Pax Futura: A Multifamily Passive House HVAC Adventure

Aaron Barnett, HVAC Manager
www.CascadeBuilt.com
Cascade Built

- Sustainable GC and real estate developer
- Multi-family focus
- Specializing in high-performance buildings
  - Pax Futura
  - Park Passive
  - ViewHaus
  - SolHaus
  - 1300 Pike
- HVAC via Cascade Comfort Systems
Cascade Comfort Systems

• 1st installation on ViewHaus
• Specialize in design + installation of high performance HVAC systems
• Installations include Cascade Built projects and outside projects for other builders, developers, clients
Pax Futura Highlight

• Seattle’s 1st Multi-Family Passive House apartments
• 35 Units, including 3 live / work and one commercial space
• Located in Columbia City, Seattle
• Design team:
  • NK Architects
  • Staengl Engineering
Ventilation design considerations

- Code requires 60 cfm ventilation per unit
  - 25 cfm for bathroom, 35 cfm for kitchen
  - In SEDU’s, this results in 1.5 ACH
- ASHRAE 62.2 suggests about 18 cfm
- Targeting 0.3 ACH suggests about 13 cfm
- Code exemption from city of Seattle
  - 30 cfm total ventilation rate
  - Extraction from bathroom, supply to living room/kitchen
Heating and Cooling design considerations

- Heating and cooling loads for small, well insulated units are tiny
  - Typical heating loads for SEDU’s range from 1000 to 1500 BTU/h

- Existing high-efficiency equipment struggles to meet such a low demand
  - Mitsubishi MUZ-FH06 minimum capacity is 1600 BTU/h
  - Electric resistance is inefficient

- Solution: tempering with Chiltrix, backup with electric resistance.
Pax Futura Mechanical Systems

• Ventilation: Zehnder CA550’s, two per floor, each serving 6-8 units

• Space conditioning: Two Chiltrix CX34 heat pumps, feeding water coils in the supply ducting provide tempering. Electric resistance heaters provide heat in each unit.

• Domestic Hot Water: Silk Road solar array, backed up by a gas fired, tankless boiler.
Ventilation Systems

- Six Zehnder CA550 HRV’s
- Located in small, dedicated closets on each floor
- 26ga metal ductwork
- Shared boost function
Heating and Cooling Systems

- Two Chiltrix CX-34 heat pumps
- One chilled water coil at each HRV
  - Combined with the HRV, makes an “air handler”
- Centralized
  - Highly efficient
  - Limited control
Domestic Hot Water

- Solar hot water system from Silk Road Environmental
- 600 gallons of DHW storage
- Backed up with Navien NP240
HRV Install Complications

Ventilation systems

- Airflow – Deviations from mechanical design to accommodate architectural elements resulted in excessive static pressure
- Ductwork crossing at right angles – creates height problems
- Balancing – No balancing dampers, so balancing done at the register
- Sound transmission – Hard pipe carries sound between units
Solar Hot Water Complications

• Mixing
  • Temperature of hot water supply is more variable than mechanical systems

• Commissioning
  • Variable supply
  • Variable Load
  • High consequence of outages
Takeaways

Allow adequate physical space for mechanical systems

• Floor space
  • FAR exemption
    • The Heights
• Vertical Space
  • Insulation
  • Ducts have to cross
• Shortcuts have higher costs in high performance builds than in traditional buildings
  • Verification
Takeaways, Part 2

Sharing resources among units is challenging

• Fire code
  • Fire Dampers
  • Volume Dampers
  • Service Access

• Controls/Comfort
  • How to solve for different usage patterns
  • Tenant education

• Noise
  • Flex duct
  • Mufflers/silencers
Thank you!

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