

WHY I CHOSE TO INSTALL A SOLAR HOT WATER SYSTEM

Larry Moore

Mancos, CO

l.moore@ix.netcom.com

BACKGROUND

- Building new home for long-term retirement living
- Objective: To have an Energy Star Certified Home
- Reason: Long-term energy efficiency
- Solar hot water system currently in the process of installation
 - Dedicated to radiant floor heating
- Original home plan was for all SIP exterior walls and roof panels
 - SIP manufacturer to be used went out of business before panel delivery
 - Had to use stick-built walls with sprayed-in urethane foam insulation
 - SIP roof panels were used from another manufacturer
 - Not a good experience

BACKGROUND

- First all-SIP building completed in 2005
 - 2,100 sq. ft. workshop
 - Includes $\frac{3}{4}$ bath
 - Enclosed loft living area
 - Staging area for house components
 - Sited for optimal Photovoltaic panel installation
 - South roof faces 15 deg. East-of-South
 - 8/12 pitch (about 45 deg)
 - No trees on South side

BACKGROUND

- Radiant floor heating used in woodworking shop and office (propane-fired 48 gal water heater)
 - Woodworking shop thermostats maintained at 60 deg F
 - Office thermostat maintained at 64 deg F
 - Automotive workshop not heated
 - Never below 50 deg F in Winter (4 Winters)
- Tankless hot water heater (single use) for DHW
- Some passive solar gain from two 2' x 4' skylights in South-facing roof.
- Electric spot-heating used in sleeping loft
 - Econo-Heat 400 watt radiant panel very effective (www.eheat.com)

BACKGROUND

- Obtained local quote from a Durango company – Too expensive for me
- Online research into solar hot water systems
- Looked at companies mentioned over time at www.renewableenergyworld.com
- Interested in a well-designed kit for do-it-yourself installation

TURNING POINT

- When costing a radiant floor heating system for the house,
 - Had a high-efficiency boiler unit costing \$4,500 (tax credit limit \$150)
 - Net cost \$4,350
 - Solar hot water system cost \$5,300 (tax credit 30% of cost up to \$2,000)
 - Net cost \$3,710

TAX CONSIDERATIONS

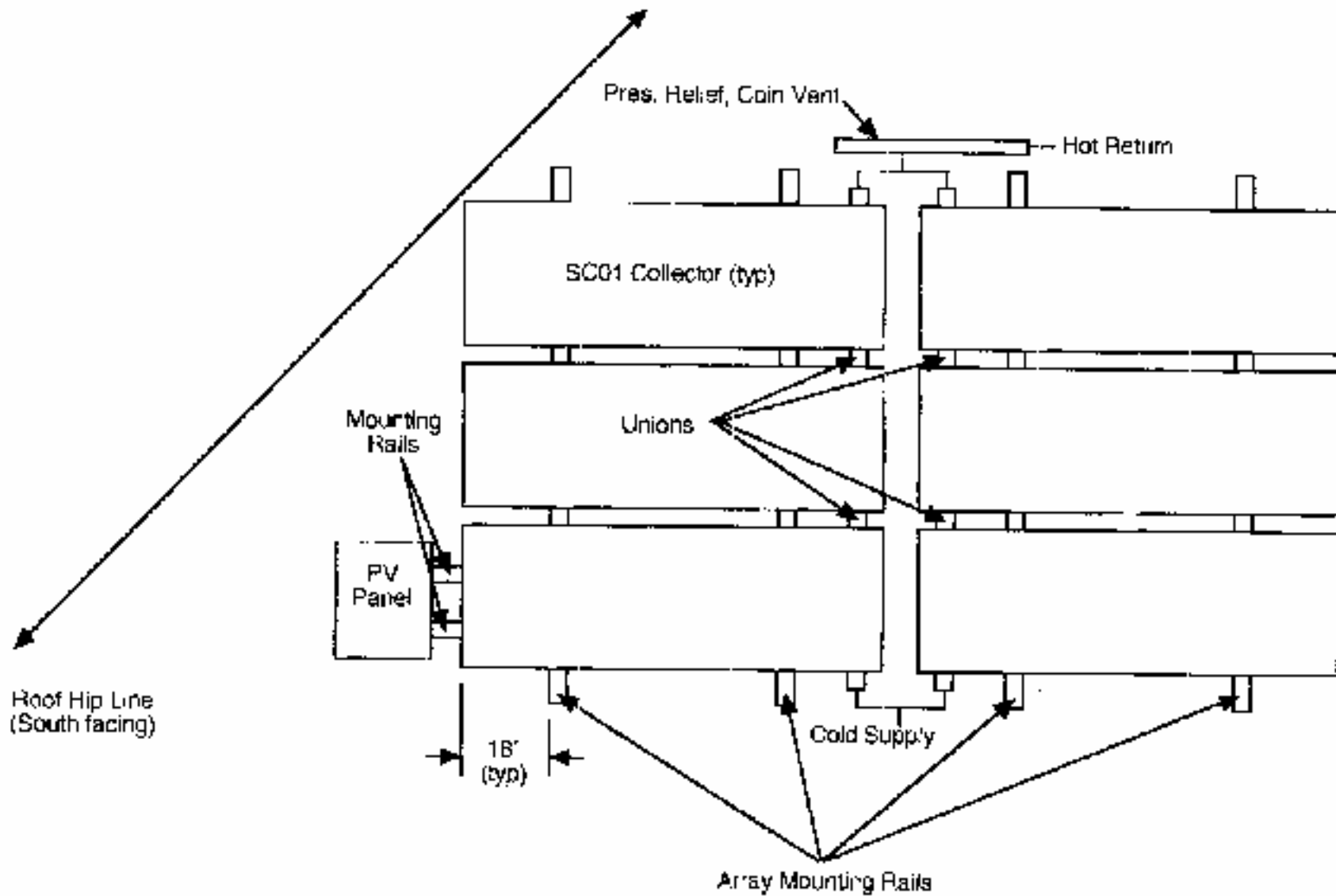
- **Retirees need to check tax code carefully!!**
- Tax credit of no value without tax liability!!
 - Tax credit can be carried forward (for 1 year?).
 - Cash-in of Traditional IRA results in taxable Adjusted Gross Income
- Tax rebates may be of no value without withholding!!
- Income taxes may be eliminated for retirees with less than \$50,000 income (Obama proposal).
 - Therefore, tax benefits may be effectively eliminated.

DESIGN PARAMETERS

- Supply closed-loop water system for radiant floor system (PEX tubing)
 - In concrete basement floor and laundry room on main floor
 - Under tiled floor in kitchen and master bath
 - Direct attachment under sub-floor
 - Reflective insulation under PEX tubing
 - » Truss system between floors presented problems for reflector attachment
- Six zones (3 in basement, 3 on main level) covering 1,116 sq. ft.

DESIGN PARAMETERS

- Panel Sizing factor: 1 sq. ft. of collector per 20 sq. ft. of heated floor area
 - $1116/20 = 55.8$ sq. ft. of panels
 - 6 panels @ 10 sq. ft. per panel = 60 sq. ft. (7.5% oversized)
- Expandable at 10 sq. ft. per panel



DESIGN PARAMETERS

- Storage Sizing Factor: 1.5 – 2.0 gal. per sq. ft. of collector area
 - 60 sq. ft. x 1.5 gal = 90 gal
 - 60 sq. ft. x 2.0 gal = 120 gal
- For future expansion (if needed) choice was for 120 gal storage tank
 - 80 sq. ft. x 1.5 gal = 120 gal
- Storage tank is superinsulated
 - Holds temperature up to three days
- Tank located in garage

DESIGN PARAMETERS

- Circulation of glycol between storage tank and panels uses PV panel (12VDC)
- Heavy duty Propylene Glycol is environmentally friendly
- Electric heating backup in storage tank
- Off-peak electric heating is NOT a viable option (per Empire Electric)
 - May use timer anyway,
 - Extra heating is more likely needed at night
 - Lighten load on local grid

DESIGN PARAMETERS

- Insulating all hot water lines
 - Foam sleeves
 - Aluminum-faced bubblewrap material
- Light-weight panels (38 lbs per panel for 10 sq. ft. panels)





SYNERGY WITH DOMESTIC HOT WATER SYSTEM

- Using propane-fired hot water heater with internal heat exchange loop (in garage)
 - Radiant floor hot water circulates through domestic hot water tank
 - Hot months where radiant floor heating is not needed, can heat domestic hot water from solar storage tank
 - Cold months (days) may allow backup to solar storage tank
 - Will be able to block flow between tanks
- DHW tank services laundry, main floor powder room, master bath and outdoor shower (with recirc. pump)
- Tankless hot water heater in basement for guest bath, powder room, basement kitchenette, and kitchen above

EXPERIMENTATION

- Tilt angle from roof in Summer and Winter (30 deg roof + up-to 27 deg tilt kit)
- Flow of storage tank heat through DHW tank in Summer
- Flow of DHW tank heat through storage tank in Winter
- Effect of temperature setting changes in DHW tank