The Road to Passive House Design:

Mechanical Design Considerations
Code Implications
District Energy Discussion

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Skeena Residence:
a six-storey student housing project located at UBC Okanagan campus in Kelowna, BC.

Corvette Landing:
a multi-family housing project located in Esquimalt, BC. Corvette Landing is significant due to the nature of being a wood construction hi-rise, heating only system.
Skeena Residence
Program

- 6 storeys
- 221 Residence rooms
- Shared bathrooms
- Laundry services
- No kitchen / dining
- Common areas / lounges
- Campus setting
- Dense occupancy
DISTRICT ENERGY
Ambient Loop - Energy Sharing
District Energy Modes

- Balanced: energy sharing between buildings
- Heating: net heat input requirement
  - Boilers
  - Electricity
  - Geoexchange / Aquifer
- Cooling: net heat rejection requirement
  - Geoexchange / Aquifer
  - Cooling Towers
Ambient Loop

- Heating Energy Sources
- Passive House PER Factors
- District Energy System Documentation!

**UBCO District Energy System Heat Sources**

- **PER Factor: 1.75**
  - Natural Gas Boiler 20%
  - Renewable Hydro Power 23%

- **PER Factor: 1.1**
  - Renewable Earth Energy 57%
  - Central Pumps
  - Groundwater Pumps
Heating Only DES

- UBC Vancouver Campus
- Heating Source – Natural Gas
• Operating Efficiency (COP)
• Operating Limitations: Summer, Winter
• Cooling is a must
• Summer peak: 35°C
• Winter low: -23°C
• Airsource for Building HVAC
• Airsource for Domestic Hot Water
• Winter Limitations

Building ASHP Shuts Down
• Winter Limitations

Hot Water ASHP Shuts Down
• R54 Walls
• R99 Roof
• U-0.16 Glazing w/frame
• Ventilation with Energy Recovery and central boost
• 4 pipe HVAC with Airsource Heat Pump AND backup boiler
• Airsource Heat Pump for Hot Water AND backup heaters

• No air admittance valves allowed in Kelowna....
• Envelope is still important
  AND
• Documentation for District Energy Systems
• Backup systems required due to Climate
  • Technology limitation – stay tuned
Corvette Landing
CORVETTE LANDING

- Located in Esquimalt, BC
- 12 Storeys: Wood Construction /Concrete Structure
- ~108,750 ft$^2$ total area – 83 Suites
- Architect: LWPAC
- Developer: Standing Stone Developments Ltd.
Space Heating & DHW Completely Separated

- Simplifies the Control System Strategy
- High Temperature Heat Pump System for DHW
- Low Temperature Heat Pump System for Heating Water
- Increases overall average efficiencies of each system
Eliminating Plumbing Vent Terminations to the Exterior

• This is not always possible
• Rejected immediately in Kelowna
• Rejected in Whistler
• Allowed in Vancouver
• Alternate solution required in Esquimalt
Why is an alternate solution required?

- BC Plumbing Code – 2.5.9 – Air Admittance Valves shall only be used on individual vents provided they:
  - Are for island vents
  - Are for fixtures that may be subject to frost closure
  - Are part of an ongoing renovation and are temporary
  - Are located where typical venting is not practical
What is the solution?

- AAVs & Positive Air Pressure Attenuators

These systems add:

- Maintenance – part of regular maintenance checks in the building
- Complexity to what is a relatively simple system
Complexity & Maintenance

- Addition of PAPA’s to stacks
- AAVs located throughout the building
- System maintenance likely required within suites
- Exterior vent generally at ground level

Figure 4 (c)
SUMMARY

- Eliminating cooling needs to consider orientation, exterior shading and natural ventilation
- Consider effects of decision making on system distribution
- Simplifying controls to reduce operational confusion
- Understand what eliminating plumbing venting means
Thank you!