Welcome to Today’s Webinar

December 16, 2020

Passive House Design and Residence Halls: The Perfect Pairing
Passive House and Campus Housing
The Perfect Pairing

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Questions related to specific products and services may be addressed at the conclusion of this presentation.
Course / Learning Objectives


2. Discuss how an integrated planning approach was implemented to enable the campus to realize its goal of a Passive House building.

3. Identify how Passive House design principles are incorporated into the Residence Hall design documents using UTSC as a case study.

4. Discover how to restructure your RFP packages/project delivery approaches to allow for proper incorporation of Passive House design into a project.
University of Toronto Scarborough (UTSC): A Campus Committed to Experimentation and Innovation

Campus opens 1967
UTSC: 2020 Campus Facts and Figures

- **Total Number of Students**: 14,068
  - 28% International from over 100 countries
  - 72% Domestic
- **77% with curricular experiential learning experience**
- **282 student clubs**
- **FALL 2019 graduates**: 2,384
- **TOTAL ALUMNI**: 55,267
UTSC: Current Innovation

1. Design excellence
2. Aspiration to influence change
3. Create a culture of leadership.
4. Create an inclusive, healthy learning and working environment
Campus focus on Health and Wellness

Healthy Campus Initiative

Derives from the Okanagan Charter:

• The Healthy Campus Initiative strives to embed health in all aspects of campus culture, operations and academic mandates.

• To lead health promotion action and collaboration locally and globally.

• Our Goal is to recognize all campus activities, events, programs, initiatives that align with the Healthy Campus mandate.
The Student Demographics Have Changed - Energy Usage and Cost

Students require more energy; the University aims to reduce overall energy consumption

<table>
<thead>
<tr>
<th></th>
<th>1973</th>
<th>Today</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tuition¹</td>
<td>$417 CAD ($306 USD)</td>
<td>$6,100 CAD ($4,477 USD) (Doubled in real dollars)</td>
</tr>
<tr>
<td>Air Conditioning</td>
<td>no - Open a window!</td>
<td>AC expected</td>
</tr>
<tr>
<td>Plug Load needs</td>
<td>Low! Lighting, stereos</td>
<td>High! Lighting, WiFi, gaming, computers, refrigerators</td>
</tr>
<tr>
<td>Source of Energy</td>
<td>Primarily Oil</td>
<td>Leaning to electrification</td>
</tr>
<tr>
<td>Diversity of user group</td>
<td>Primarily local</td>
<td>25% international</td>
</tr>
</tbody>
</table>

¹ Value of CA currency from 1970 to today: $1 = $6.79
The Student Demographics Have Changed - Health and Wellness

Students require an environment that is sensitive to their needs

<table>
<thead>
<tr>
<th></th>
<th>1973</th>
<th>Today</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mental Health Support</td>
<td>Minimal Social Services</td>
<td>Holistic awareness of mental health needs</td>
</tr>
<tr>
<td>Accessibility needs</td>
<td>Lack of accommodation</td>
<td>Inclusive built environment</td>
</tr>
<tr>
<td>Emotional Support</td>
<td>Independent minded - very few support services</td>
<td>Extensive services expected - Resident advisors, live-in student support advisors</td>
</tr>
<tr>
<td>Amenity Spaces</td>
<td>None expected</td>
<td>Study rooms, collaboration rooms, elaborate food services 24/7</td>
</tr>
<tr>
<td>Interior Environment</td>
<td>Very little focus on healthy interior environment</td>
<td>Control of Allergies Temperature control Infiltration of natural light Air Quality/Circulation Acoustic mediation</td>
</tr>
</tbody>
</table>
What is driving your decision making process at the onset of a new building project? Choose 2:

1. **Health and wellness**
2. **Sustainability** in regard to curtailing energy usage
3. **Sustainability** in regard to materials/embodied energy
4. **User experience**, ie amenities, student services
5. **Affordability**
6. **Durability** of the building to stand the test of time
WHAT IS PASSIVE HOUSE?

- **A rigorous certification** program whose primary focus is to curtail energy usage and increase user comfort.
- Unlike **pass/fail checklists** of Prescriptive standards, Passive House is an overall holistic approach based on ultimate full building Performance.
- Focus is on **Building Enclosure** and **MEP systems**.
- Requires careful detailing during design and a strict quality control program during construction to yield an extremely **well built building**.
WHY PASSIVE HOUSE TO COMBAT GLOBAL WARMING

- **Reduce energy** needed to operate a building by 60-80%
- **Eliminate** dependence on fossil fuels
- **Reduce** carbon emissions
- **Lower** greenhouse gas impact
- **Ease compliance** with government mandates (new laws, codes, standards)
Median Energy Use of All NYC Buildings over 200,000 sq. ft.

130.0 kBTU/SF/yr (PEUI)

Energy Use of Passive House Buildings

38.1 kBtu/ft²/yr (pEUI)

60-80% REDUCTION

Doing radically more with radically less
Making the Case for PH
The Passive House Impact: Source Energy Use Intensity (pEUI) Distribution Comparison

Typical NYC Multifamily Residential Building

- 38% HEATING
- 15% PLUG LOADS
- 15% DHW DEMAND
- 14% PUMP & AUX ELEC
- 10% LIGHTING
- 5% COOLING

Multifamily Passive House Building

- 34% PLUG LOADS
- 29% DHW DEMAND
- 13% LIGHTING
- 13% PUMP & AUX ELEC
- 5% HEATING
- 6% COOLING

61% REDUCTION

130 kBtu/ft²/yr → 50 kBtu/ft²/yr


1IECC 2018 Average

SCUP - Passive House and Campus Housing  |  © Handel Architects 2020
## Passive House Institute (PHI) Performance Criteria for Certification

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall Source Energy Allowed ((p\text{EUI}))</td>
<td>38.1 kBTu/ft(^2)/yr*</td>
</tr>
<tr>
<td>Heating Energy Allowed</td>
<td>Max 4.75 kBTu/ft(^2)/yr</td>
</tr>
<tr>
<td>Cooling Energy Allowed (NY)</td>
<td>Max 5.39 kBTu/ft(^2)/yr (region specific)</td>
</tr>
<tr>
<td>Minimize Air Infiltration (5-10 times tighter than typical)</td>
<td>0.6 ACH (Air Changes per Hour) through the facade at 50 pascals of pressure</td>
</tr>
<tr>
<td>Exhaust and Supply Ventilation</td>
<td>Balanced, with energy recovery</td>
</tr>
</tbody>
</table>

*Can be adjusted for density and use.

\(p\text{EUI (source)} \text{ kBtu/ft}^2/\text{yr}\)

130.0 IECC 2018 Average from NYSERDA Energy 2018 Report

38.1* Passive House
WHY PASSIVE HOUSE

HEALTH AND WELLNESS

- **Offer a healthier** interior environment to our students
- **Provide superior indoor air quality** via fresh filtered ventilation to every habitable rooms 24/7
- **Offer a quieter** interior environment to our students
- **Increase durability** of building materials
- **Eliminate** drafts/temperature differentials and provide **superb thermal comfort**
WHY PASSIVE HOUSE
FOR UNIVERSITY OF TORONTO SCARBOROUGH

- **Reduce energy** needed (and cost) to operate the building
- **Align** with the Okanagan Charter for Health Promoting Universities and Colleges
- **Align** with overall Campus Strategic Plan
- **Enlighten** the student body - Build Advocacy
- **Bring Passive House** techniques to the construction industry
- **Lead by Example** - Put the University at the forefront of innovation
Initial Project Planning and Internal Approvals
Gathering Stakeholder Input

Need to hit all the checks and balances

• Financing Partners
  Capital planning at UT is in-house.
  UT process for Residential buildings require outside funding from like-minded partner

• Can we afford PH?

• 2016 UTSC Team attends Darmstadt, Germany PHI Conferences.

• 2017 Fengate joins and attends PHI Conference in Vienna, Austria to learn more about PH.

• UTSC attends tour of Cornell Tech in NYC

• Need the support of UT Governing bodies for capital projects
  UTSC Campus Council
  Academic, Business, Planning and Budget

• UT Sustainability Group
Assembling the RFP

Establishing Criteria

- University wanted to “explore the potential” for PH certification
- RFP required Tier 3 Toronto Green Standards, but DESIRED better
- University standard: 40% better than ASHRAE
- Created a Passive House feasibility phase
Making the Case for PH

**Speaking to the stakeholders**

- UT Sustainability Group
  - Illustrate energy savings
  - Tier 3 Analysis
  - 40% Better than ASHRAE Analysis

- Campus Planning/Facilities Management
  - System Design
  - Facade Design
  - Flexibility of PH to suit the project

- Financial oversight
  - Cost Comparison exercises
Making the Case for PH
Tier 3 Vs Passive House

**Tier 3**
- Façade R value: R 20-30
- Roof R value: R 30
- Double Glazing
- Non-VRF systems possible, but difficult

**Both**
- Conduct whole building air tightness test
- Provide Energy Recovery
- Reduce Energy needed for Domestic Hot Water delivery
- Specify extremely Low Energy Power, Pumps, Electrical Equipment
- Provide extensive occupancy sensors connected to MEP systems
- Provide Lighting Controls and an Addressable system
- LED lighting, Energy Star appliances throughout
- Fresh air ventilation to each habitable room

**Passive House**
- Taping at all façade joints, taping around all pipe penetrations to meet stringent air tightness criteria
- Thermally break all metal to metal connections.
- Façade R Value: R 25-30
- Roof R value upwards of R 40
- Triple Glazing
- Extremely low U values for windows
- VRF heating and cooling system
### FACADE SELECTION

<table>
<thead>
<tr>
<th>Higher Cost</th>
<th>Lower Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Field installed rain screen on stud wall, taped foil faced insulation</td>
<td></td>
</tr>
<tr>
<td>Prefab “Super Panel” w/ insulation, membrane air barrier</td>
<td></td>
</tr>
<tr>
<td>Precast panel + insulated wall, membrane air barrier</td>
<td></td>
</tr>
<tr>
<td>Brick + block cavity wall, liquid air barrier</td>
<td></td>
</tr>
<tr>
<td>EIFS, on metal stud, taped foil faced insulation</td>
<td></td>
</tr>
</tbody>
</table>

### WINDOW SELECTION

<table>
<thead>
<tr>
<th>Higher Cost</th>
<th>Lower Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fiberglass</td>
<td></td>
</tr>
<tr>
<td>UPVC</td>
<td></td>
</tr>
<tr>
<td>Aluminium</td>
<td></td>
</tr>
<tr>
<td>Curtain wall</td>
<td></td>
</tr>
</tbody>
</table>

### HVAC / MECH SELECTION

<table>
<thead>
<tr>
<th>Higher Cost</th>
<th>Lower Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>All air limited zone</td>
<td></td>
</tr>
<tr>
<td>Electric fan coil</td>
<td></td>
</tr>
<tr>
<td>VRF: 3-Pipe multi-zone maximum individual control</td>
<td></td>
</tr>
</tbody>
</table>

**Making Informed Decisions Early**

**$***

**$$**

**$$**

**$$**
Facade Selection: Wall Composition

Panelized System
R-19 Average

Masonry
R-20 Effective

Curtainwall
R-18 Effective

The House at Cornell Tech

Sendero Verde Building A

Winthrop Center
<table>
<thead>
<tr>
<th>Window Performance</th>
<th>U-VALUE GLASS</th>
<th>U-VALUE WHOLE WINDOW</th>
<th>SOLAR HEAT GAIN COEFFICIENT (SHGC)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>STANDARD WINDOW</strong></td>
<td>0.27</td>
<td>0.45</td>
<td>0.31</td>
</tr>
<tr>
<td>Double-glazed, Low-E Glass Argon Gas Metal Spacer Metal Frame</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>CORNELL TECH</strong></td>
<td>0.11</td>
<td>0.17</td>
<td>0.28</td>
</tr>
<tr>
<td>Triple-glazed, Low-E Glass Warm Edge Spacer Thermally Broken Aluminum Frame</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>UTSC</strong></td>
<td>0.096</td>
<td>0.13</td>
<td>0.38</td>
</tr>
<tr>
<td>Triple-glazed, Low-E Glass Warm Edge Spacer Thermally Broken uPVC Frame</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Report on UTSC Energy Usage - Then & Now

<table>
<thead>
<tr>
<th></th>
<th>2000</th>
<th>2020 - PH</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Utility Costs</td>
<td>$450,000 CAD ($329,580 USD)</td>
<td>$150,000 CAD ($109,860 USD)</td>
<td>66% Decrease!</td>
</tr>
<tr>
<td>Green House Gas Emissions</td>
<td>30 kg per m²</td>
<td>5 kg per m²</td>
<td>83% Decrease!</td>
</tr>
</tbody>
</table>

Changes are related to earlier times when we ran on dirty oil, and before sustainable, energy saving measures were considered or implemented.

Source: UTSC Facilities management
## HVAC Selection: Heating & Cooling Delivery Method

<table>
<thead>
<tr>
<th>Passive House / Efficiency</th>
<th>Modeling Required to prove feasibility. Efficiency may not comply.</th>
<th>X</th>
<th>X</th>
<th>XX</th>
<th>XX</th>
</tr>
</thead>
<tbody>
<tr>
<td>EER</td>
<td>9.7</td>
<td>13</td>
<td>14</td>
<td>14</td>
<td>11-14</td>
</tr>
<tr>
<td>System Flexibility</td>
<td>Heating and Cooling Year Round</td>
<td>Heating and Cooling Year Round</td>
<td>Heating and Cooling Year Round</td>
<td>Heating and Cooling Year Round</td>
<td>Heating and Cooling Year Round</td>
</tr>
<tr>
<td>Cooling</td>
<td>Compressor in each room</td>
<td>Compressor in each room.</td>
<td>Compressor in each room.</td>
<td>Compressor located on roof / mechanical room</td>
<td>Compressor located on roof / mechanical room</td>
</tr>
<tr>
<td>Boiler plant</td>
<td>Not Required</td>
<td>-</td>
<td>Required - 75% of the Heating Capacity - Conventional 100% capacity for Hybrid</td>
<td>Required - 75% of the Heating Capacity - Conventional 100% capacity for Hybrid</td>
<td>Not Required</td>
</tr>
<tr>
<td>Cooling Tower</td>
<td>-</td>
<td>-</td>
<td>X</td>
<td>X</td>
<td>-</td>
</tr>
<tr>
<td>Outdoor Mechanical Space (sqft)</td>
<td>-</td>
<td>-</td>
<td>XX</td>
<td>XX</td>
<td>XX</td>
</tr>
<tr>
<td>Pumps / HX</td>
<td>-</td>
<td>-</td>
<td>X</td>
<td>-</td>
<td>X</td>
</tr>
<tr>
<td>Location of Unit</td>
<td>Perimeter</td>
<td>Perimeter inside closet with ductwork into the unit</td>
<td>Perimeter / Interior</td>
<td>Interior</td>
<td>Interior</td>
</tr>
<tr>
<td>Zone Control</td>
<td>Per Room</td>
<td>Per apartment</td>
<td>Interior: One per room / One Per apartment</td>
<td>Interior: One per room / One Per apartment</td>
<td>Interior: One per room / One Per apartment</td>
</tr>
<tr>
<td>Acoustical Level</td>
<td>XXX</td>
<td>XXX</td>
<td>XX</td>
<td>XX</td>
<td>X</td>
</tr>
<tr>
<td>First Cost</td>
<td>$</td>
<td>$</td>
<td>$</td>
<td>$</td>
<td>$</td>
</tr>
<tr>
<td>Maintenance Cost</td>
<td>$</td>
<td>$</td>
<td>$</td>
<td>$</td>
<td>$</td>
</tr>
<tr>
<td>Remarks</td>
<td>1. Lowest cost</td>
<td>1. Low first cost</td>
<td>1. No insulation on piping</td>
<td>1. Difficult to find leaks</td>
<td>1. Difficult to find leaks</td>
</tr>
<tr>
<td>PH Comments</td>
<td>Rejected Unacceptable Efficiency</td>
<td>Rejected Unit leaks outdoor air into building.</td>
<td>Compiles: Requires boiler plant or Combined w/air to water heat pumps. Pump energy impacts model.</td>
<td>Compiles: Most energy efficient system. Simultaneous heating and cooling is expensive.</td>
<td>Compiles: Requires boiler plant. Pump energy impacts model. Simultaneous heating and cooling is expensive.</td>
</tr>
</tbody>
</table>
## Making the Case for PH

Cost Comparison - VRF vs. 2/4 Pipe Fan Coil

<table>
<thead>
<tr>
<th></th>
<th>UTSC</th>
<th>Comparable 1</th>
<th>Comparable 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Suite Count</td>
<td>342</td>
<td>204</td>
<td>172</td>
</tr>
<tr>
<td>GFA - Fit out space (m²)</td>
<td>26,690</td>
<td>17,422</td>
<td>17,076</td>
</tr>
<tr>
<td>GFA / Suite (m²)</td>
<td>78.0</td>
<td>85.4</td>
<td>99.3</td>
</tr>
<tr>
<td>Common area %</td>
<td>42%</td>
<td>40%</td>
<td>43%</td>
</tr>
<tr>
<td>Mechanical System</td>
<td>Air-Cooled VRF</td>
<td>4-Pipe FCU</td>
<td>2-Pipe FCU</td>
</tr>
<tr>
<td>Plumbing $/m² (ex Site)</td>
<td>$359.95</td>
<td>$398.95</td>
<td>$314.00</td>
</tr>
<tr>
<td>Plumbing $/Suite</td>
<td>$28,090.83</td>
<td>$34,071.11</td>
<td>$31,173.63</td>
</tr>
</tbody>
</table>

Note: Values are in Canadian dollars $1 CAD = $.75 USD

16-Jul-19
## Stats: Project Characteristics & Costs
Sample Set: 16 Projects

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Min</th>
<th>Max</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td># of Units</td>
<td>30</td>
<td>385</td>
<td>184</td>
</tr>
<tr>
<td>Gross SF</td>
<td>33,729</td>
<td>386,859</td>
<td>171,917</td>
</tr>
<tr>
<td>Floors</td>
<td>6</td>
<td>37</td>
<td>15</td>
</tr>
<tr>
<td>% Increase for PH</td>
<td>1%</td>
<td>8%</td>
<td>4%</td>
</tr>
</tbody>
</table>
UTSC Passive House Design

Energy Savings Reduces Energy Cost: Reduce Green House Gas Emissions

Est. Add for PH Design at 100% DD (2% overall estimate) = $1,481,000 US

Est. Yearly savings as compared to code compliant design powered by electricity = $82,885 US

18 YR PAYBACK

GHG emission from code compliant SB-10 Building = 206 tonnes CO2e/yr

GHG emission from UTSC = 154 tonnes CO2e/yr

52 Tonnes Savings (25% Less)
HOW TO ACHIEVE PASSIVE HOUSE?

PH Implementation Process

OWNERS

ARCHITECT

COST ESTIMATOR/DB CONTRACTOR

CONSULTANTS AFFECTED BY PASSIVE HOUSE
- MEP
- Structure
- Code
- Envelope
- Energy/Passive House

PASSIVE HOUSE CONSULTANT

PH CERTIFIER certifies application

PHI (Passive House Institute - Germany) provides final certification

PH CERTIFICATION
Implementing Passive House Design at UTSC

**Enclosure: Roofs, Walls, and Foundation**
- Strive for a compact shape
- Take building orientation into account
- Carefully detail to achieve air tightness
- Select Windows with exceptionally low U-Values.
- Provide Continuous insulation and thermal bridge free detailing leading to high R-Values

**MEP Systems**
- Provide a high performance, low energy heating and cooling system that is powered primarily by electricity
- Ventilate all habitable spaces with constant fresh air with heat recovery
- Balance exhaust and supply ventilation within 10% of one another
- Specify energy efficient equipment, lighting and appliances
University of Toronto at Scarborough (UTSC)

Project Design Team:
Handel Architects w/ CORE Architects
Steven Winter Associates
Integral Group
RWDI - Envelope Consultants

SCUP - Passive House and Campus Housing | © Handel Architects 2020
Student Residences: Project Challenges

PROJECT CHALLENGES

• Supply chain – PH compliant windows for climate zone 6
• Colder climate leading to stricter window criteria
• Dining hall – very high energy intensity for commercial kitchens
• Conflict between U of T energy efficiency requirements, building type and Passive House criteria
• Incredibly dense building – Source EUI target needs adjusting
UTSC: Building Plans

Ground Floor Plan
UTSC: Building Plans

Planning - Typical Floor Plan

- Community A
- Community B
- Community C
- Common Area

Community B

Community A

Community C
Passive House Envelope & Certified Area

Ph Airtight Layer
Ph Certified Area
Non-Certified Area

The PH Standard is Flexible

Facade: Stickbuilt Rainscreen

<table>
<thead>
<tr>
<th>Component</th>
<th>Efficiency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roof</td>
<td>R-40</td>
</tr>
<tr>
<td>Walls</td>
<td>R-30 Avg.</td>
</tr>
<tr>
<td>Windows</td>
<td>U: .013</td>
</tr>
</tbody>
</table>

UTSC
Stick-Built Wall System: Site Built

- High performance triple glazing
- Insulated uPVC Frame
- Continuous Air/Water Barrier/Permeable Vapor Barrier
- Permeable Vapor Retarder
- 18 Gauge Structural Steel Stud Wall
- Built on site
- Standing Seam Metal Rainscreen
- CIPC

University of Toronto
Stick Built Rainscreen
Quality Control Pays Off
Final Blower Door Test

• Final Blower Door Test results for The House were .15 Air Change/Hour (ACH).
• Passive House requirements allow a maximum .6 ACH.
Heating & Cooling: VRF

- Roof mounted condensers
- System is zoned vertically
- Refrigerant runs are primarily vertical

---

**SPECIFICATIONS**

- **Capacity**
  - **Cooling**: 6,000 Btu/h
  - **Heating**: 6,700 Btu/h

- **Power Source**: 208 / 230V, 1-phase, 60Hz
- **Power Consumption**
  - **Cooling**: 0.05 kW
  - **Heating**: 0.03 kW
- **Current**
  - **Cooling (208/230V)**: 0.42 / 0.41A
  - **Heating (208/230V)**: 0.32 / 0.31A
  - **Minimum Circuit Ampacity (MCA) (208/230V)**: 0.47 / 0.50 A
  - **Maximum Overcurrent Protection (MOCP) Fuse**: 15 A
- **External Finish**: Galvanized Steel Sheets
- **External Dimensions**
  - **Inches**: 7-7/8 h x 31-1/8 w x 27-9/16 d
  - **mm**: 200 h x 790 w x 700 d
- **Net Weight**: 42 lbs / 19 kg

- **Coil Type**: CrossFin (Aluminum Fin and Copper Tube)
- **Fan Type x Quantity**: Sirocco Fan x 2
- **Rate (Low - Mid - High)**: 176 - 212 - 247 CFM
- **External Static Pressure**: 0.02 - 0.06 - 0.14 - 0.20"WG
- **Motor Type**: DC Motor
- **Air Filter**: Polypropylene Honeycomb
- **Refrigerant Piping Dimensions (R410A)**
  - **Liquid (High Pressure)**: 1/4" / 6.35 mm Brazed
  - **Gas (Low Pressure)**: 1/2" / 12.7 mm Brazed
- **Drainpipe Dimension**: O.D. 1-1/4" / 32 mm
- **Sound Pressure Levels**
  - **Low - Mid - High**: 22 - 24 - 28 dB(A)

---

**Model**: PEFY-P06NMSU-E

**GENERAL FEATURES**

- Dual set point functionality (*1)
- Multiple fan speed settings
- Auto fan mode
- Built-in condensate lift; lifts to 21-11/16" (550 mm)
- 7 - 7/8" (200 mm) high for low ceiling heights

**OPTIONS**

- * Cooling / Heating capacity indicated at the maximum value at operation under the following conditions:
  - **External Heater Adapter**: PAC-YU25HT

**Note:**
Ventilation air to be introduced independent of or in series with VRF indoor units. Please refer to local codes for the required ventilation rates specific to the application.

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Specifications are subject to change without notice.

*1 – All components of the system must be compatible. For more details on system compatibility, please refer to Technical Bulletin 100-151 available on our website.
Balanced Ventilation with Heat Recovery

- All bedrooms and living rooms require supply air, balanced within 10% of exhaust
- Conflict in codes regarding amount of Ventilation: LEED / CODE / PH
- Delivery methodology:
Ventilation

Central:
RISER PER SUITE
It’s All About The Students!

- Enhance the Dormitory Room Experience!
- Great acoustical separation from neighbor and exterior.
- Low cost for heating and cooling.
- Comfortable temperatures, with option for control.
- Comfortable humidity control.
- Healthy filtered fresh air 24/7
- Light filled rooms with operable windows
- Colors and materials that calm and protect
Thank You!

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Questions?
Upcoming Events

WEBINAR | January 13, 2021

WORKSHOP | January 15, 2021
SCUP Planning Institute
Laying the Groundwork for Strategic Planning

WEBINAR | January 19, 2021
Unleashing the Power of Difference: Creating Neuro-Inclusive Learning Spaces