

bsc

**1: SINGLE-FAMILY HOUSE
BEDFORD, MA**


©2008 Building Science Corporation

bsc

Lowell Habitat for Humanity Bedford, MA
1400 sq. ft. @ \$80/sq. ft. **HERS 55**

Gas = \$50/month @ \$1.50 /therm
Electric = \$50/month @ \$.15/kWh Average = **\$3.30 per day**

With 4 kW PV and 94 sq. ft. solar hot water \$105/sq.ft.
Electric = \$0 Gas = \$37.50/month Average = **\$1.25/day**



©2008 Building Science Corporation

bsc



First floor plan Second floor plan

©2008 Building Science Corporation

bsc

House characteristics

Building envelope

- Ceiling: R-26 4" polyisocyanurate on roof deck (x2 2" layers) with R-40 loose-fill cellulose (2x12 bays; 11.25")
- Walls: R-19 2x6 OVE frame w. R-26 4" polyiso (x2 2" layers)
- Foundation: Sealed conditioned crawl space R-26 4" polyiso walls (x2 2" layers) / 2" (R-10) XPS on floor 4" from exterior
- Windows: Double Pane Vinyl Spectrally Selective LoE, U=0.33, SHGC=0.40 (minimum requirements)
- Infiltration: 2.5 sq in leakage area per 100 sf envelope / 1016 CFM 50 (3.9 ACH 50) Plan 1


Mechanical systems

- Heat: 95% AFUE gas furnace
- Cooling: 14 SEER air conditioner split system
- DHW: 0.85 EF water heater (e.g., instantaneous)
- Ducts: R-4.2 flex runouts in conditioned space
- Leakage: none to outside (5% or less)
- Ventilation: Aprilaire VCS 8126 or similar supply-only system integrated with AHU; 25 W system power 50 CFM @ 33% Duty Cycle: 10 minutes on; 20 minutes off / Transfer grilles/jump ducts at bedrooms
- Return Pathways: no information
- PV System: no information
- Solar Hot Water: no information

©2008 Building Science Corporation


bsc

Building Section



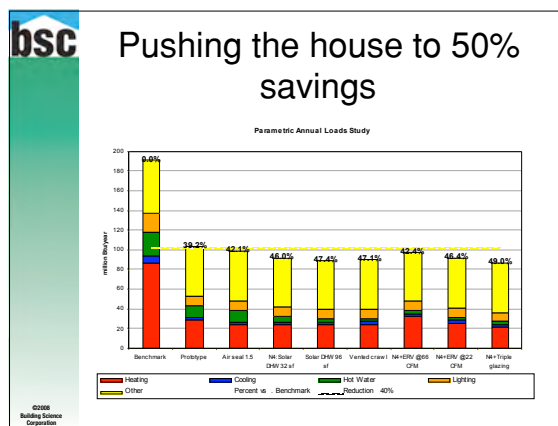
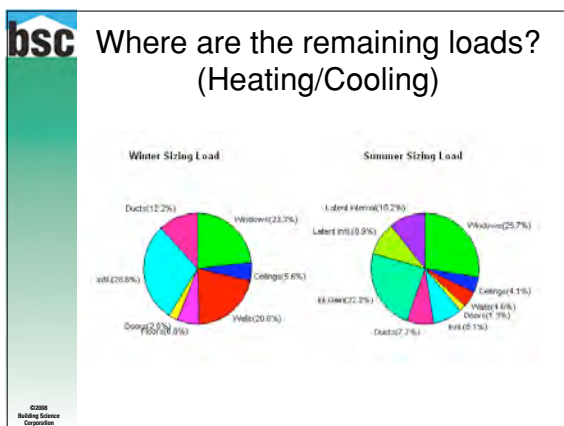
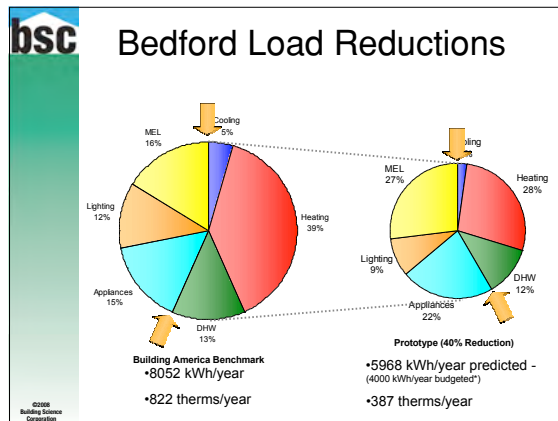
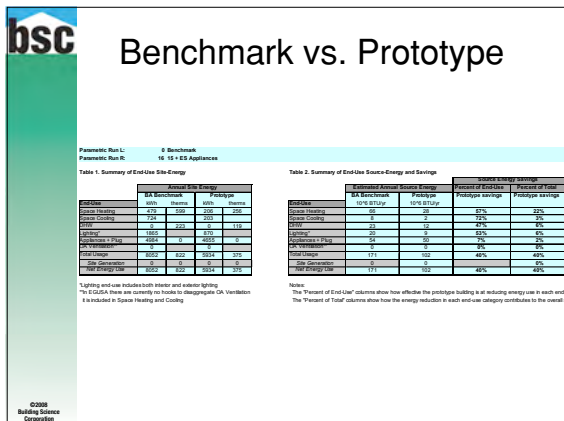
©2008 Building Science Corporation

bsc



Bedford
Cross section

©2008 Building Science Corporation



Adding Solar Thermal and Solar Electric (PV)

	kWh	therms	MBtu Electricity	MBtu Gas	MBtu Total
BSC Bedford House	5968	387	64.3	39.5	103.8
BSC + airtighten	5944	341	64.1	34.8	98.9
BSC with solar DWH	5944	276	64.1	28.2	92.2
BSC with solar DWH in CO	6013	217	64.8	22.1	87.0
What PV system needed to zero out	6551		92.2		92.2
8 kW system @ 45 degrees	9909	Placed in Boston, 0.77 derate			
7 kW system @ 45 degrees	8670	Placed in Boston, 0.77 derate			
6 kW system @ 45 degrees	7432	Placed in Boston, 0.77 derate			
4 kW system @ 45 degrees	4954	Placed in Boston, 0.77 derate			
NREL House-Simulation	4295	167	46.3	17.0	63.3
NREL House-Actual (w/o PV)	3585	56	38.7	5.7	44.4
NREL House-Actual (with PVs)	-1542	56	-16.6	5.7	-10.9

How the Costs Breakdown

- Foundations installed including concrete \$ 3,500
- Slab installed including concrete \$ 1,000
- Lumberyard Pricing of entire package including foam sheathing \$70,000
- Framer's cost to enclose building including windows and foam \$12,500
- Electrical, Plumbing, Mechanical equipment and installation \$30,000

TOTAL PRE SITE GENERATED ENERGY \$117,000*

* This price assumes volunteer labor completes the rest

- 94 sq. ft. glycol solar hot water installed with storage \$ 5,000
- 4 kW PV system with MA rebates \$20,000

TOTAL WITH SITE GENERATE ENERGY \$142,000

Energy Balance left:
+ 300 therms of gas at \$1.50/therm \$450 per year

bsc

Gas = \$50/month @ \$1.50 /therm
 Electric = \$50/month @ \$.15/kWh Average = \$3.30 per day

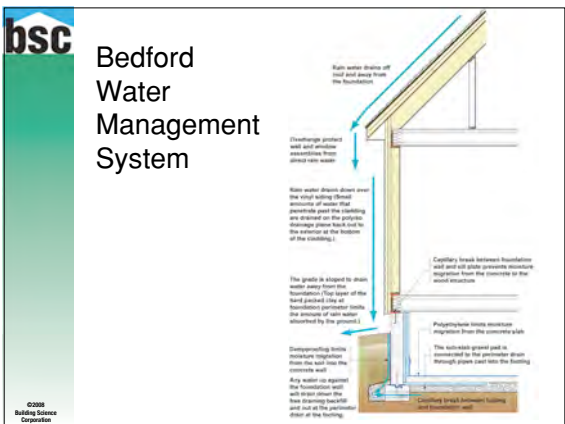
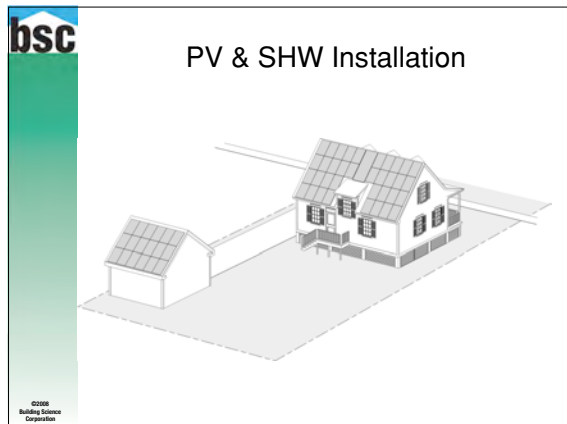
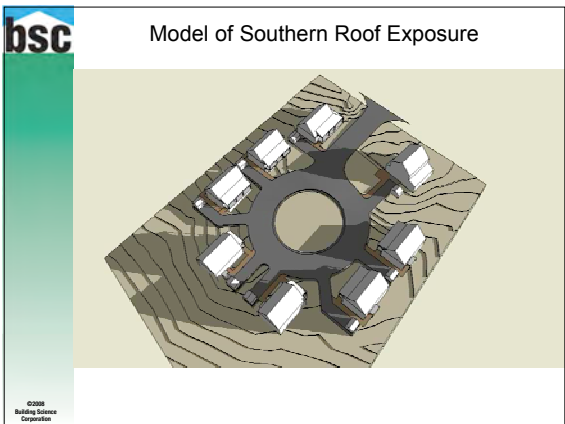
With 4kWh PV and 94 sq. ft. solar hot water \$105/sq.ft.
 Electric = \$0 Gas = \$37.50/month Average = \$1.25/day

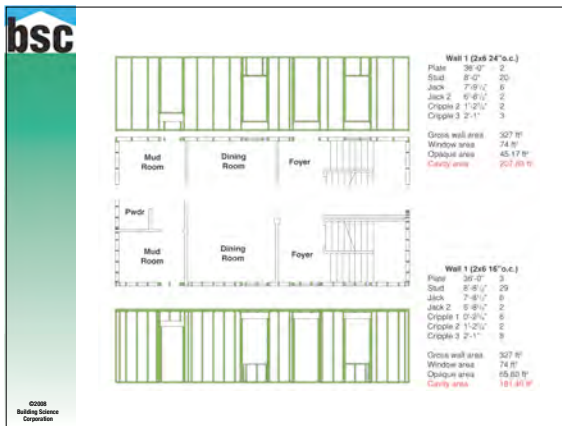
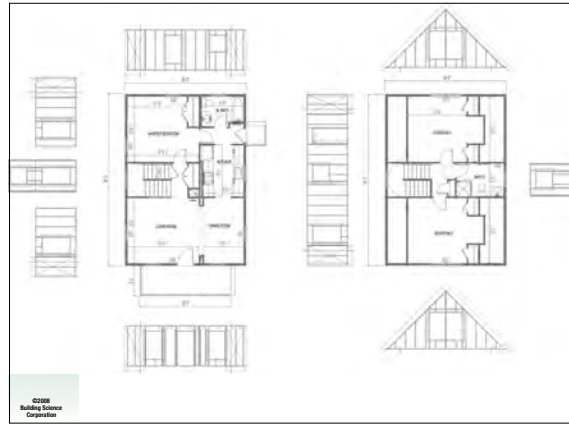
Solar Thermal @ \$5,000 saves \$150/yr
 33 year simple payback

Solar Electric @ \$20,000 saves \$600/yr
 33 year simple payback

Solar Electric @ \$40,000 saves \$600/yr
 Without subsidy 66 year simple payback

©2008 Building Science Corporation





bsc

Advanced Framing System

- Drywall clips allow for better installation with less drywall cracking

©2008 Building Science Corporation

bsc

Details

Alternative 1x4 support for gypsum board, allows for insulation past interior partition wall.

Alternative horizontal blocking for gypsum board support.

Clip and sheathing.

©2008 Building Science Corporation

bsc

©2008 Building Science Corporation

bsc

Bedford Thermal Insulation System

©2008 Building Science Corporation

bsc

©2008 Building Science Corporation

bsc

Bedford Air Flow Retarder System

©2008 Building Science Corporation

