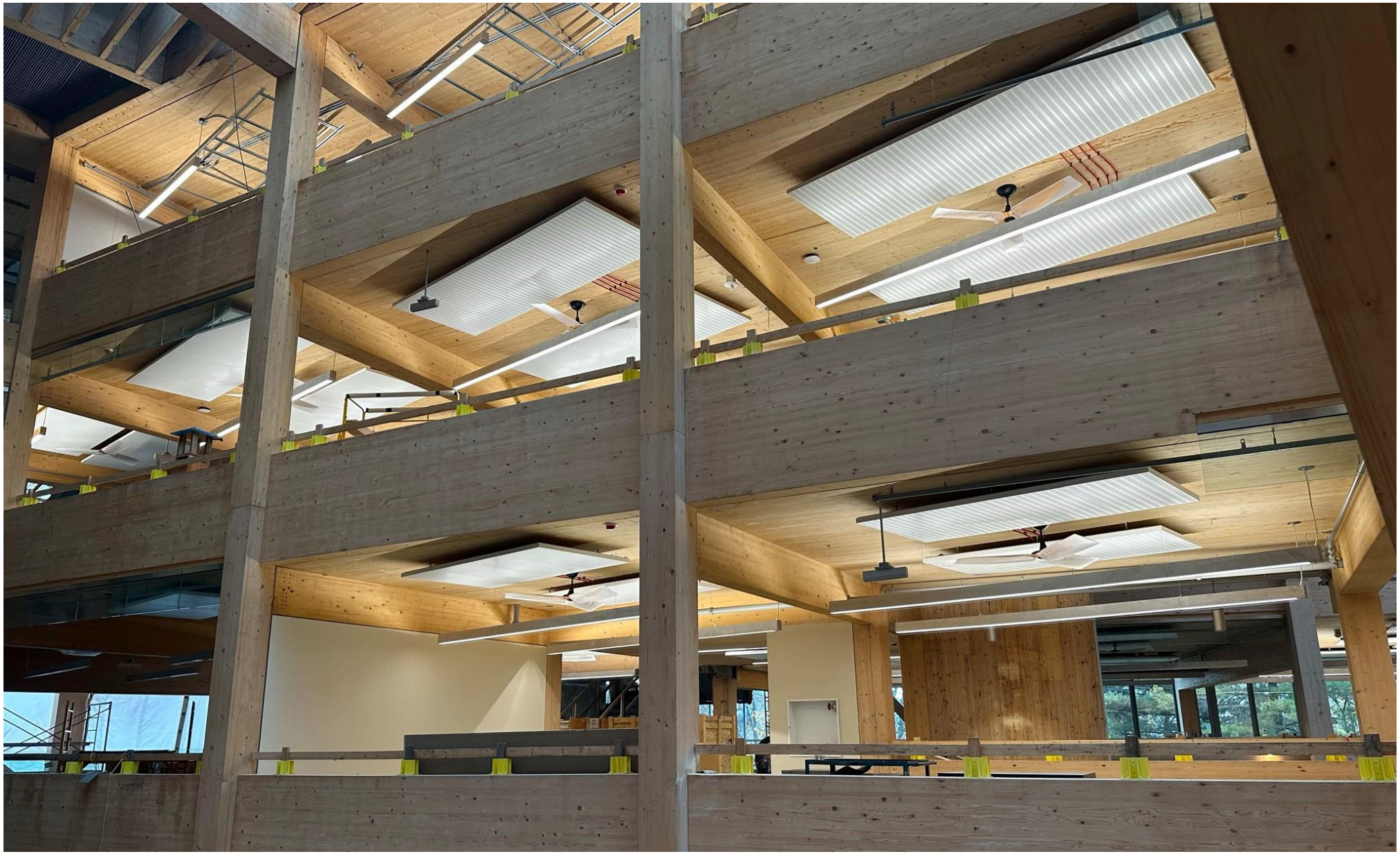
1. Main Entrance
2. Reception
3. Workspaces
4. Meeting Rooms
5. Community Meeting Space
6. Exhibition Space
7. Waiting Area
8. Staff Offices
9. Cafeteria
10. Kitchen
11. Terrace
12. Water Wall

Second Floor

Legend

1. Workspaces
2. Quiet Rooms
3. Meeting Rooms
4. Flexible Workspace
5. Open to Below
6. Water Wall

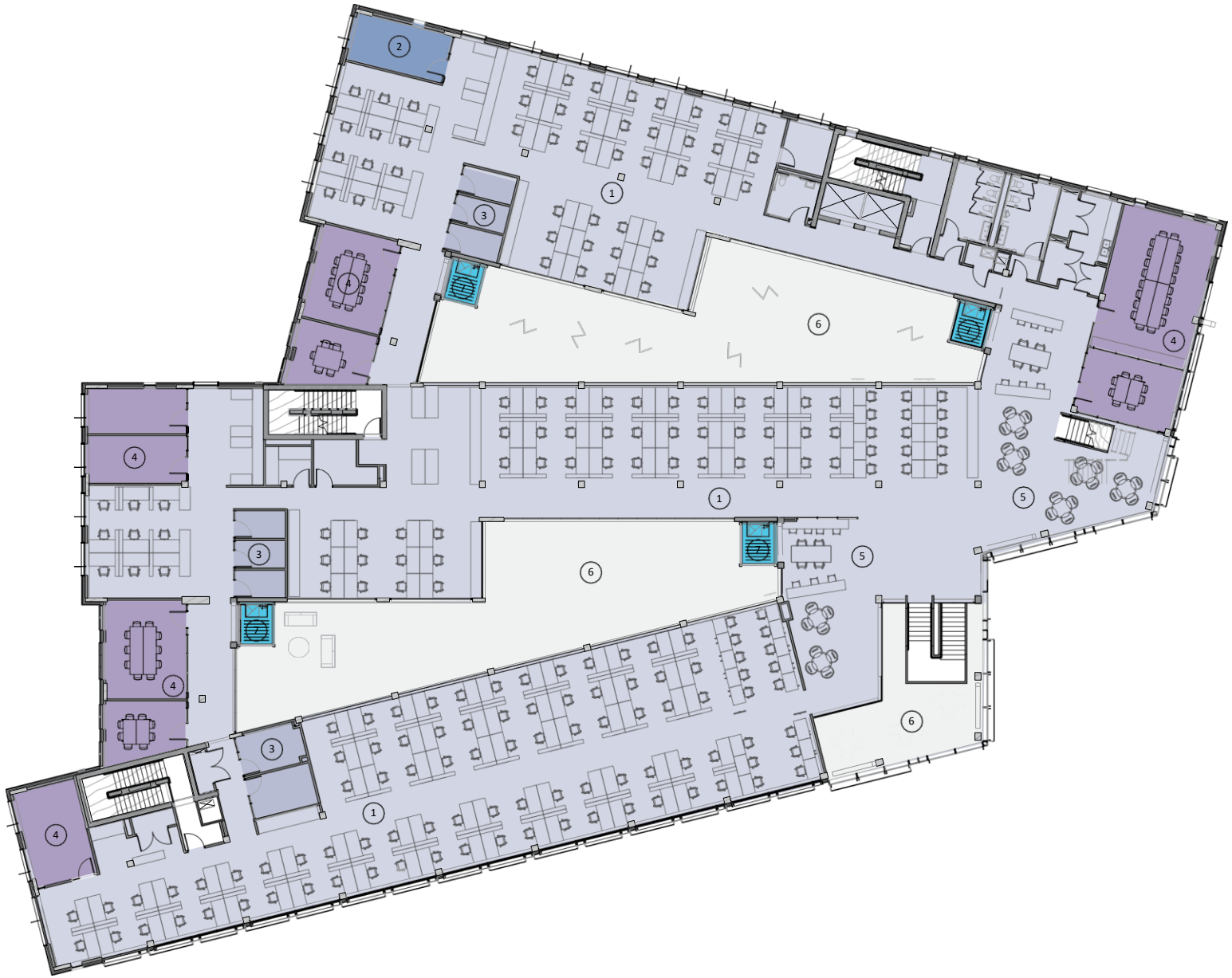




Third Floor

Legend

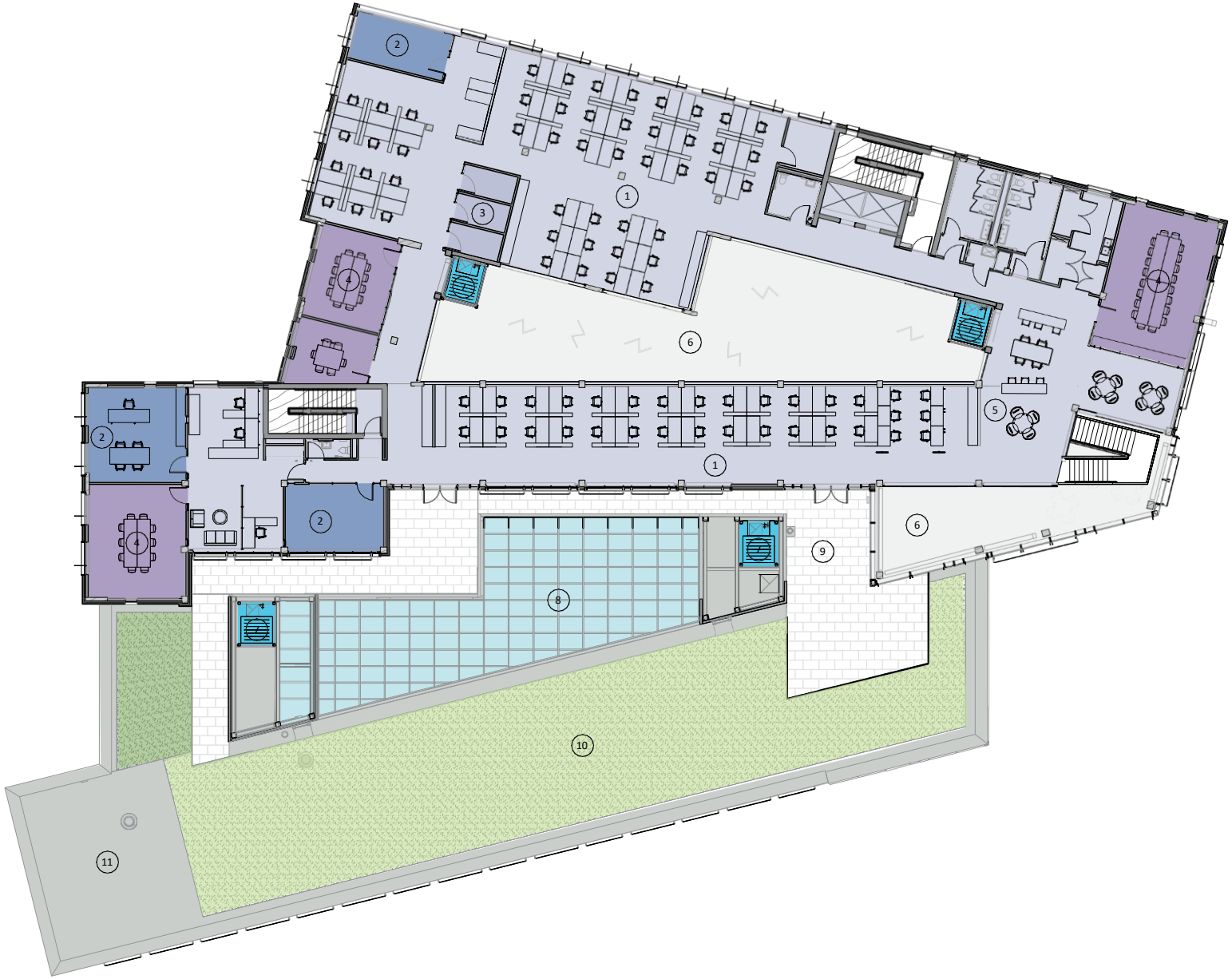
1. Workspaces
2. Staff Offices
3. Quiet Rooms
4. Meeting Rooms
5. Flexible Workspace
6. Open to Below
7. Water Wall

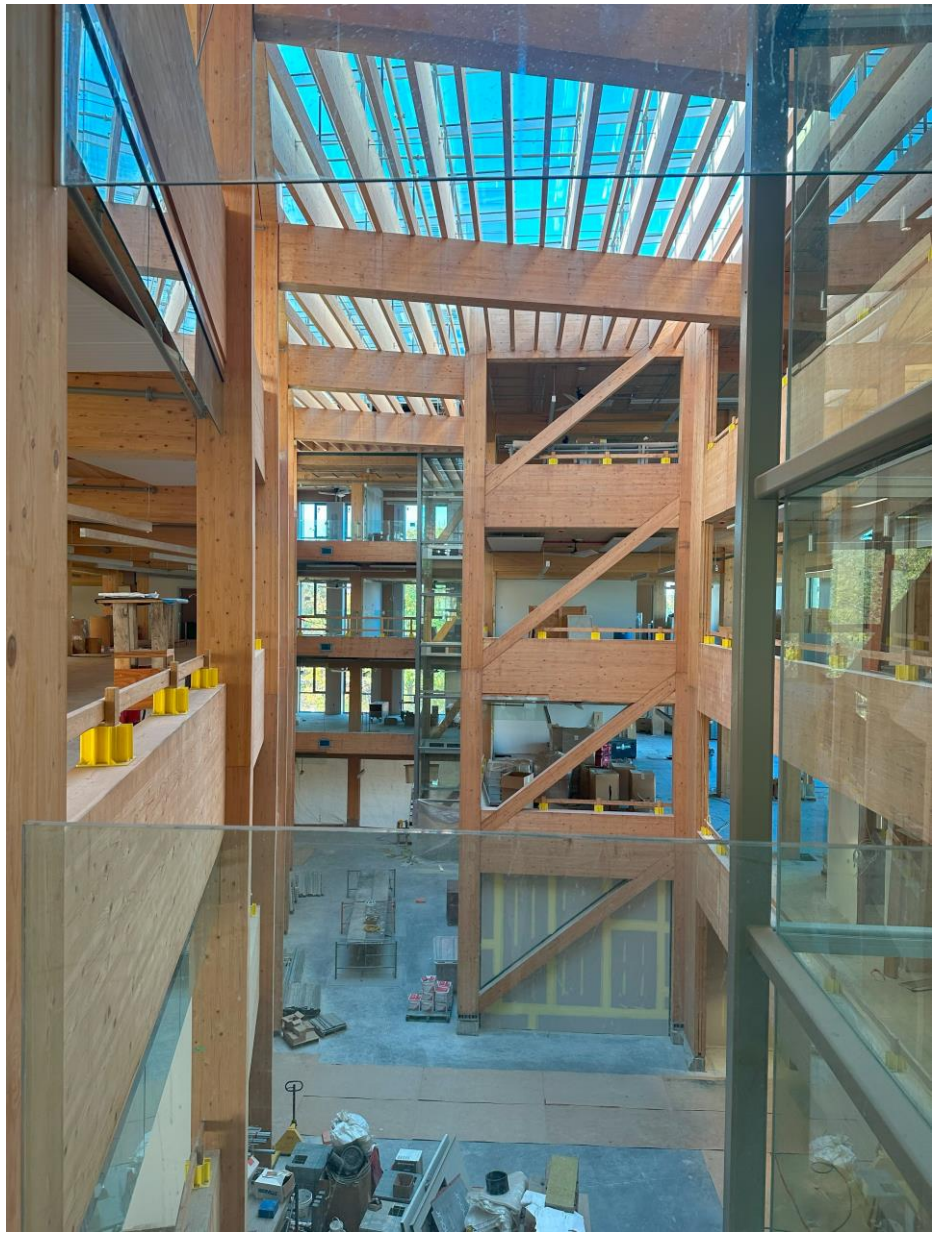


Fourth Floor

Legend

1. Workspaces
2. Staff Offices
3. Quiet Rooms
4. Meeting Rooms
5. Flexible Workspace
6. Open to Below
7. Water Wall
8. Skylight
9. Roof Terrace
10. Green Roof
11. Roof



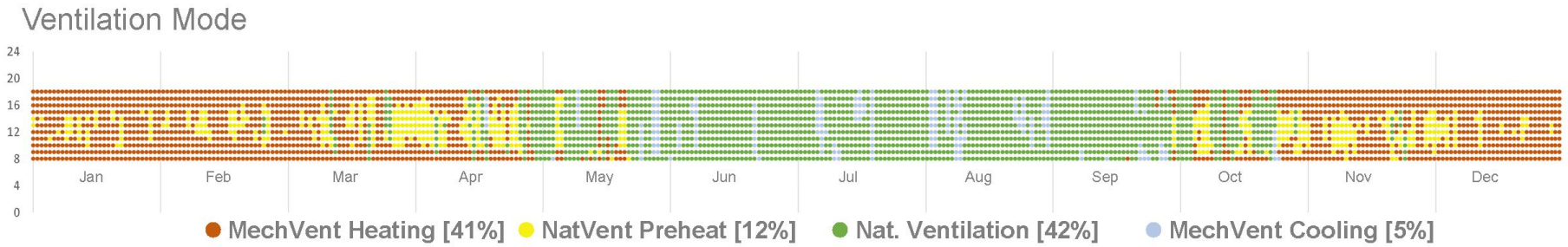


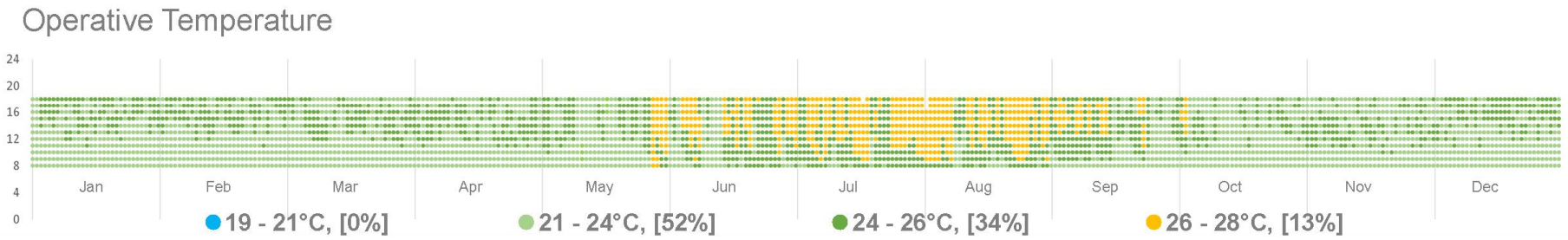
Indoor Comfort - Ensuring Comfortable Indoor Environment

Comfortable Seasonal Targets High
Indoor Air Quality Responsive Built
Fabric Environmentally Tuned
Facades

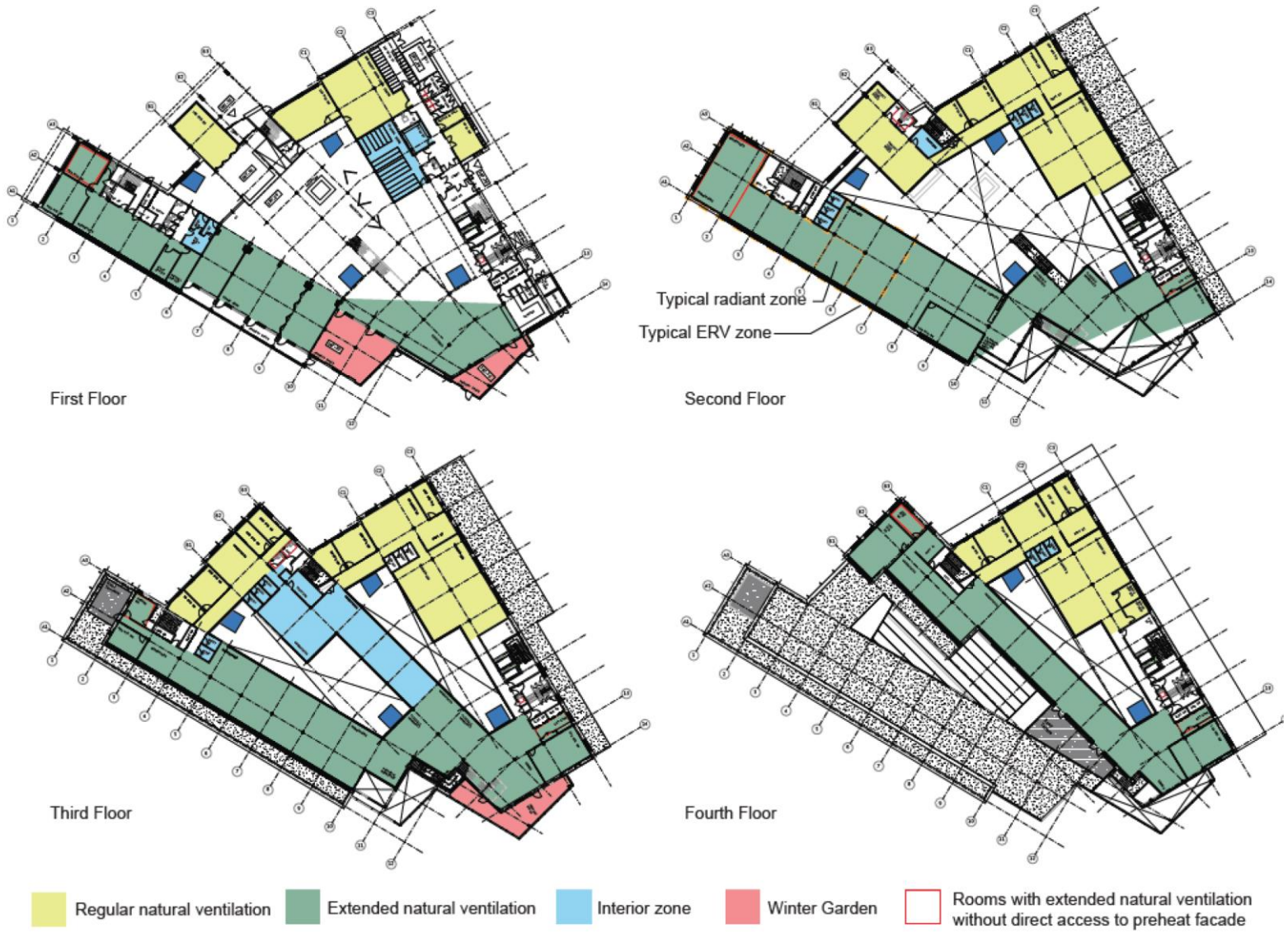
Operative Temperature – Wider Comfort Range

South facing office, 40% radiant slab, 60% WWR, operable exterior shading

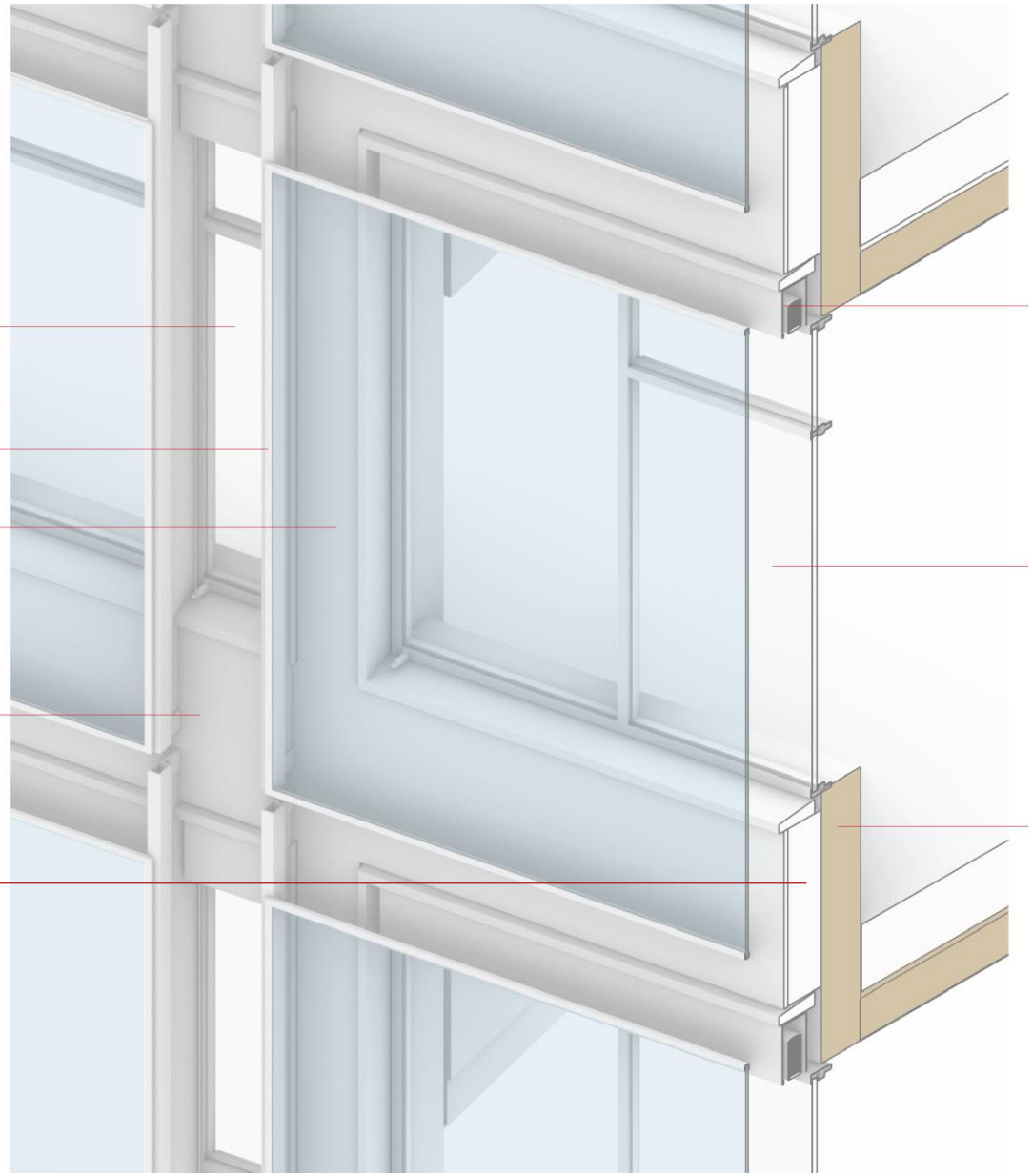




Natural Ventilation Strategies for High Indoor Air Quality



Sophisticated Building Facade




GP
PanoGlass
VIP 160


Blueskin

NORTH-EAST ELEVATION

SOUTH-EAST ELEVATION

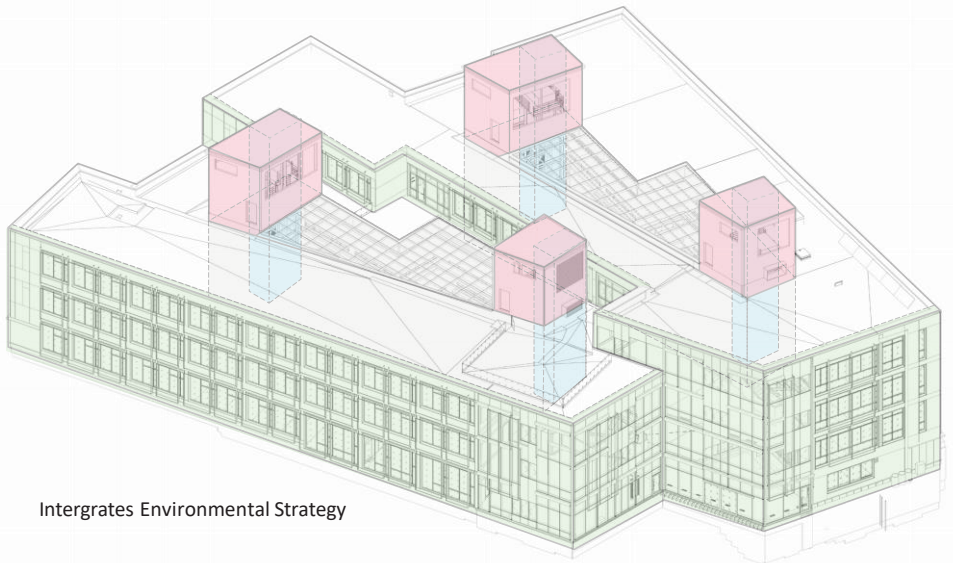
SOUTH ELEVATION

WEST ELEVATION

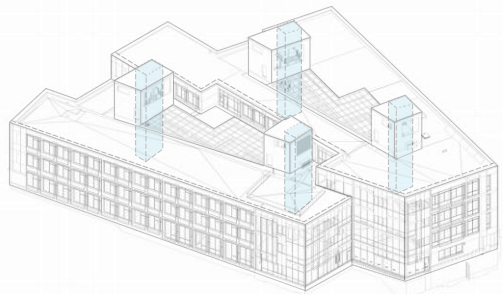
Sustainability - Synergistic Integration Of Building And Energy Systems

Harnessing Natural Energies
Renewable Fuel Resources
Opitmizing Systems Integration With Building
Evidence Based Design

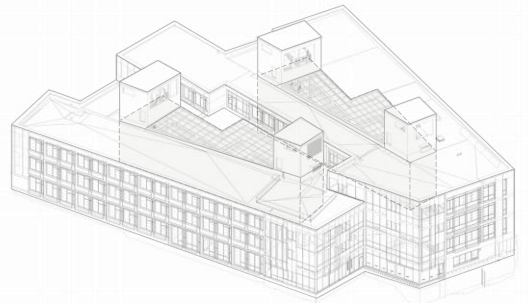
Integrated Environmental Strategy Backbone



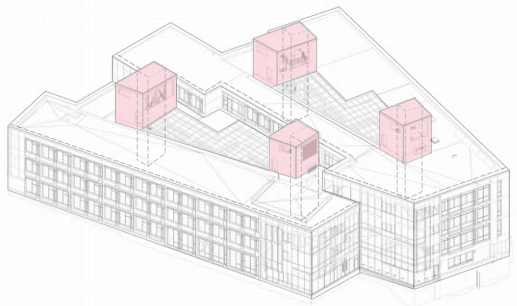
Intergrates Environmental Strategy



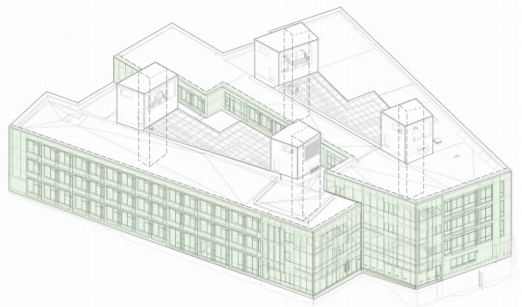
Water Walls



Atria



Solar Chimney



Preheat Facade

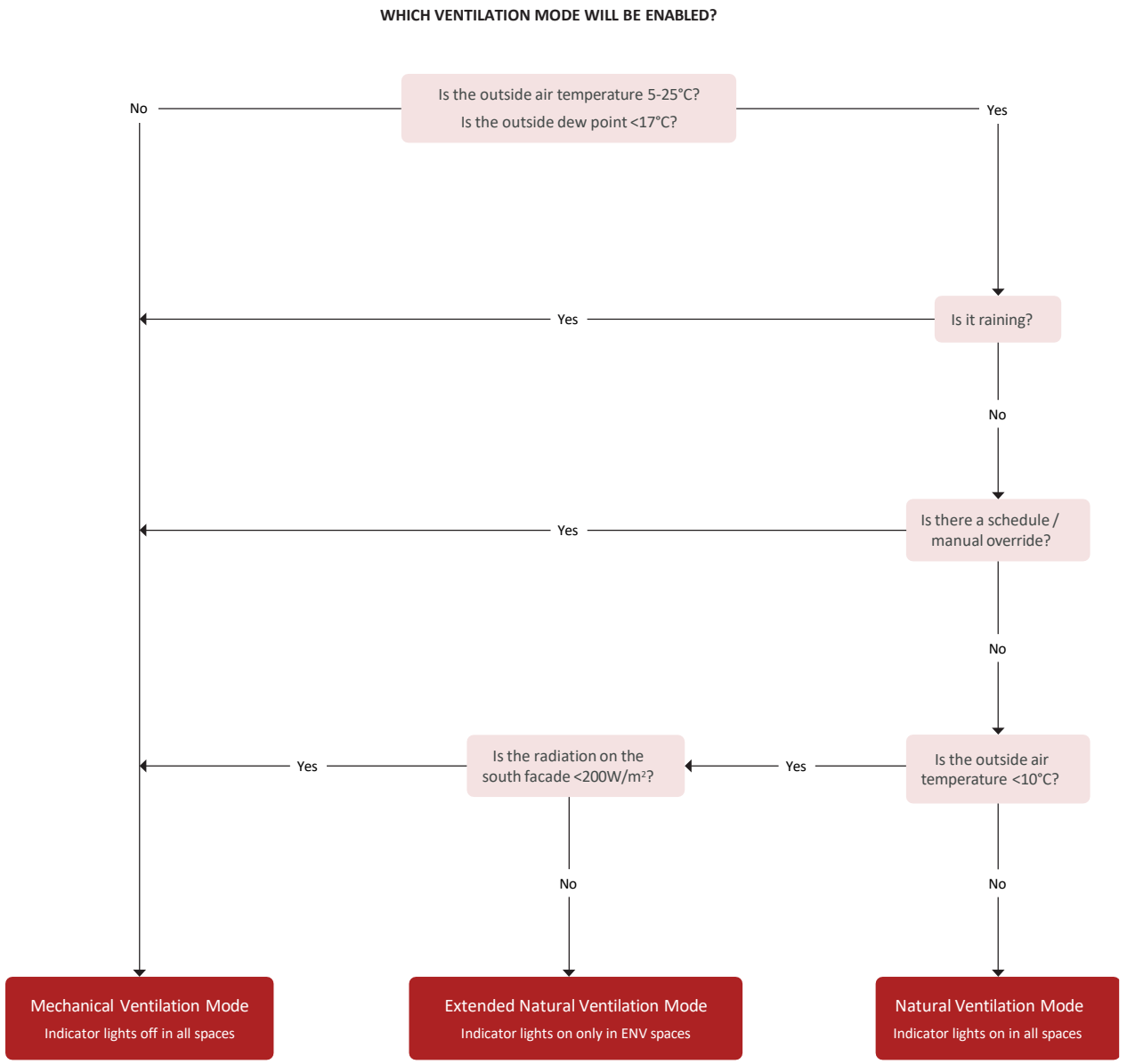
Sustainability - Synergistic Integration Of Building And Energy Systems

Active Systems 47%

- Mechanical Ventilation (MV) Heating Mode
- Mechanical Ventilationm (MV) Cooling Mode

Passive Systems 53%

- Extended Natural Ventilation (ENV) Mode
- Natural Ventilation (NV) Mode



Overall Building Diagram

1 **Solar Chimney**
Creates a draft that provides the building with fresh, cool air. Hot air is pulled up and out of the chimney, while cool air is pulled in from the outside.

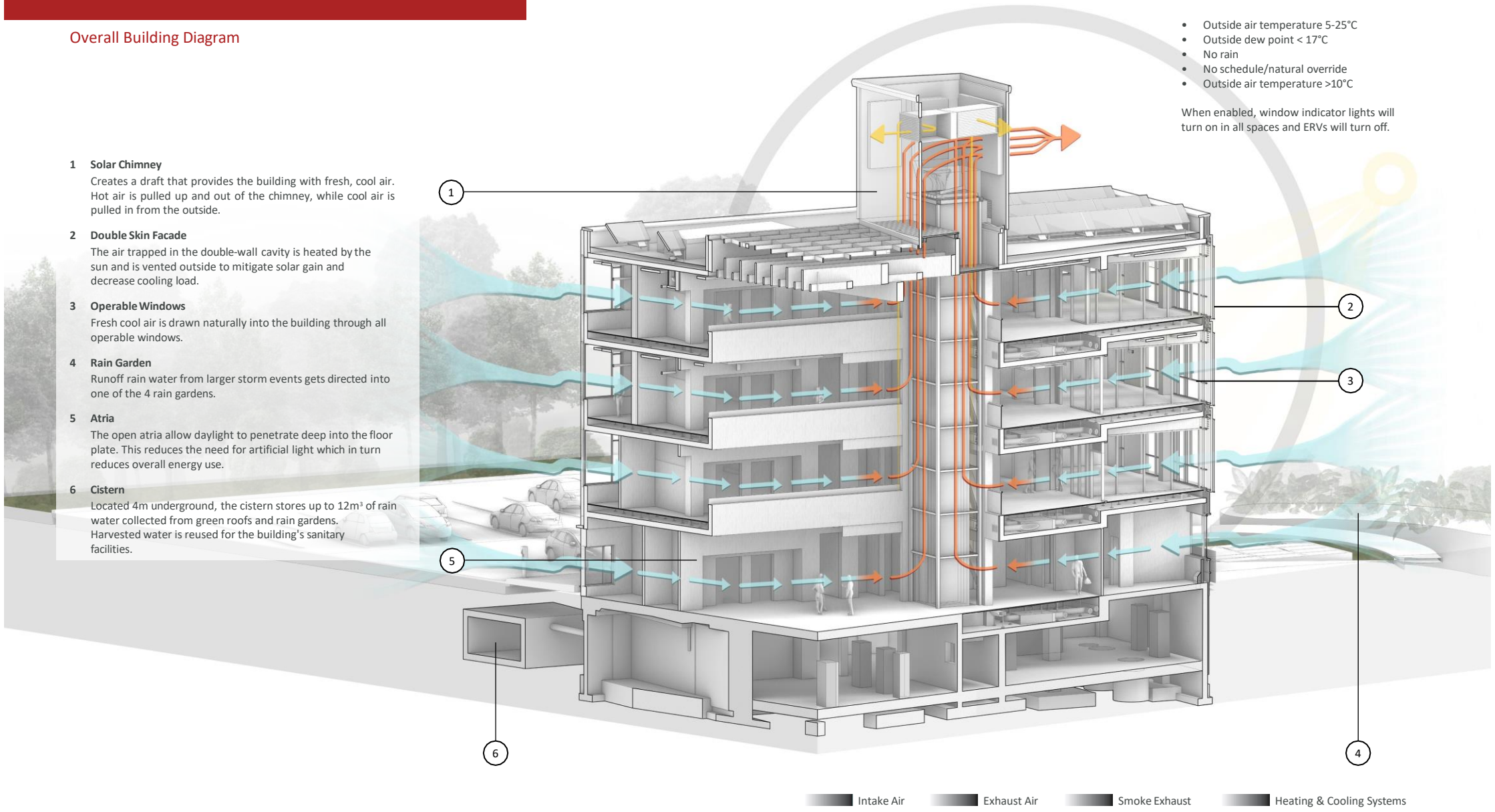
2 **Double Skin Facade**
The air trapped in the double-wall cavity is heated by the sun and is vented outside to mitigate solar gain and decrease cooling load.

3 **Operable Windows**
Fresh cool air is drawn naturally into the building through all operable windows.

4 **Rain Garden**
Runoff rain water from larger storm events gets directed into one of the 4 rain gardens.

5 **Atria**
The open atria allow daylight to penetrate deep into the floor plate. This reduces the need for artificial light which in turn reduces overall energy use.

6 **Cistern**
Located 4m underground, the cistern stores up to 12m³ of rain water collected from green roofs and rain gardens. Harvested water is reused for the building's sanitary facilities.



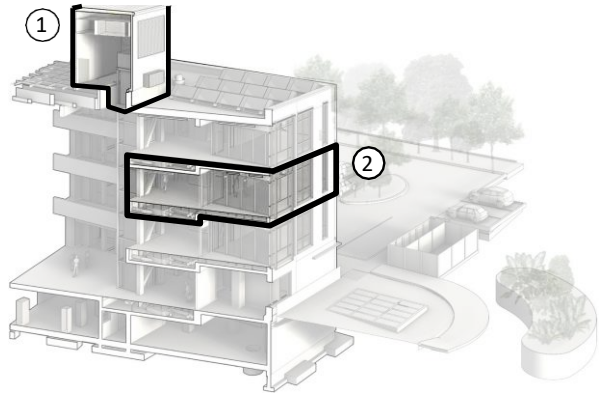
Conditions to Enable NV Mode:

- Outside air temperature 5-25°C
- Outside dew point < 17°C
- No rain
- No schedule/natural override
- Outside air temperature >10°C

When enabled, window indicator lights will turn on in all spaces and ERVs will turn off.

Natural Ventilation (NV) Mode

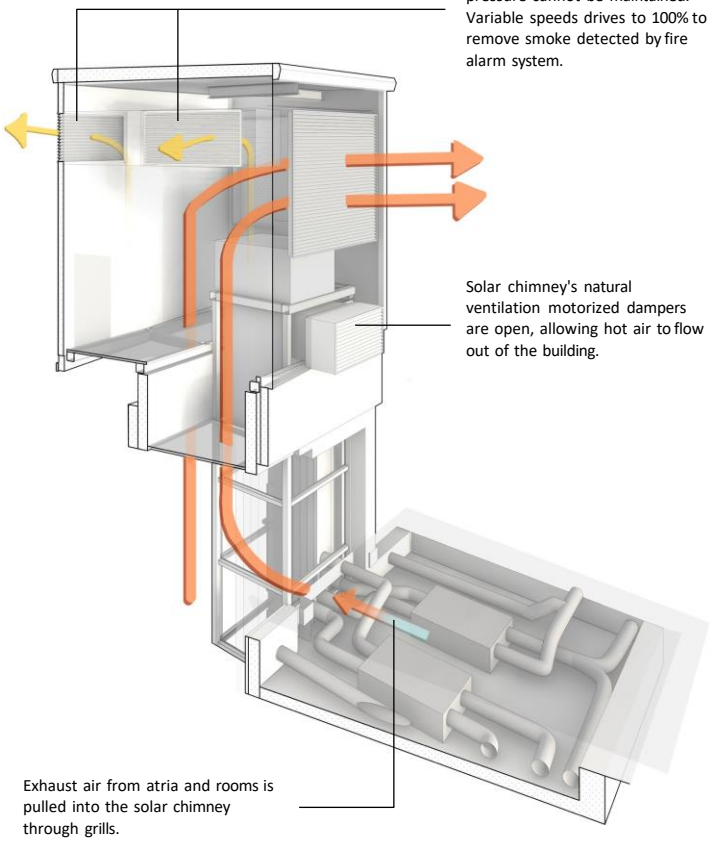
Detail Diagrams



1 Solar Chimney

Smoke exhaust dampers open when atrium's negative pressure cannot be maintained. Variable speeds drives to 100% to remove smoke detected by fire alarm system.

Solar chimney's natural ventilation motorized dampers are open, allowing hot air to flow out of the building.

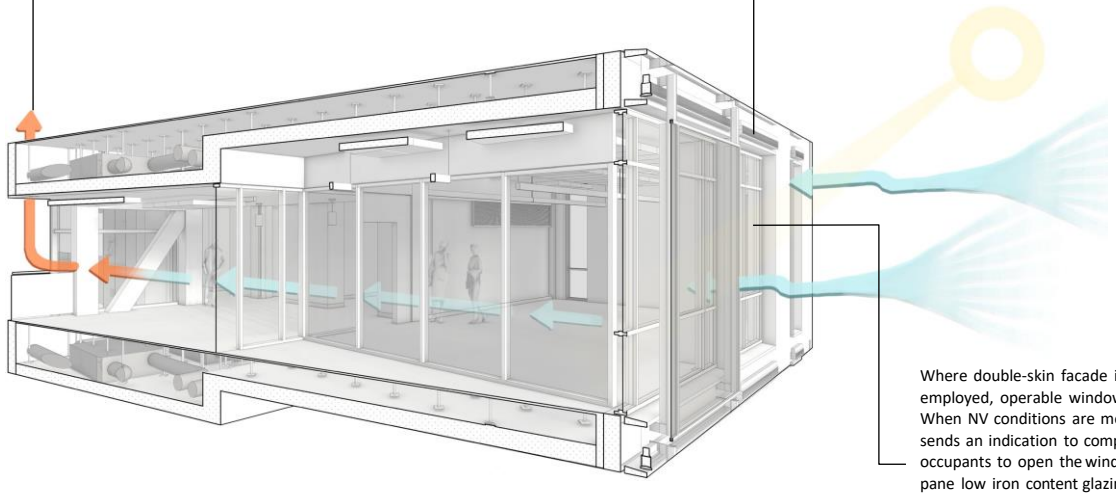


Exhaust air from atria and rooms is pulled into the solar chimney through grills.

2 Typical Floor

Air from spaces is pulled in and out of atria into solar chimneys

Motorized blinds monitored and controlled by the Building Automation System (BAS) reduce solar radiation on south facade when it exceeds 200W/m²



Ceiling fans increase air flow

Where double-skin facade is not employed, operable windows are used. When NV conditions are met, the BAS sends an indication to computers, allowing occupants to open the windows. Triple-pane low iron content glazing increases light penetration while low-emissivity coating reduces heat gain.

Intake Air Exhaust Air Smoke Exhaust Heating & Cooling Systems

ij1

Extended Natural Ventilation (ENV) Mode

Overall Building Diagram

1 Solar Chimney
Creates a draft that provides the building with fresh, cool air. Hot air is pulled up and out of the chimney, while cool air is pulled in from the outside.

2 Radiant Heating
Radiant heating can be permitted in rooms that are less than 10°C.

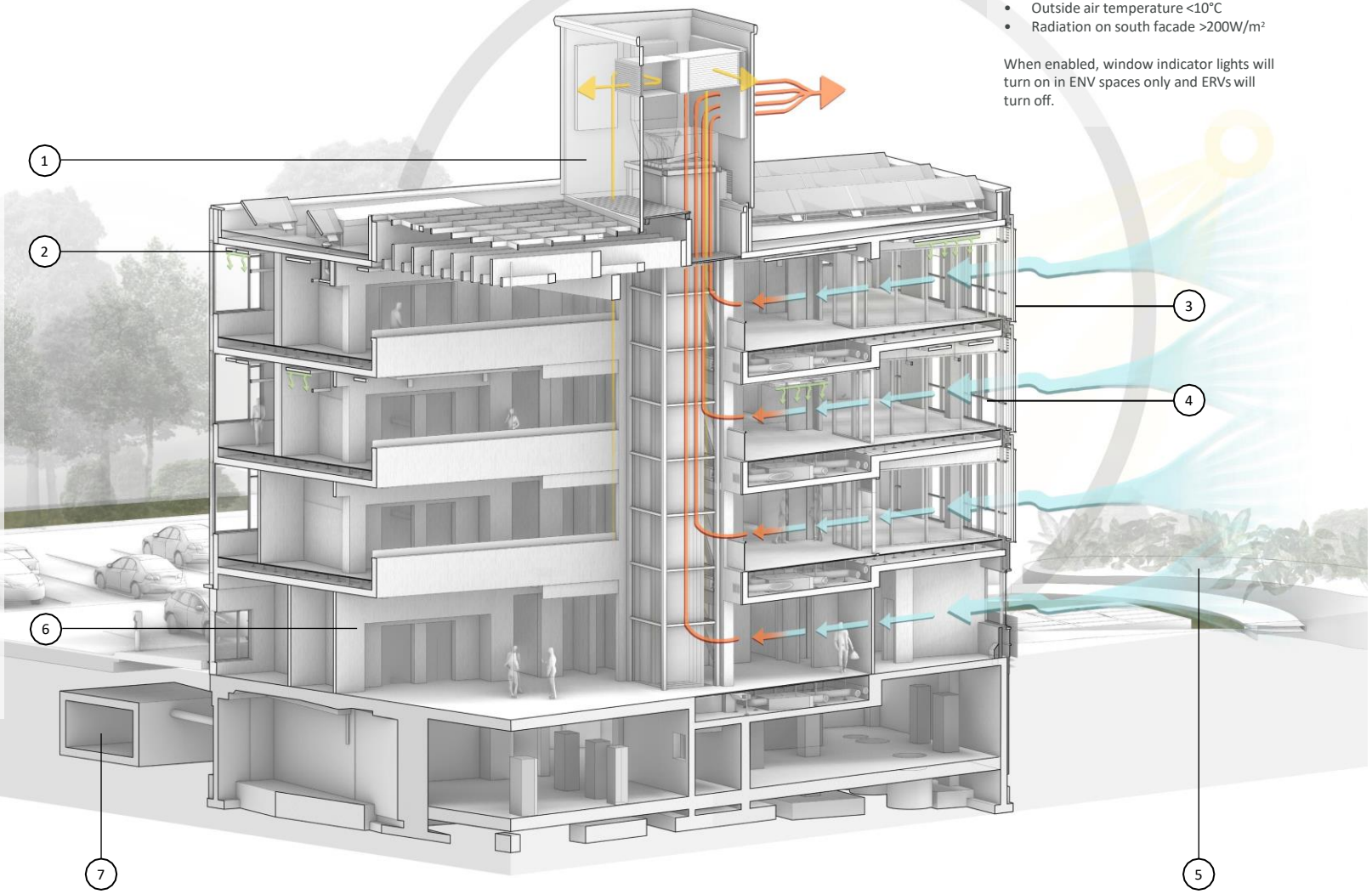
3 Double Skin Facade
The air trapped in the double-wall cavity is heated by the sun and is vented outside to mitigate solar gain and decrease cooling load.

4 Operable Windows
Fresh cool air is drawn into the building naturally through south-facing operable windows, making use of abundant southwest wind gusts.

5 Rain Garden
Runoff rain water from larger storm events gets directed into one of the 4 rain gardens.

6 Atria
The open atria allow daylight to penetrate deep into the floor plate. This reduces the need for artificial light which in turn reduces overall energy use.

7 Cistern
Located 4m underground, the cistern stores up to 12m³ of rain water collected from green roofs and rain gardens. Harvested water is reused for the building's sanitary facilities.



Conditions to Enable ENV Mode:

- Outside air temperature 5-25°C
- Outside dew point <17°C
- No rain
- No schedule/natural override
- Outside air temperature <10°C
- Radiation on south facade >200W/m²

When enabled, window indicator lights will turn on in ENV spaces only and ERVs will turn off.

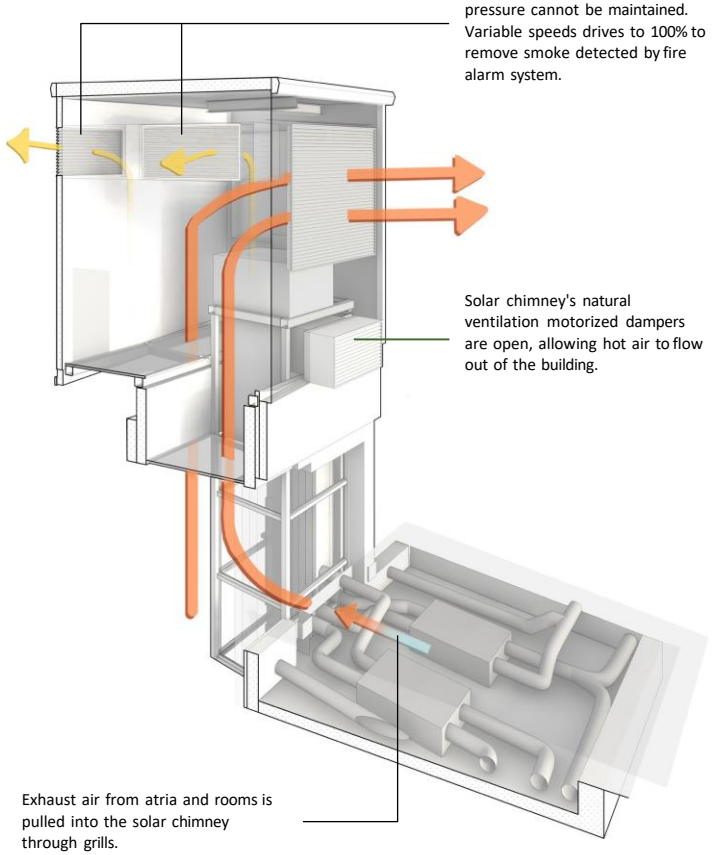
Extended Natural Ventilation (ENV) Mode

Detail Diagrams

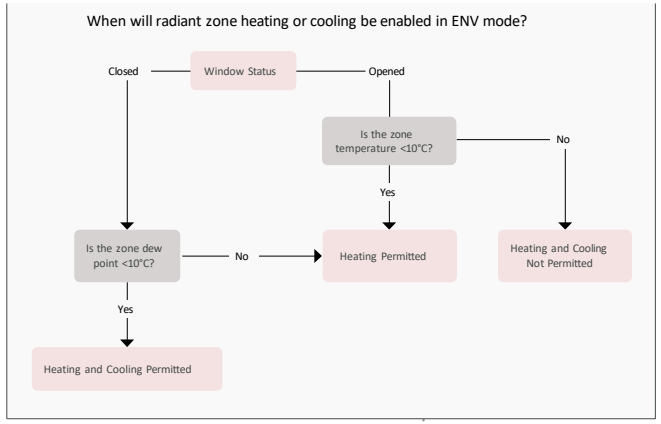
1 Solar Chimney

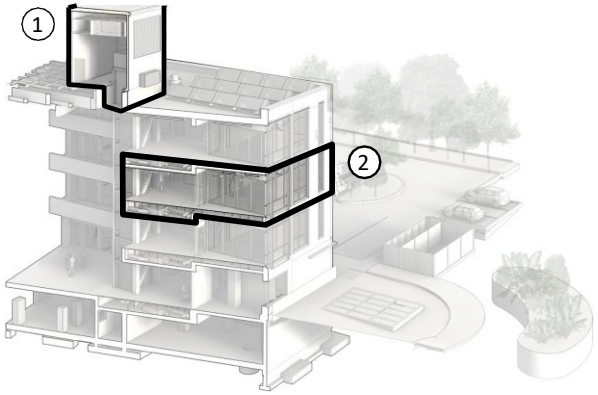
Smoke exhaust dampers open when atrium's negative pressure cannot be maintained. Variable speeds drives to 100% to remove smoke detected by fire alarm system.

Solar chimney's natural ventilation motorized dampers are open, allowing hot air to flow out of the building.



Exhaust air from atria and rooms is pulled into the solar chimney through grills.



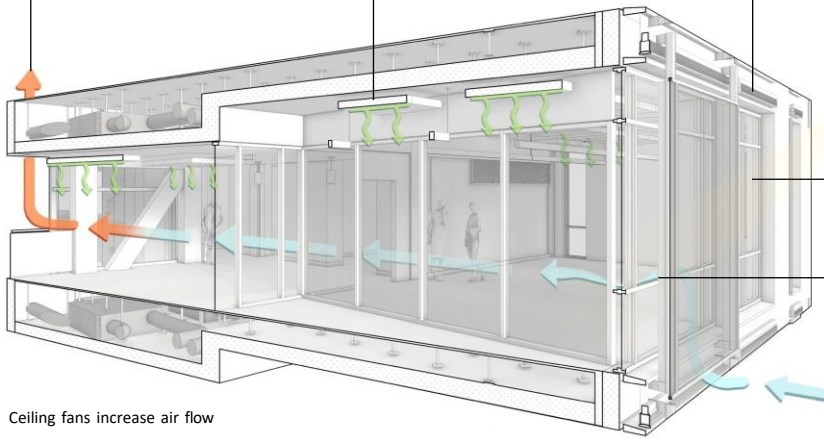


2 Typical Floor

Air from spaces is pulled in and out of atria into solar chimneys

Radiant ceiling panels heating or cooling mode permitted under certain conditions

Motorized blinds monitored and controlled by the Building Automation System (BAS) reduce solar radiation on south facade when it exceeds 200W/m²

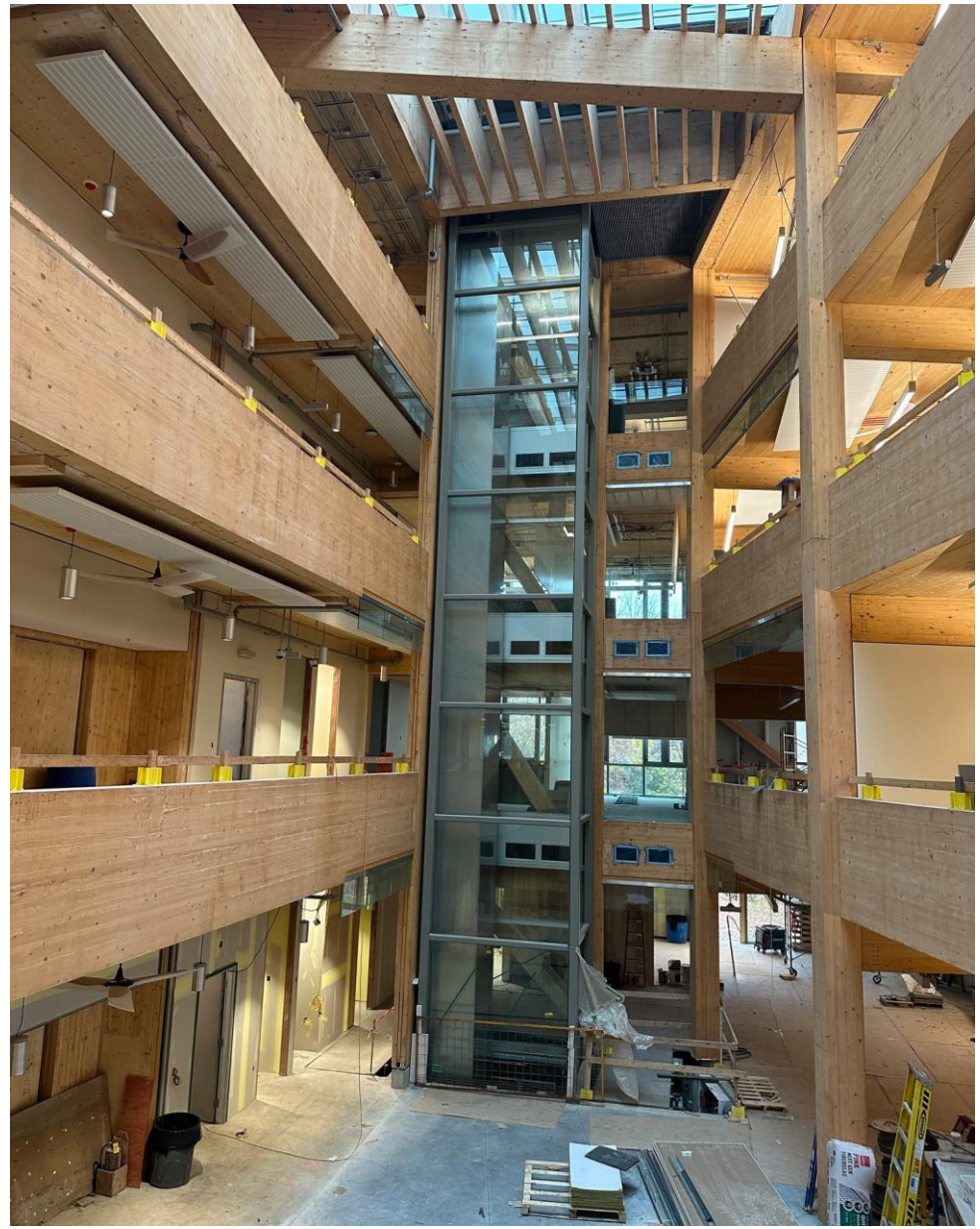


Where double-skin facade is not employed, operable windows are used. When ENV conditions are met, the BAS sends an indication to computers, allowing occupants to open the windows. Triple-pane low iron content glazing increases light penetration while low-emissivity coating reduces heat gain.

Fresh air is drawn into the building through openings in the preheat double-skin facade.

Ceiling fans increase air flow

Intake Air | Exhaust Air | Smoke Exhaust | Heating & Cooling Systems



Mode

Overall Building Diagram

1 **Open Loop Geothermal System**
Consists of a deep well with naturally heated water, three conduit pipes for pressure transmitters, and a well that injects cooled water back into the ground.

2 **Dedicated Heat Recovery Chiller/Heater (DHRC-1)**
Chills water using condensers. The heat exhausted from the water is reused for hot water.

3 **Heat Exchangers**
10 heat exchangers transfer reused heat from the DHRC-1 into a glycol distribution circuit.

4 **Energy Recovery Units (ERVs)**
28 ERVs dispersed through the building further heat the air as it passes through the raised floor distribution plenum into the rooms.

5 **Solar Chimney**
Transfers heat absorbed from the exterior surface into the building.

6 **Photovoltaic Panels**
Provide at least 5% of the building's energy use. The rooftop panels feed heat into the glycol exchange circuit while the solar chimney panels preheat intake coils.

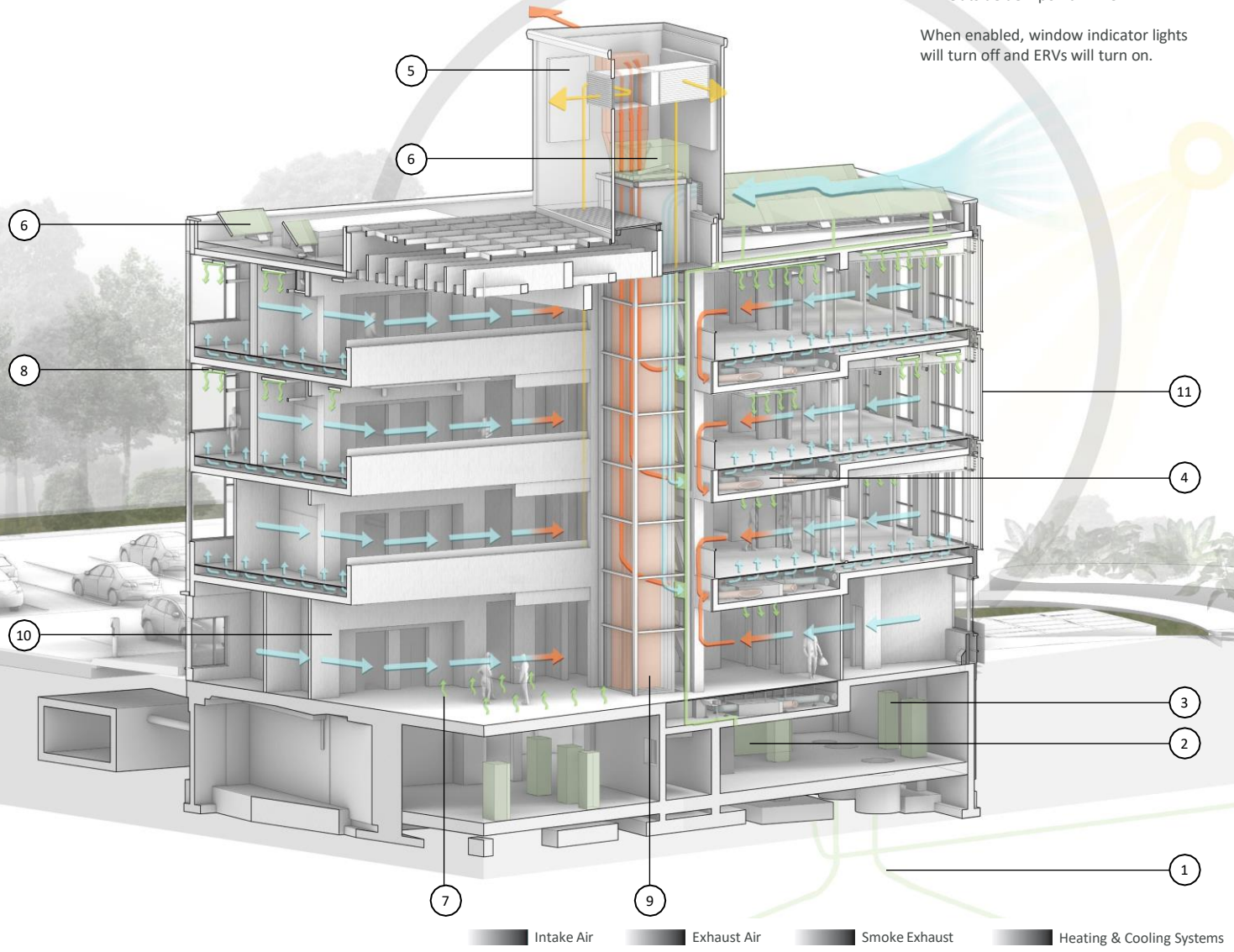
7 **In-Slab Radiant Floor Heating**
In-slab radiant heating circuits on the ground level provide additional heating in the atrium.

8 **Radiant Ceiling Heating Panels**
Provides supplemental heating that can be individually controlled in each room.

9 **Water Walls**
Heats air entering building through solar chimney using 10°C water running down 4 sheets of water walls.

10 **Atria**
Low winter sun enters through the skylight, penetrating deep into building. Hot air rises from regularly occupied spaces to the atria and ERVs before being exhausted, improving air quality.

11 **Double Skin Facade**
The air trapped in the double-wall cavity is heated by the sun, mitigating heat loss and reducing heating load.



Conditions To Enable MV Heating Mode:

- NV and ENV conditions are not met
- Outside air temperature <5°C
- Outside dew point <17°C

When enabled, window indicator lights will turn off and ERVs will turn on.

Mode

Overall Building Diagram

1 **Open Loop Geothermal System**
Consists of a deep well with naturally heated water, three conduit pipes for pressure transmitters, and a well that injects cooled water back into the ground.

2 **Dedicated Heat Recovery Chiller/Heater (DHRC-1)**
Water is chilled using condensers and distributed throughout the building, while heat is exhausted externally.

3 **Heat Exchangers**
10 heat exchangers transfer the chilled water from the DHRC-1 into a glycol distribution circuit.

4 **Energy Recovery Units (ERVs)**
28 ERV units dispersed through the building further cool the air as it passes through the raised floor distribution plenum into the rooms.

5 **Solar Chimney**
Creates a draft that provides the building with fresh, cool air. Hot air is pulled up and out of the chimney, while cool air is pulled in from the outside.

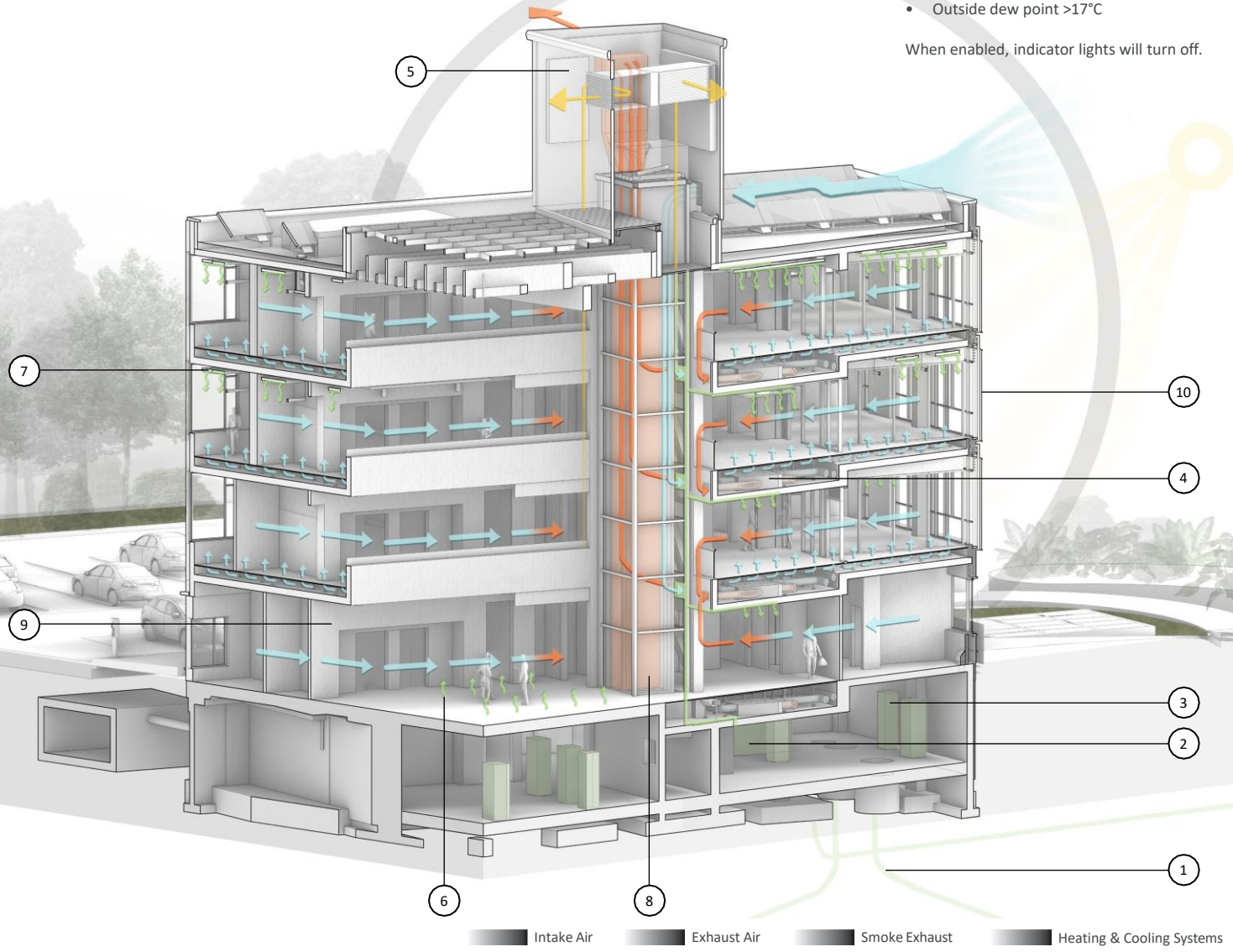
6 **In-Slab Radiant Floor Cooling**
In-slab radiant cooling circuits on the ground level provide additional cooling in the atrium.

7 **Radiant Cooling Ceiling Panels**
Provides supplemental cooling that can be individually controlled in each room.

8 **Water Walls**
Cools air entering building through solar chimney using 10°C water running down 4 sheets of water walls.

9 **Atria**
Hot air rises from regularly occupied spaces to the atria and ERVs before being exhausted, improving air quality.

10 **Double Skin Facade**
The air trapped in the double-wall cavity is heated by the sun and is vented outside, mitigating solar gain and decreasing cooling load.



Conditions to Enable MV Cooling Mode:

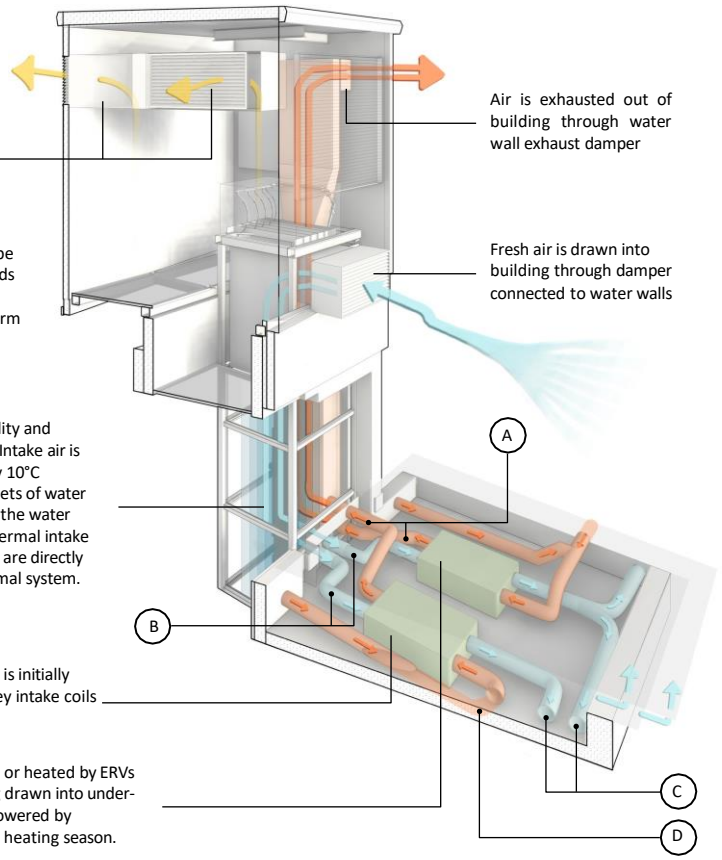
- NV and ENV conditions are not met
- Outside air temperature >25°C
- Outside dew point >17°C

When enabled, indicator lights will turn off.

Heating Mode

Detail Diagrams

1 Solar Chimney



Air is exhausted out of building through water wall exhaust damper

Smoke exhaust dampers open when atrium's negative pressure cannot be maintained. Variable speeds drives to 100% to remove smoke detected by fire alarm system.

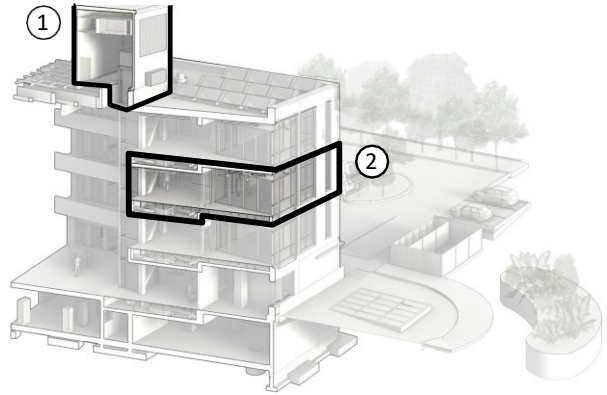
Fresh air is drawn into building through damper connected to water walls

Water walls control humidity and temperature of intake air. Intake air is precooled or preheated by 10°C water running down 4 sheets of water walls. The temperature of the water matches that of the geothermal intake well, since the water walls are directly connected to the geothermal system.

During heating season, air is initially preheated by solar chimney intake coils powered by PV panels.

Intake air is further cooled or heated by ERVs on each level before being drawn into under-floor plenums. ERVs are powered by geothermal system during heating season.

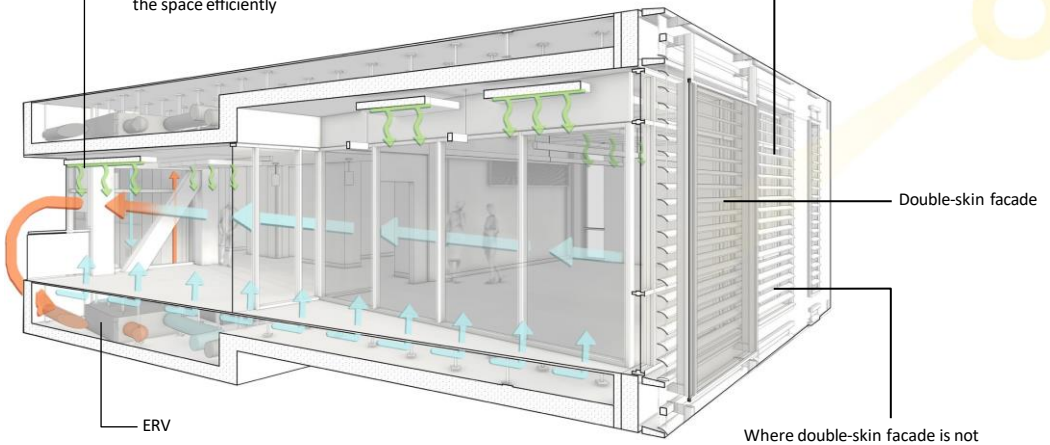
A. Exhaust air to water wall shaft
B. Supply air from water wall (outside air shaft)
C. Supply air to under floor plenum
D. Exhaust air from office space



2 Typical Floor

Motorized blinds monitored and controlled by the Building Automation System (BAS) reduce solar radiation on south facade when it exceeds 200W/m²

Radiant panels cool and heat the space efficiently



Double-skin facade

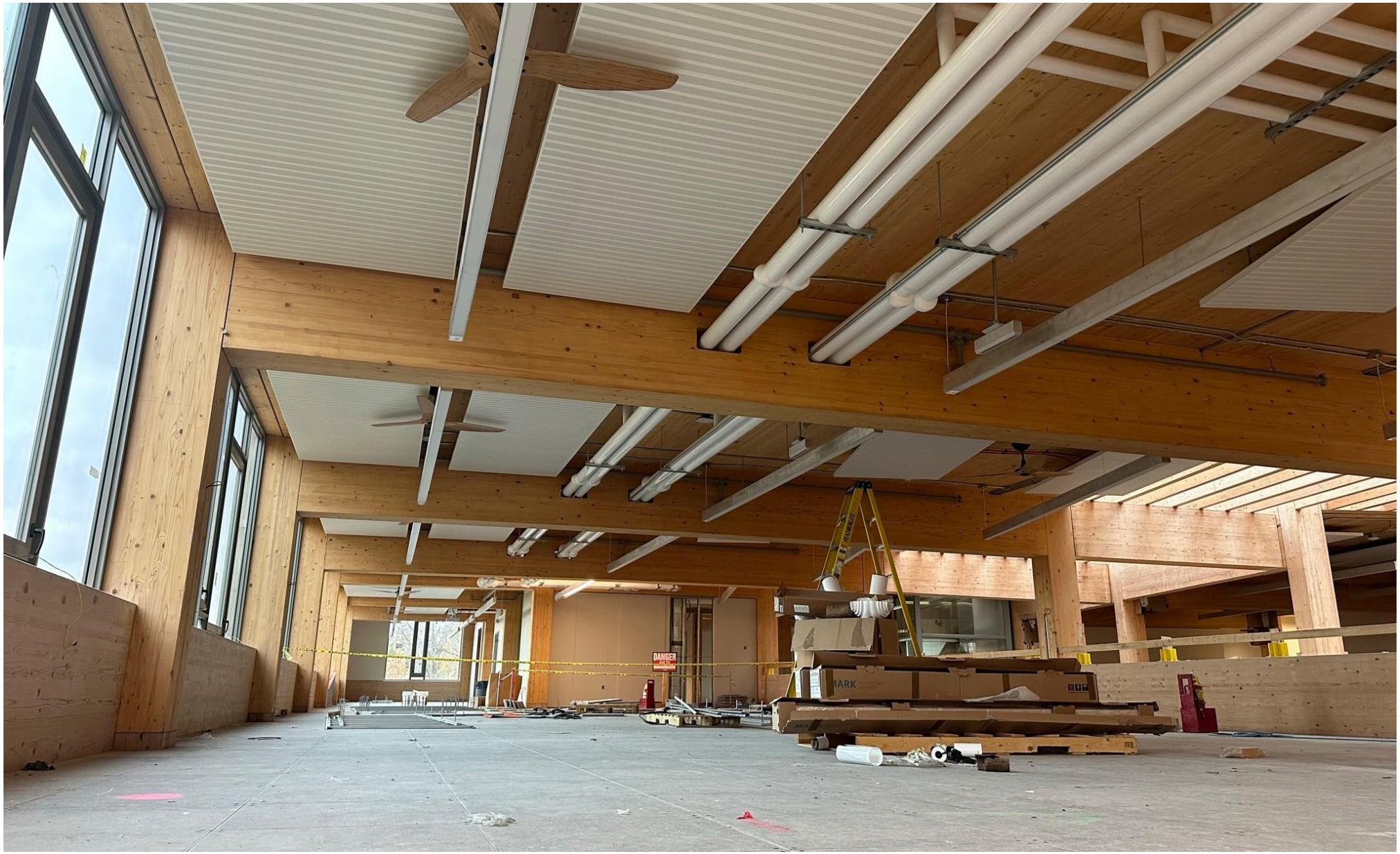
ERV

Ceiling fans increase air flow during cooling mode

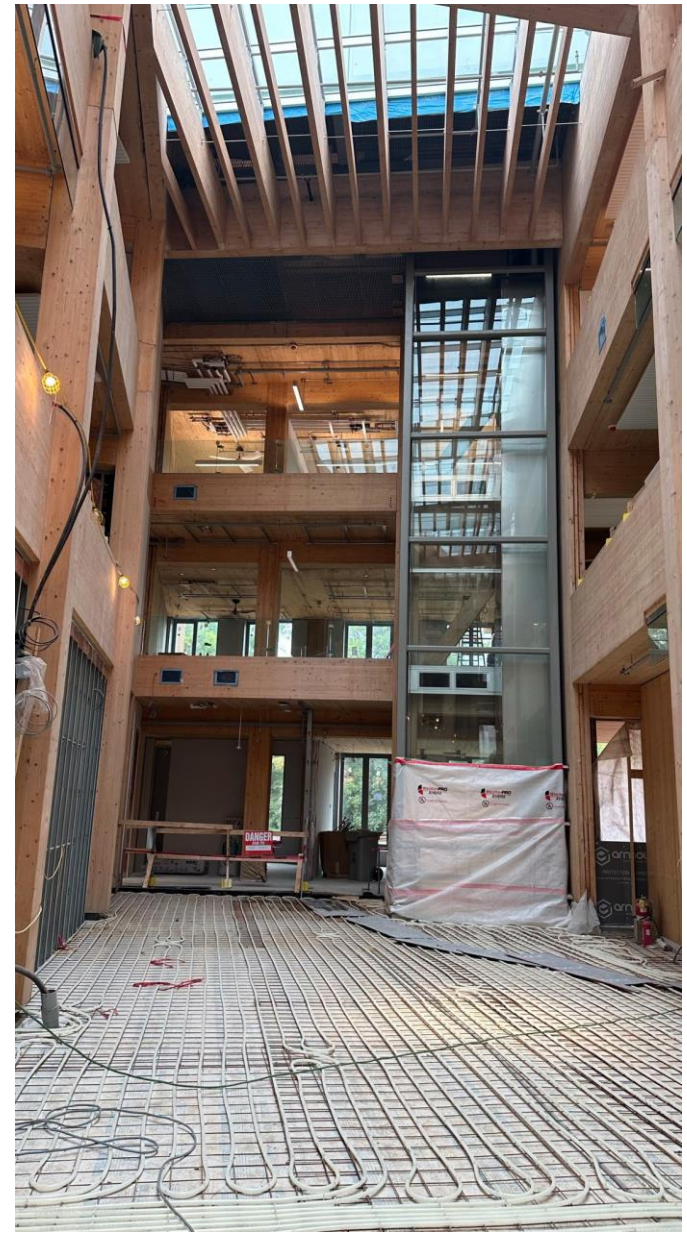
Where double-skin facade is not employed, triple-pane glazing is used. Low iron content increases light penetration, maximizing heat gain during heating season. Low-emissivity coating reduces heat gain during cooling season and reduces heat loss during heating season.

Intake Air | Exhaust Air | Smoke Exhaust | Heating & Cooling Systems


RIDGID

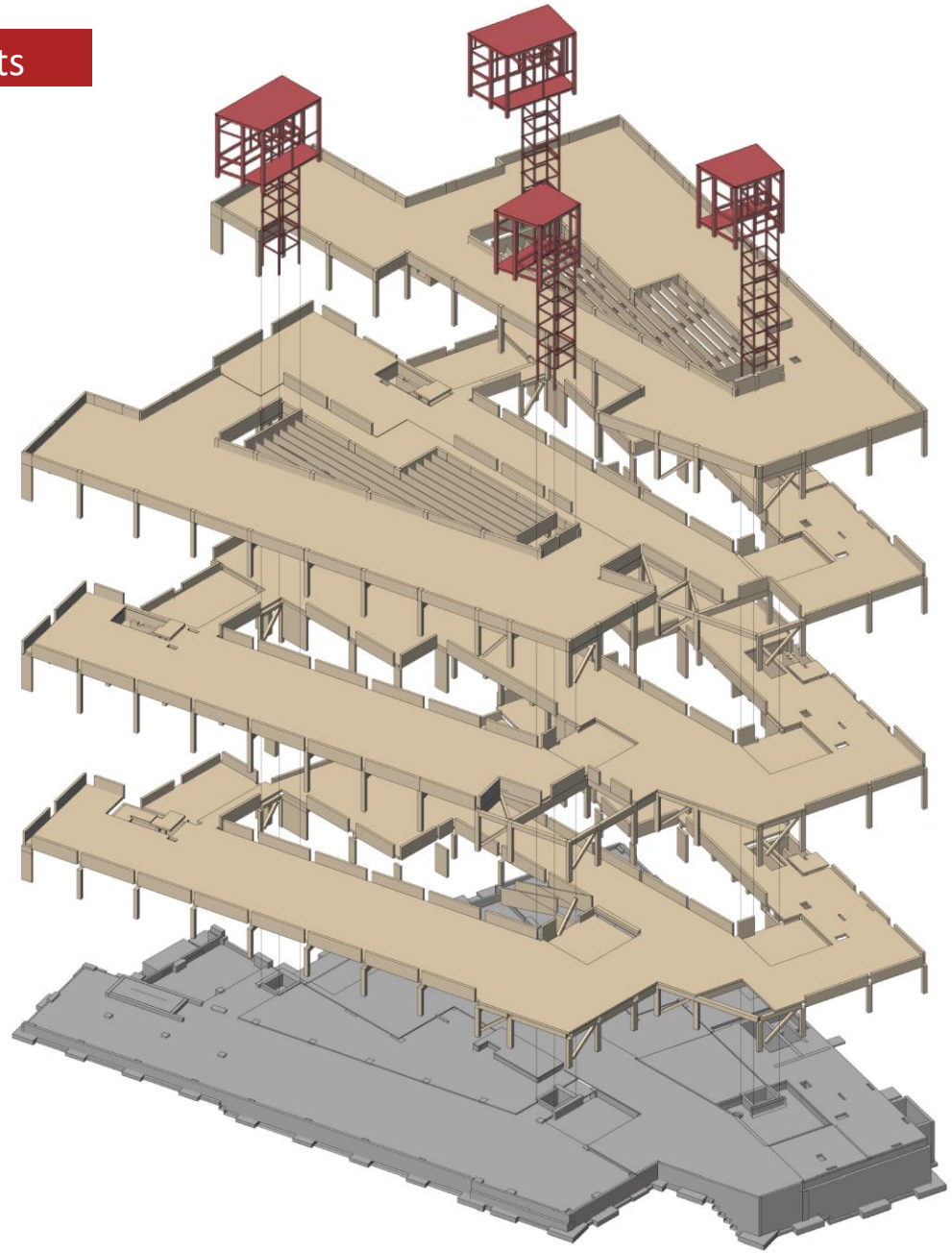

DANGER


GREENLEE
kelson


DANGER


VIESSMANN

Building Structure Components



Steel

Timber

Concrete

Leading By Design - Lofty Ambitions / Lessons Learnt

Model simulations predict an over 50% reduction in operating emissions and an over 75% reduction in embodied carbon compared to the average commercial buuilding in Toronto.

- LEED Platinum
- CaGBC Zero Carbon Building Standard
- WELL Silver
- Toronto Green Standard Tier 3
- All Mass Timber Structure
- Energy Use Intensity (EUI) is modelled to a very low 59.8 kWh/m²/year
- Water Use Intensity (WUI) modelled to an efficient 0.26 m² m³/year

Lessons Learnt

- Climate engineering/environmental consultant
- Evidence-based design process
- Real time energy modelling
- Building envelope coordination

Toronto and Region Conservation Authority

TRANS SOLAR

rjc Engineers

INTEGRAL GROUP

MULVEY&BANANI INTERNATIONAL INC.

ZAS ARCHITECTS + INTERIORS

bucholzmcevoyARCHITECTS

VORTEX FIRE

SCHOLLEN & Company Inc.

TMIG

green reason

EASTERN CONSTRUCTION EST. 1951

ELEMENT5

kelson

NE Net Electric

STOUFFVILLE GLASS INC.


THANK YOU

Q&A

Canada Green Building Council

Canada Green Building Council | Conseil du Bâtiment Durable du Canada

November 7, 2023

The Future is Zero Carbon

Building our way forward to a more sustainable future.

WE REPRESENT

Canada's green building sector. Our members include all the people and businesses involved in the design, construction and operation of buildings.

Construction companies

Engineers

Construction workers

Designers

Architects

Trades people

Owners and operators

ZERO CARBON BUILDING STANDARDS

Canada Green Building Council®

CAGBC

Advancing Zero Carbon Buildings will create the low-carbon building stock of the future.

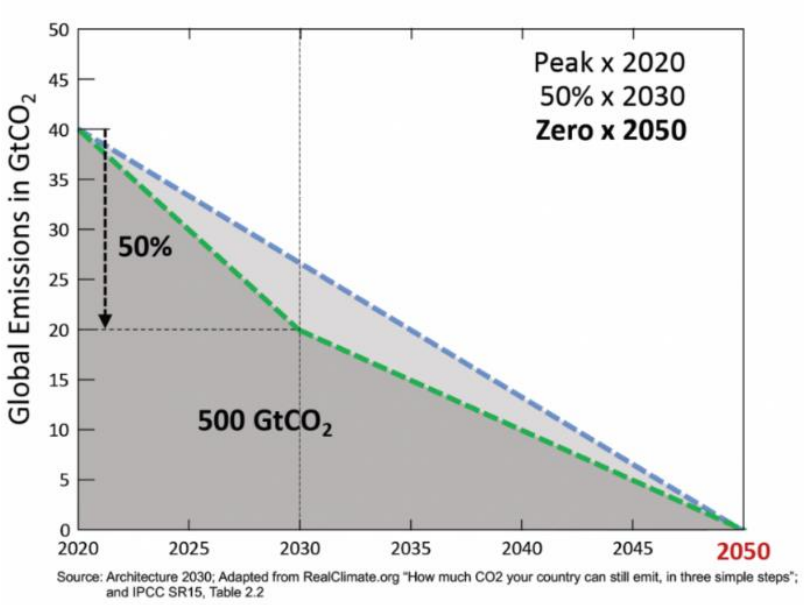
CAGBC

We need to scale up to reach 2030 climate targets.

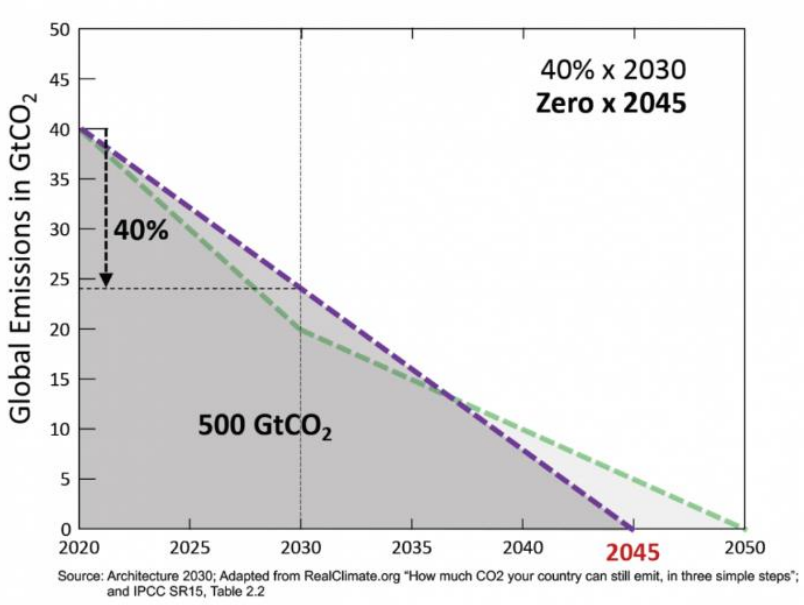
The Urgency to Act Now

- To stop global warming at 1.5 C, there is a cap on the total emissions that can be emitted over time
- The time between now and 2050 is shorter than the lifespan of a boiler or enclosure
- Every tonne we emit today reduces what we can emit later, this is often referred to as the carbon budget.

The next 7 years are critical



Source: Architecture 2030; Adapted from RealClimate.org "How much CO2 your country can still emit, in three simple steps"; and IPCC SR15, Table 2.2



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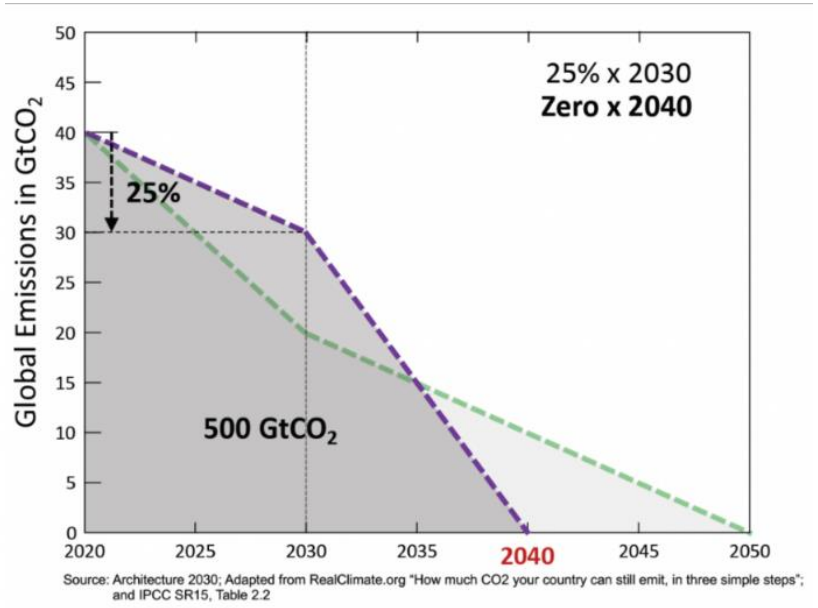


Source: Architecture 2030; Adapted from RealClimate.org "How much CO2 your country can still emit, in three simple steps"; and IPCC SR15, Table 2.2

CAGBC

The Context for Buildings

- Residential, commercial, and institutional buildings contribute 18% of Canada's greenhouse gas (GHG) emissions. Including building materials and construction brings that number to 30%, making the building sector Canada's third-highest carbon emitter.

- We must design all new buildings to be zero carbon and take advantage of every building retrofit.

ZCB Standard Leaders

What is a Zero Carbon building?

A Zero Carbon Building is a highly energy efficient building that produces onsite, or procures, carbon-free renewable energy or high-quality carbon offsets in an amount sufficient to counterbalance the annual carbon emissions associated with building materials and operations.

Guiding Principles

- Prioritize carbon emissions reductions
- Ensure energy efficient design
- Encourage good grid citizenship
- Incentivize reductions in embodied carbon
- Keep it simple and accessible

A shift in focus: from energy to carbon

The carbon-intensity of energy sources matters.

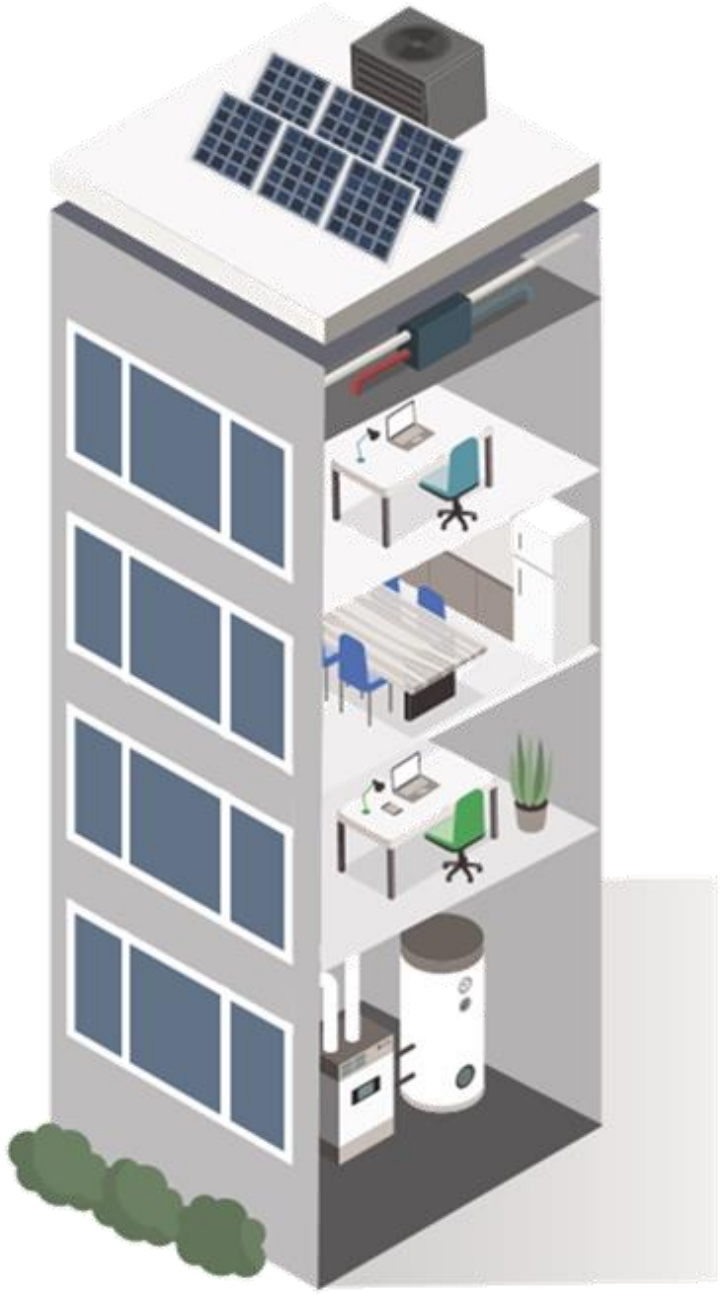
Two identical, equally energy-efficient buildings in Quebec, one is emitting 36 times as much greenhouse gases as its twin.

Electric energy heating source	Gas energy heating source
0.5 kg CO_2e/m^2 carbon emissions	18 kg CO_2e/m^2 carbon emissions

Source: A Roadmap for Retrofits in Canada, CAGBC, 2017

CAGBC

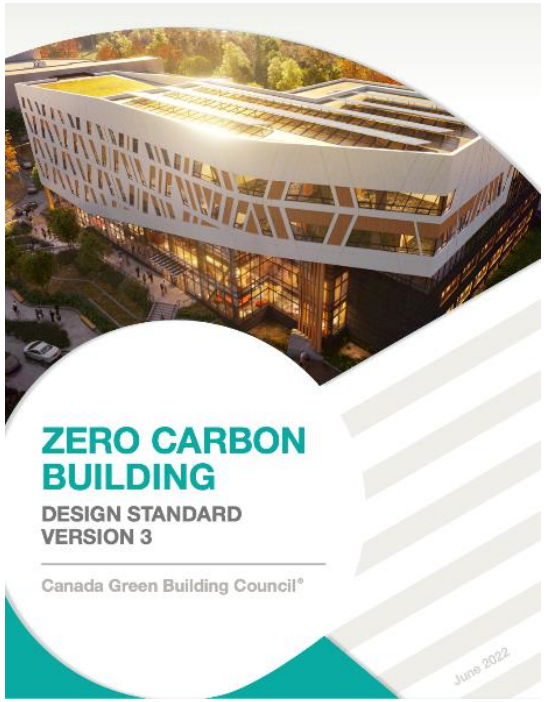
Why Zero Carbon Buildings?



- Reduce climate impact & Increase climate resiliency
- Lifecycle value through O+M savings
- Meet investor expectations and demonstrate leadership
- Drive innovation, jobs & economic growth
- Improve health, comfort & productivity
- Protect asset value from rising energy & carbon costs

CAGBC

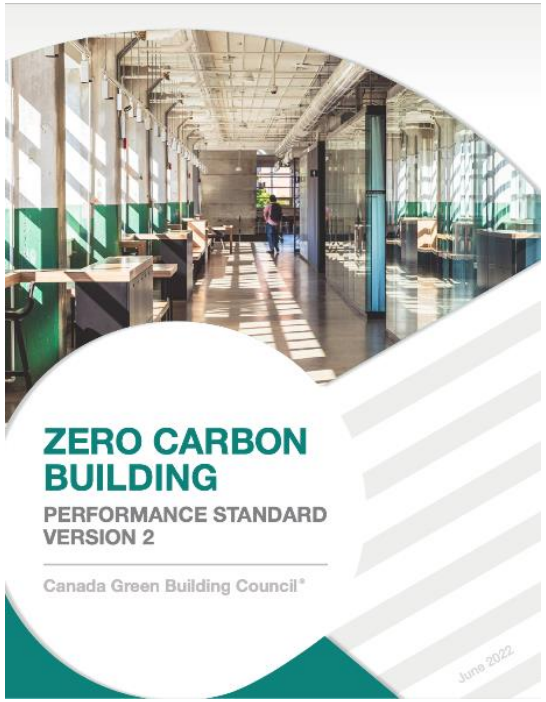
Positioning of ZCB-Design and ZCB-Performance



ZCB-Design

New Construction and Major Retrofit

ZCB-Design provides a framework for designing buildings and performing major retrofits. Not just for new construction.



ZCB-Performance

Existing Building Performance Verification

ZCB-Performance is an annual performance verification of zero carbon in operations.

ZCB-Design v3 launched 2022

Incentivizes efficiency, alternatives to fossil fuels

Informed by two years of market and project feedback, as well as changing market expectations

Prioritizes reductions in carbon emissions and embodied carbon

Encourages energy-efficient design that promotes good grid citizenship

Flexibility without compromising carbon reductions

Structure of ZCB-Design

Carbon Requirements

Projects must account for and eliminate carbon emissions across the entire project life-cycle.

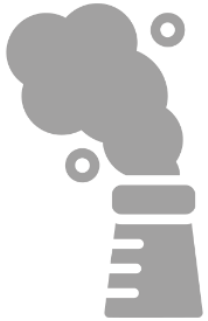
Energy Requirements

Projects must demonstrate superior energy efficiency. Some metrics have thresholds, and some are for reporting.

Impact and Innovation Requirements

Projects must incorporate impactful and innovative technologies and design approaches. Customizable to project.

What’s new in ZCB-Design v3



Embodied carbon

Introduces a maximum embodied carbon threshold

2 Impact and Innovation thresholds for higher performance targets against a baseline or an absolute threshold

Energy performance

Recognizes smart design choices for EUI and tensity (TEDI) targets

Enables some building types to leverage absolute EUI targets instead of improvements against NEC buildings baseline

Onsite combustion

Limits onsite combustion for space heating

Impact & Innovation for 100% of space heating & 100% of service hot water (MURBs) without onsite combustion

No combustion permitted for fireplaces or residential stoves

District energy & green heat

Helps district energy providers recoup initial investments and reinvest in further decarbonization over time

Provides new options for demonstrating a future path to operations that do not rely on fossil fuel combustion

CAGBC

Zero Carbon Balance

NET EMISSIONS

=

EMBODIED CARBON

- Upfront carbon
- Use Stage Embodied Carbon
- End of Life Carbon

+

OPERATIONAL CARBON

- Direct emissions
- Indirect emissions

-

AVOIDED EMISSIONS

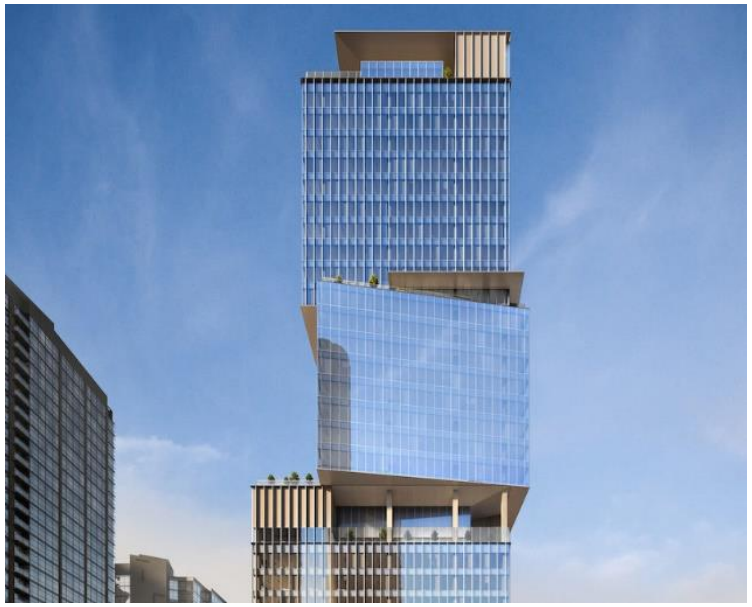
- Exported green power
- Carbon offsets

New Embodied Carbon Requirements

	Percent Reduction	Absolute Target
Prerequisite	≥10%	≤500 kg CO_2e/m^2
Impact & Innovation	≥20%	≤350 kg CO_2e/m^2
Impact & Innovation	≥40%	≤240 kg CO_2e/m^2

Impact & Innovation thresholds provide stretch targets. The 2nd threshold align
2030 ambitions for both the World Green Building Council and the City of Vanc

Examples of recent certified projects



The Stack

Vancouver’s Tallest Office Building

Concrete Structure

Achieves 1st Impact & Innovation Threshold

Centennial College

A Block Expansion Project

Mass Timber Structure and Cladding

Achieves 2nd Impact & Innovation Thresh

CAGBC

Zero Carbon in Canada

Updated as of January 1, 2023

Financial Results

Incremental 25-year Life-Cycle Return

$27/m² | **$34/tCO₂e** | **1%**

Incremental Capital Cost

$253/m² | **8%**

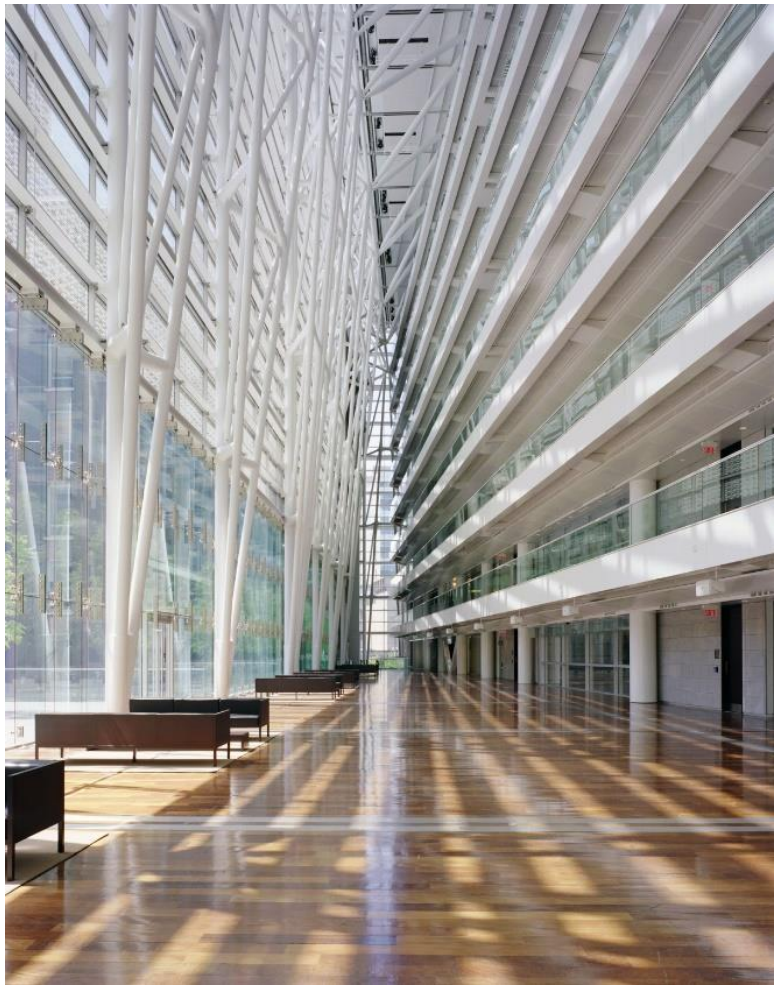
Annual Operating Savings

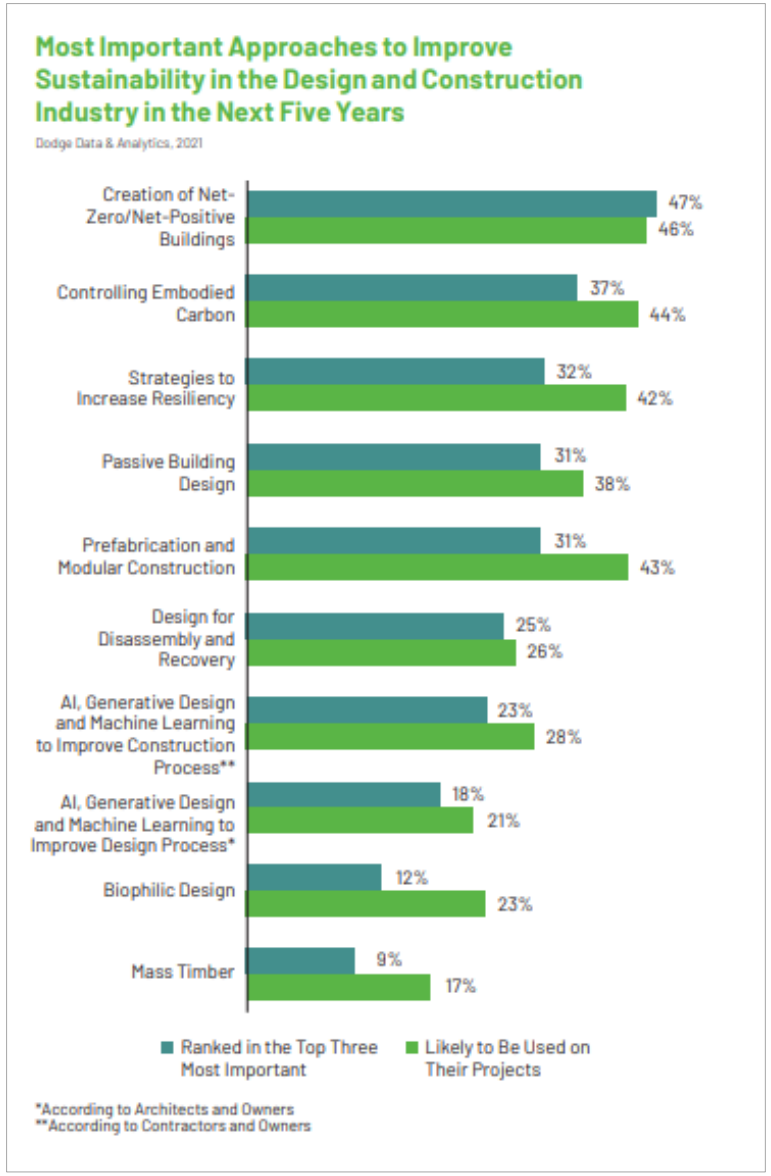
$17/m² | **24%**

CAGBC

Why certify your ZCB?

- Trusted third party verification for sustainability actions and investments
- Funding and financing opportunities (e.g. GICB, Business Development Canada, CMHC)
- Visibility of commitment
- Increased sales and lease rates
- Offers a sustainable design perspective to guide decision-making
- Important leadership signal to the investors and tenants
- CAGBC has remained an established certification body for over 20 years
- Assurance of desired outcomes





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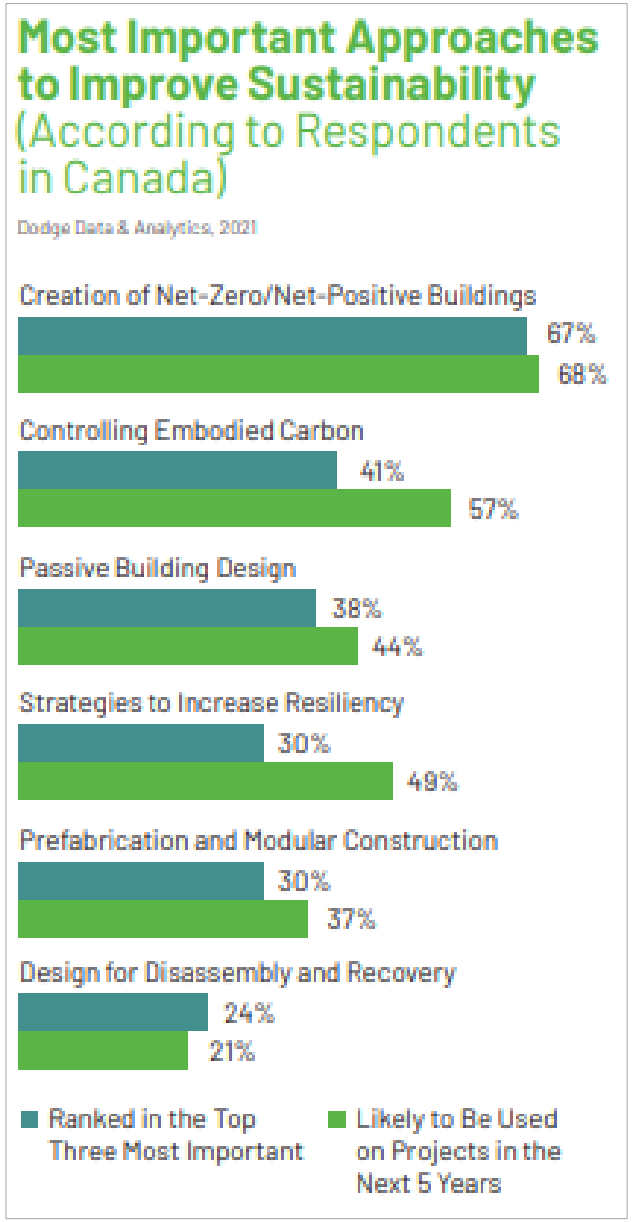

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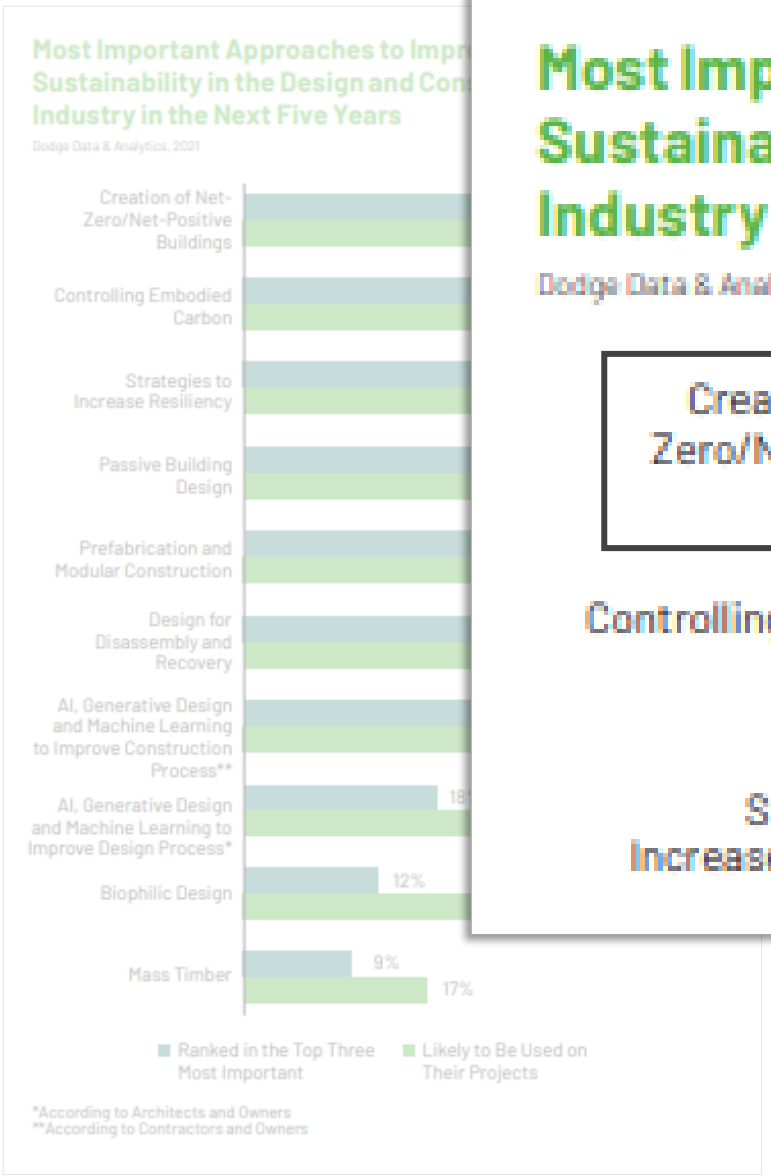
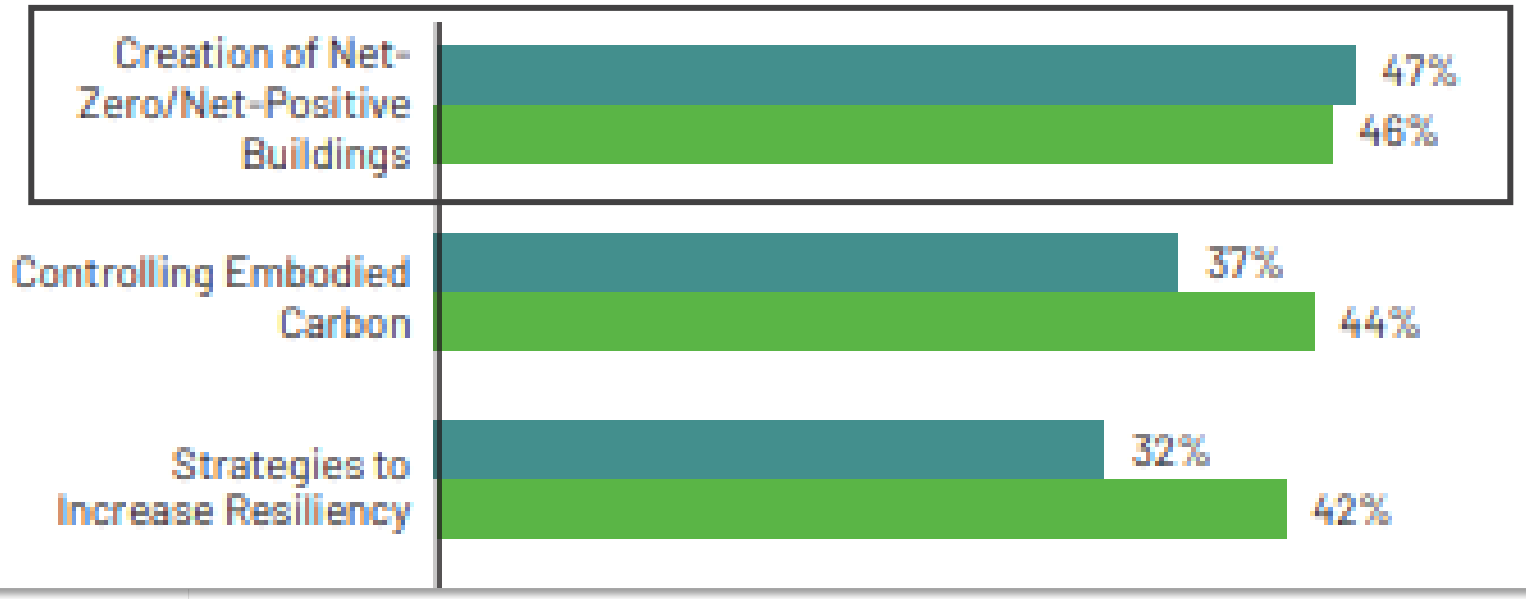
CAGBC



Most Important Approaches to Improve Sustainability in the Design and Construction Industry in the Next Five Years

Dodge Data & Analytics, 2021



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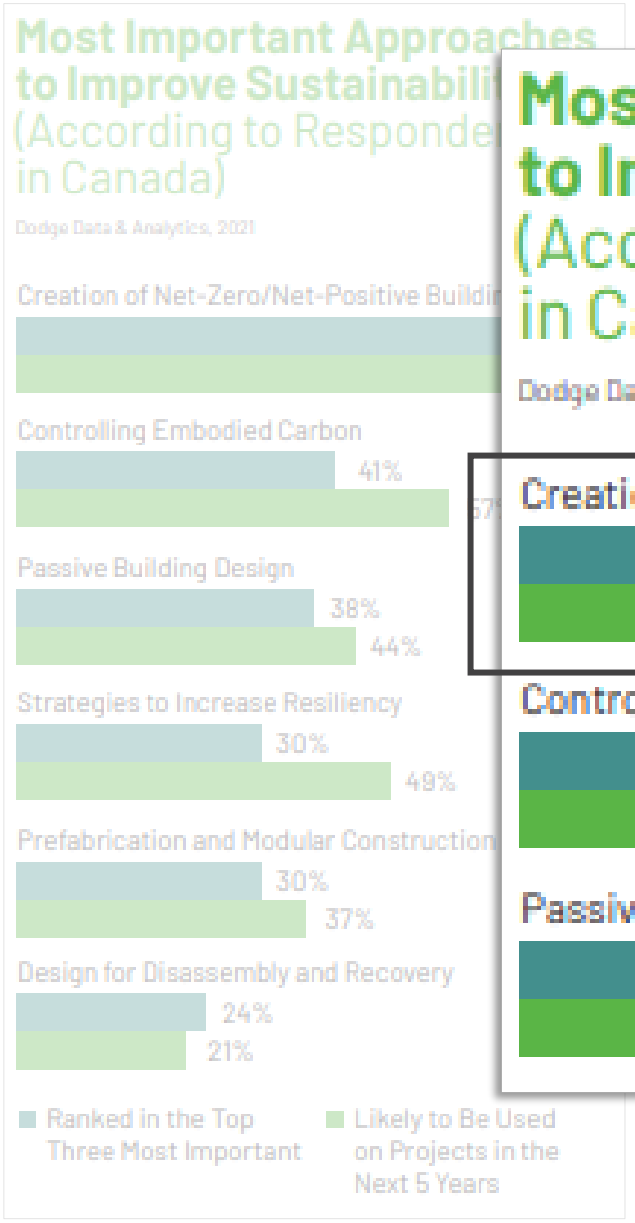
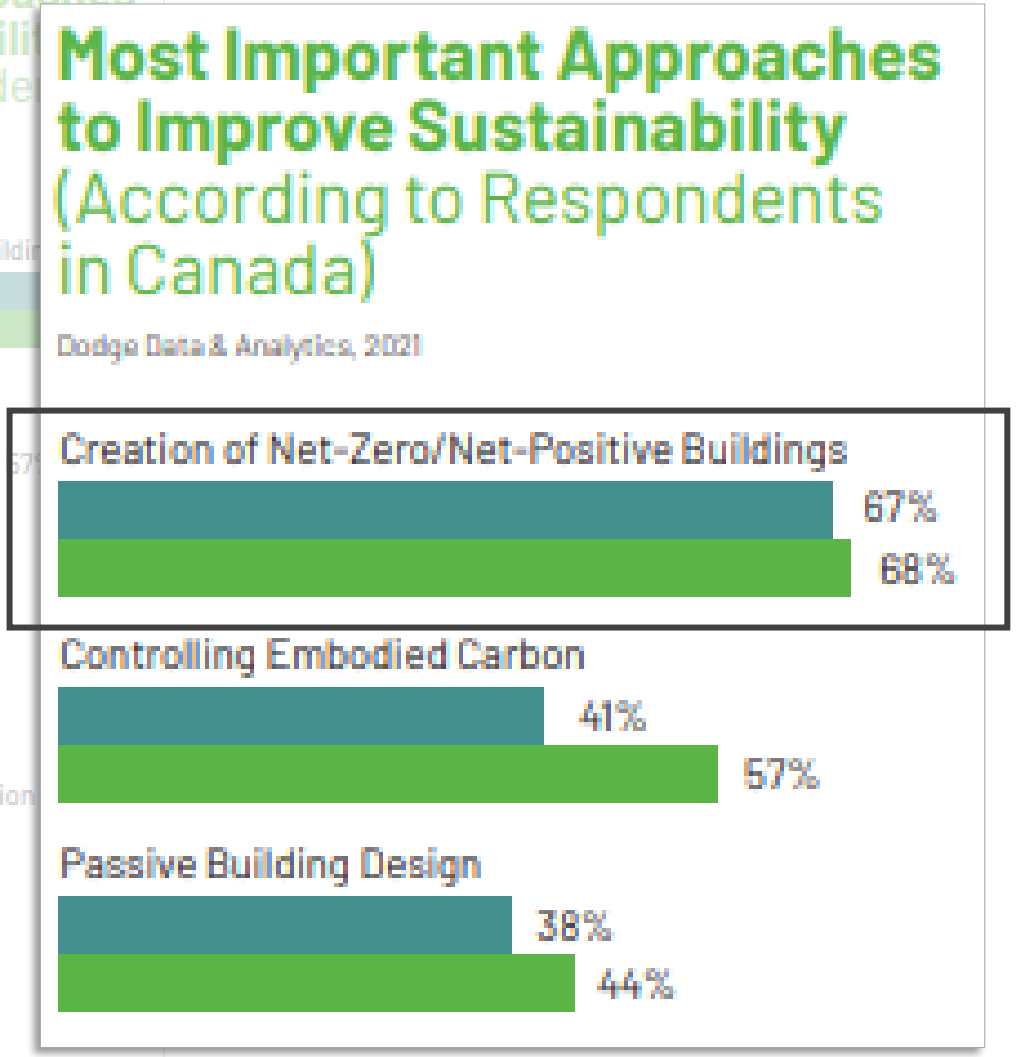
CAGBC


Most Important Approaches
to Improve Sustainabili
(According to Respond
in Canada)
Dodge Data & Analytics, 2021
Creation of Net-Zero/Net-Positive Buildi
Controlling Embodied Carbon
41%
Passive Building Design
38%
44%
Strategies to Increase Resiliency
30%
49%
Prefabrication and Modular Construction
30%
37%
Design for Disassembly and Recovery
24%
21%
Ranked in the Top Three Most Important
Likely to Be Used on Projects in the Next 5 Years


Most Important Approaches to Improve Sustainability
(According to Respondents in Canada)
Dodge Data & Analytics, 2021
Creation of Net-Zero/Net-Positive Buildings
67%
68%
Controlling Embodied Carbon
41%
57%
Passive Building Design
38%
44%

n=63

CAGBC

Strategic market opportunities

Focus on **performance** + **transformation** of entire building portfolio to zero carbon

Building retrofit strategy to reduce carbon emissions to zero over next 10-30 years

Benchmarking + disclosure of energy, carbon + water performance to guide investment

Carbon validation, aggregation + accounting in growing global markets for carbon credits

Performance verification + recognition through credible, rigorous standards/systems

Carbon offsets as a transition to zero carbon performance

Closing Sentiments

Every building has a path to decarbonization.

The zero-carbon balance includes embodied carbon and operational carbon, counterbalanced by avoided emissions.

Buildings are the third highest carbon emitter in Canada, behind transportation and heavy industry (oil & gas).

We need Zero Carbon Buildings to make good on climate commitments.

There is a strong business case for ZCBs.

CAGBC

CAGBC

Building Our Way Forward

Zero Carbon Team

info@cagbc.org

cagbc.org

CAGBC

Region of Peel

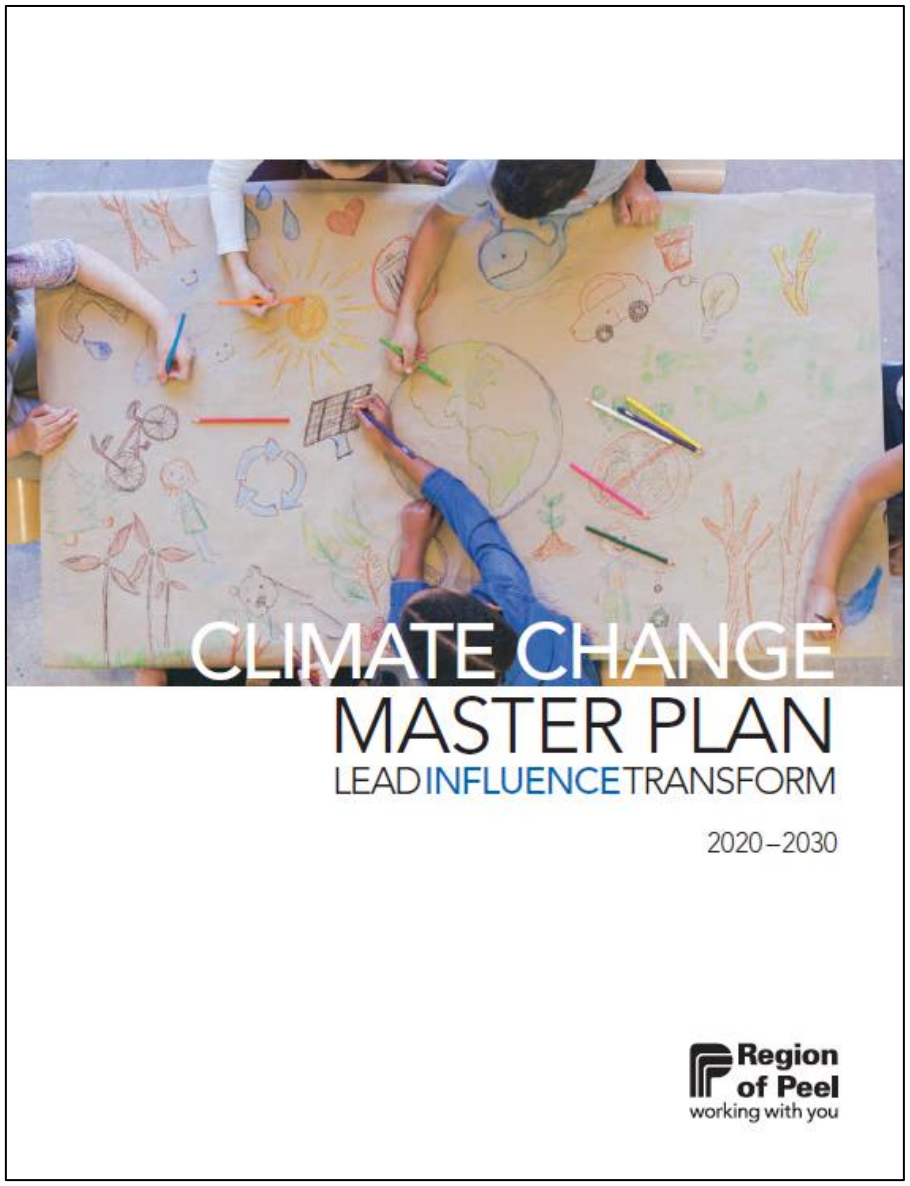
Region of Peel
working with you

Net Zero Emission Standards

Alex Bogun,
Advisor, Office of Climate Change and Energy Management
Region of Peel

The Region of Peel

Climate Change Master Plan Overview



- Timeline 2020-2030
- GHGs 45% below 2010 by 2030
  More prepared for extreme weather
- 20 Actions and 66 Activities
- $300-$400 million estimated incremental costs over 10 years

Decarbonization Journey

- Corporate Targets
- NZE Standard for New Construction
- EEMP for Housing
- NZE Standard for Building Retrofits

Region of Peel NZE Bundle for New Construction

- **Policy:** Declares the NZE Commitment for all new builds
- **Standard**: NZE requirements
- **Implementation Guide**: Roles and responsibilities

NZE Standard for New Construction

- Team effort
- Analysis of impacts
- CaGBC ZCB Design Standard – foundation
- Additional Requirements

ZERO CARBON BUILDING STANDARD
Canada Green Building Council®

+ Additional Requirements

NZE New Construction Projects

- NZE 200 Unit Affordable housing: Geothermal
- NZE + NZEn PW Yard
- NZE + NZEn Paramedic Station

Thank you!

Alex Bogun
Advisor, Office of Climate Change and Energy Management
Region of Peel
Alex.Bogun@peelregion.ca

Region of Peel
working with you

Material Carbon Emissions in Net Zero Emission Buildings

Adam Vaiya, B.Sc., C.E.T., C.E.M., LEED AP BD+C
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Corporate Services
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November 7, 2023

In the fight against climate change… Materials Matter!

Cradle-to-Gate emissions make up 70-80% of a material's full lifecycle emissions

Measuring Life Cycle Environmental Impacts

Life Cycle Analysis (LCA)

measures **environmental impacts** of a building, product, or process over its full life cycle, from raw material extraction through end-of-life and disposal.

Global Warming Potential *($t\ CO_2e$)*

+

- acidification
- eutrophication
- smog formation potential
- ozone depletion

Example Tools:

tally®

One Click LCA

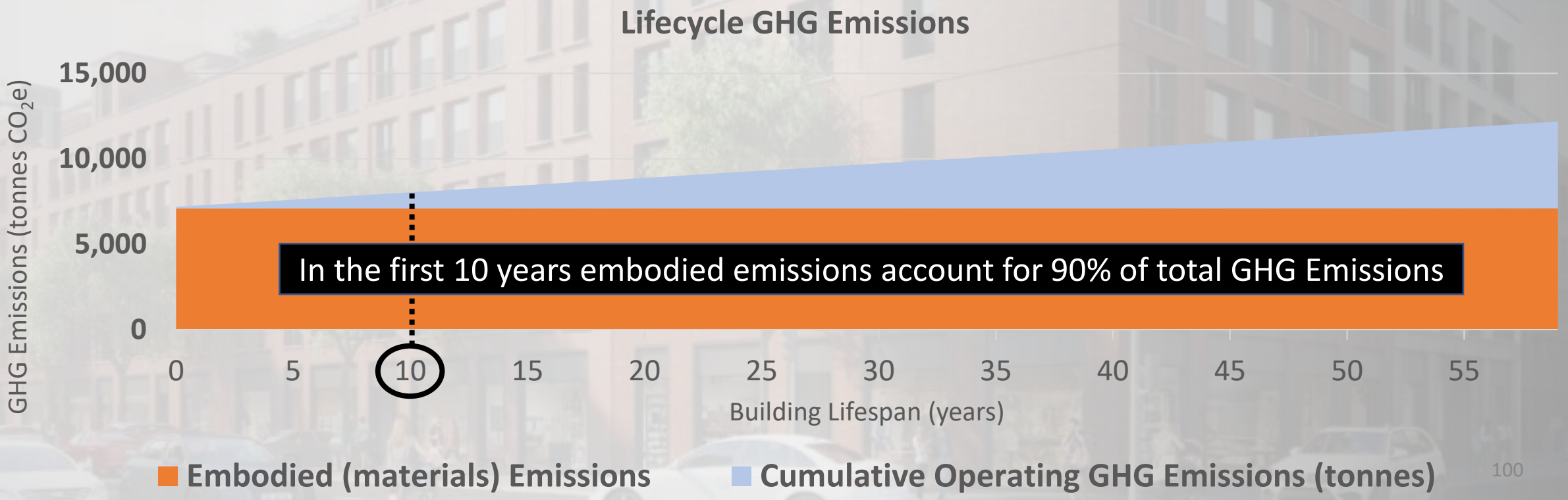
Athena Sustainable Materials Institute

BEACON

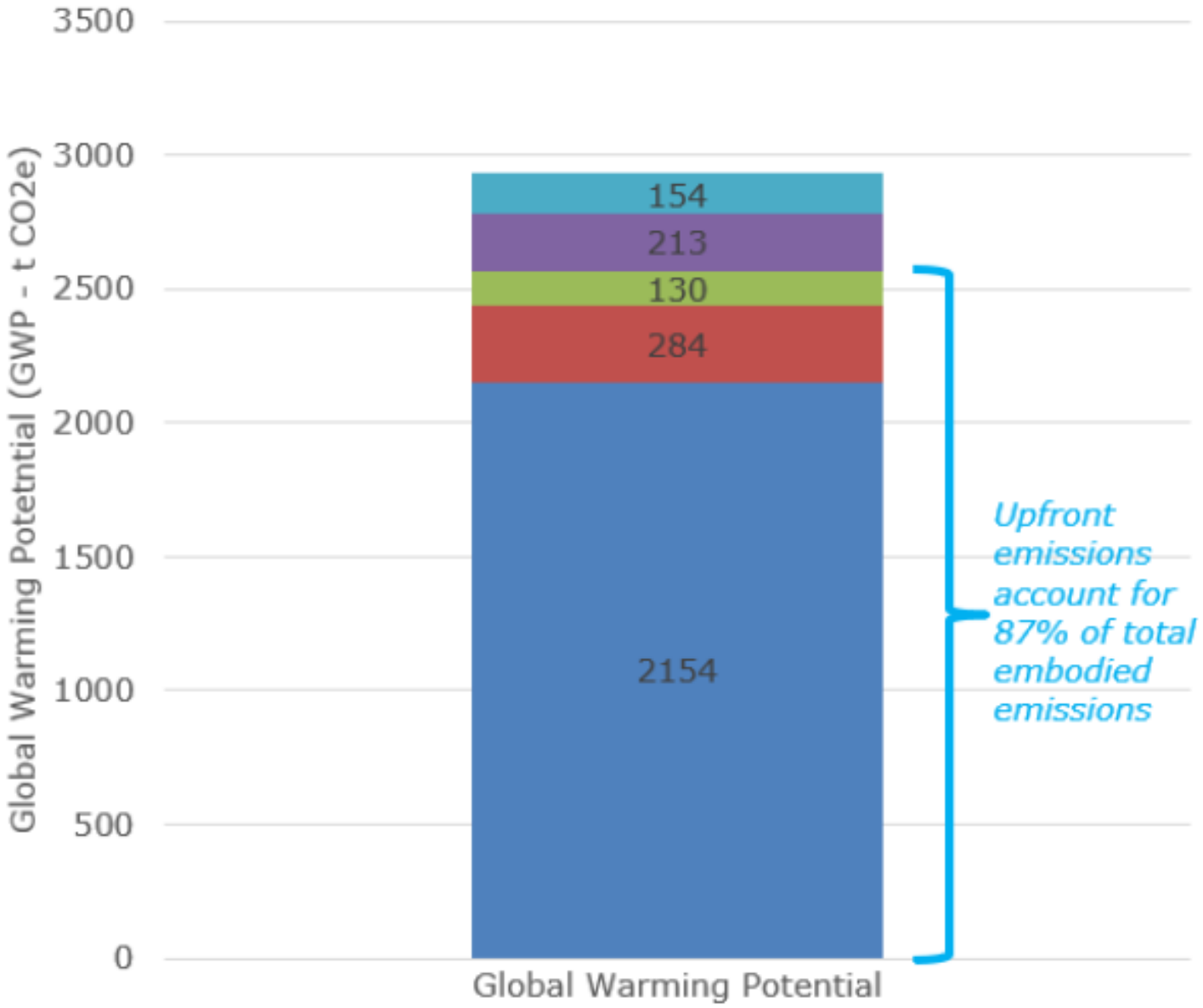
AND MANY MORE….

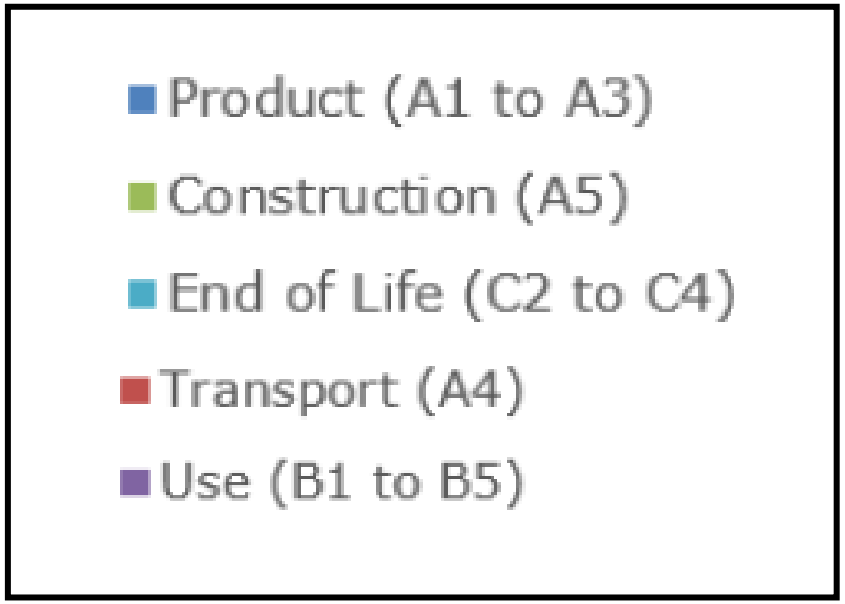
Case Study: Affordable Housing Project

Embodied Carbon *(Structural Construction Materials)*	**7,100 tonnes**
Operational Carbon – NZB *(60-year lifespan; no offsets purchased)*	**5,076 tonnes**
Operational Carbon - base building *(60-year lifespan)*	**16,920 tonnes**



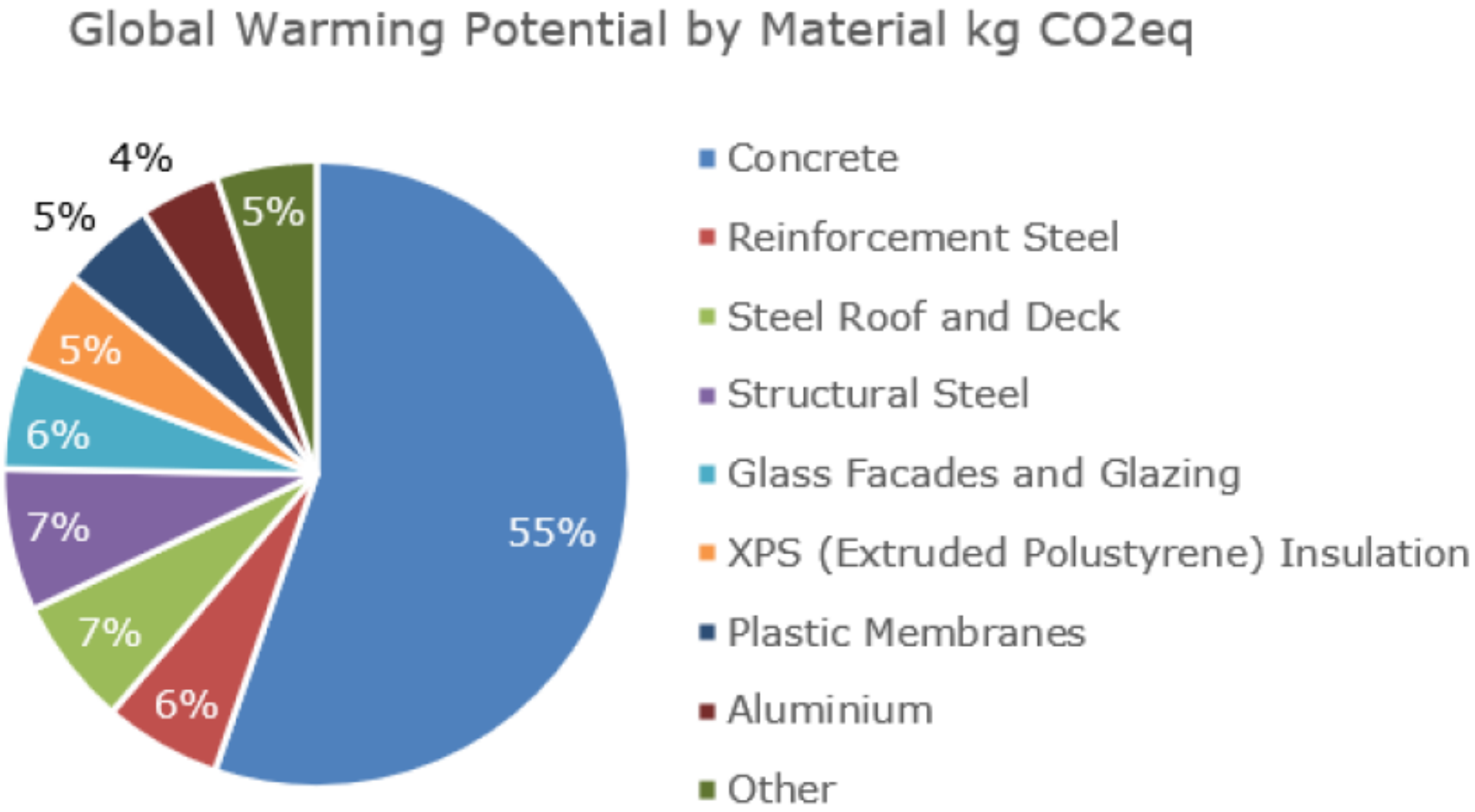
Case Study: Peel Regional Police - New Division



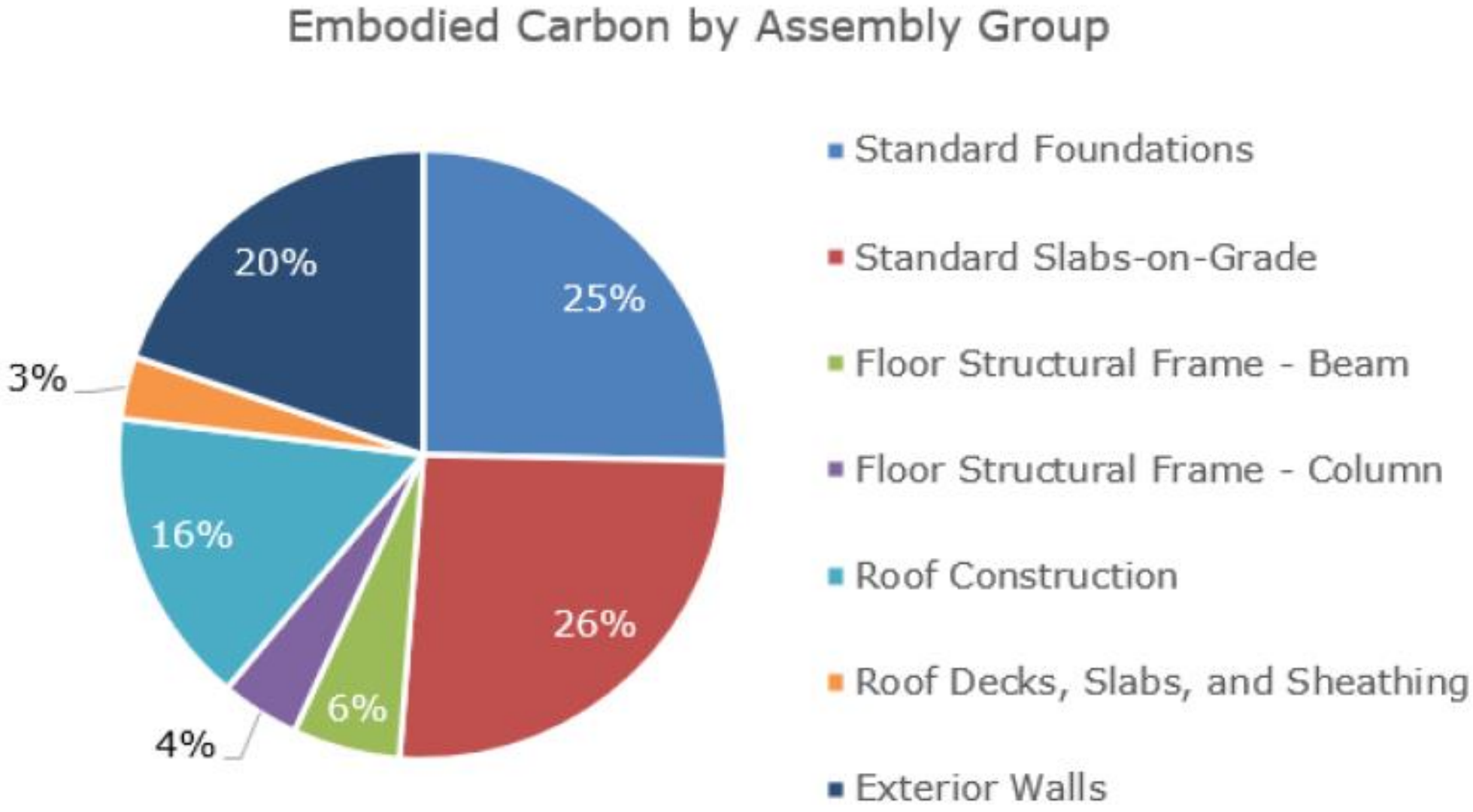


Total GHGI:
447 kg CO_2e/m^2

Case Study: Peel Regional Police - New Division



Case Study: Peel Regional Police - New Division



Case Study: Peel Regional Police - New Division

Optimizing Roof R-Value for minimal GHG Emissions Impact

- Evaluated increasing roof R-Value from effective R-33 → R-40 and R-50
- Operational GHG emissions reduction between 0.2-0.4 tonnes eCO_2 per year
- Embodied carbon increased 19 and 38 tonnes eCO_2 respectively

$160k to $400k increased capital costs for a 95-year return on carbon investment?

Taking a closer look at insulation

Cost and MCE Comparison of Continuous Board Insulation Options				
Board insulation	**Type**	**R/inch**	**$kgCO_2e$ for 10 m^2 @ R10**	**Cost for 10 m^2 @ R10**
	Wood fiber (European imports)	3.6	-36	$567.44
	EPS foam with graphite	4.7	49	$150.12
	Polyiso foam	6.5	50	$244.32
	Mineral wool	4.3	51	$467.87
	EPS foam	4	66	$145.75
	XPS foam	5	987	$279.55

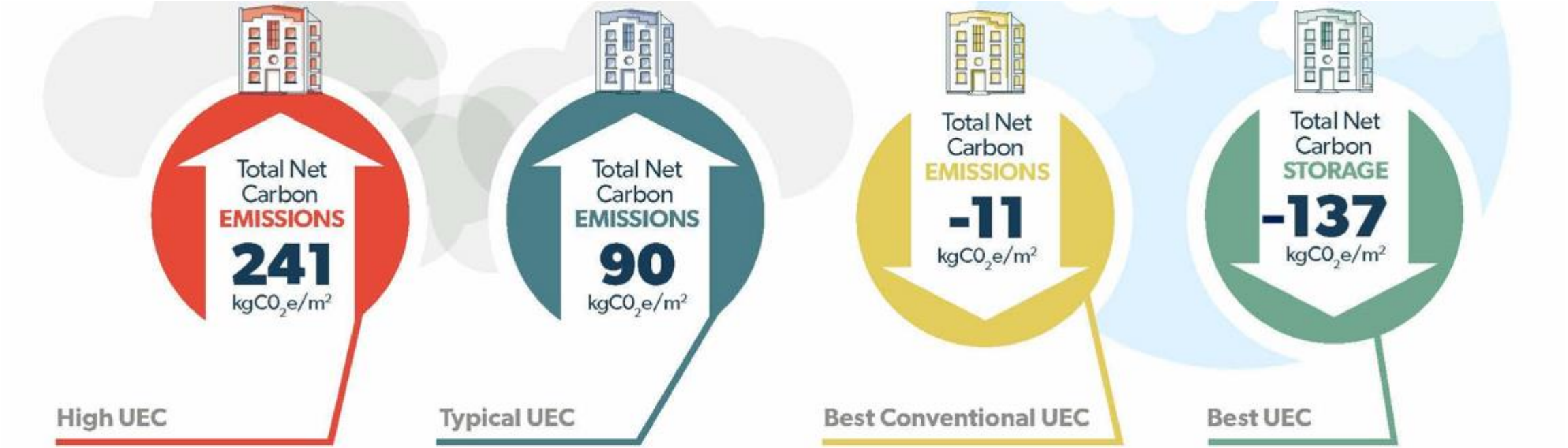
Source: Achieving Real Net Zero Homes

Taking a closer look at insulation

Cost and MCE Comparison of Wall Cavity Insulation Options				
Wall Cavity Insulation	**Type**	**R/Inch**	**$kgCO_2e$ for 10 m^2 @ R10**	**Cost for 10 m^2 @ R10**
	Straw bale	3.3	-128	$49.11
	Hempcrete	2.1	-76	$213.15
	Hemp fiber batt	3.7	-31	$96.33
	Wood fiber batt	3.8	-19	$210.33
	Cellulose batt	3.6	-14	$70.79
	Cellulose dense packed	3.7	-13	$40.83
	Fiberglass batt	3.6	12	$55.47
	Mineral wool batt	3.8	23	$75.84
	Wool batt	3.6	23	$133.93
	ccSPF with HFO blowing agent	6.6	73	$11.73
	ccSPF with HFC blowing agent	6.6	232	$10.66

Source: Achieving Real Net Zero Homes

Rethinking construction: Carbon Source → Carbon Sink!



High UEC

Assembly includes:

- High carbon concrete
- XPS & closed cell spray foam
- Brick cladding
- Steel interior framing
- Drywall
- Vinyl windows
- Tile & carpet flooring
- Clay tile roofing

Typical UEC

Assembly includes:

- Average carbon concrete
- Mineral wool insulation
- Fiber cement cladding
- Wood & TJI interior framing
- Drywall
- Vinyl windows
- Engineered wood & vinyl flooring
- Asphalt shingle roofing

Best Conventional UEC

Assembly includes:

- High SCM concrete
- Cellulose & wood fiberboard insulation
- Wood cladding
- Wood interior framing
- Drywall & wood walls
- Aluminum clad wood windows
- Engineered wood & FSC hardwood flooring
- Steel roofing

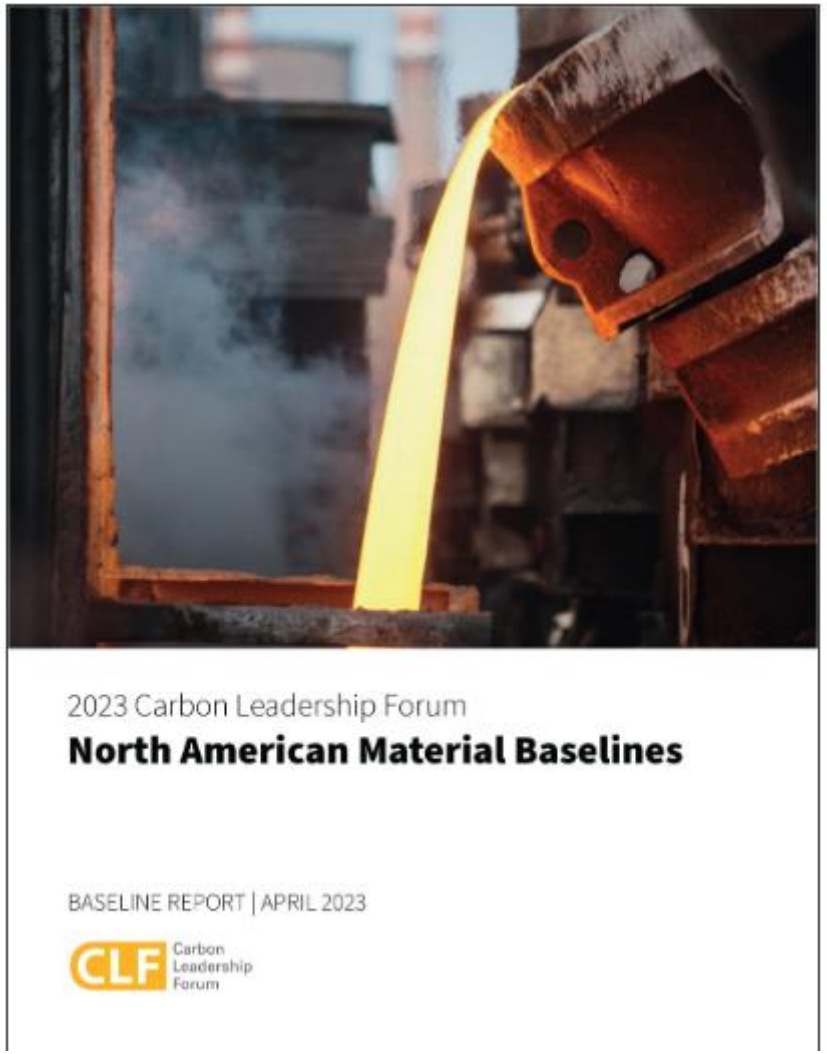
Best UEC

Assembly includes:

- Iso-Span ICF with high SCM concrete
- Expanded glass sub-grade insulation
- Straw & wood fiberboard insulation
- Wood cladding
- Compressed straw panel interior walls
- ReWall interior cladding
- Wood windows
- Linoleum & FSC softwood flooring
- Cedar shake roofing

Specifying Low Carbon Materials

- Use mass timber and other bio-based products
- North American Steel with high recycled content
- Concrete
  - Portland Limestone Cement (Type GUL)
  - More Supplementary Cementitious Materials (SCMs)
  - Carbon sequestering materials
  - Allowing for longer cure times
  - Pouring in warmer temperatures
- **GET THE EPDs!**



RESOURCES: 2023 Materials Baselines
Concrete Ontario: Guide for Specifying Low Carbon Concrete in Ontario

Embodied Carbon Policy: Coming soon to city near you?

SOURCES: https://carbonleadershipforum.org/tangible-next-era-building-codes/ |
Mantle Developments - Toronto Becomes First Jurisdiction in North America to Enact Whole-building Embodied Carbon Caps on New City-owned Buildings

Q&A


Partners in
Project Green
A Program of Toronto and Region Conservation Authority

Thank You!