Design of the PH heating/ventilation system

26 March 2010

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Regional PassiveHaus Northwest Gathering 2010

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Summary, Mechanical Systems in Passive Houses

- 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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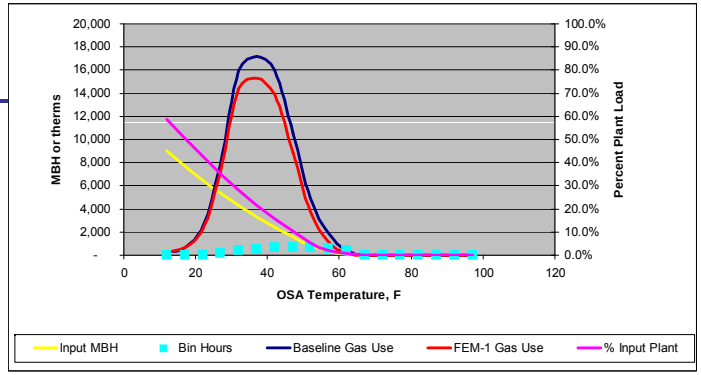

- Ventilation
- Peak heating/cooling load
- Load vs. consumption
- Supply-, return-, outside-, exhaust-air
- OA economizer
- Types of heating
  - Equipment

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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

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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 (+ waste “coolth”)
  - Earth tube
  - (Hydronic Coil)
  - (Air-Source) heat pump

Interaction w/ other systems

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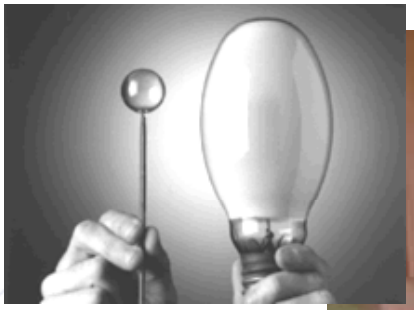
- Domestic hot water
- Stove / Hood
- Dryer
- Lights
- Fridge
- Other appliances, gadgets



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Air transport and delivery

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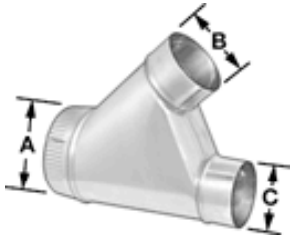
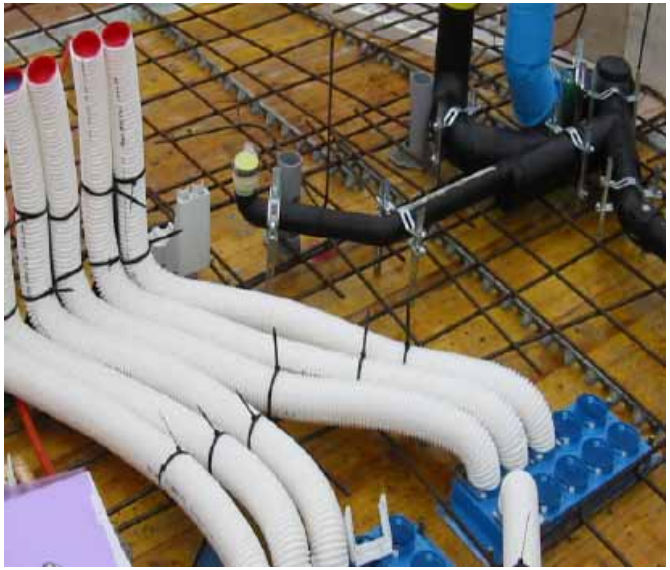


- Ducts
- Diffusers, Return grilles
- Transfers
- Silencers
- T&B



Controls

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- KISS
- Temperature
- Supply Air flow rate
- (Outside Air flow rate)

Test	Inlet Water *F*	Water Flow *GPM*	Air Flow *CFM*	Inlet Air *F*	Outlet Water *F*	Outlet Air *F*	DP Fan *in. wg.*	Capacity *Btu/hr*
Options For Post Heat (Space Conditioning)								
1	160	2.5	200	55	152.8	95.7	0.02	8777
2	160	2.5	200	65	153.5	102.0	0.02	7,972
3	160	5.0	200	65	156.6	103.9	0.02	8,393
4	160	2.0	100	65	153.7	123.5	0.01	6,220
5	120	2.0	200	65	115.5	85.9	0.03	4,452
6	120	5.0	200	65	118.1	87.2	0.02	4,783
7	120	2.5	100	65	117.1	98.8	0.01	3,585

Integration of Renewables

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- Electric systems
  - Photovoltaics
  - Micro-Hydro
  - Micro-Wind
- Solar Thermal
  - Hot Water
  - Air collectors

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Equipment sizing, basics

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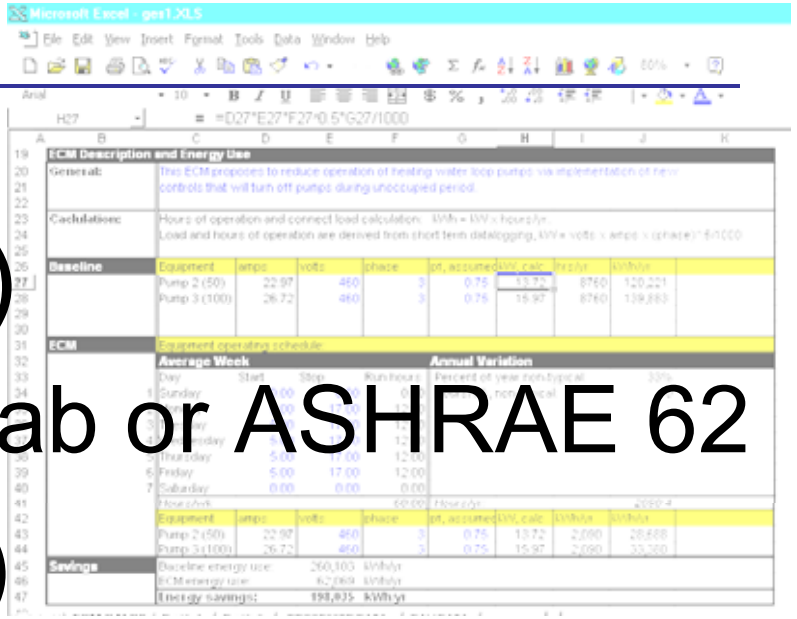

- Ventilation (V in cfm)
  - PHPP, “Ventilation“ tab or ASHRAE 62
- Heating (Q in Btu/hr)
  - PHPP, “Heat Load“ tab, Q84 (+ ?? %)
- Equipment sizing
  - Coils: rated capacity in Btu/h or Watts
  - Air: $Q = 1.085 \times V\ (cfm) \times \Delta T\ (°F)$
  - Hydronic: $Q = 500 \times GPM \times \Delta T\ (°F)$

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Questions…

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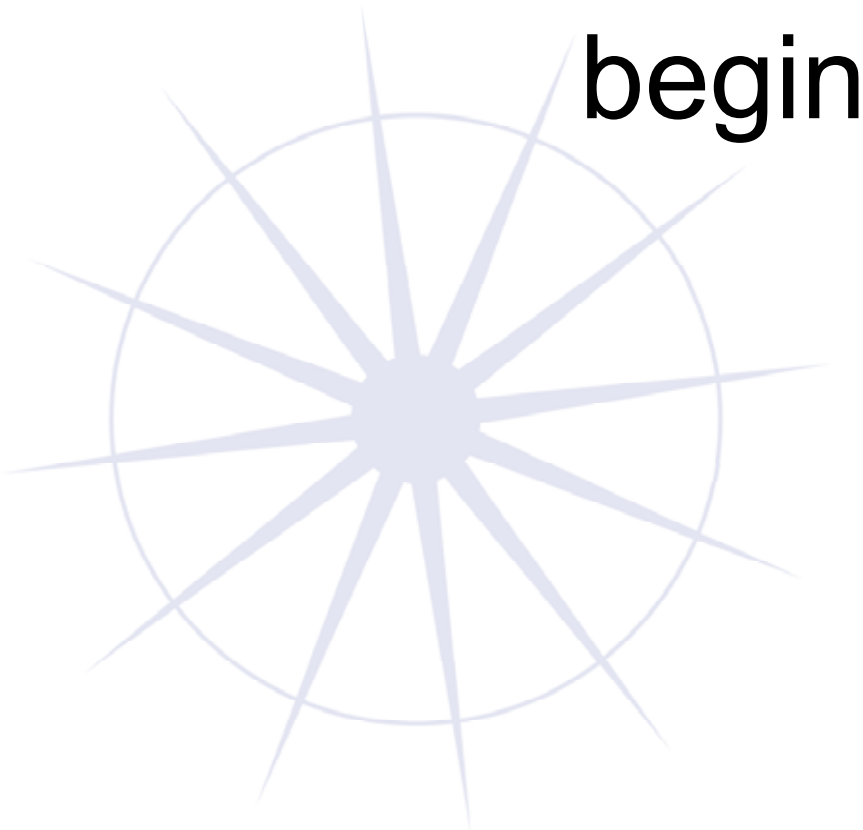
The End (or the beginning?)



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