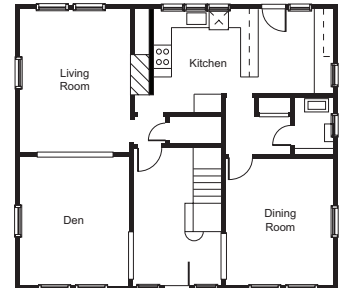


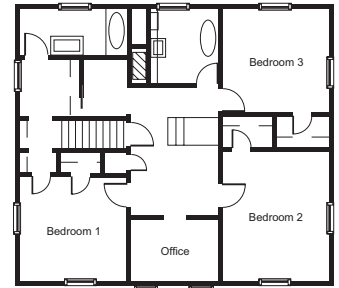
Case Study  
**Concord Four Square Retrofit**  
 Concord, Massachusetts



Photos courtesy of Dan Morrison, Fine Homebuilding



First Floor



Second Floor

Homes built prior to 1980 make up 80% of the housing stock in the United States, and are responsible for a majority of the residential energy use in the country. The Architecture 2030 goals call for a 50% reduction in home energy use by 2010. The objective of this project was to show that this energy goal could be met today in existing housing. The house was built in 1916 and is typical of the Sears kit homes available at that time. All systems were in need of updating, including plumbing, electrical and heating. Using systems engineering techniques, the enclosure and mechanical systems were analyzed to determine the most cost effective ways to meet this goal. Care was taken to provide proper water management details as the additional insulation was added.



**PROJECT PROFILE**

**Project Team:**  
 Building Science Corporation

**Address:**  
 West Concord, Massachusetts

3,600 ft<sup>2</sup> two-story, 4 bedrooms, 3 1/2 bath single family home

To be completed October 2008

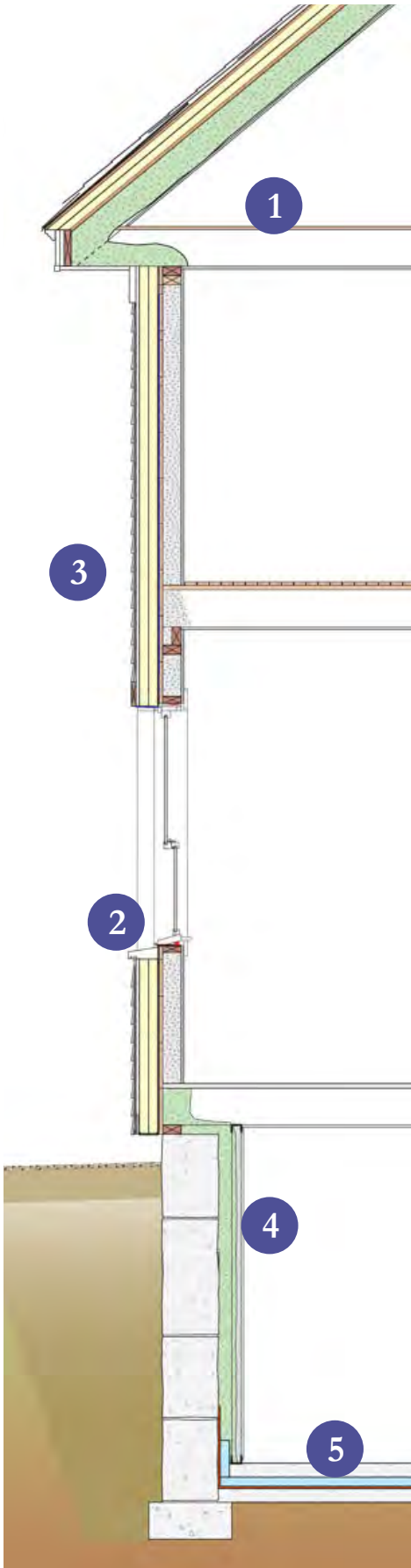
**Cost of renovation:** \$100/ft<sup>2</sup>

**Annual utility costs:**  
 Gas before: \$2,400/year  
 Gas after: \$858/year

Electric before: \$960/year  
 Electric after: \$471/year

**Total annual utility savings:**  
 \$2,031/year

**bsc** Building Science Corporation  
 30 Forest Street  
 Somerville, MA 02143  
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## BUILDING ENCLOSURE

**Roof:** Unvented

**1 Attic Insulation:** R-60 with 4" rigid foam on the exterior and 5" high density sprayed polyurethane foam to the underside of the roof sheathing

**Roof insulation:** Two layers of 2" polyisocyanurate rigid insulation

**Air Sealing:** Airtight drywall approach; low expanding foam sealant around windows, sealants and adhesives used between framing components

**2 Window Specifications:** Double-glazed, Low-E, argon-filled: U=0.33

**3 Wall Insulation:** R-41 with blown cellulose cavity insulation and 4" of rigid foam on the exterior

**Foundation:** Conditioned basement

**4 Foundation Wall Insulation:** R-20 walls with 4" high density sprayed polyurethane foam

**5 Slab Insulation:** R-10; 2" XPS insulating sheathing under the slab

**Drainage Plane:** Taped foil-faced polyisocyanurate

**Radon Protection:** Passive system installed

**Infiltration:** 2.5 in<sup>2</sup> leakage area per 100 ft<sup>2</sup> envelope



### MECHANICAL DESIGN

**1 Heating:** 92% AFUE sealed combustion gas boiler in conditioned space

**1 3 Cooling:** 13 SEER split system in conditioned space

**2 3 Ventilation:** Supply-only system with outside air to return; run at low speed with an ECM motor

**Filter:** MERV 13

**Return Pathways:** Transfer grilles at bedrooms

**Ducts:** Sheet metal trunk and flex runouts in conditioned space

**DHW:** 0.8 EF side-arm storage tank

**Appliances:** ENERGY STAR dishwasher, refrigerator, range, clothes washer, clothes dryer

**Lighting:** Energy Star CFLs

**Site Generated Power:** None

### ADDITIONAL FEATURES

- Large overhangs with crown molding to accommodate additional exterior foam **4**
- Front porch
- Maintenance-free fiber cement siding and trim
- Very high efficiency faucets, showerheads and toilets
- Plan minimizes water run-off from the site

