Design of the PH heating/ventilation system

26 March 2010

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Regional PassiveHaus Northwest Gathering 2010
Summary, Mechanical Systems in Passive Houses

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- Glossary for the non-engineer
- Unique aspects of PH mechanical systems
- System options / variations (esp. for NW climate)
- Interaction between mech system and other uses (hot water, dryer, lights)
- Ducts / diffusers (locations, layout, products)
- Controls (how and why)
- Integration of Renewables
- Basics of equipment sizing
Glossary for the non-engineer

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- Ventilation
- Peak heating/cooling load
- Load vs. consumption
- Supply-, return-, outside-, exhaust-air
- OA economizer
- Types of heating

Equipment
Unique aspects of PH mechanical systems

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- Low air flow rates
- Variable speed fans
- Low supply air speeds into space
- Little/no temperature stratification in bldg.
- 100% outside air system
- Ultra-low flow-resistance ductwork
System Options in moderate Pacific Northwest Climate

- Heat or energy recovery ventilator

- **Heating options:**
  - Electric resistance (air / hydronic)
  - (Air-Source) Heat pump (S.S.)
  - Wood / Natural Gas (hydronic)
  - Solar (air / hydronic)

- **Cooling options:**
  - Prevention\(^3\) + passive cooling
  - Earth tube
  - (Hydronic Coil)
  - (Air-Source) heat pump
Interaction w/ other systems

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- Domestic hot water
- Stove / Hood
- Dryer
- Lights
- Fridge
- Other appliances, gadgets
Air transport and delivery

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- Ducts
- Diffusers, Return grilles
- Transfers
- Silencers
- T&B
Controls
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- KISS
- Temperature
- Supply Air flow rate
- (Outside Air flow rate)

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<th>Water Flow GPM</th>
<th>Air Flow CFM</th>
<th>Inlet Air F</th>
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<th>Capacity Btu/hr</th>
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Integration of Renewables

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- Electric systems
  - Photovoltaics
  - Micro-Hydro
  - Micro-Wind
- Solar Thermal
  - Hot Water
  - Air collectors
Equipment sizing, basics

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- Ventilation (V in cfm)
  - PHPP, “Ventilation” tab or ASHRAE 62

- Heating (Q in Btu/hr)
  - PHPP, “Heat Load“ tab, Q84 (+ ?? %)

- Equipment sizing
  - Coils: rated capacity in Btu/h or Watts
  - Air: \[ Q = 1.085 \times V \text{ (cfm)} \times \Delta T \text{ (°F)} \]
  - Hydronic: \[ Q = 500 \times GPM \times \Delta T \text{ (°F)} \]
The End (or the beginning?)