

Getting to Passive House in Vermont

Peter Schneider, Vermont Energy Investment Corporation

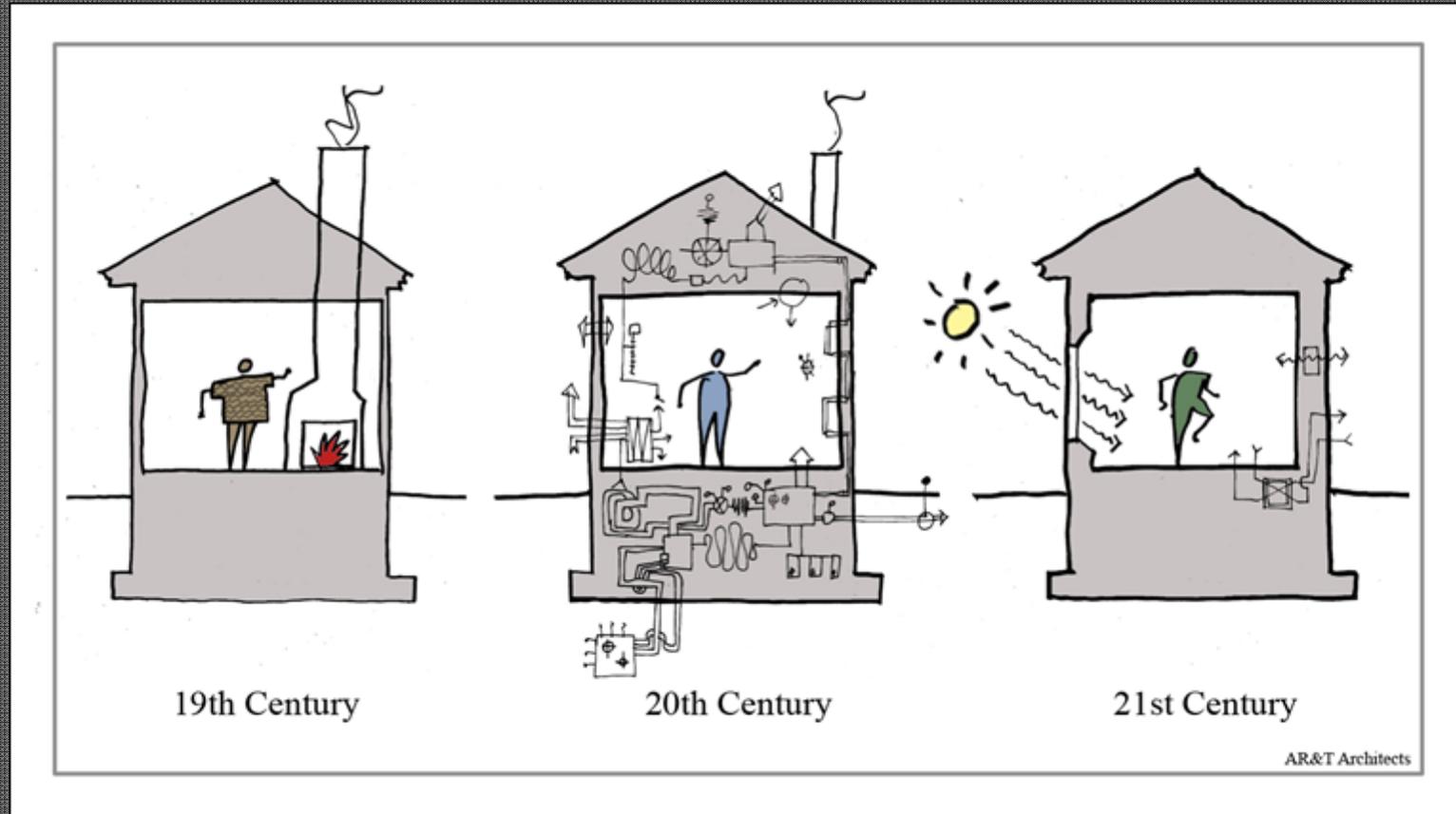
Habitat for Humanity, Charlotte, VT

Green Mountain Habitat for Humanity
Albert, Righter & Tittmann Architects, Inc.
Peter Schneider, Vermont Energy Investment Corp.
Eric Morrow, 22 Collaborative
Preferred Building Systems, Claremont, NH
UltimateAir, Akron, OH
Go Sunward, Vergennes, VT

GETTING TO PASSIVE HOUSE in VERMONT

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Moving Towards Simplicity



Albert, Righter & Tittmann Architects Inc.

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Passive House Energy Standard

Heating Load (Site): 4.75 kBTU/SF/YR

Cooling Load (Site): 4.75 kBTU/SF/YR

Total Energy Demand (Source): 38 kBTU/SF/YR

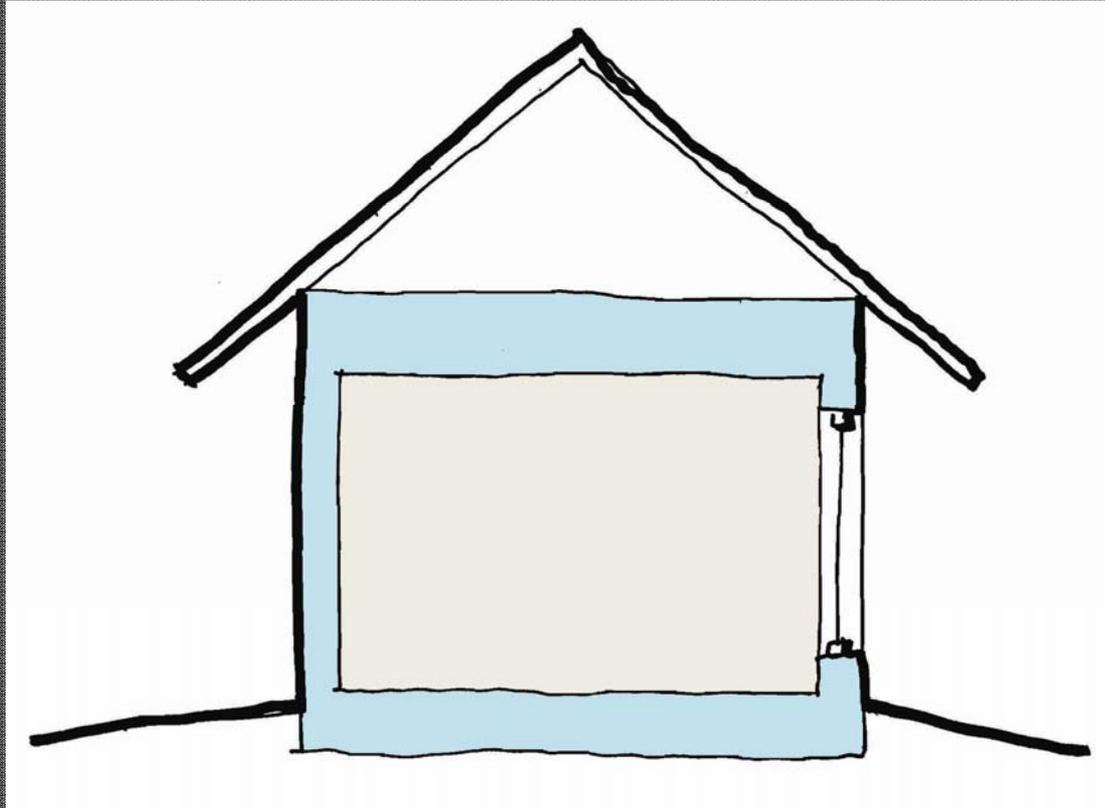
Air Tightness: .6 ACH @ 50pa

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Passive House Concept

Controlling Heat Loss... INSULATION



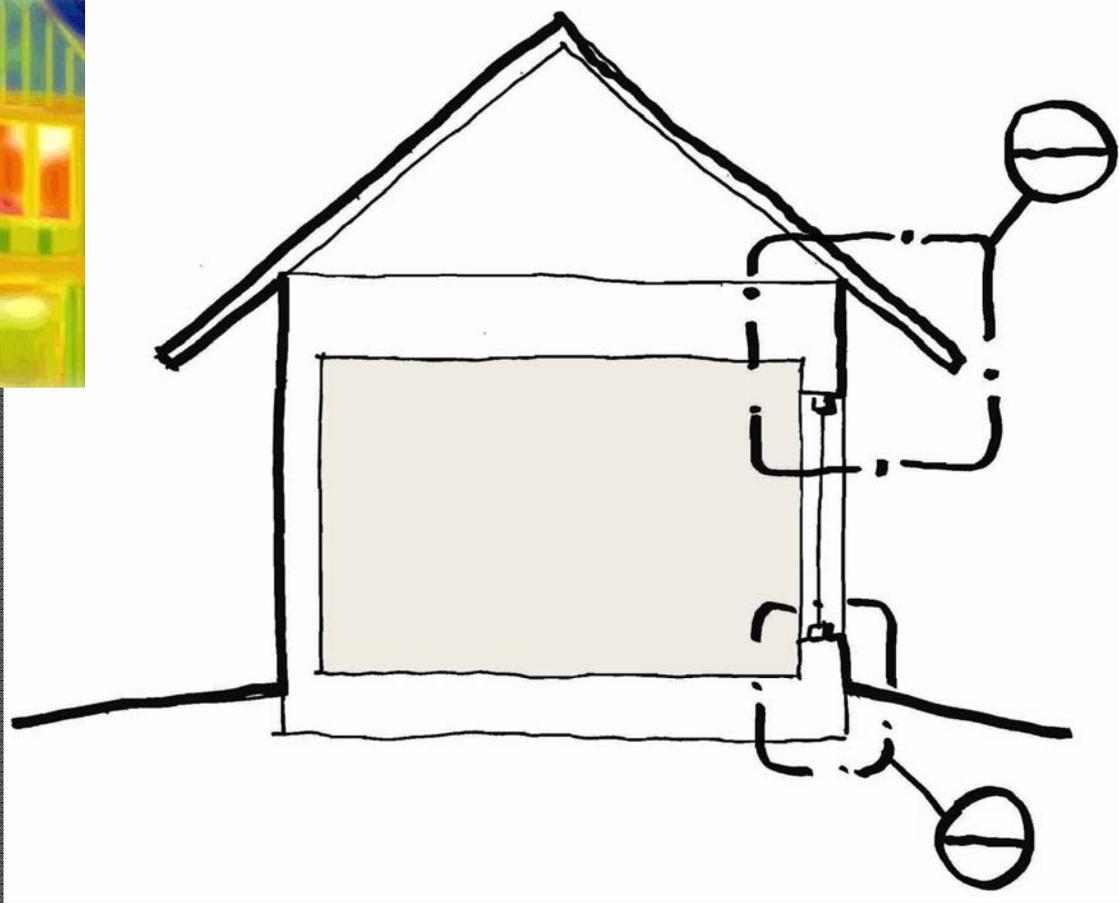
R58 WALLS: R130 CEILING: R60 SLAB
High Performance WINDOWS U value 0.18

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Passive House Concept

Controlling Heat Loss... **ELIMINATE THERMAL BRIDGES**

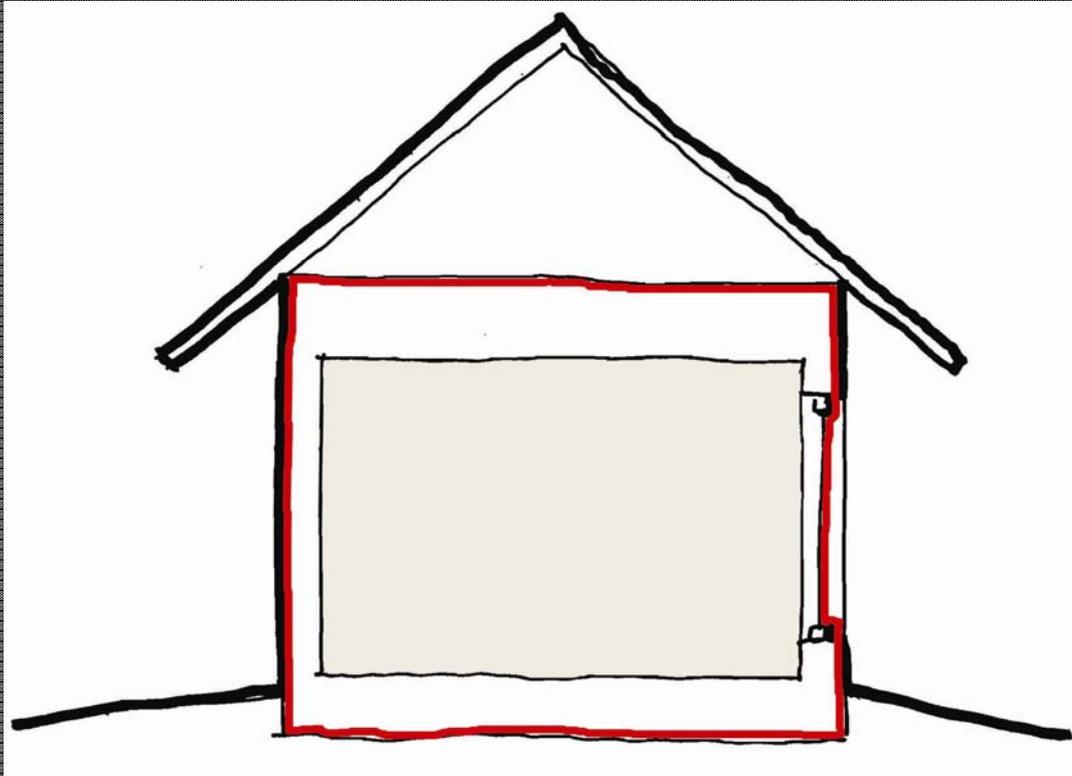


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Passive House Concept

Controlling Heat Loss... **REDUCE AIR INFILTRATION**



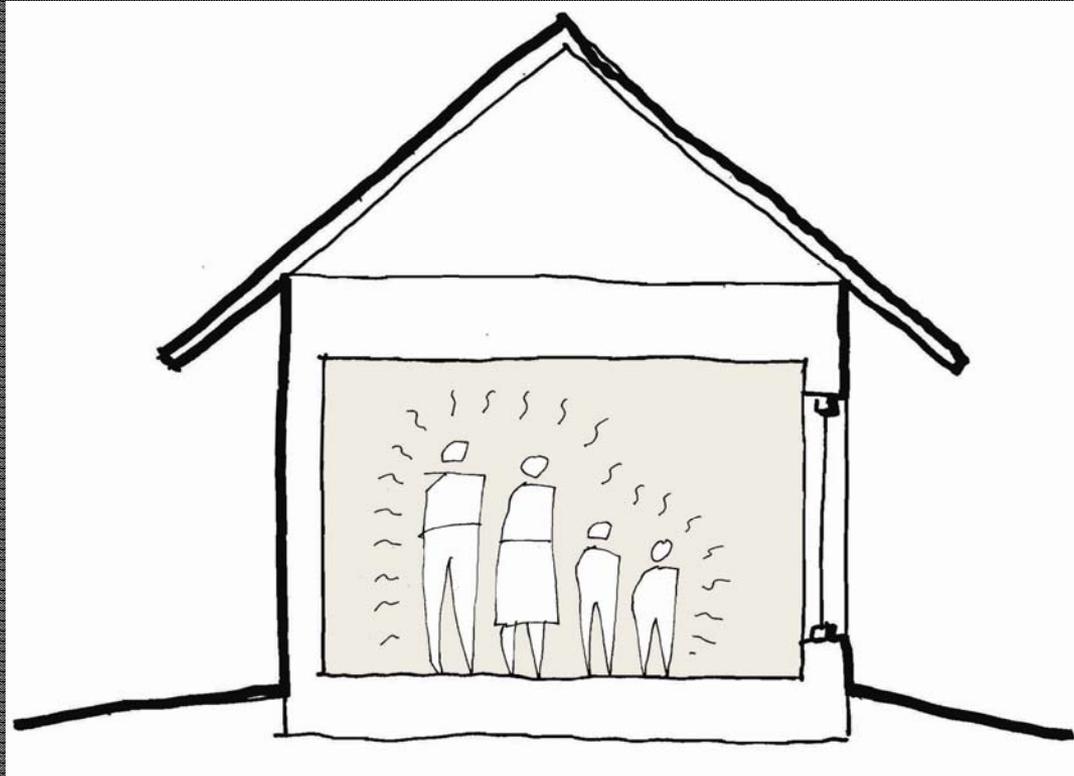
.6 ACH @ 50 PA

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Passive House Concept

Capturing Heat Gains... PEOPLE

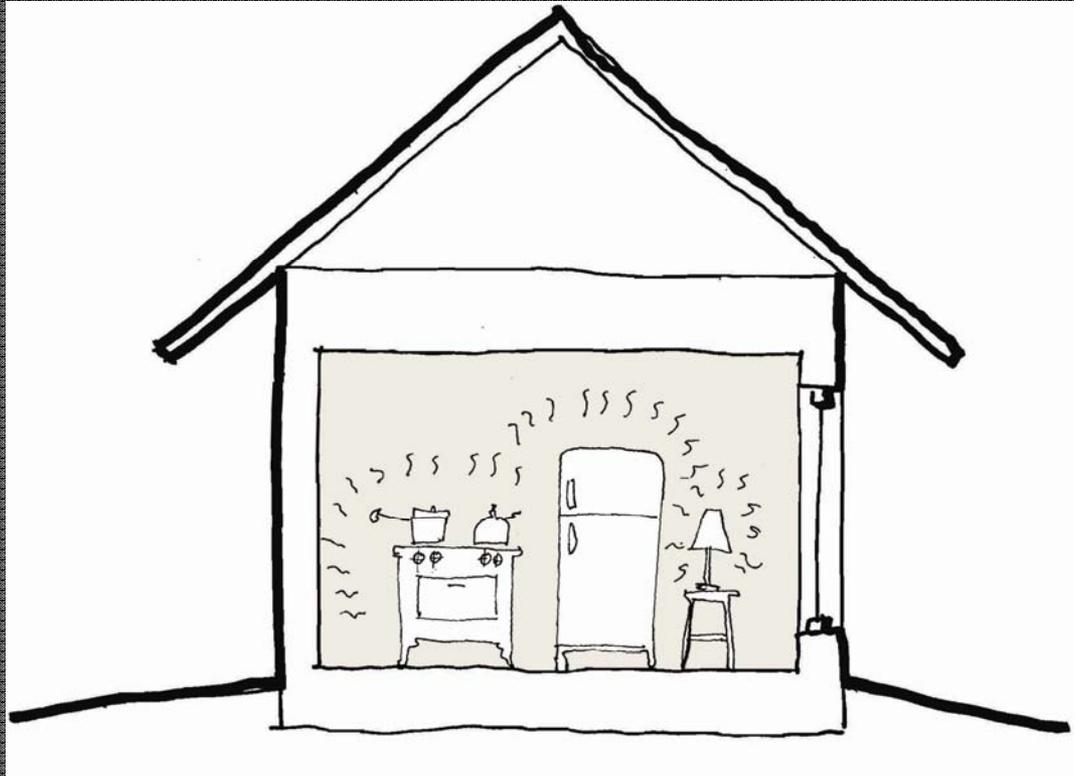


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Capturing Heat Gains... EQUIPMENT

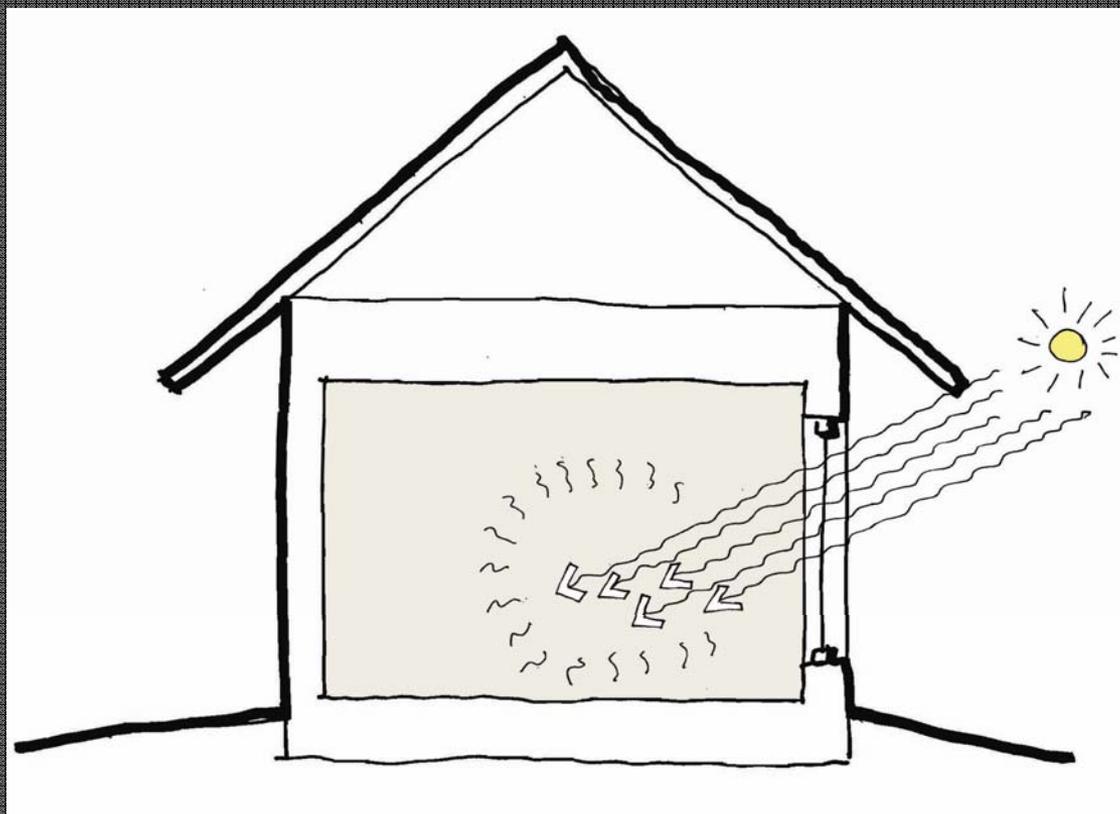


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Capturing Heat Gains... SOLAR ENERGY

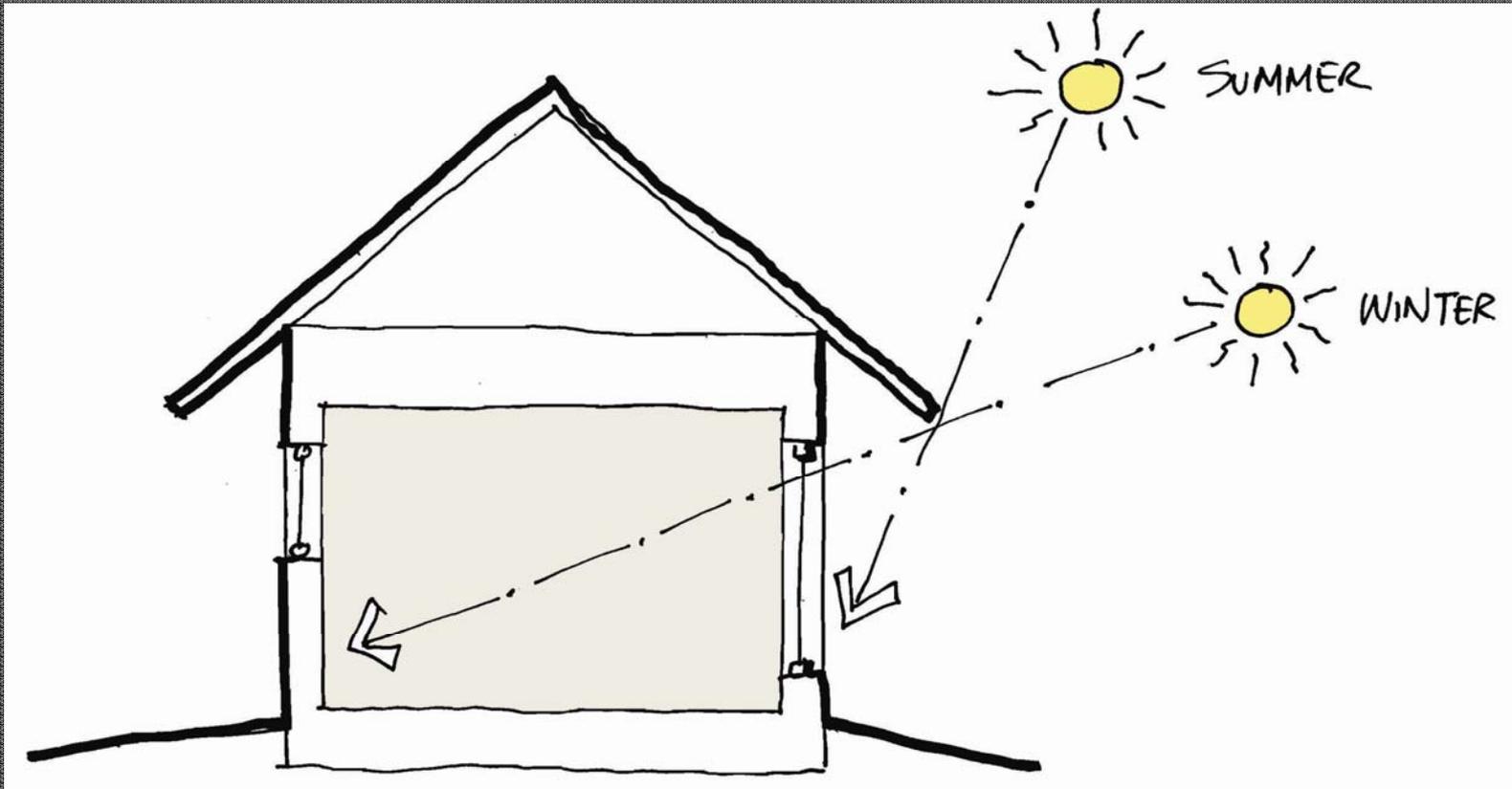


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Controlling Gains Seasonally... **WINDOWS AND ORIENTATION**



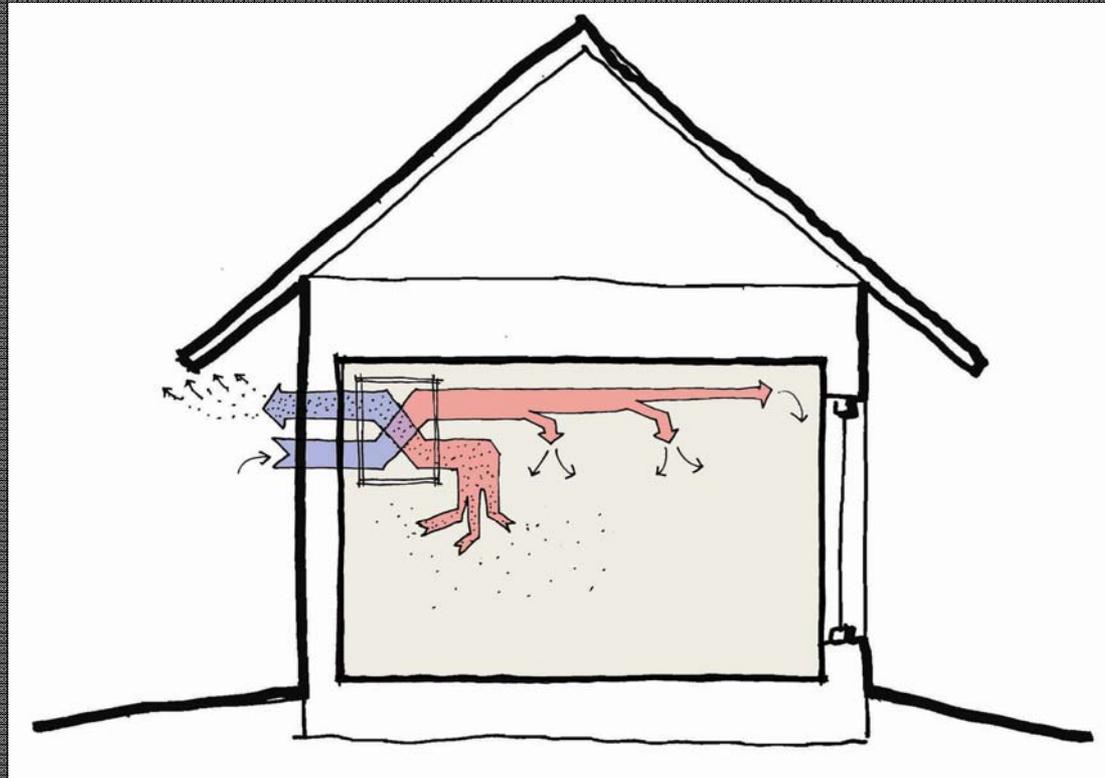
U VALUE .10; TRIPLE GLAZED: $>.5$ SHGC ON SOUTH WINDOWS

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Passive House Concept

Providing Fresh Air... **HEAT RECOVERY VENTILATION**



MINIMUM .35 ACH

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Passive House Results

- **90% reduction** in heating and cooling loads when compared to Code
- **70%-80% reduction** in total energy demand
- Superior **indoor air quality**
- Occupant **comfort**
- Lower annual energy costs
- **Smaller carbon footprint**

A Tale of Two Houses

Same plan, Same site, Different results



Cape

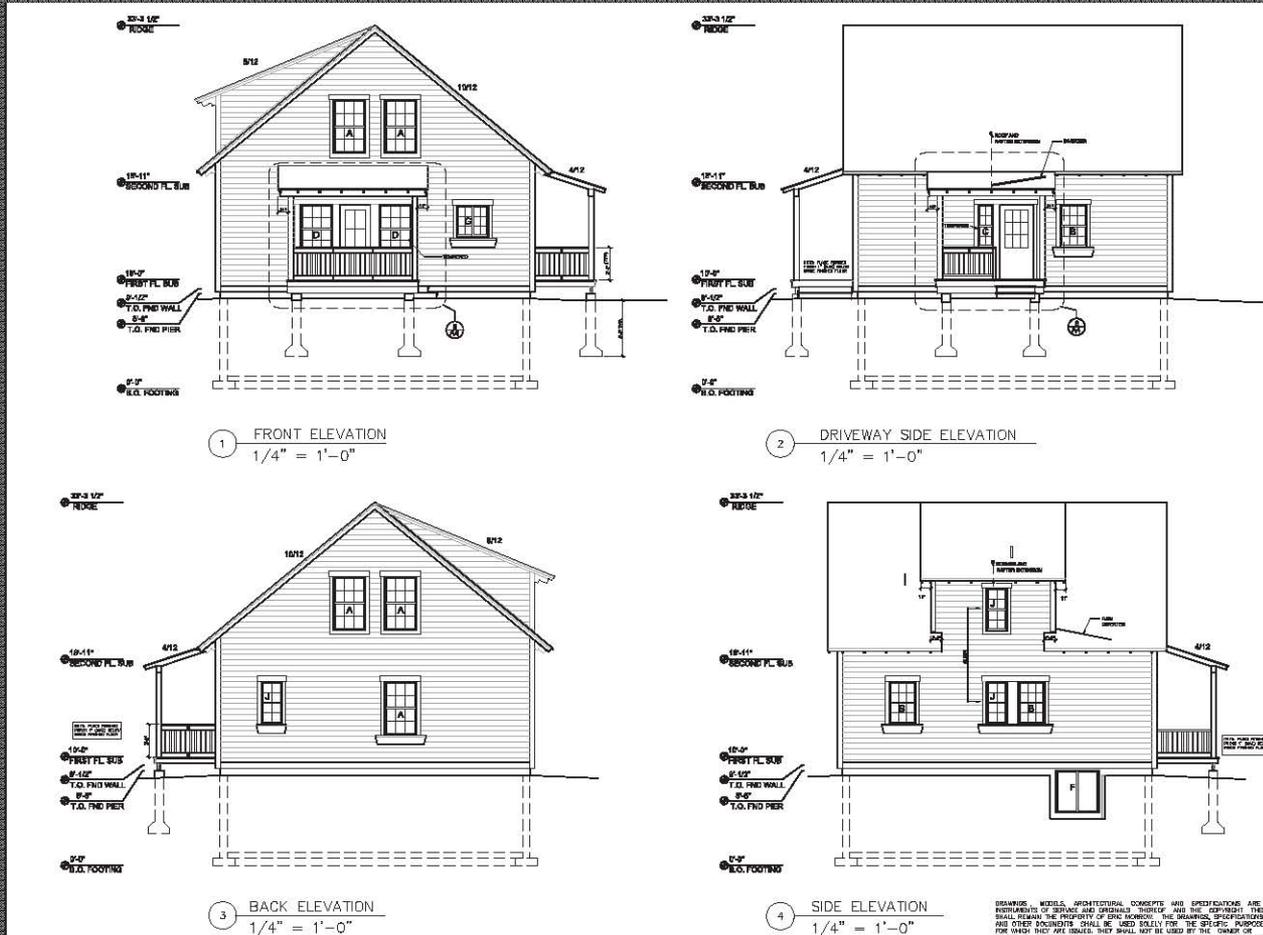


Passive House

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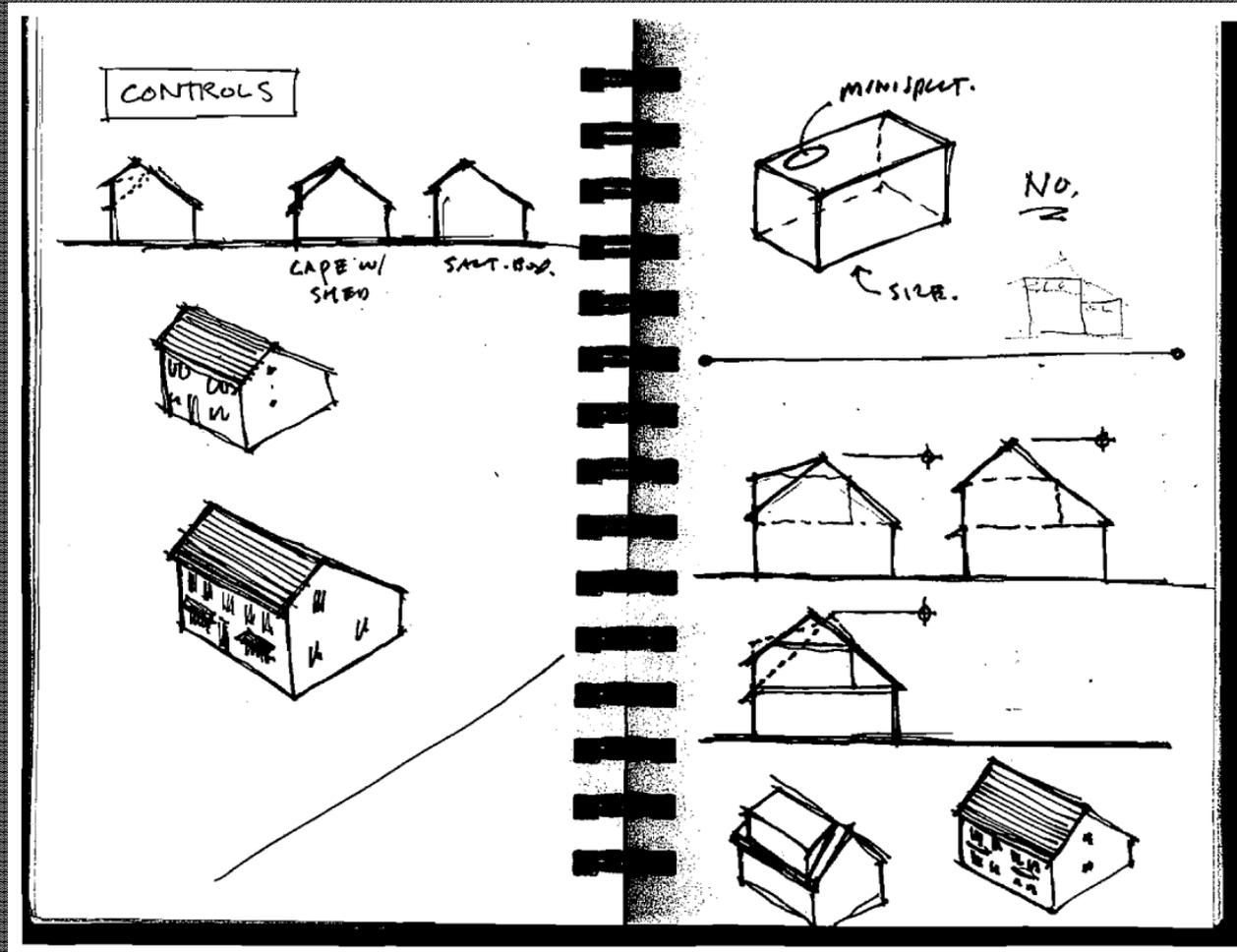
Initial Cape Design



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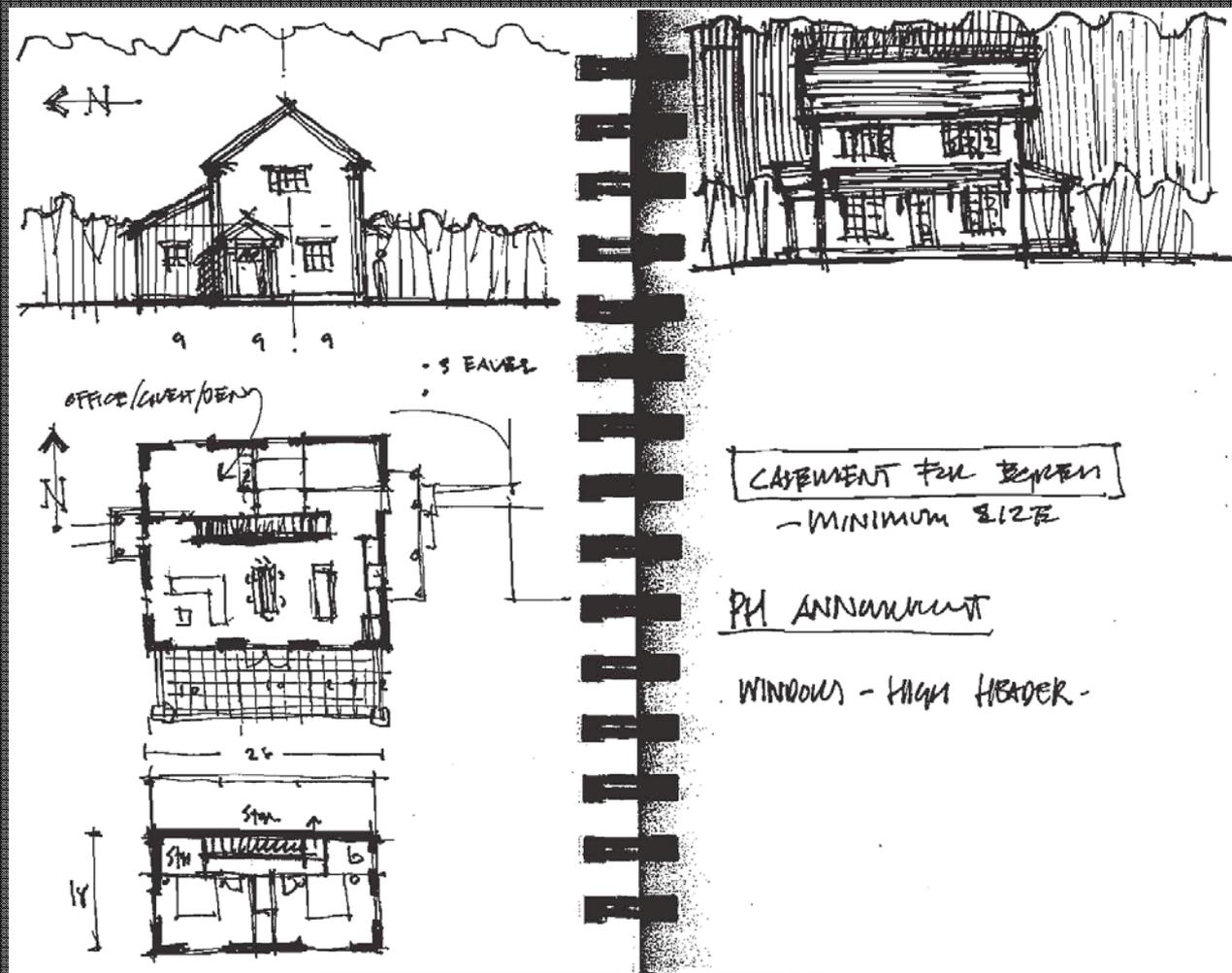
Preliminary Passive House Sketches



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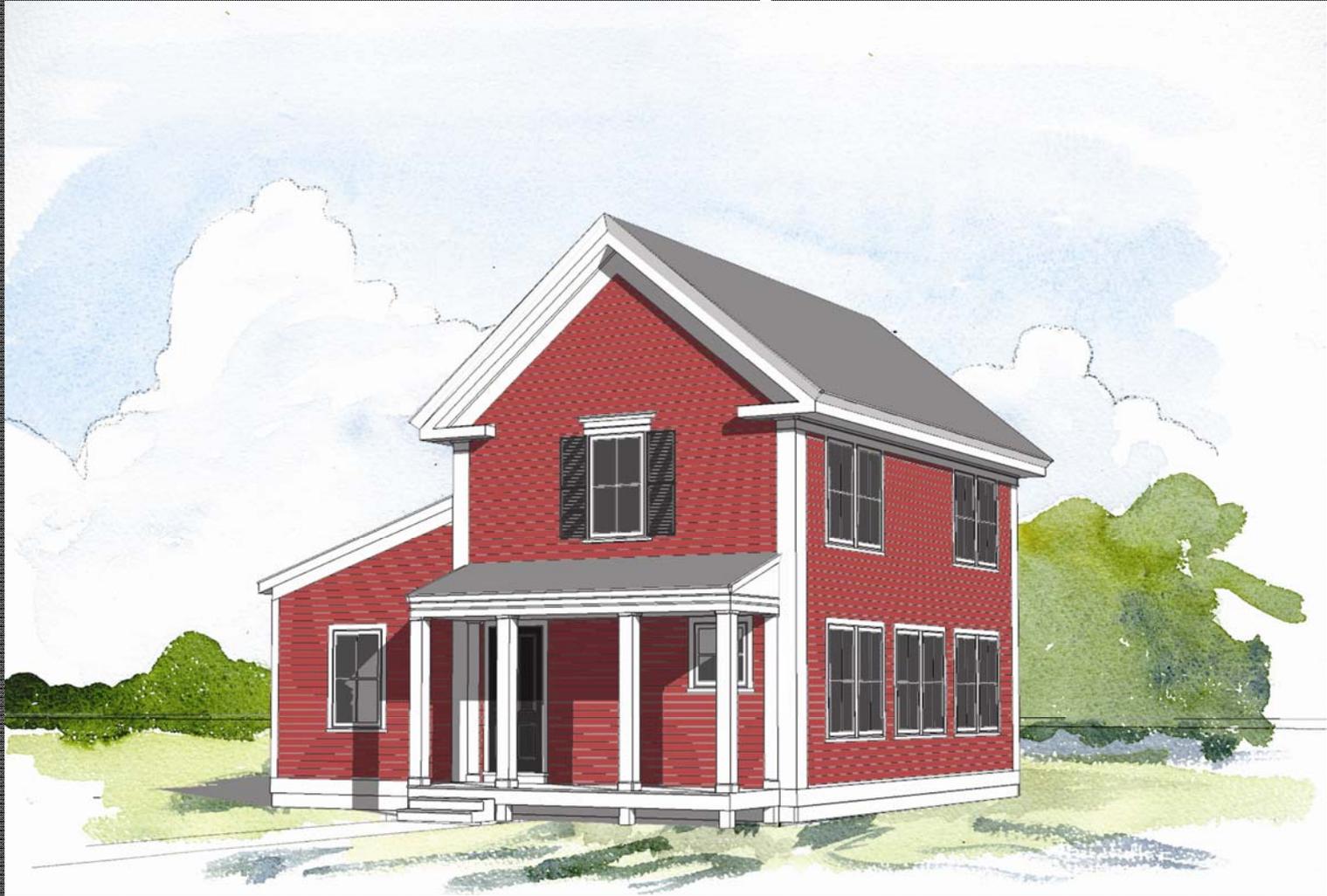
Preliminary Passive House Sketches



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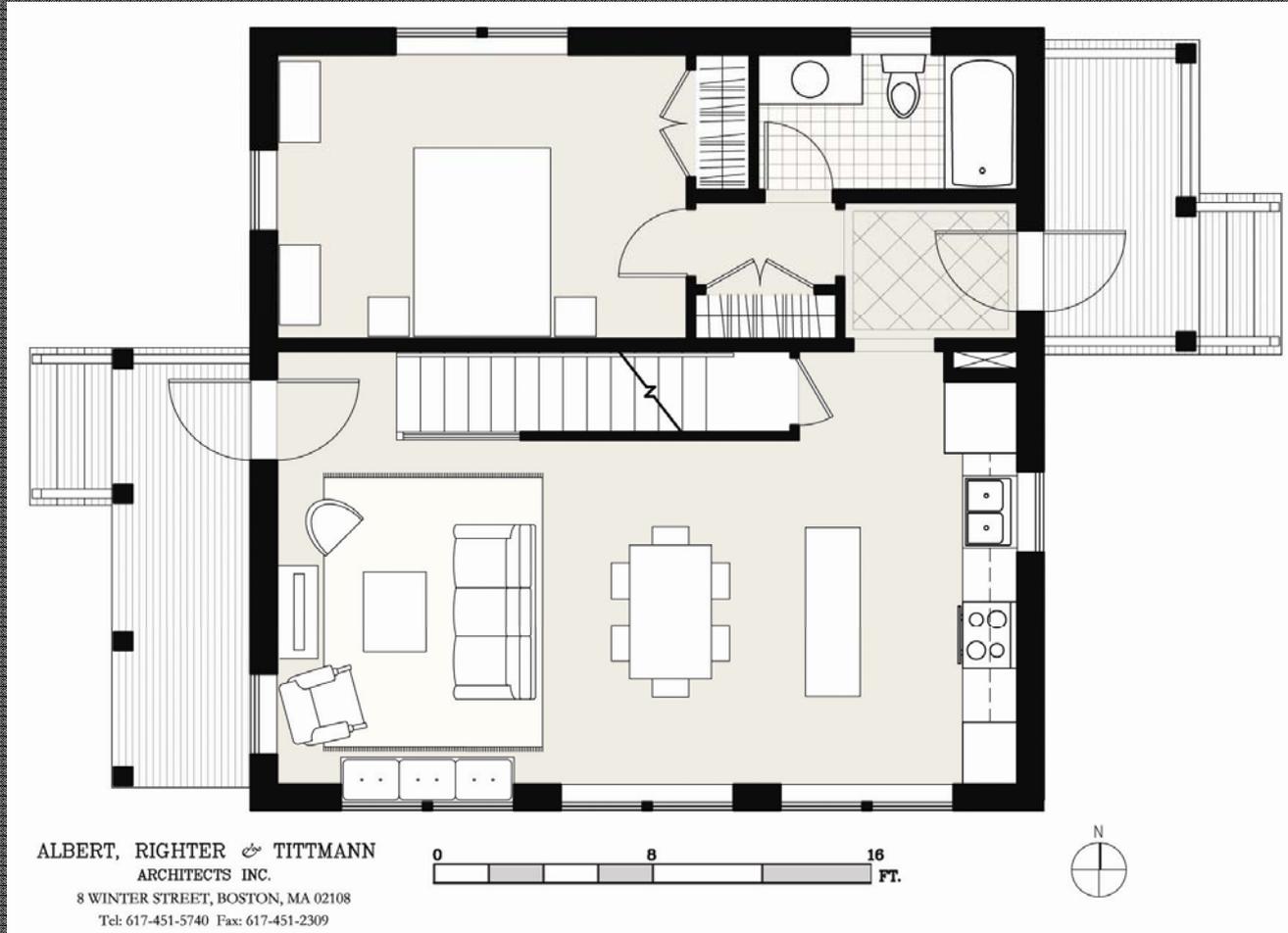
Habitat for Humanity Passive House



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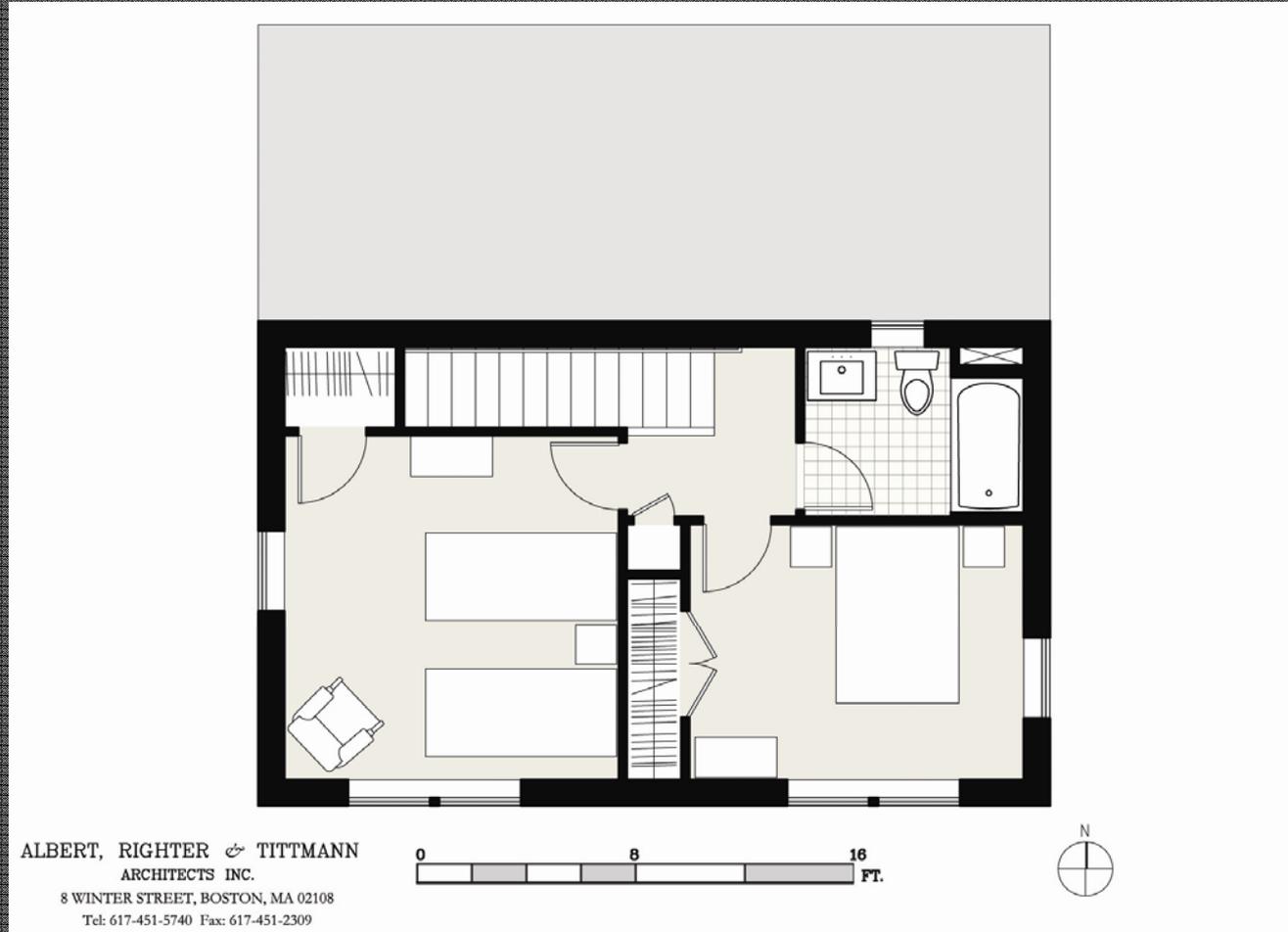
Habitat Passive House – 1st Floor



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Habitat Passive House – 2nd Floor



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Habitat for Humanity Passive House



WEST ELEVATION

SOUTH ELEVATION

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Habitat for Humanity Passive House



EAST ELEVATION

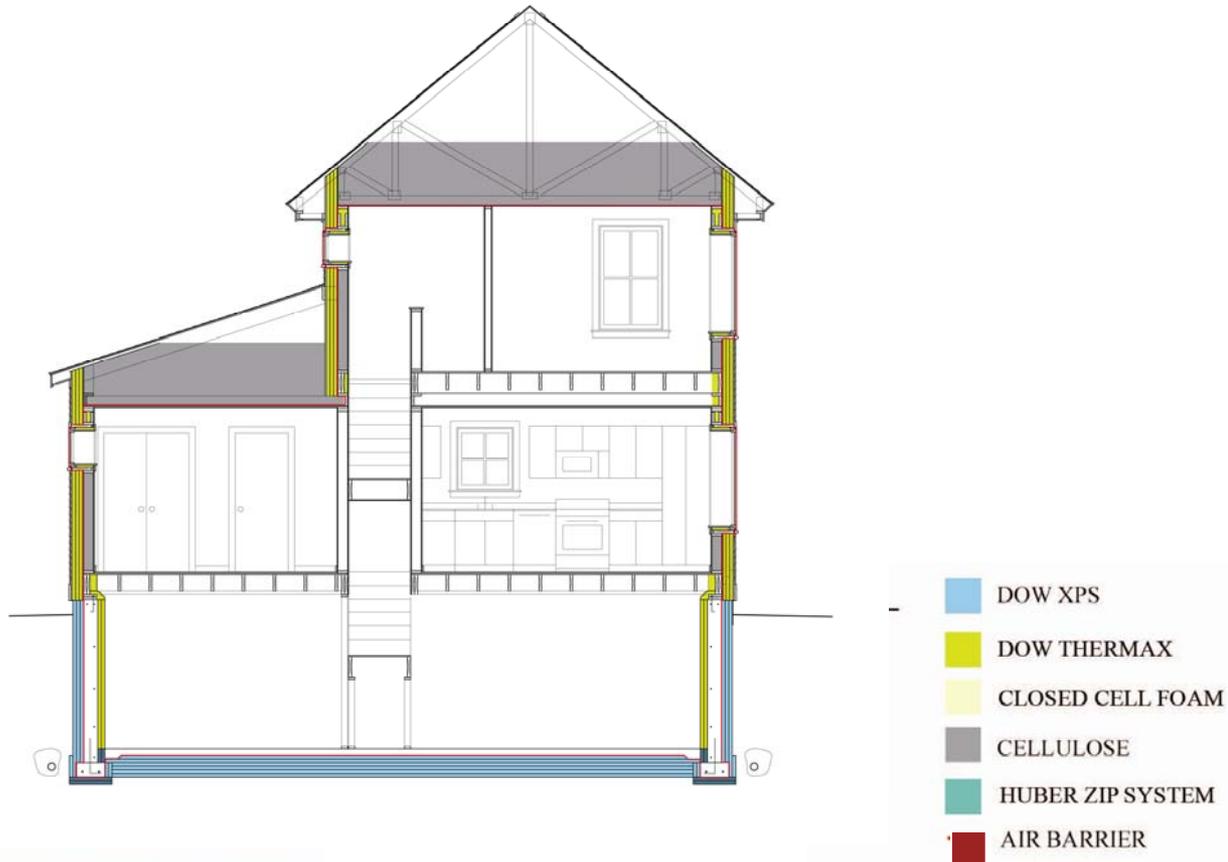


NORTH ELEVATION

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Habitat Passive House – Section

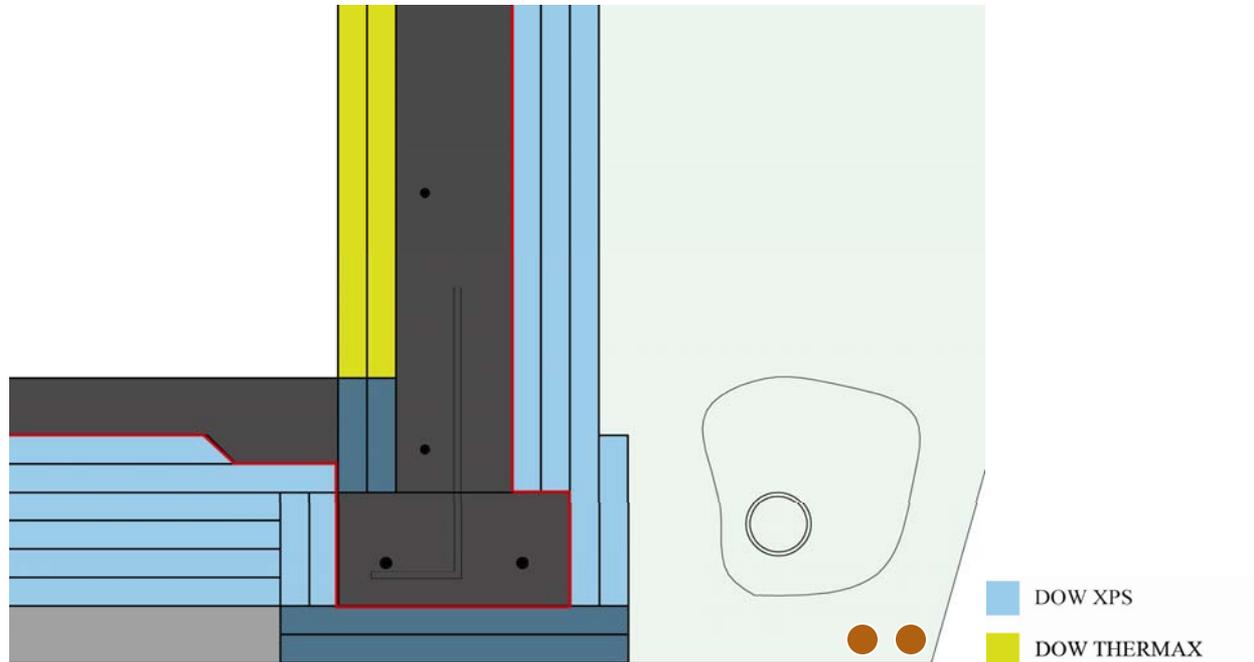


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Habitat for Humanity Passive House Footing Detail

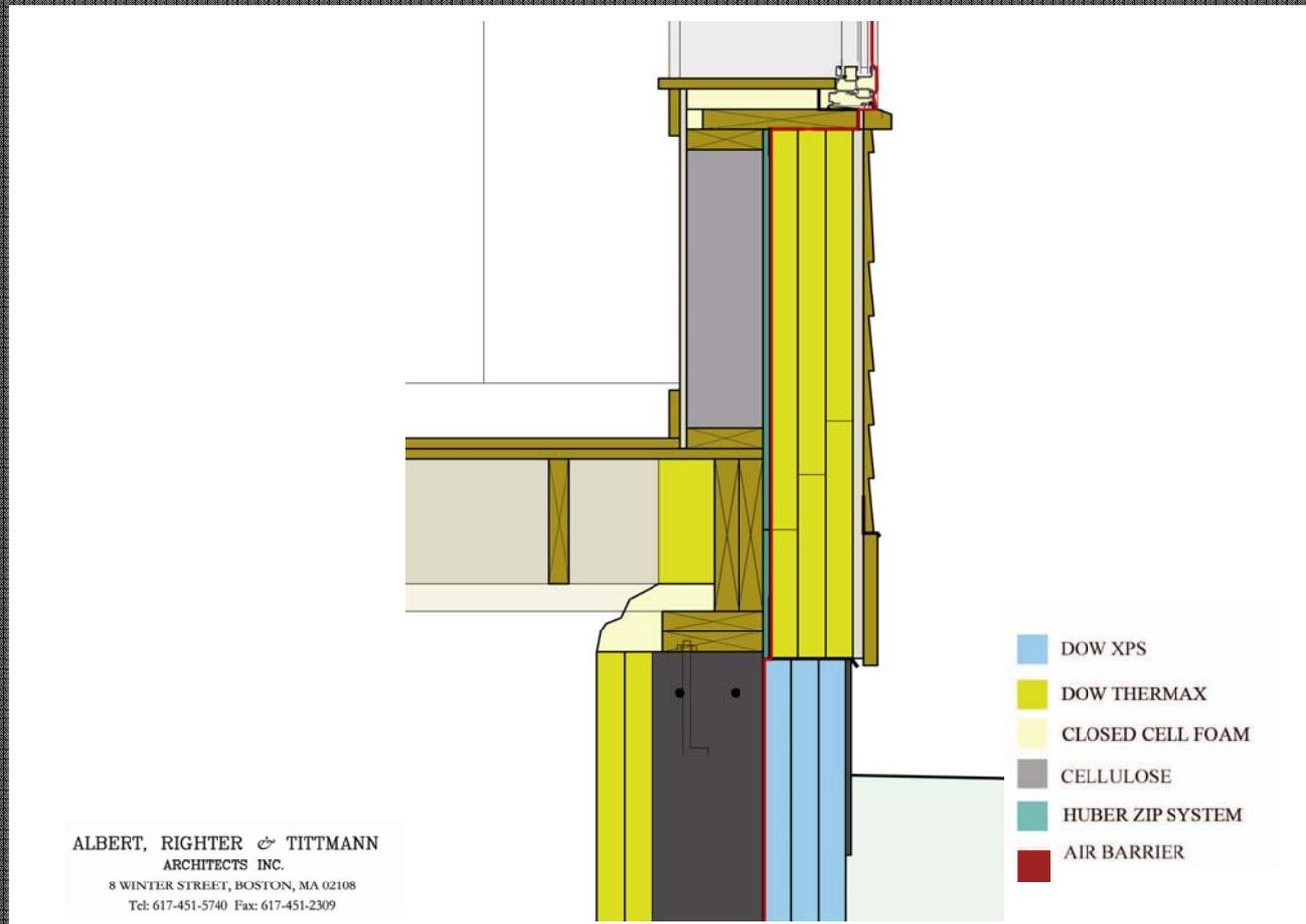


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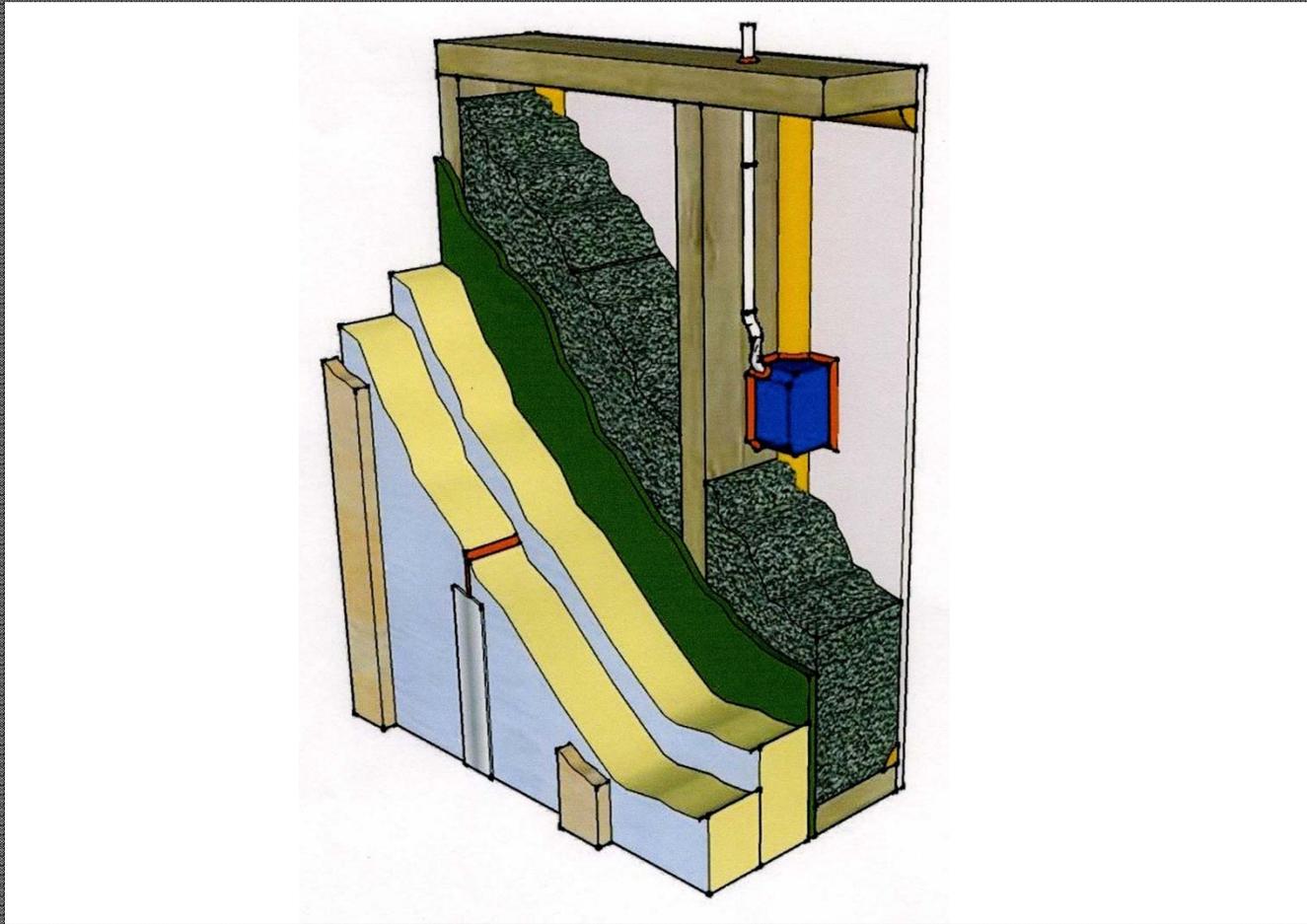
Habitat for Humanity Passive House Sill Detail



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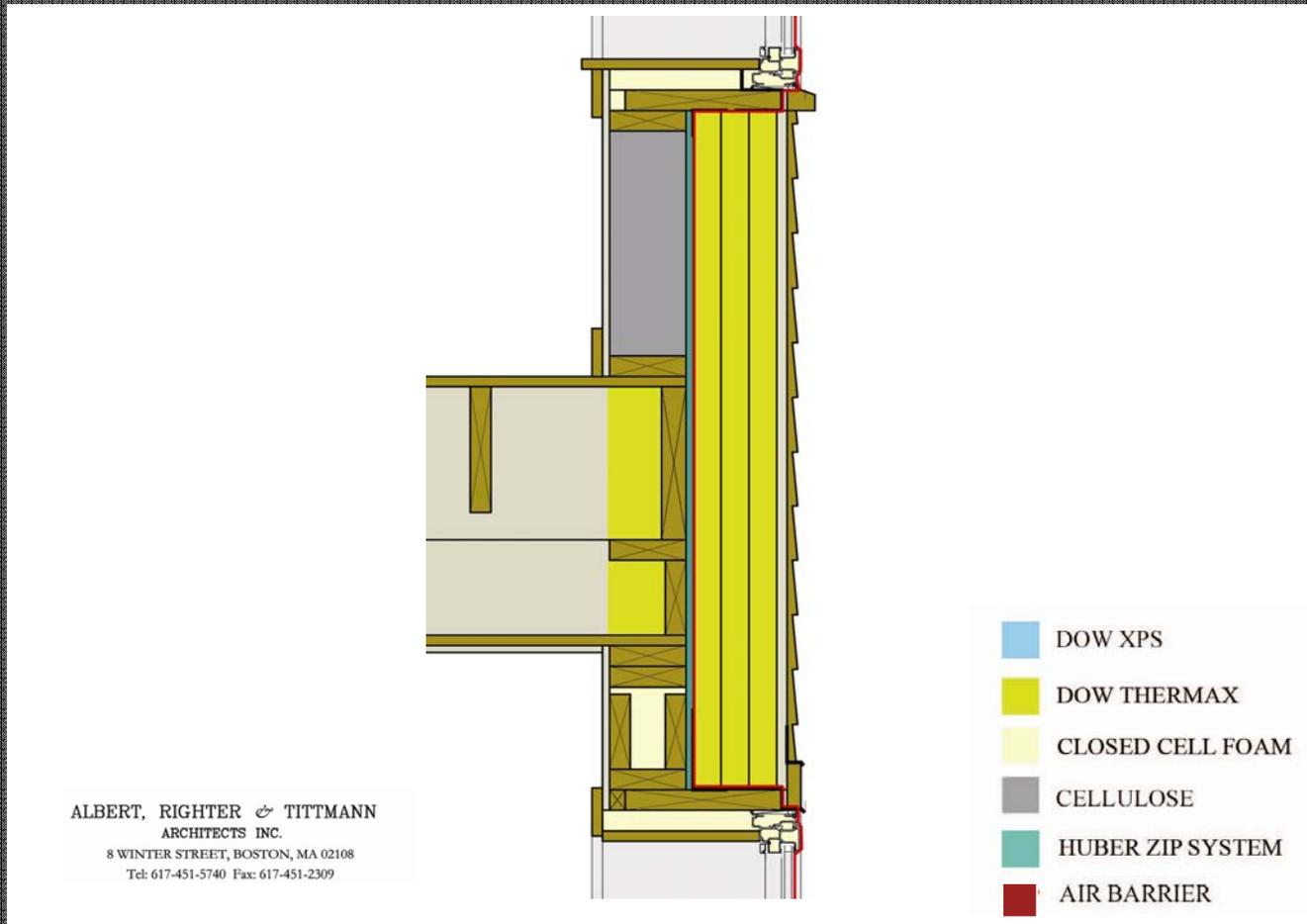
Habitat for Humanity Passive House Wall Section



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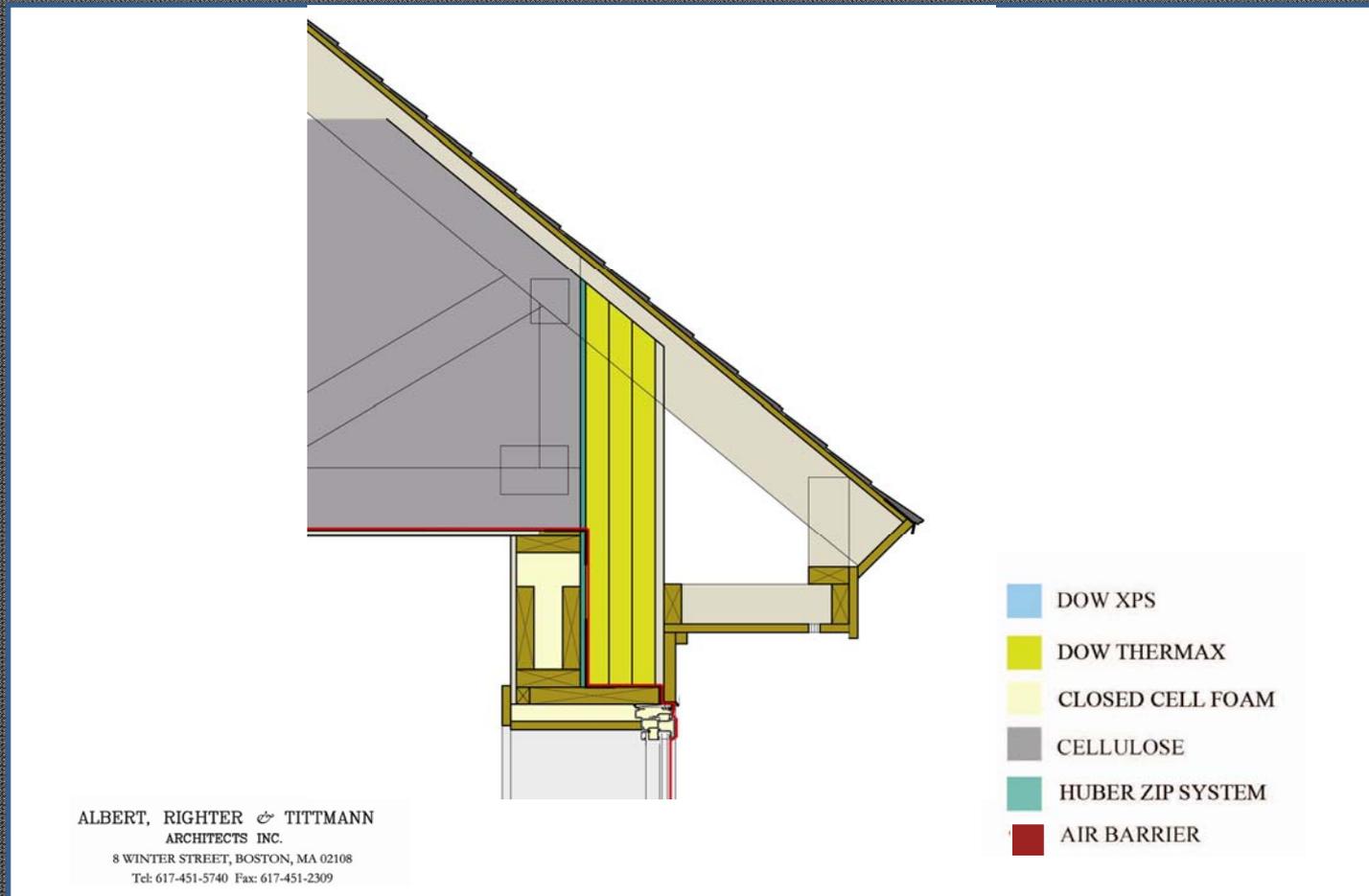
Habitat for Humanity Passive House Second Floor Platform Detail



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Habitat for Humanity Passive House Eave Detail



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Habitat for Humanity Passive House Windows

**Serious Materials
925 Series**

.47 SHGC

**Glazing U-value .107
Frame U-value .17**

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Habitat for Humanity Passive House HVAC System

Air Source Heat Pump:

Mitsubishi Hyper-heat MSZ-MUZ FE 09

ERV:

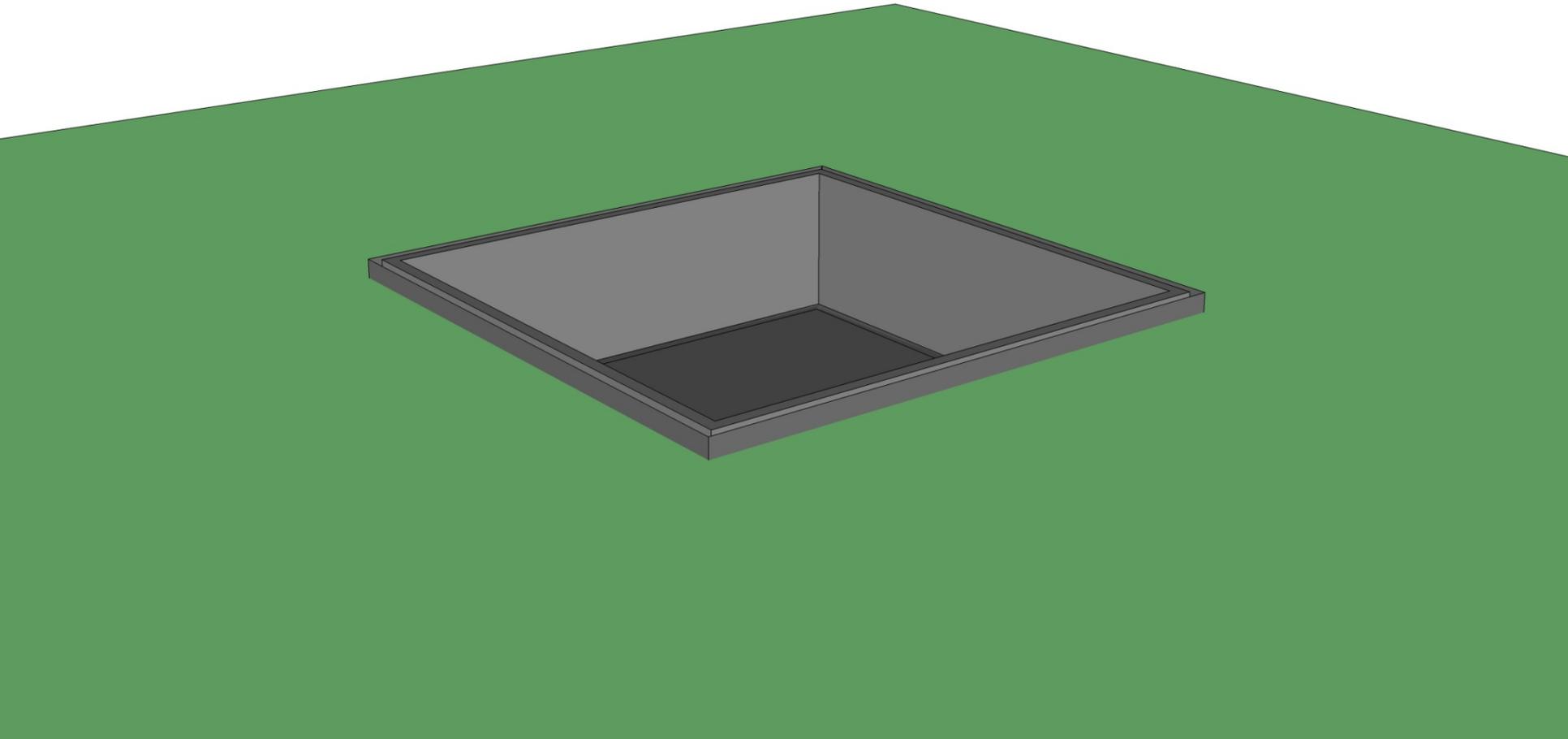
UltimateAir Recouperator ERV

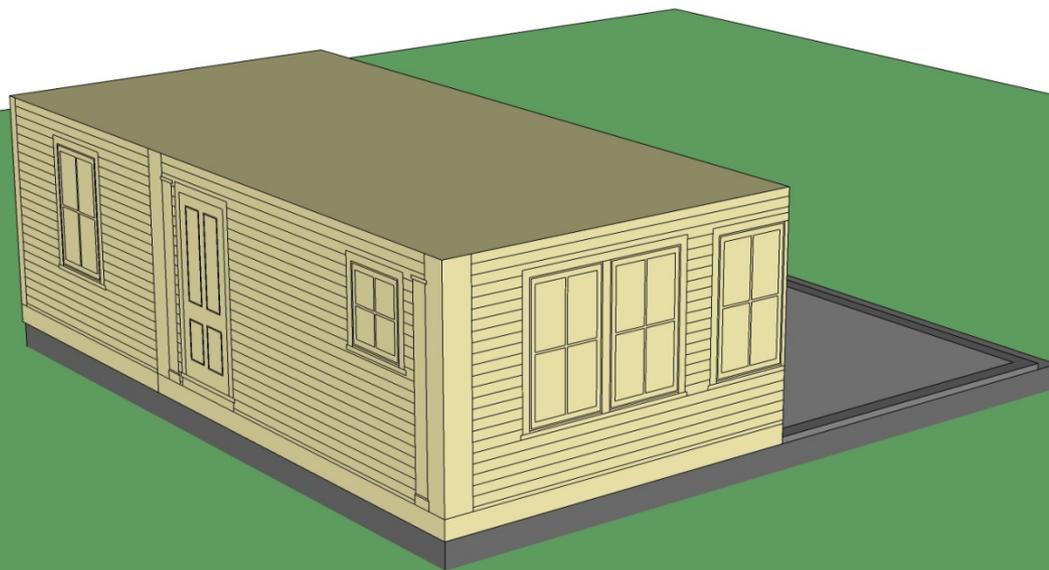
Soil heat exchange system:

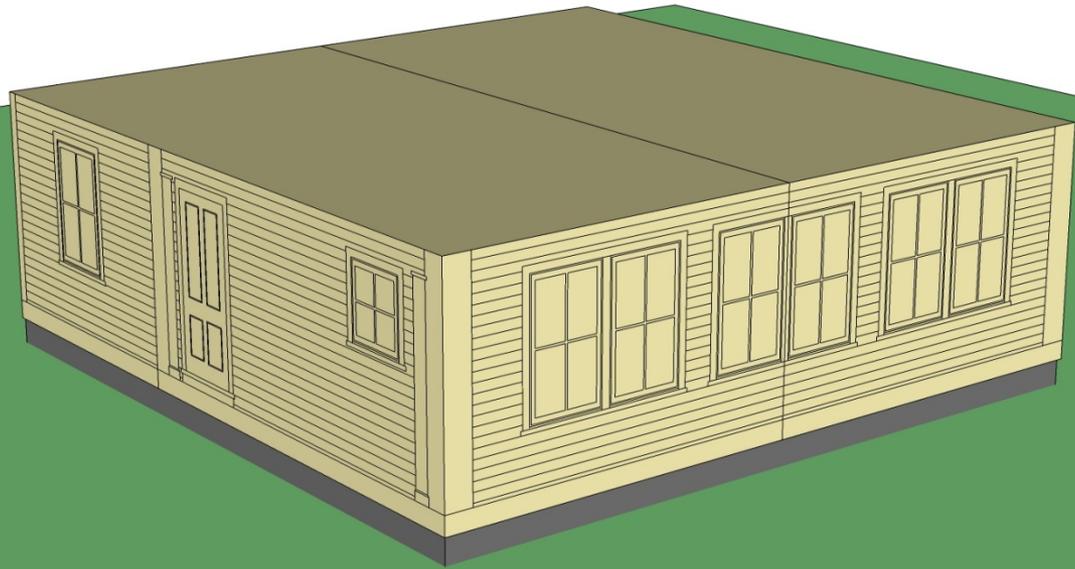
Two 125' loops of 1" pex around the base of the footings filled with water/glycol mix & tied to Laing 30W AC Pump & water-to-air coil made by UltimateAir (~40F Temp Rise)

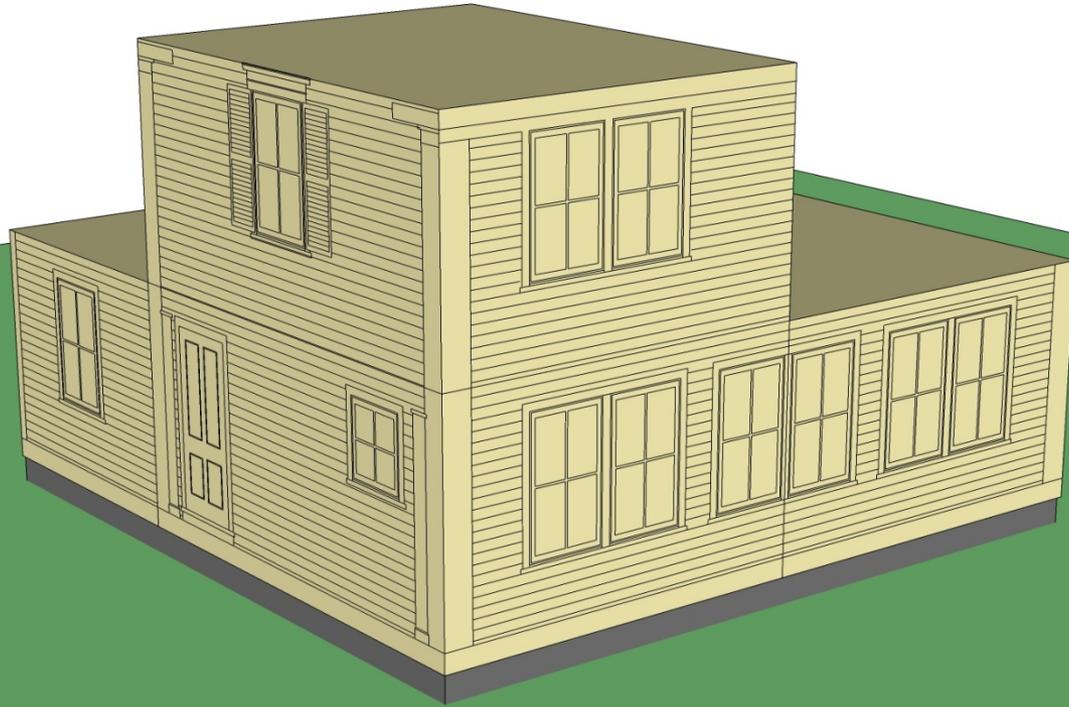
Solar Hot Water:

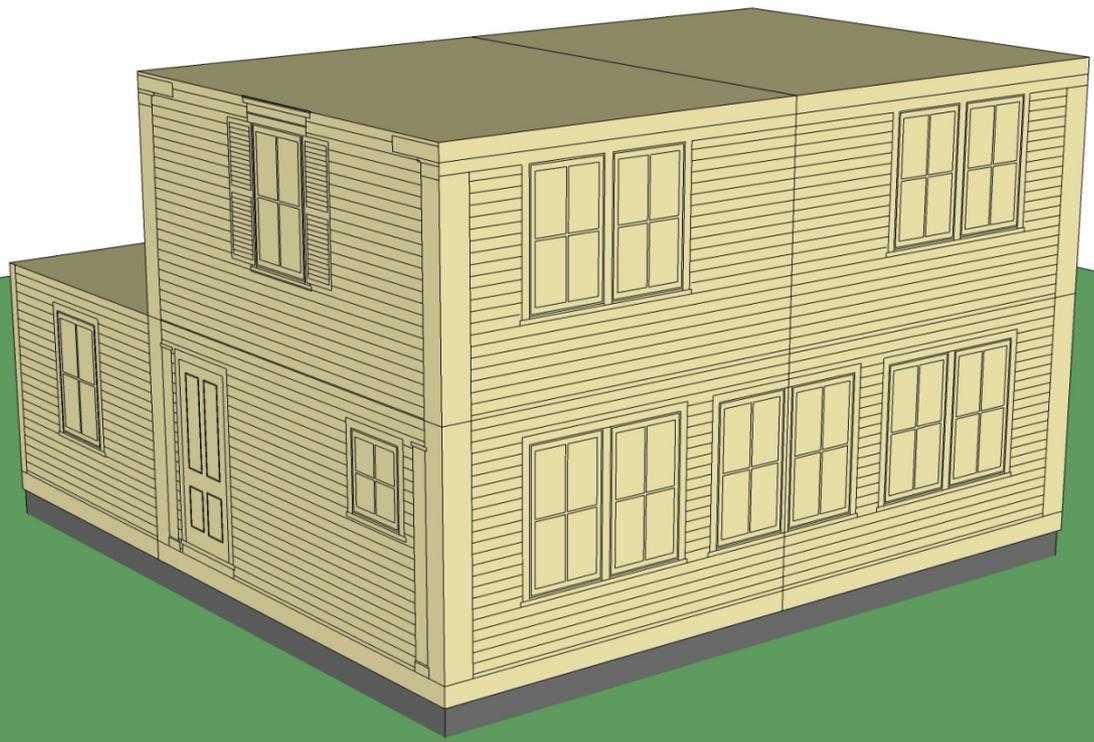
Sunward Solar water heating system mounted on roof with 40g electric hot water heater as back-up

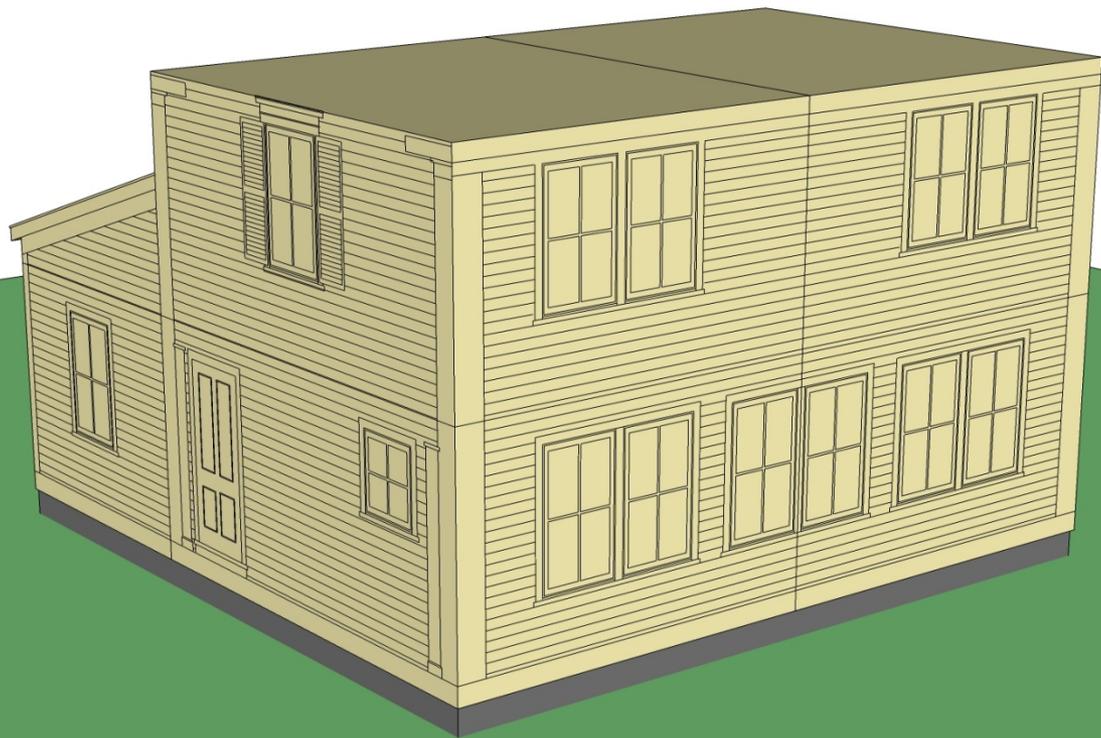




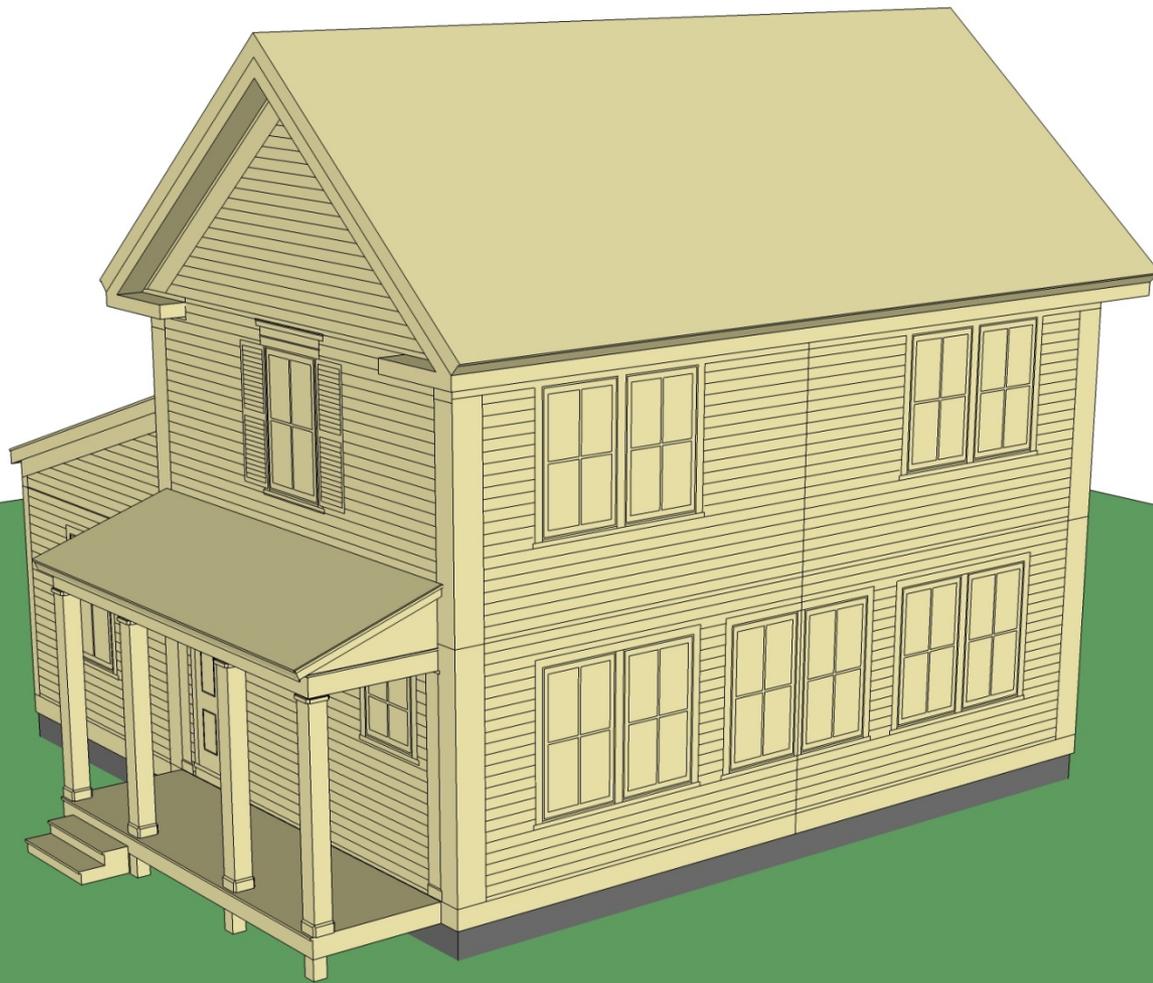




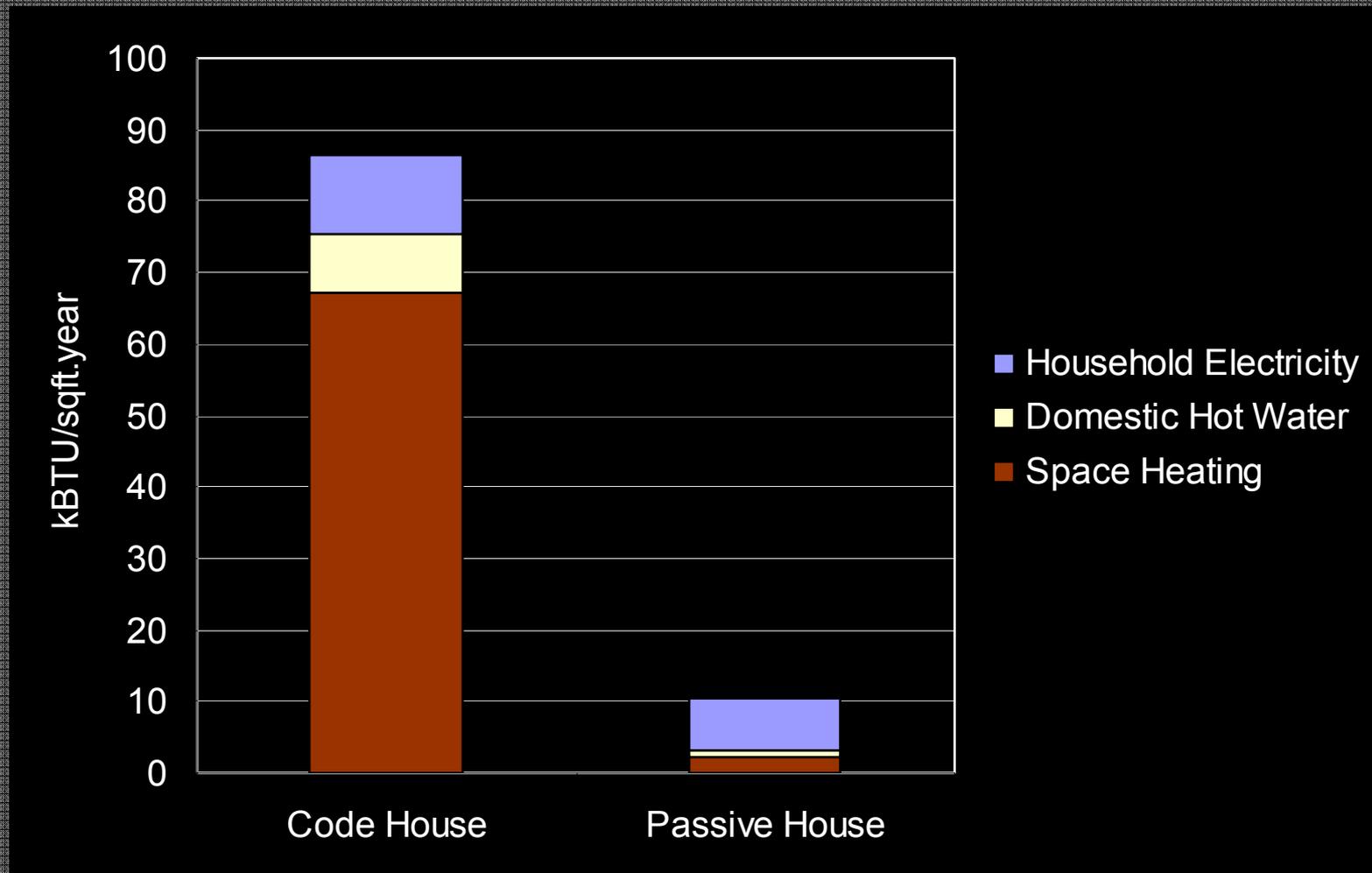








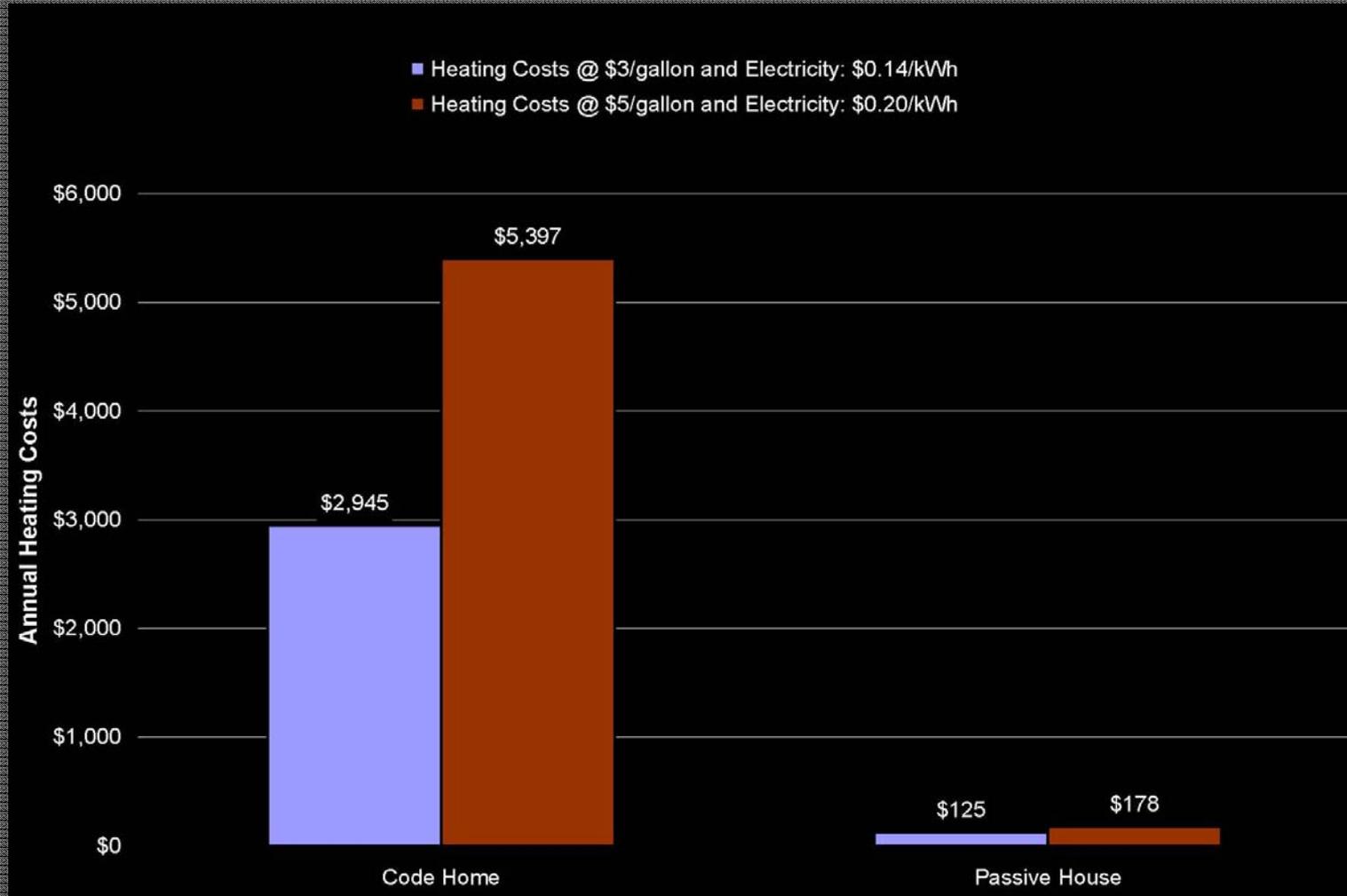
How much energy is used in houses?



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Comparison of Annual Heating Costs



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Comparison of Total Costs

	Energy Code Home	Passive House
Total Cost of Home (Includes \$200k for Land and Site Work)	\$324,417	\$364,925
Mortgage/month 30 year fixed @ 5%	\$1,742	\$1,959
Insurance	\$35	\$35
Property Taxes	\$500	\$500
Estimated monthly energy costs @ \$3/gal; elec \$.14/kWh	\$333	\$52
Total Costs/month @ \$3/gal; elec \$.14/kWh	\$2,610	\$2,546
Estimated monthly energy costs @ \$5/gal; elec \$.20/kWh	\$583	\$73
Total Costs/month @ \$5/gal; elec \$.20/kWh	\$2,860	\$2,567

Passive House yearly savings @ \$3/gal; elec \$.14/kWh over energy code home = \$768

Passive House yearly savings @ \$5/gal; elec \$.20/kWh over energy code home = \$3,509

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Habitat for Humanity Passive House



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