

Green Building Net Zero Homes in Vermont



New South Farm, Hinesburg VT




New South Farm



- ✓ Specifications
- ✓ Decisions, Decisions, Decisions
- ✓ Performance to date
- ✓ Issues & Lessons Learned



Building Specifications

- ▶ **New South Farm 6 home development**
 - ▶ Chuck Reiss - Reiss Building and Renovation
 - ▶ Rolf Kielmann – Truex Cullins and Partners
- ▶ 2,100 sqft
 - ▶ Full southern exposure
 - ▶ Two levels integrated into hillside
- ▶ Five Star Plus 
 - ▶ HERS index = 53
 - ▶ Passive and active solar coupled with bio-fuel



Building Specifications

- ▶ **Windows:**
 - ▶ 220 sqft. South facing passive
- ▶ **Insulation**
 - ▶ Closed cell foam walls (R-30)
 - ▶ Cellulose ceilings (R-60)
 - ▶ Under slab (R-20)
- ▶ **Infiltration**
 - ▶ 575 cfm50
- ▶ **Lighting / Appliances**
 - ▶ Energy Star



Building Specifications

▶ Mechanicals

- ▶ HS Tarm 1.5 Pellet boiler
 - ▶ 51,000 btu
- ▶ Argo wall mounted electric boiler
 - ▶ 20,000 btu
- ▶ 50 gal DHW tank single coil
- ▶ Radiant floor
- ▶ ERV Air exchanger 100cfm
- ▶ Flat plate Solar collectors (Heliodyne)
 - ▶ 80 gal superstore feeds 50 gal DHW
- ▶ 2.4 – 3.6kW PV 2-axis active tracker (Spring 09)
- ▶ Propane – Convection stove



Decisions – Heating Plus / Minus

▶ Geothermal

- + Proven
- + No maintenance
- + No chimney
- + Easy to locate
- Limited capacity
- Electric/PV commitment for Net Zero
- New technology
- Complex (to me)

▶ Pellet Boiler

- + Proven
- + High capacity
- + Net Zero
- + Comfortable technology
- + Local fuel source
- Chimney
- Space integration
- Limited selection
- Constant Burn



Decisions – Which Pellet Boiler?

- ▶ Heat/DHW load \approx 32,000 Btu
- ▶ Limited choices in NA
- ▶ Self starting vs. constant burn
- ▶ Power vent vs. chimney
- ▶ Hopper size
- ▶ Bulk feed
- ▶ Service and reputation



Viessmann 2009?



Decisions – Pellet Boiler

▶ HS Tarm

- ▶ Personal experience 20yrs with wood boiler
- ▶ Self starting of other makers has problems
- ▶ NRG experience
- ▶ Capacity – but too much?
- ▶ Chimney required – challenge building layout
 - ▶ Combustion make-up air

▶ Pellet Source / Grade

- ▶ Premium Grade
- ▶ DIN 51731
- ▶ Availability



Decisions - Solar

- ▶ Solar - Hot Water
 - ▶ Obvious 1st Choice
- ▶ Solar – PV tracker vs. roof
 - + Ground Maintainable
 - + Expandable
 - + Efficiency
 - + Movable
 - + Supplier Relationship
 - Yard space
 - More complex



Decisions - Construction

▶ Wall Construction

- ▶ Double wall vs. Single wall
- ▶ Dense-pack cellulose vs. closed cell foam

▶ Windows

- ▶ Double & Triple Glazing

▶ Natural Lighting

- ▶ Transoms
- ▶ Full glaze exterior doors
- ▶ Interior window

▶ Storage

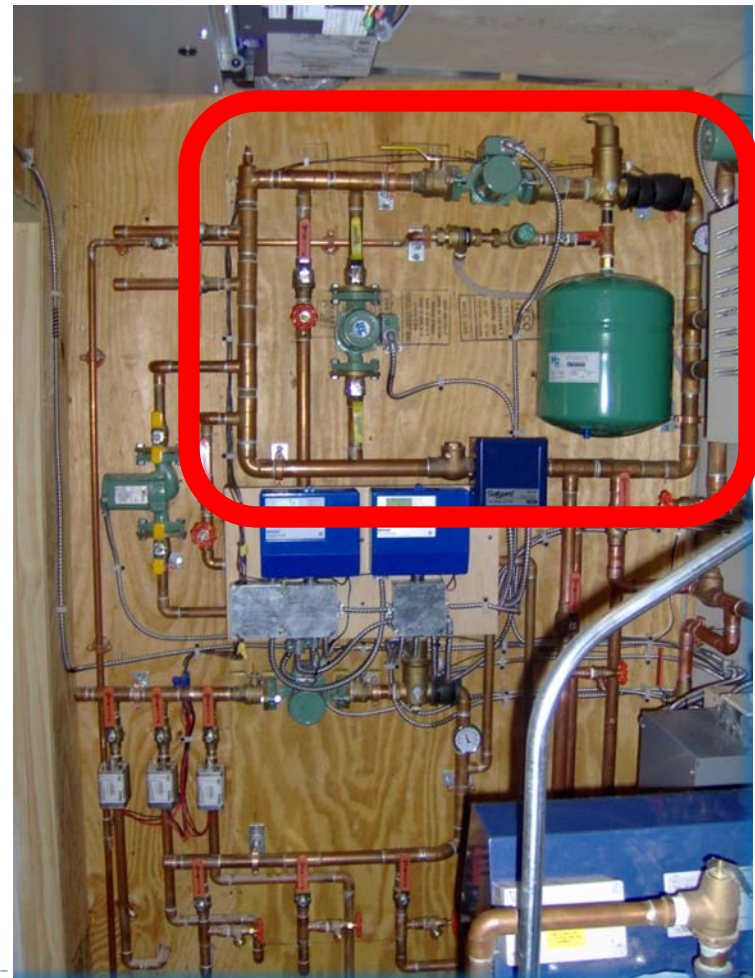
- ▶ Full Attic
- ▶ Stairway access



Performance – Pellet Heating

- ▶ Nov-Feb 09
 - ▶ < 35 lbs day
 - ▶ 20,000 Btu/hr @ 75% eff.
 - ▶ Est. 2.5t/yr = \$545
- ▶ Maintenance
 - ▶ Hopper capacity 200lbs
 - ▶ Daily check
 - ▶ Monthly Clean (15 min.)
 - ▶ Constant burn – No issues
 - ▶ Make-up air – working

Very Pleased!



Performance - Electric

- ▶ **Electric**
 - ▶ 530kWh – Dec / Jan
 - ▶ Yearly est. = 6,000 kWh
- ▶ **PV Offset**
 - ▶ 2.4kW = 3100kWh
 - ▶ 3.6kW = 4700kWh



Goal is Net Zero



Issues – Lessons Learned

▶ Pellet boiler

- ▶ Requires owner maintenance
- ▶ Back-up highly recommended
- ▶ Pellet storage and access
- ▶ Circulator = 60kWh/month
- ▶ Noise of auger/circulators
- ▶ Consider over-temp dump zone



Issues – Lessons Learned

▶ Electrical

- ▶ Power consumption > previous home
 - ▶ Dryer = Bad Behavior
 - ▶ Additional heating circulators/controls
 - ▶ Electric boiler between seasons
 - ▶ Behavior modification

▶ Heating/DHW

- ▶ Fine tuning controls
- ▶ Optimize Tarm for swing seasons
- ▶ Tie 2 DHW tanks together (130gal)



What's Next

- ▶ Install solar PV tracker
- ▶ Reduce electrical demand
- ▶ Optimize controls
 - ▶ Minimize electrical boiler use
 - ▶ Maximize Solar hot water
 - ▶ Tie DHW tanks together
- ▶ Consider window coverings
- ▶ Continue sound proofing project
- ▶ Bulk Pellet Storage



Questions ??

