

DOE Solar Energy Technologies Program Peer Review: RDI's Wisdom Way Solar Village



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Track: Demonstrations

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Rural Development, Inc.

- Non-profit organization providing environmentally responsible, energy efficient, affordable housing.
- Started building ENERGY STAR[™] homes in 2002.
- Steadily improving efficiency.
- Many homes now incorporate renewable energy.



“Near Zero Energy” Prototype

Key Features:

- R-43 double walls
- R-50 ceiling insulation
- Heat Mirror™ windows
- Efficient lights and appliances
- Solar thermal space and water heating (33%)
- PV provides electricity (96%)

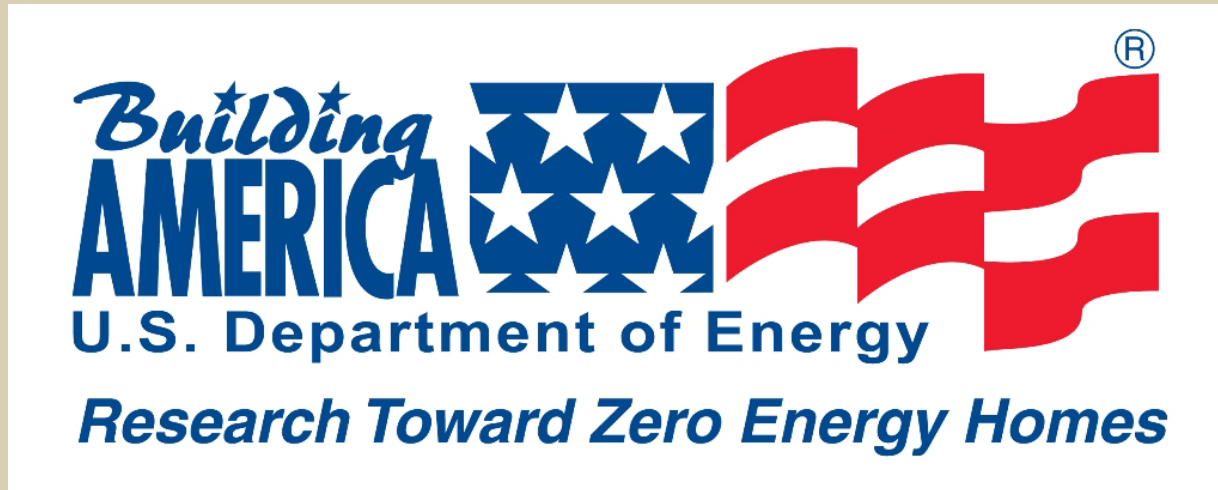


Wisdom Way Solar Village

- Closer to zero energy.
- Used many systems and lessons learned from prototype.
- Grant through DOE provided funding for:
 - Solar water heating
 - Triple-pane windows
 - Local, FSC-certified, hardwood floors



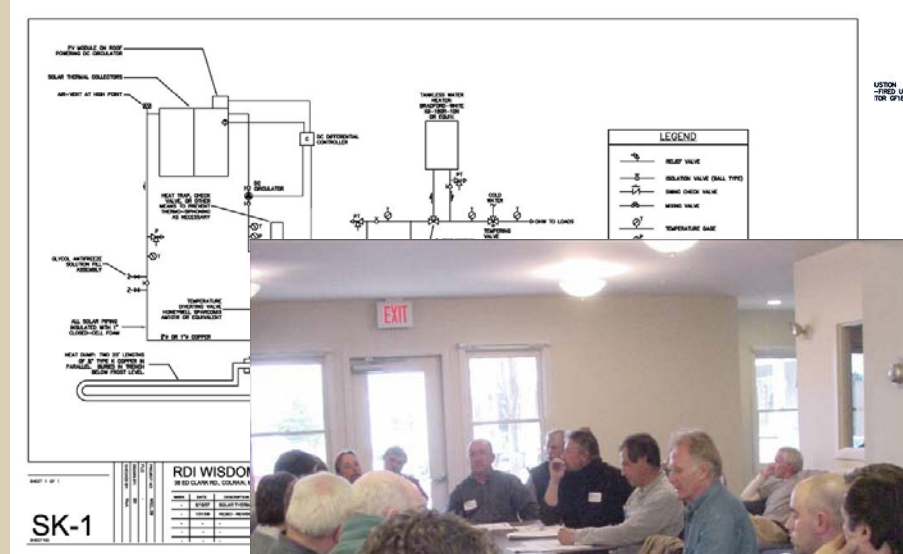
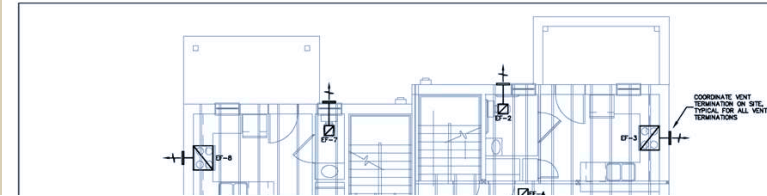
DOE's Building America Program



- Building America forms research partnerships with all facets of the residential building industry to improve the quality and energy efficiency of homes.
- The goal is to develop cost effective solutions that reduce the average energy use of housing by 40% to 100%.
- Ultimately, Building America research will lead to net zero energy homes, which produce as much energy as they use.

SWA's Building America Role

- Design & design support
- Energy modeling
- Systems integration
- Product & system research
- Monitoring and evaluation



SWA's Building America Role (2)

- Design & design support
- Energy modeling
- Systems integration
- Product & system research
- Monitoring and evaluation

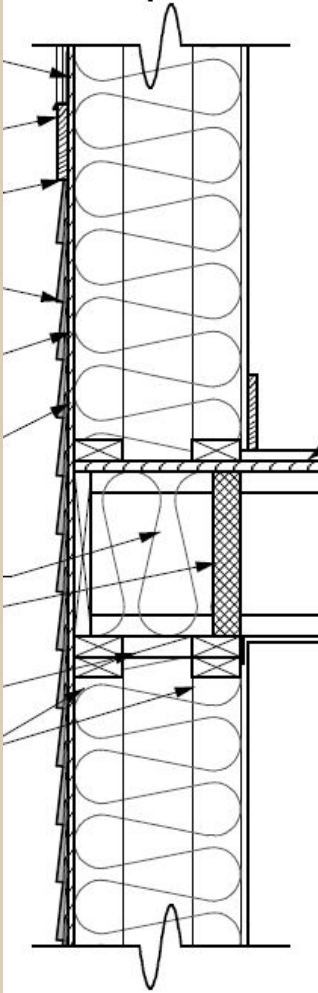


Excellent Solar Planning



Preliminary site & landscape
plan from Joan Rockwell

Envelopes: R-40+ walls



Detail from Austin Design, Inc.



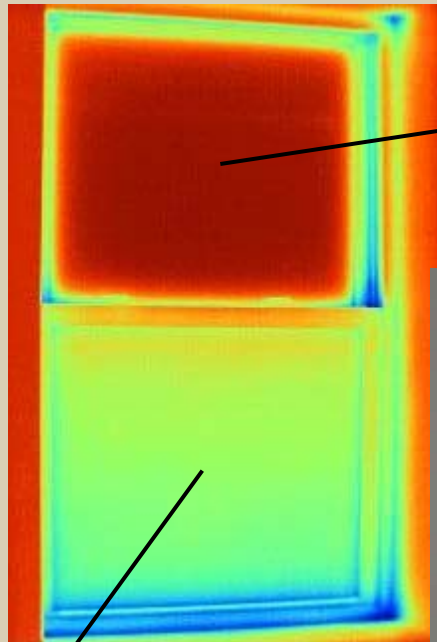
Envelopes (cont'd)

- R-50+ cellulose attic insulation
- R-40 cellulose insulation above basement



Prototype: Heat Mirror™ Windows

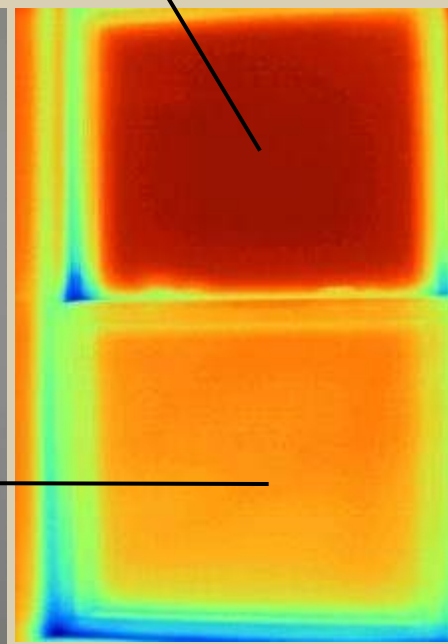
U-value: 0.20 Btu/ft²hr°F (R-5) SHGC: 0.34



68°F

61°F

64°F



Outdoor temperature: 52°F

Indoor temperature: 69°F

Wisdom Way Windows

| Orientation | Description | U-value [Btu/ft ² hr°F] | SHGC | VT |
|-------------|---|---------------------------------------|------|------|
| S | Double-pane, low-e on surface 3 | 0.26 | 0.37 | 0.53 |
| N, E, W | Triple-pane, low-e on surfaces 2 and 5 | 0.18 | 0.26 | 0.42 |



Unit Heaters

Design Loads:

~12,000 Btu/h



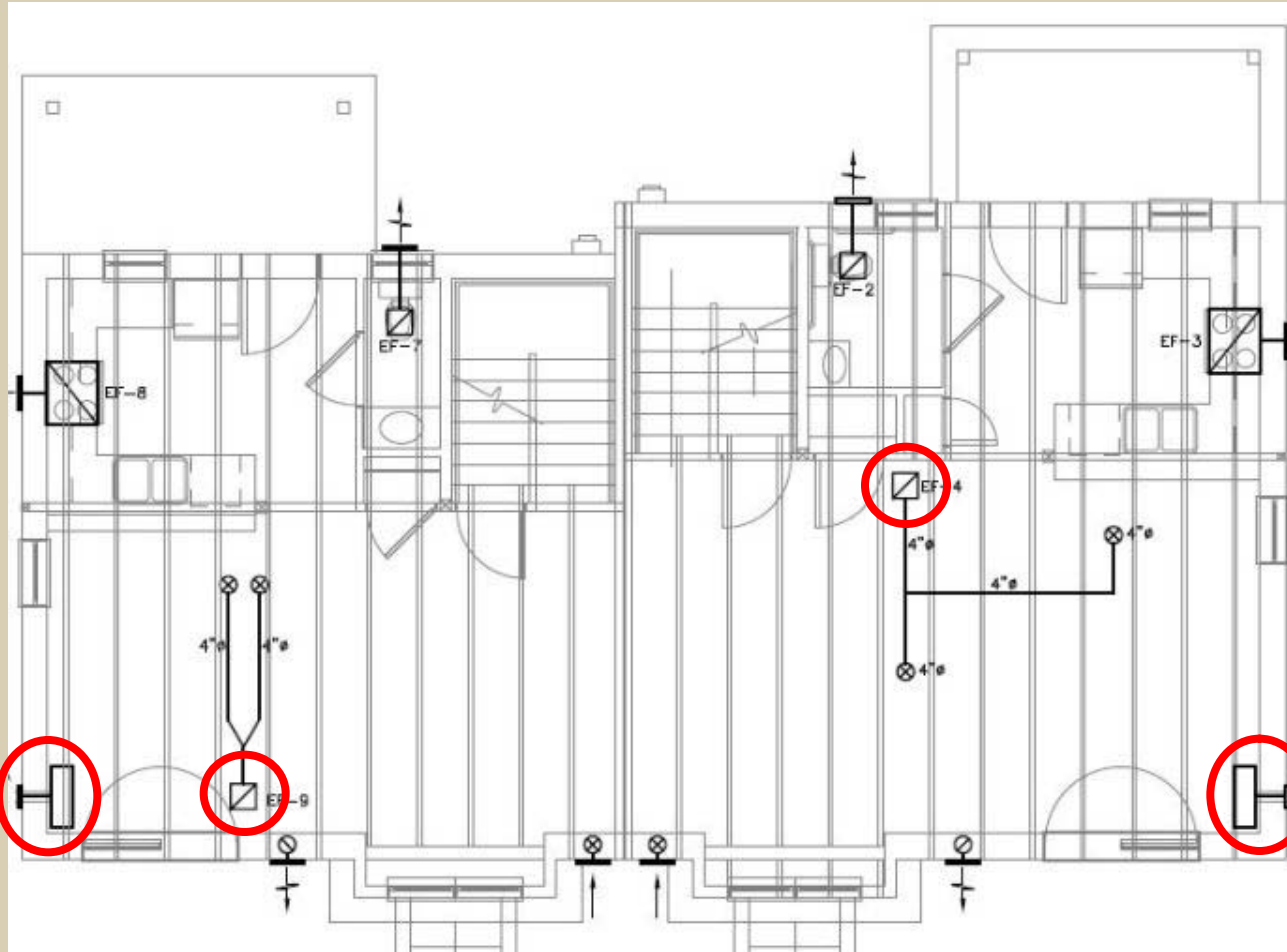
Lo: 10,200 Btu/hr

Hi: 16,000 Btu/hr

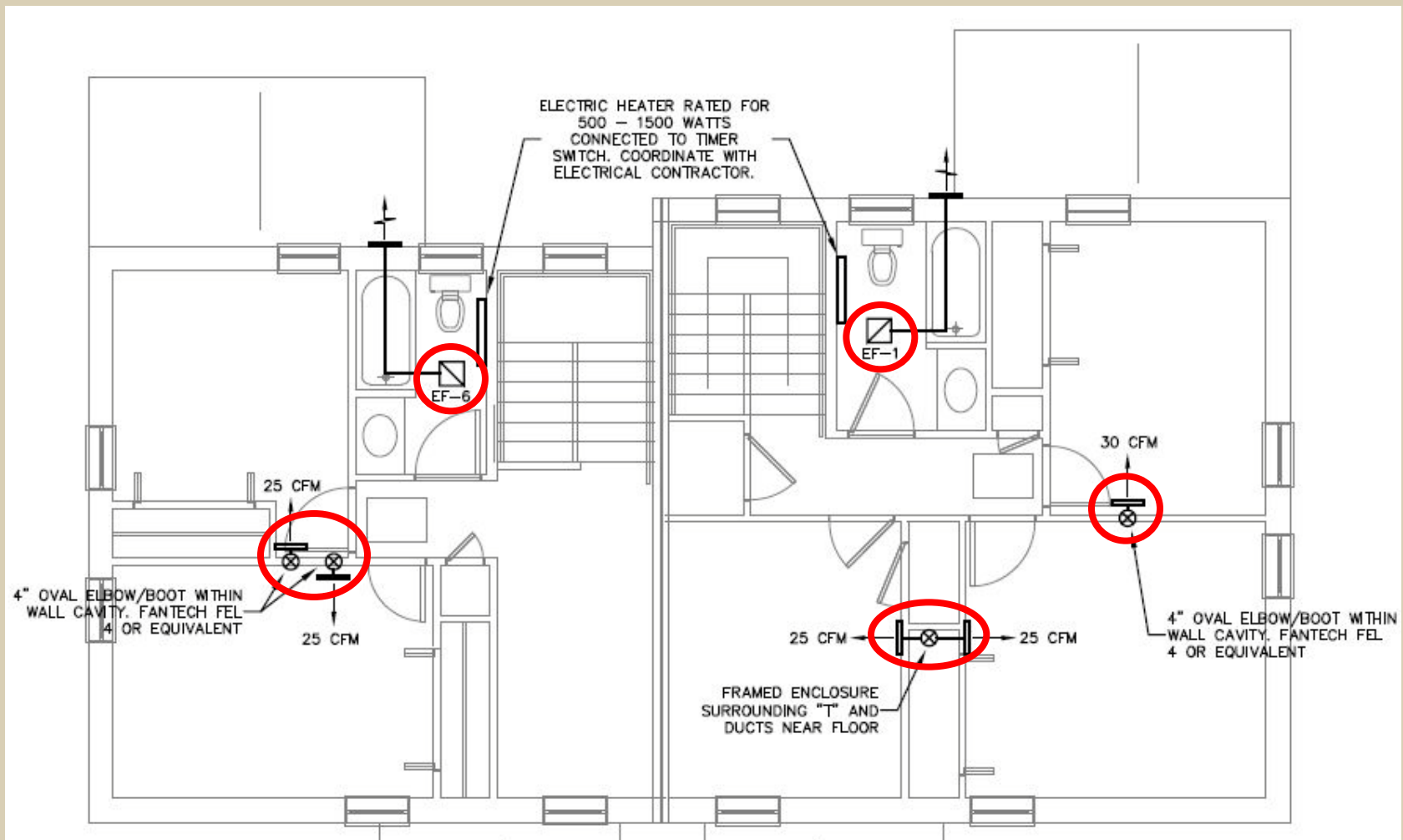
83% AFUE

Sealed Combustion

Heating System – First Floor



Heating System – Second Floor



Exhaust-Only Ventilation

Exhaust Ventilation

- Continuous
- Upstairs Bathroom
- 50 CFM (varies with unit)
- 6 Watts
- Boosts to high-speed (80 CFM) for showers



Lights and Appliances

- All lights are compact fluorescent
- All appliances ENERGY STAR

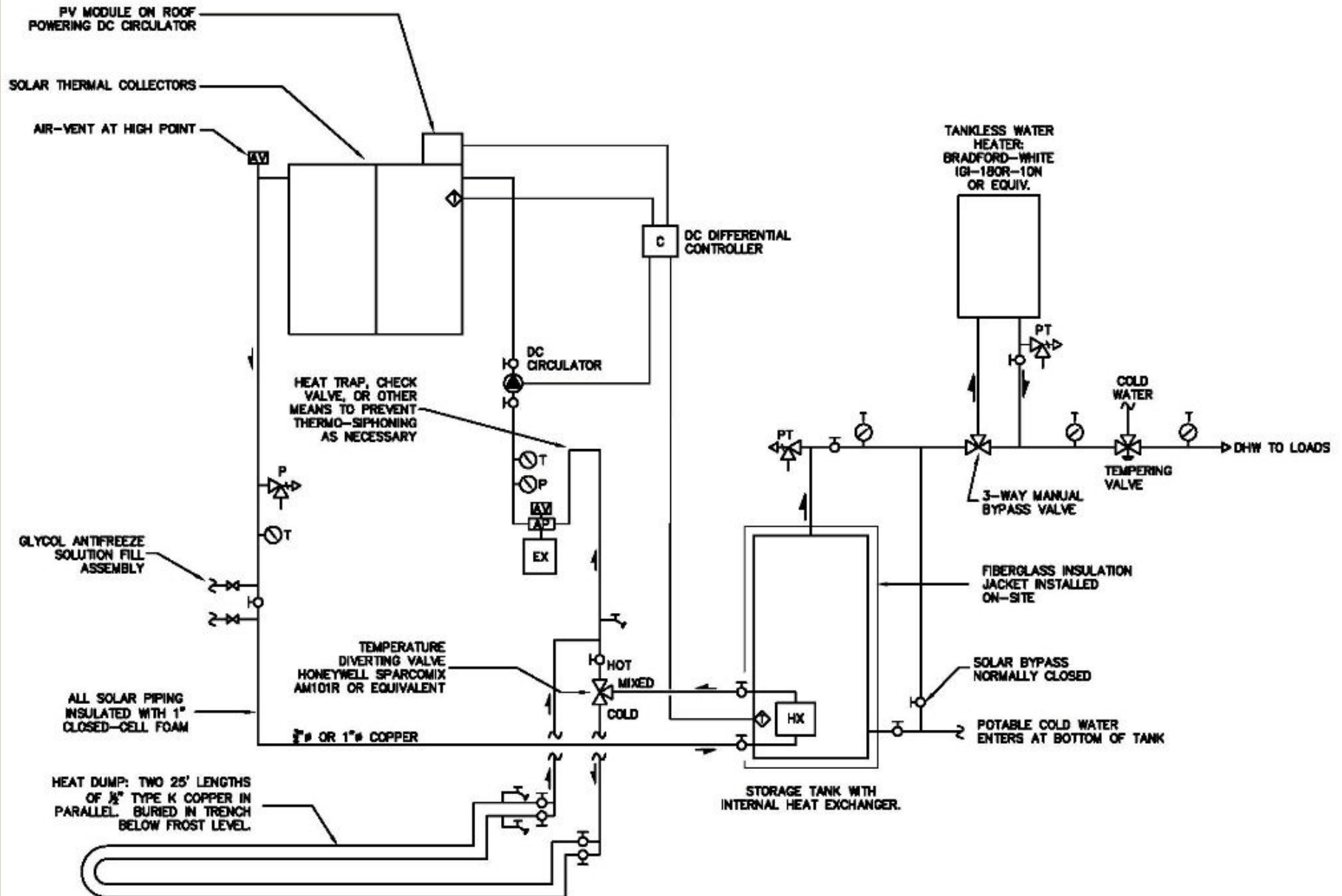


Solar Electric Systems

- 3.4-kW_{DC,STC} systems on 3- and 4-BR homes
- 2.8-kW_{DC,STC} systems on 2-BR homes
- 100% of electricity for conscientious owners.
- Funded by MTC (with utility surcharges)



Solar Thermal Systems



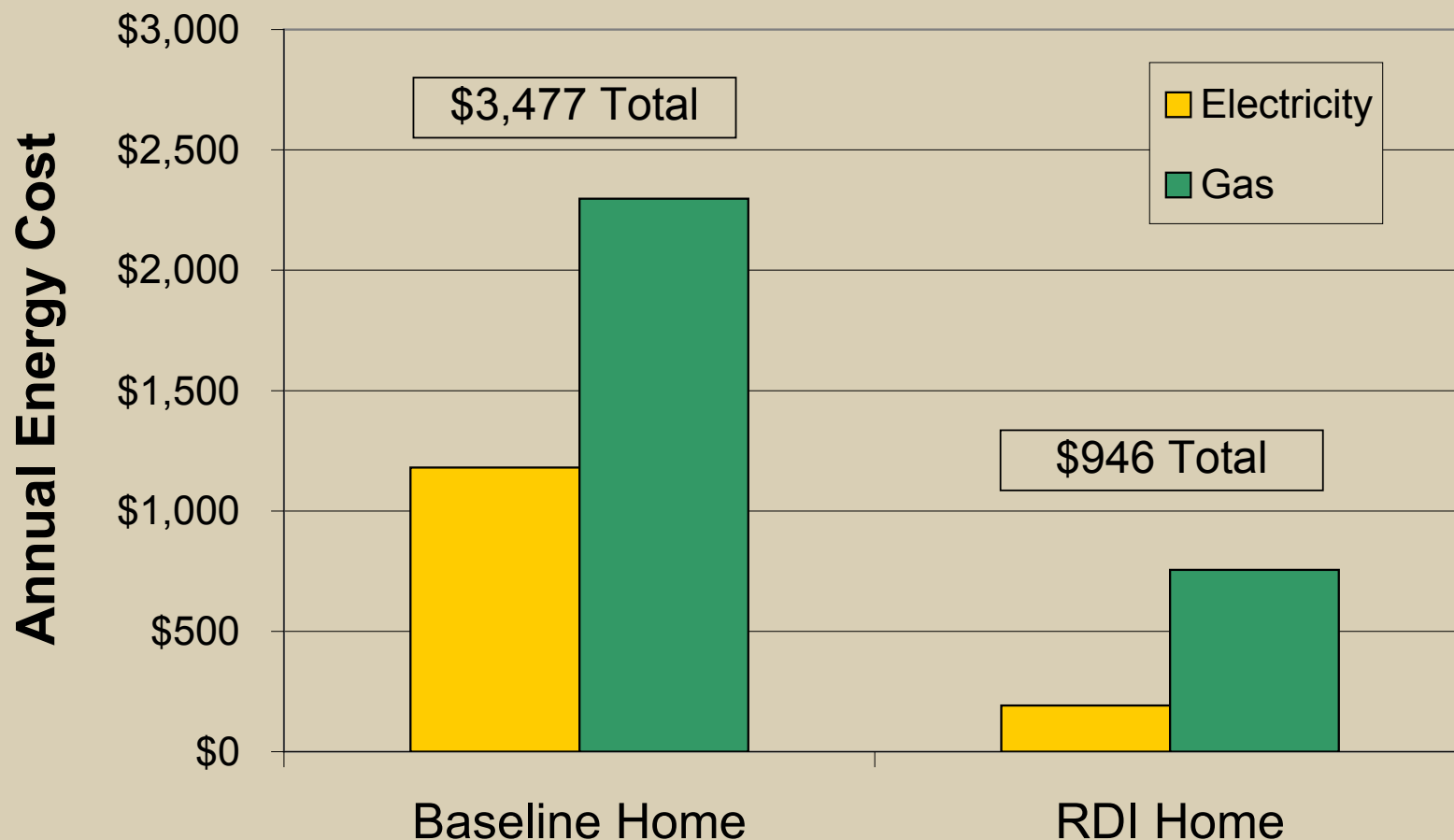
Solar Water Heating



- Three collectors (87 ft² total) on 3- and 4-BR homes
- Two collectors (58 ft² total) on 2-BR homes
- 105-gallon storage tank
- Gas-fired, tankless, auxiliary water heater
- 50-80% solar fractions

Energy Costs, 3-BR Home

Projected Annual Energy Costs



Energy Systems Cost

| System | Incremental Cost |
|-----------------------|---------------------|
| Envelope | \$ 7,000 |
| HVAC | \$ (4,500) |
| Lights and Appliances | \$ 300 |
| Solar Water Heating | \$ 10,000 |
| Photovoltaics | \$ 25,000 |
| Total | \$ 37,800 |

Incremental cost above “standard” construction – similar to MA code.

Current Status

- First two homes complete
- Second duplex insulated (complete in Spring 2009)
- Third duplex nearly enclosed (complete in early Summer 2009)
- All ten duplexes complete by mid-2010.



Future Work

- Collecting energy use
- RDI and Austin Design
- High-visibility
 - local community colleges and high schools
 - architects and builders
 - Home owners / builders
- Demonstration for simplicity and cost-effectiveness



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