



# YWCA Putman Family: Multi-Family Passive House Building



- First mid-rise full precast concrete Passive House building in Canada
- Location - Hamilton, Ontario, Canada
- Project Timeline - 2018 to 2021
- GFA: 5017 square meters
- 50 Residential units
- 2 Level podium for community space

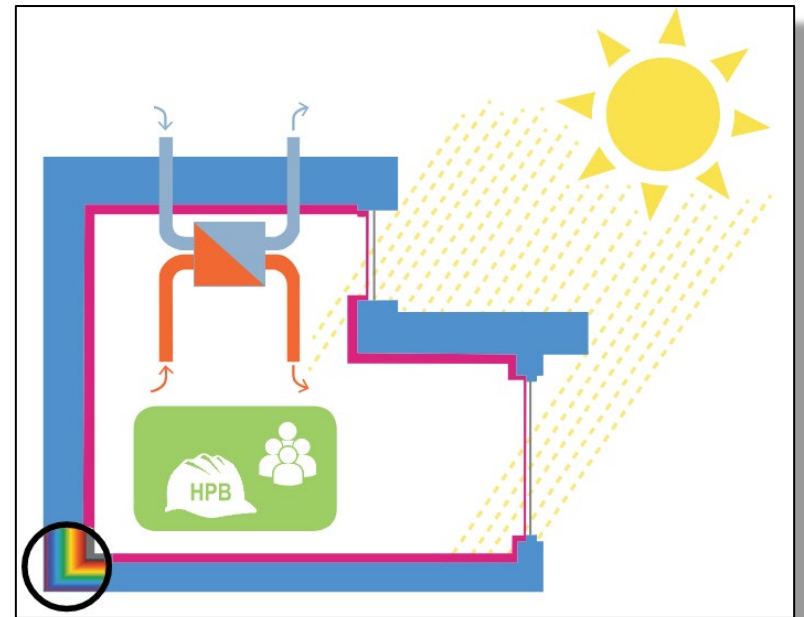
- Social Housing for women-led families
- Mixed-use building
- Community services: amenity space, garden and activities centre
- Must fit into existing residential neighbourhood
- Retain conservation elements from original building, representative of Hamilton's steel town heritage

# BUILDING TO MEET 3 CRITERIA

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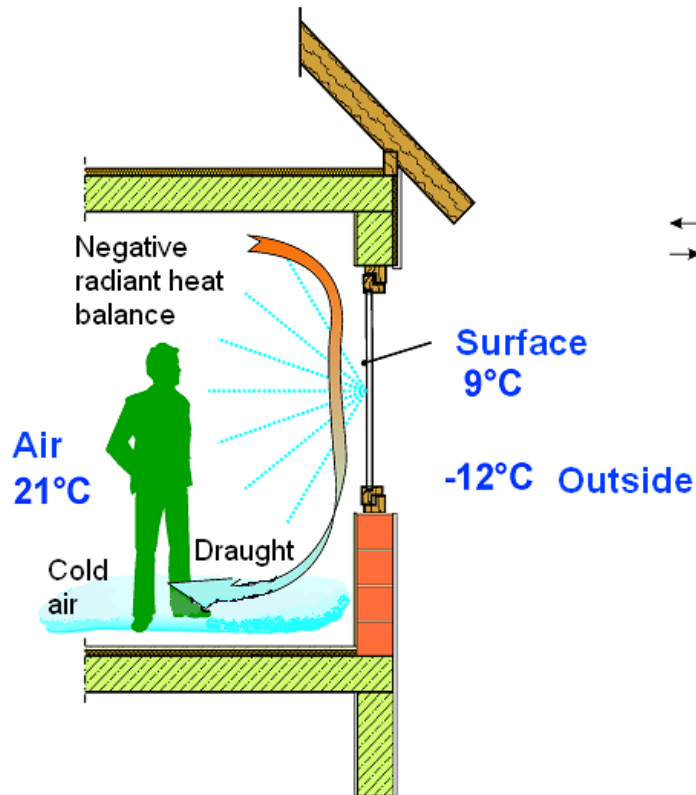
- A **robust** building constructed of a secure material that signifies strength and a place of safety for the community. Concrete offers superior defense against material degradation.
- A **local** material (and manufacturer).
- A building that gives **expression** to the historical manufacturing town it is located in.

- Super insulated
- Airtight envelope
- Triple-glazed windows
- Optimum orientation
- ERV (energy recovery)
- Thermal bridge free
- Compact Design
- PH Trained Team

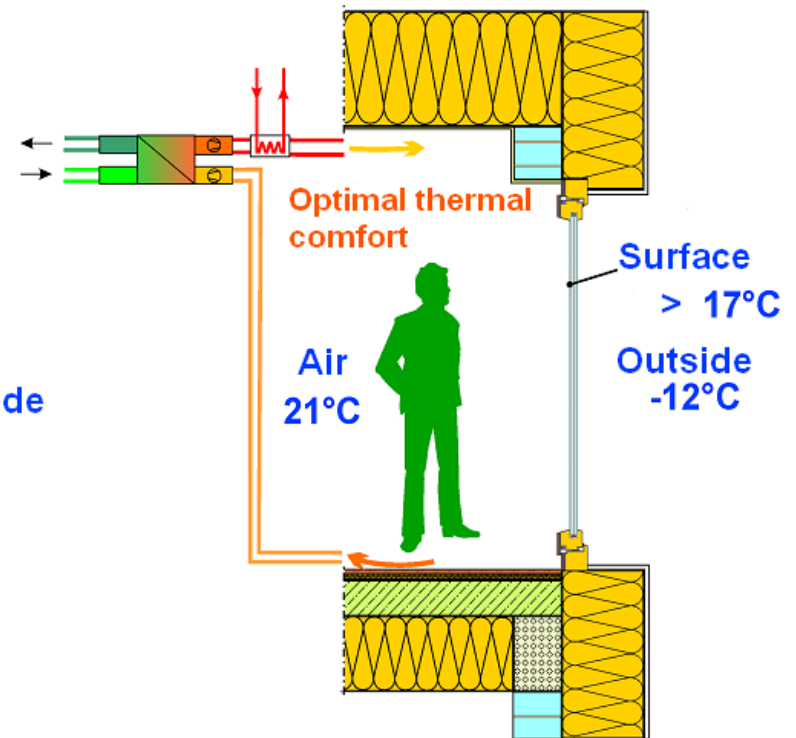


# PASSIVE HOUSE PRINCIPLES

## Building Stock



## Passive House



KEARNS MANCINI ARCHITECTS

# COMPONENT COMPARISON

YWCA  
Project Values  
PHPP v9.6

U <sub>wall</sub> W/(m <sup>2</sup> K)	
0.165 (R <sub>eff</sub> 34)	0.247 (R <sub>eff</sub> 23)
U <sub>roof</sub> W/(m <sup>2</sup> K)	
0.106 (R <sub>eff</sub> 54)	0.156 (R <sub>eff</sub> 37)
U <sub>floor</sub> W/(m <sup>2</sup> K)	
0.141 (R <sub>eff</sub> 41)	0.183 (R <sub>eff</sub> 31)
U <sub>glass</sub> W/(m <sup>2</sup> K)	
0.520 (R <sub>eff</sub> 11)	2.90* (R <sub>eff</sub> 2)

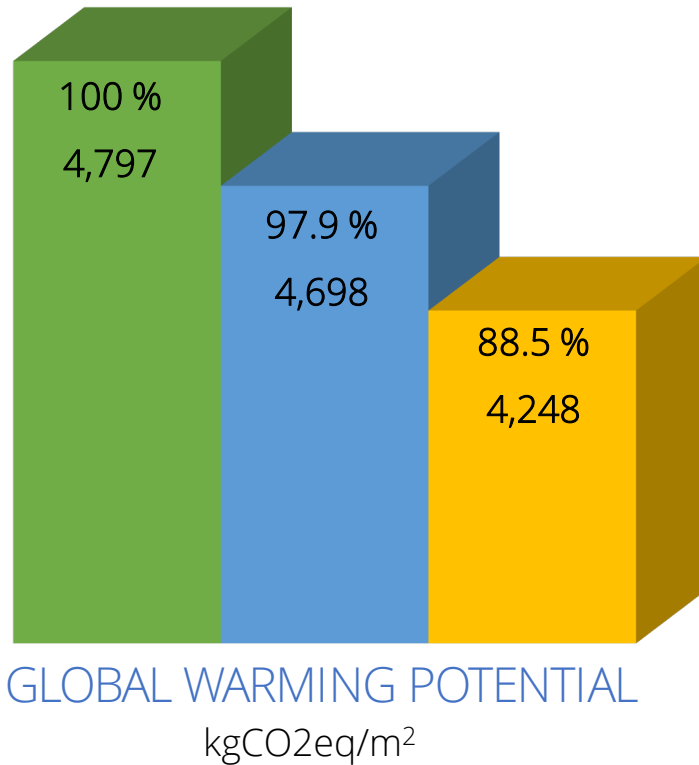
SB-10  
Per Table 3.2.2.2  
Climate Zone 6  
\*U<sub>g</sub> for double-glazed

# WHOLE LIFE CARBON STORY

OPTION A:  
CAST IN PLACE CONCRETE

OPTION B:  
PRECAST CONCRETE

OPTION C:  
HYBRID WOOD CONSTRUCTION

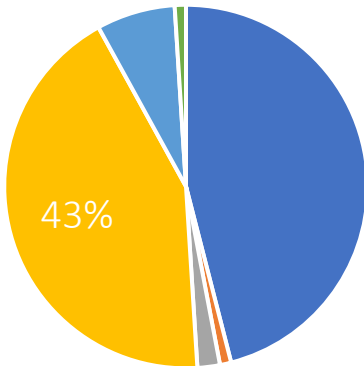


- The combination of:
  - a) a precast concrete structure and envelope
  - b) a local supplier
 helped to lower the carbon footprint of the building compared to the original proposed cast in place concrete design.
- Wood construction was not the best option for this project. While it performs a bit better, a hybrid structure is required, and the program requirements and site constraints reduce its efficiency.

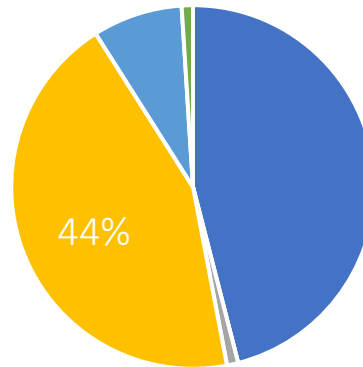


# WHOLE LIFE CARBON STORY

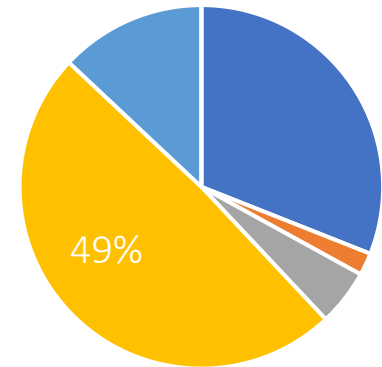
OPTION A:  
CAST IN PLACE CONCRETE



OPTION B:  
PRECAST CONCRETE



OPTION C:  
HYBRID WOOD CONSTRUCTION



- PRODUCT A1-A3
- TRANSPORTATION A4
- MAINTENANCE B2-B5
- OPERATIONAL ENERGY B6
- END OF LIFE C2-C4
- REUSE D

## THE COMMON ELEMENT: OPERATIONAL ENERGY

No matter the building structure, more than 40% of the total carbon emissions are produced during the building's use.

Low energy buildings like PH are key to reduce the overall carbon footprint.

"It is not just about the envelope"

PH is not just about the envelope, it is a holistic, science-based, performance-driven target.

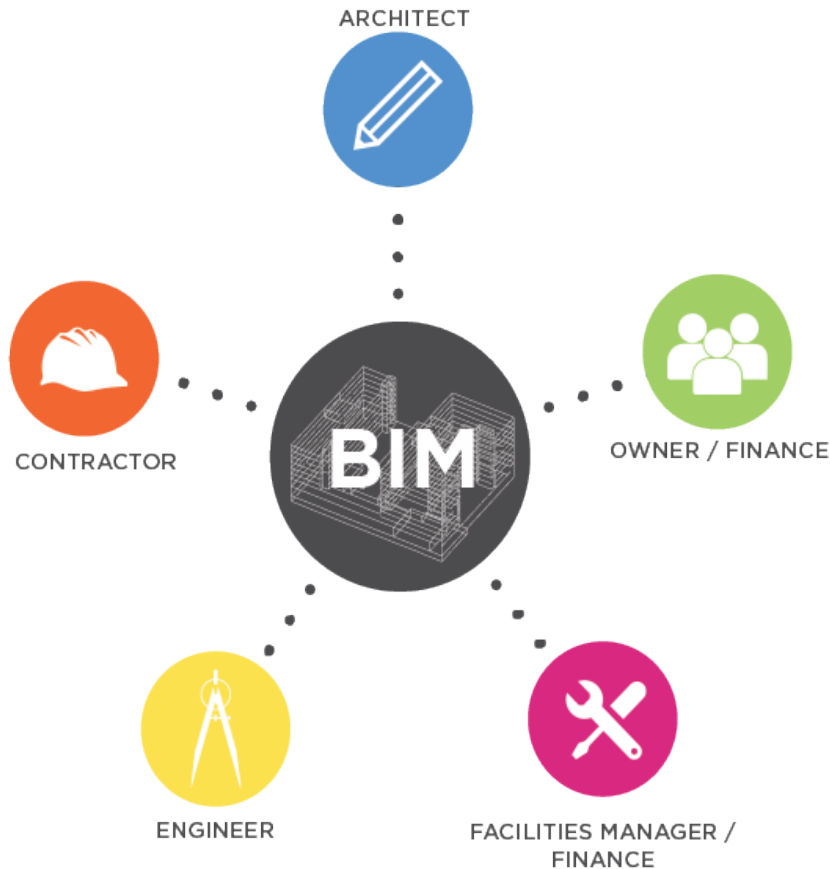
The only way to achieve that is with the whole design team, on the same page.

# INTEGRATED DESIGN PROCESS



- PH Building construction and the required level of coordination are above the typical standard in the industry.
- Discussing, designing, re-configuring precast concrete components to satisfy building requirements and overall design intent is key.
- Mechanical service and thermal bridge penetrations need to be defined prior to construction

# INTEGRATED DESIGN PROCESS



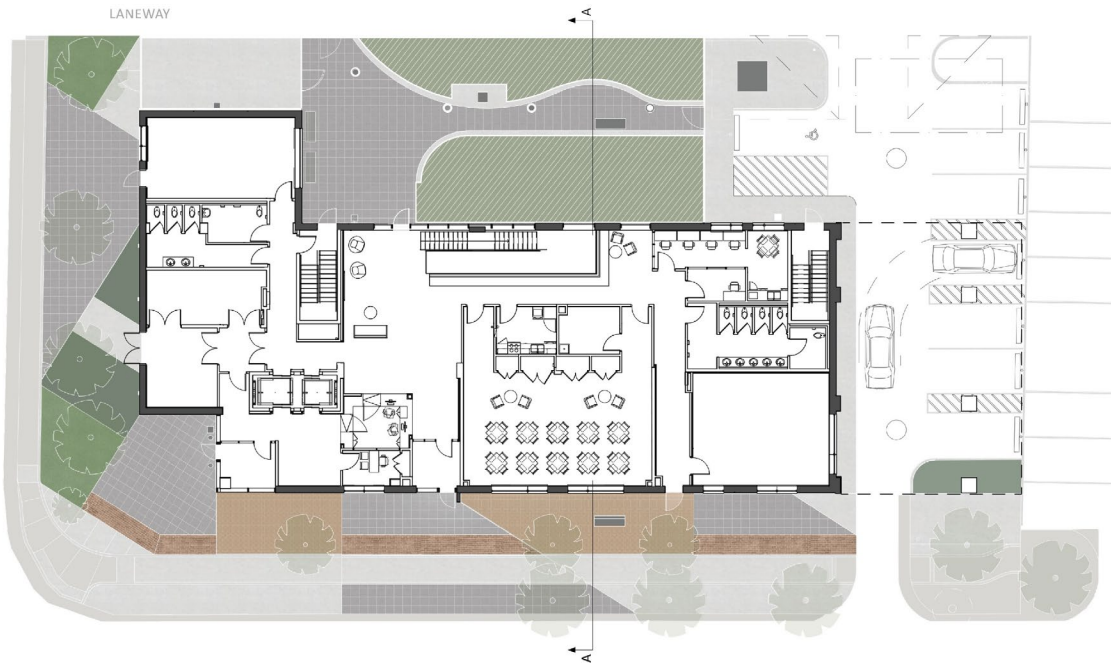
- Weekly REVIT & CAD uploads by manufacturer & consultants
- Drawings reviewed in coordination with 3D model
- Clash detection to coordinate every element of the building

# DESIGN CHARETTE

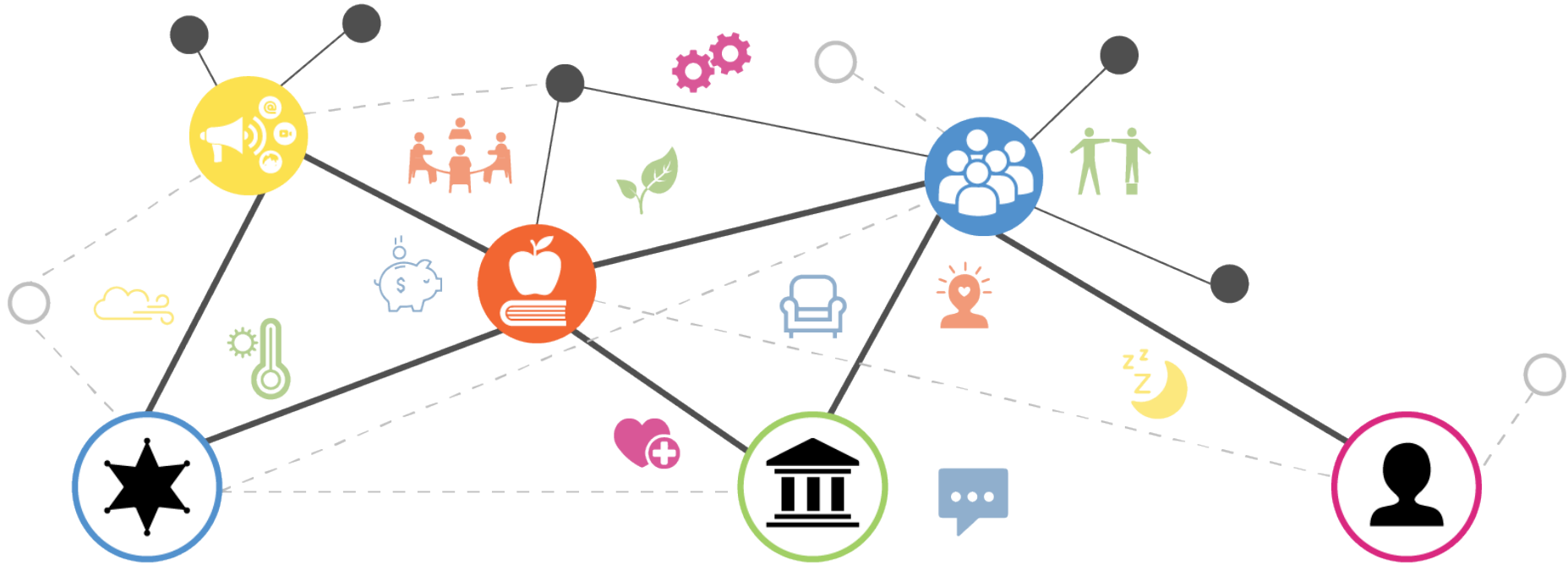
KEARNS MANCINI ARCHITECTS



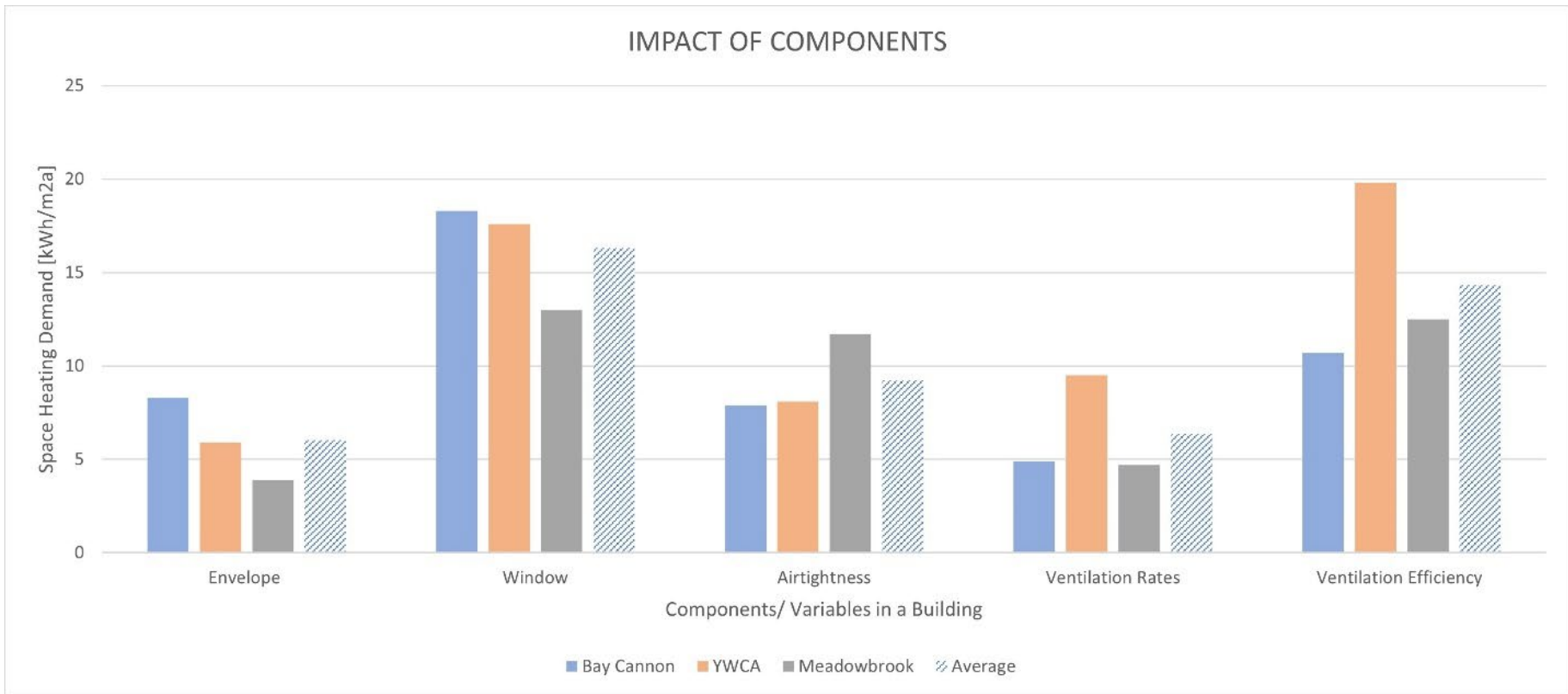
# DESIGN CHARETTE – SITE CRANE



- At these meetings we not only discovered issues with the envelope but with building site conditions and logistics.
- A tower crane was needed due to the loads of the precast, we would have needed to re-design the building footings and the shoring to accommodate the crane footing. Instead, the construction manager, manufacturer, and consultants revisited the site plan design to accommodate the smaller crawler crane, provided by Coreslab for no additional costs.



3Cs: Communicate, Coordinate, and Check!  
MECHANICAL DESIGN IMPACTS DESIGN







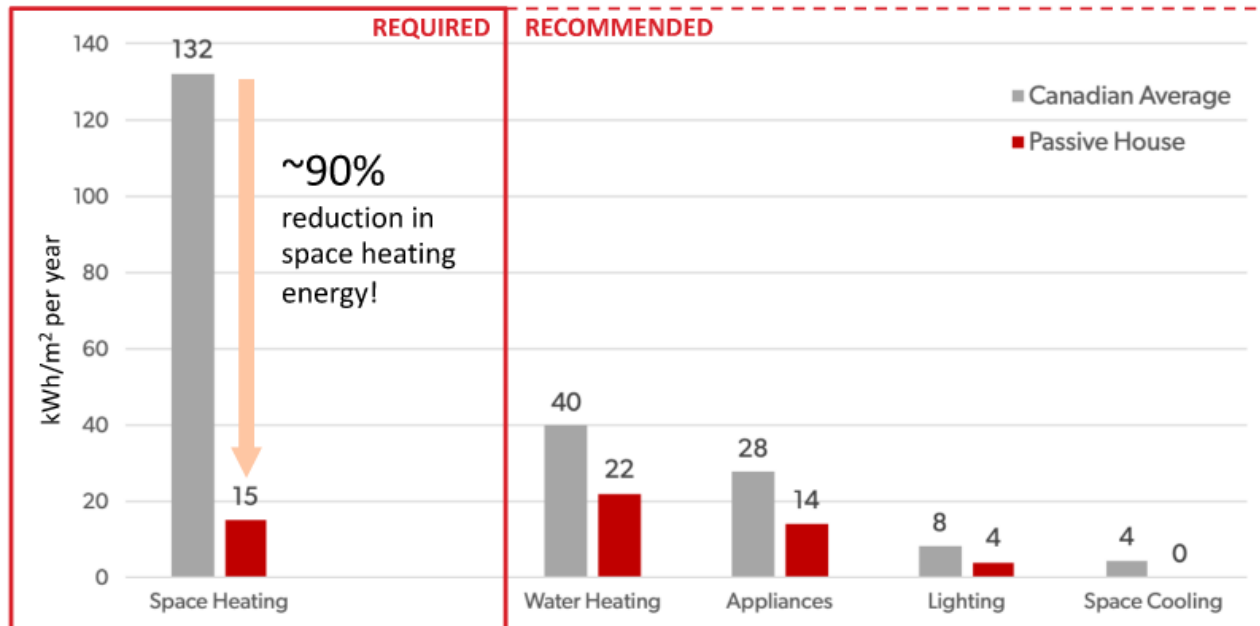
# LESSONS LEARNT

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## MECHANICAL DESIGN PH - IMPLICATIONS

# PASSIVE HOUSE DESIGN

DHW heat demand of 18 – 35 kWh/(m<sup>2</sup>·yr) is higher than space heating – efficient and cost-effective systems for DHW production are required.



Source: NRCan Energy Use Data Handbook Tables (retrieved July 2018)

Suite Type	OBC Requirement Section 6.2.2.1	Passive House Requirement	Percentage Difference
Bachelor	46	35	31%
Bachelor (Barrier Free)	49	35	37%
1 Bedroom	54	36	53%
1 Bedroom (Barrier Free)	62	35	77%
2 Bedroom	94	53	77%
3 Bedroom	100	71	41%
4 Bed Congregate	207	96	115%
Amenity	96	89	8%

# Overall Building Schematic Cartoon

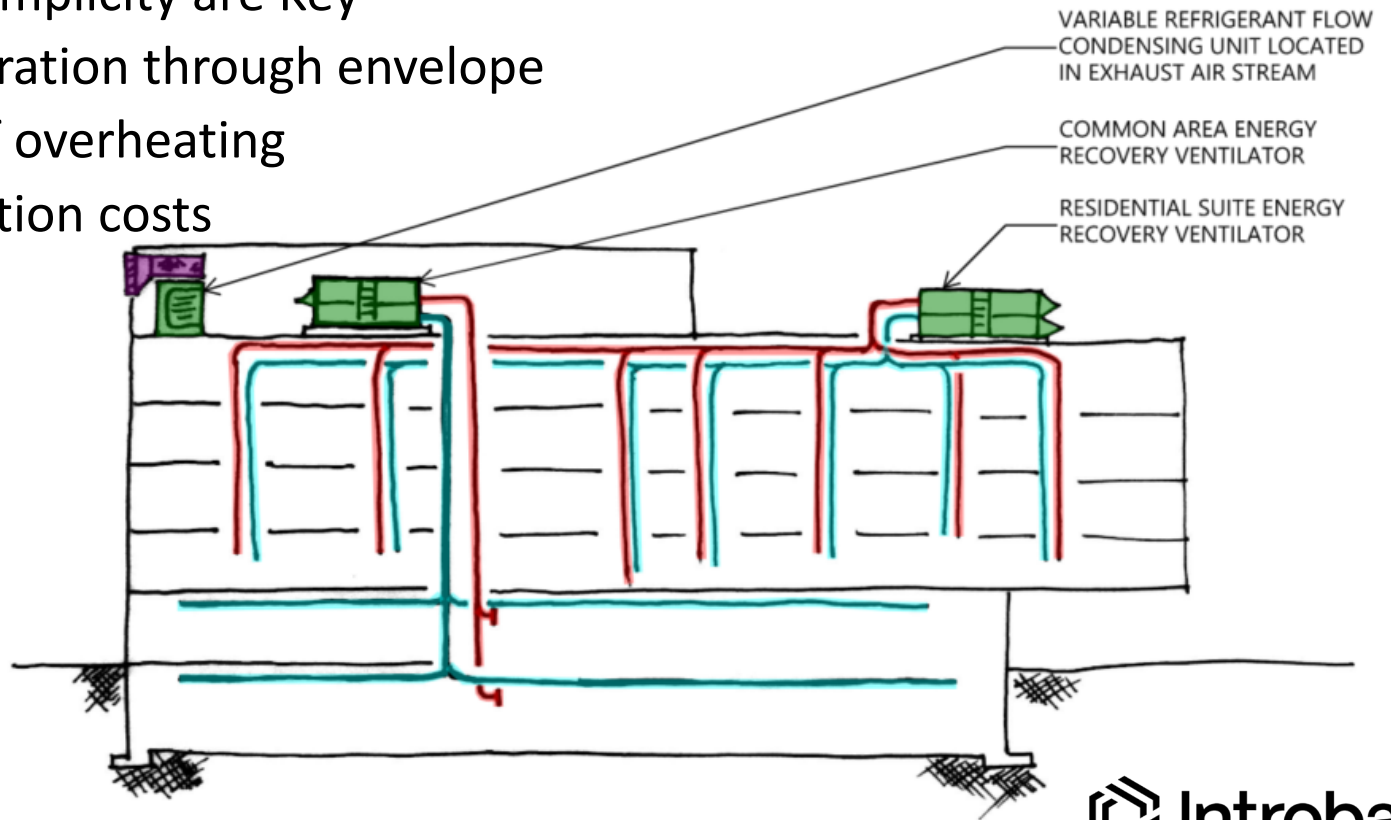
## Centralized vs. Decentralized Distribution

Efficiency & Simplicity are Key

Reduce penetration through envelope

Reduce risk of overheating

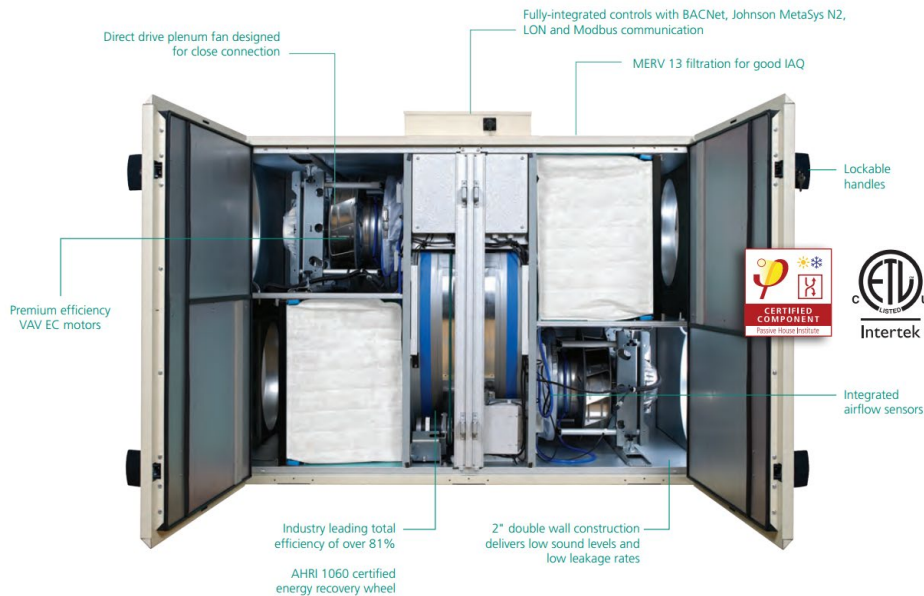
Reduce insulation costs



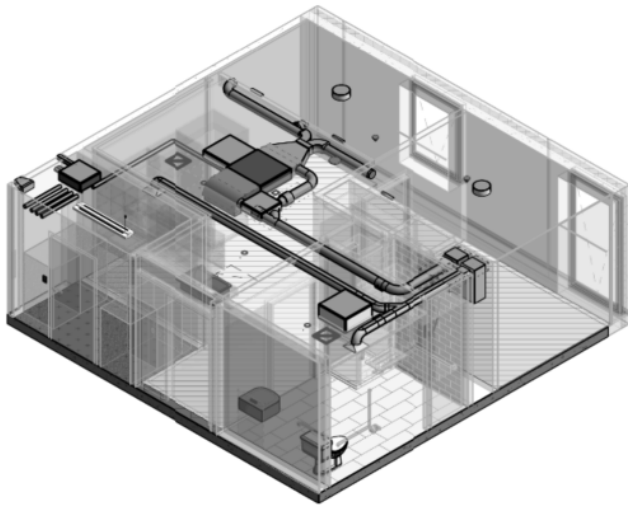
# Energy Recovery Ventilator

## Two Swegon RX-50 Energy Recovery Units

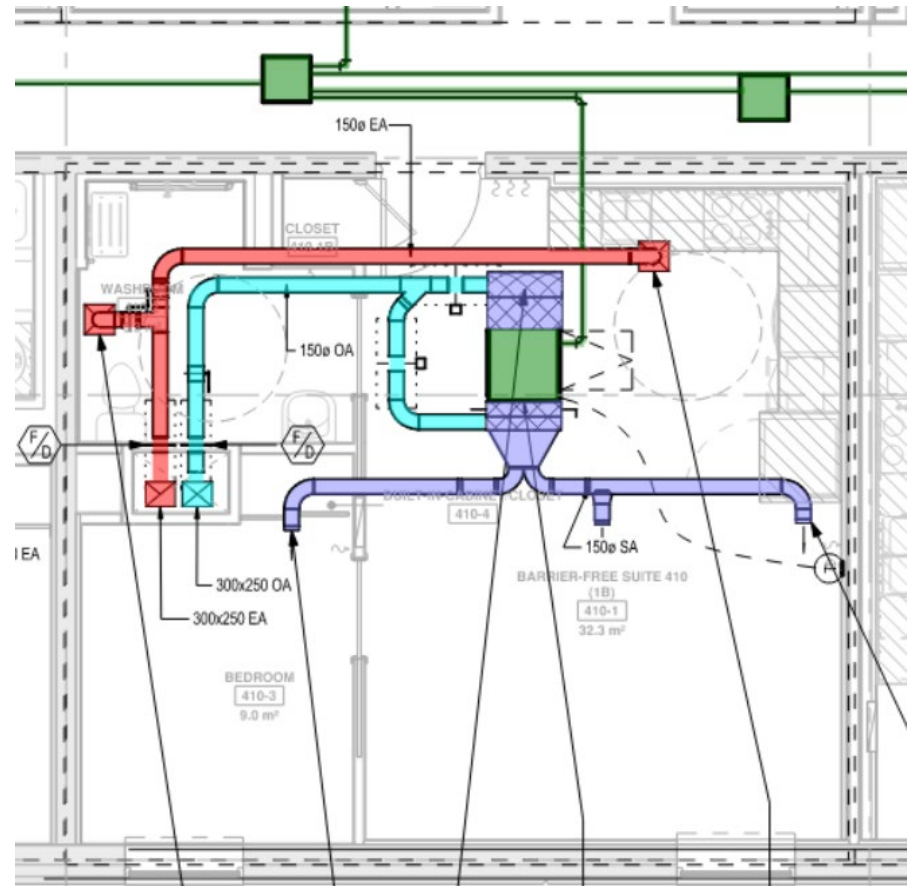
- 81% Total Heat Recovery Efficiency
- MERV 13 Filters
- EC motors
- Desiccant Heat Rotor
- Designed for Low Static Ductwork system with no VAV's



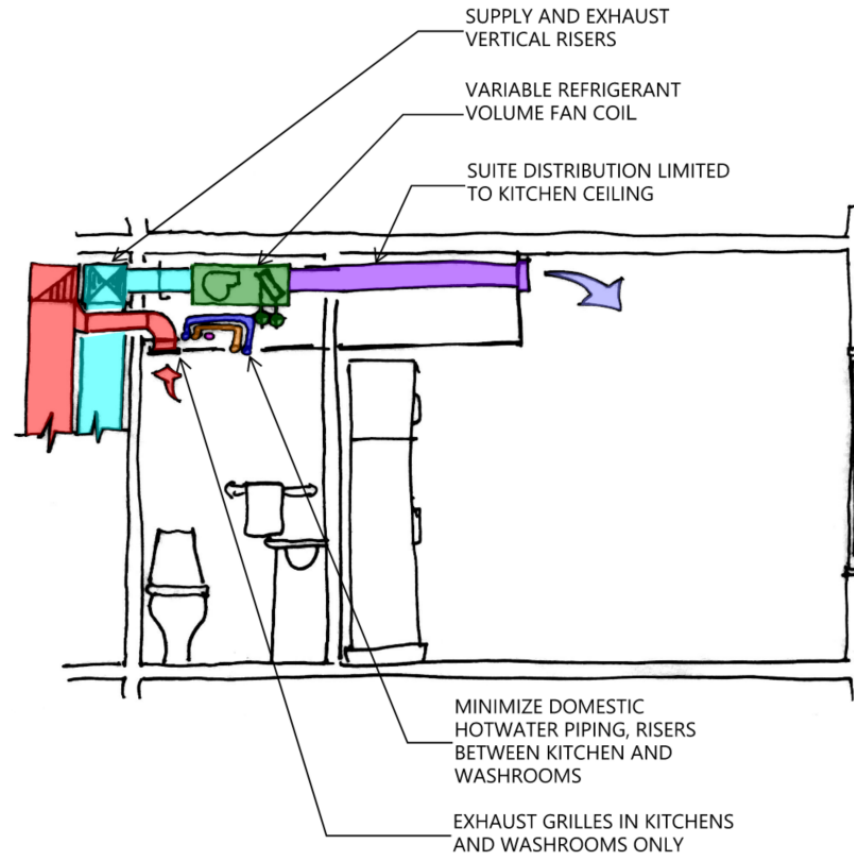
# Typical Suite Plan



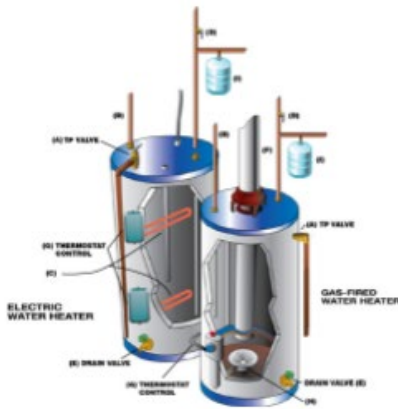
3 TYPICAL SUITE LAYOUT  
N.T.S.



# Typical Suite Section



## Domestic Hot Water



**70-100%**  
Traditional gas  
or electric tank



**200-300%**  
One-piece heat pump  
hot water heater

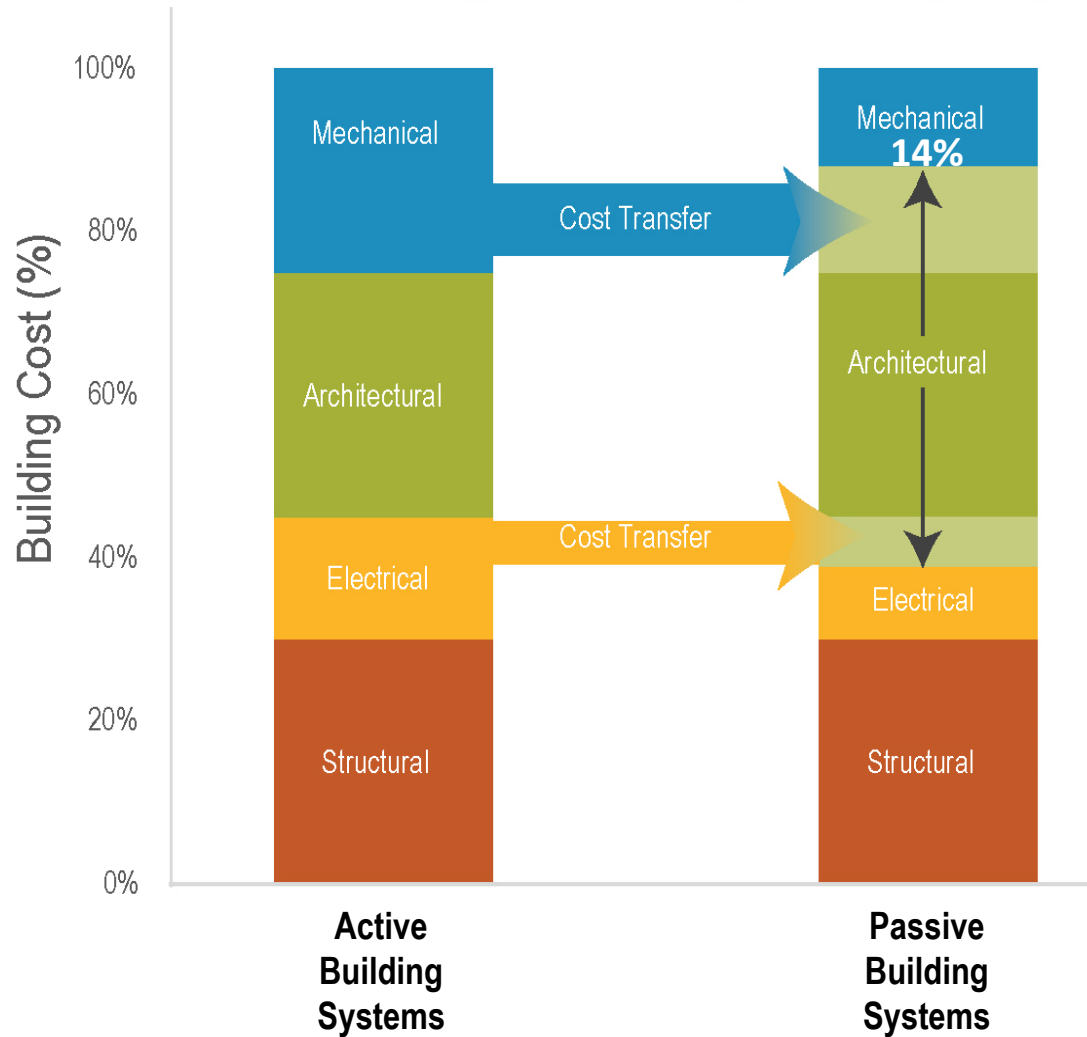


**300-500%**  
CO<sub>2</sub> air-to-water system



- Ductwork is larger than conventional North American design, plan ahead particularly the headers at the top of the suite risers.
- Centralized ERV systems are better for humidity control, this design relies on the fan coils.
- Rules of thumb are not applicable for mechanical design, front load design calculations.
- Certified Passive House equipment is (was) limited. Only two viable manufactures in 2018.
- Coordination and design of the “Corridor Sandwich” needs to be agreed at the outset.
- Using Central Risers for Ventilation can trigger additional requirements to demonstrate compliance with Prevention of Smoke Circulation Clause.
- Using Central Risers for building return and sanitary exhaust can trigger additional cross contamination control measures.

# Cost Transfer to support Passive Systems



## **Typical SB-10 Building**

- Mechanical ~20%

## **University of Toronto Scarborough**

- Mechanical 18%

## **Windsor Essex Community Housing**

- Mechanical 16%

## **Hamilton YWCA**

- Mechanical 14%



**YWCA**  
HAMILTON

# Agenda

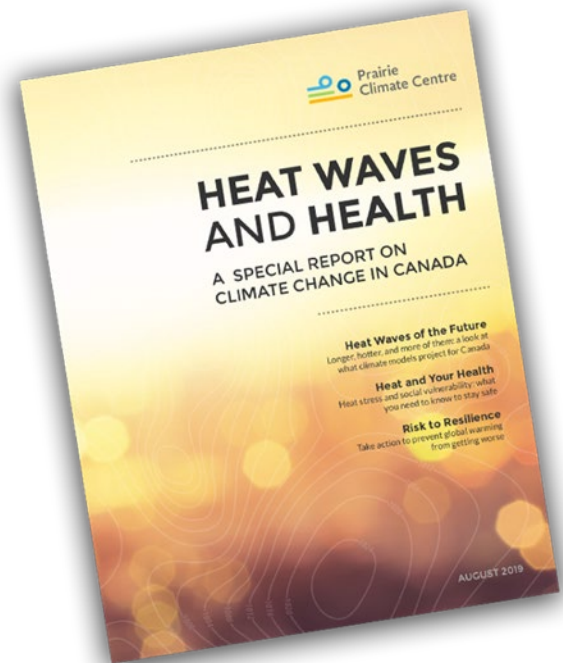
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- 1- Passive House design vs YWCA Hamilton vision
- 2- Securing Funding
- 3- Construction cost and operation cost
- 4- Post-Occupancy Study



- The more frequent severe weather events brought on by climate change have disproportionate negative effects on already vulnerable communities.
- Reducing energy consumption is an important factor in reducing the effects of climate change.
- The current vacancy rate in Hamilton is 1.9% and the average market rent for a 2 bedroom unit has increase 5.3% last year to \$1,438.

- How can we create new affordable homes, without worsening the climate crisis?
- Choose a framework for construction that limits energy use, while staying true to the values of YWCA.





**YWCA**  
HAMILTON

# Funding Requirements

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- Incentive to build better than the Building Code in order to increase the chance to be selected for funding by the federal government (point system).
- The PH Standard was not eligible at the time of the application. Numerous discussion with CMHC to clarify the outcomes of the PH Standard.



- PH experience criteria in the selection during tender.
- We were looking for a sense of safety for the tenants and a sense of community connectivity for users.





YWCA  
HAMILTON

## Make the case

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- Do non-profit organization have the capacity to overcome the construction cost premium?
- Study shows a decrease over time of the capital cost investment required to achieve PH standard.
- Hope that the maintenance costs will be lower due to simpler mechanical system and less ductwork.
- Operational cost should be lower as well, and utilities bill lower for tenants. Be cautious about the potential savings.

# Putman Family: Final Product



- Delivers more than expected. Beautiful, bright and quiet.
- Better indoor air quality
- Construction cost premium for the Putman Family YWCA is 3%
- Post-occupancy evaluation in partnership with CMHC, TAF and University of Toronto.

- Both building residents and staff like the overall aesthetic. Comfort is perceived as an appreciated design element.
- Staff note operating the building is easy to average, staff find it difficult to maintain HVAC systems.
- An informative session explaining the basics of PH has been held for tenants and staff and educational material has been distributed to tenants as well.



# YWCA point of view

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- Next development will be PH.
- The additional cost is not a barrier
- The complexity is only a perception
- Build the right team from the early stages of the project
- Hamilton is a hub for PH MURBs. CHH and Indwell are leading the way with multiples projects already completed.
- The incentives from the different levels of government have created a momentum in Hamilton. If non-for-profit organizations can build to the PH Standard, private developers can and should as well.

