

# **Natural Gas and Southern California's Renewable Energy Future**

**June 14, 2011**

***“Solar Water Heating –  
Natural Gas Assisted or  
Stand Alone Solar?”***

**Paul Outram P.E.  
Vice President & General Manager**



Since  
1978

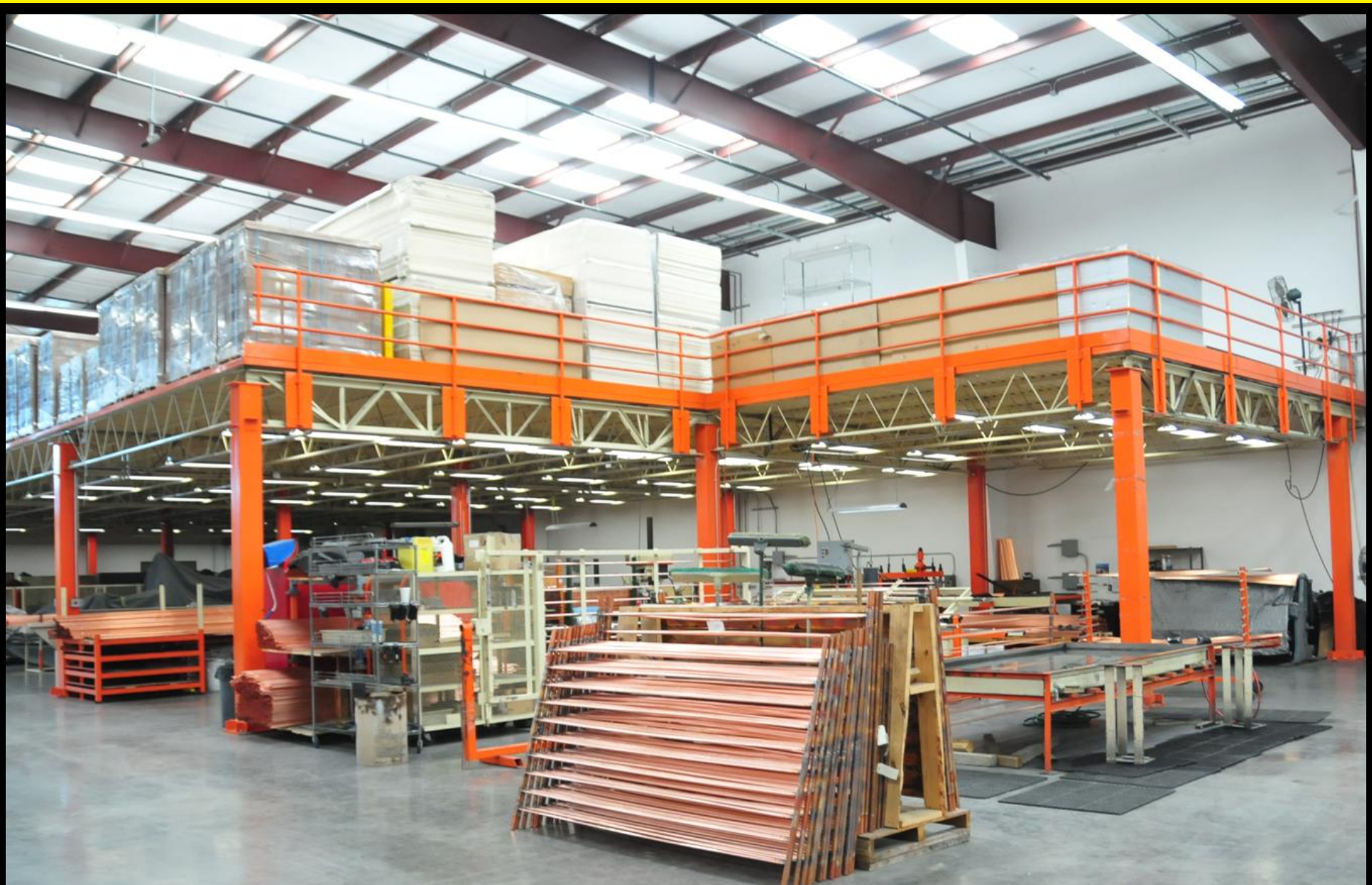


85,000 ft<sup>2</sup> Facility



35 Employees





# COPPER GRIDS

June 14 2011



SOLAR STRUT  
158"

ALUMINUM  
FRAMES

104.5" PROF. CORR.  
STEEL STRUT CHANNEL



**LOW IRON TEMPERED  
GLASS**



# **The Technology**

(Top Secret)

# PHYSICS OF SOLAR THERMAL

Pipe in Sun gets Hot



# Outram's Laws of Solar Thermal

## First Law

“Black Pipe in Sun Makes Water Hot”

## Second Law

“*More* Black Pipe in Sun Makes *More* Water Hot”

## Third Law

“Black Pipe *Under Glass* in Sun Makes Hot Shower”

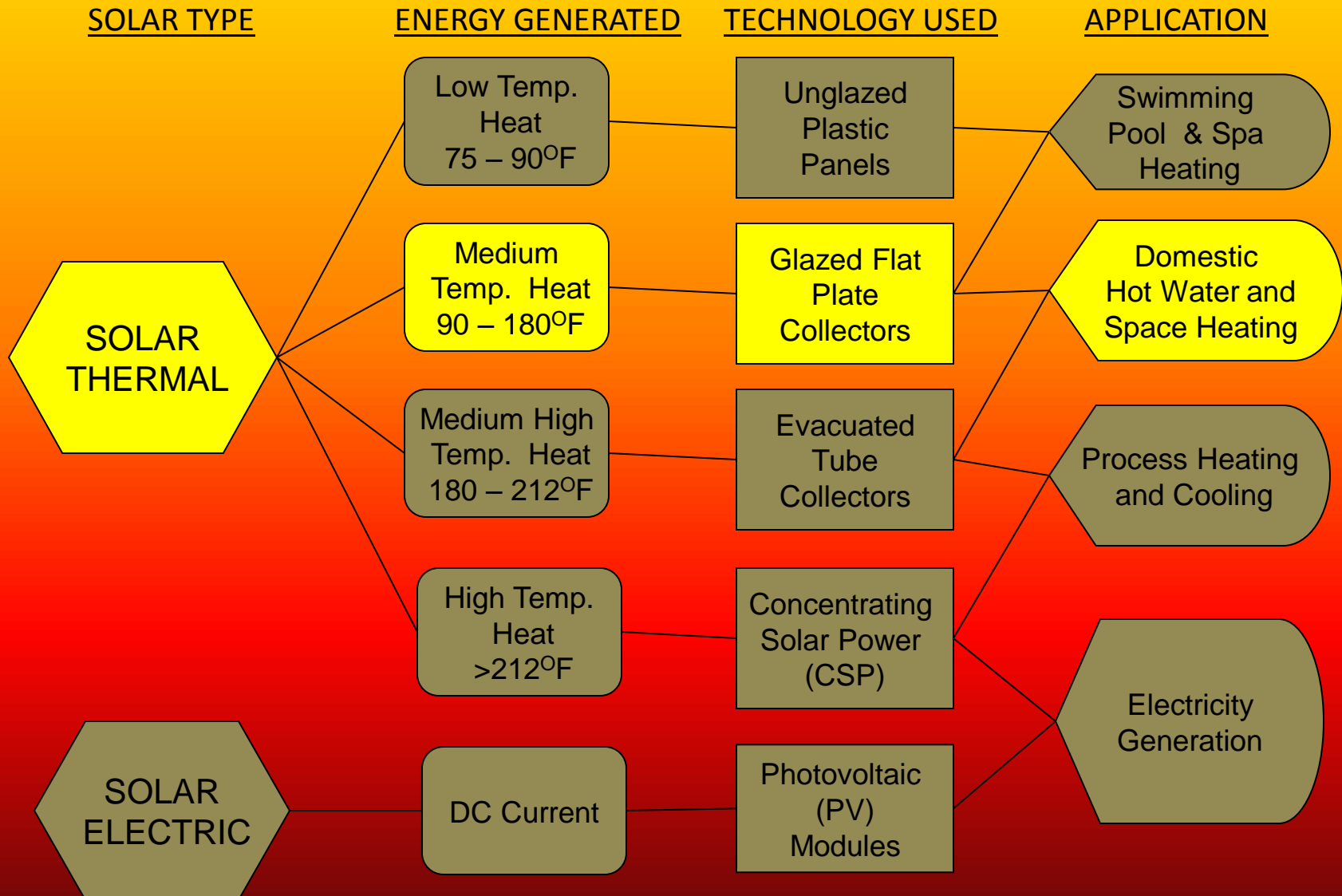


Which kind of Solar Collectors are the best?

It depends.

On Local Climate and Temperature of Heat Required for Application

# Solar Energy Technologies



# Passive Systems: Integral Storage and Collector (ICS)

## BIG BLACK PIPES UNDER GLASS



VERY SIMPLE  
NO MOVING PARTS  
NO CONTROLS  
VERY RELIABLE

NOT VERY EFFICIENT  
NIGHT TIME LOSSES  
CLIMATE LIMITED

# ICS - Proven Technology

Climax  
Solar  
Water  
Heater  
in 1892

**Climax Solar-Water Heater**  
UTILISING ONE OF NATURE'S GENEROUS FORCES  
**THE SUN'S HEAT** { Stored up in Hot Water for Baths,  
Domestic and other Purposes.

**Price Of No. 1 Heater for  
1892 Reduced to \$15 Net**



GIVES HOT WATER at all HOURS  
OF THE DAY AND NIGHT.

**NO DELAY.**  
**FLows INSTANTLY.**

**NO CARE. NO WORRY.**  
**ALWAYS CHARGED. ALWAYS READY.**

THE WATER AT TIMES  
ALMOST BOILS.

**Price, No. 1, \$25.00**  
This Size will Supply sufficient  
for 3 to 8 Baths.



**CLARENCE M. KEMP, BALTIMORE, MD.**

Figure Courtesy Perlin/Buttl Archive



## SIMPLE, DURABLE, AND RELIABLE The CopperHeart Integral Collector Storage System



**PROTECTING OUR ENVIRONMENT—SINCE 1978**



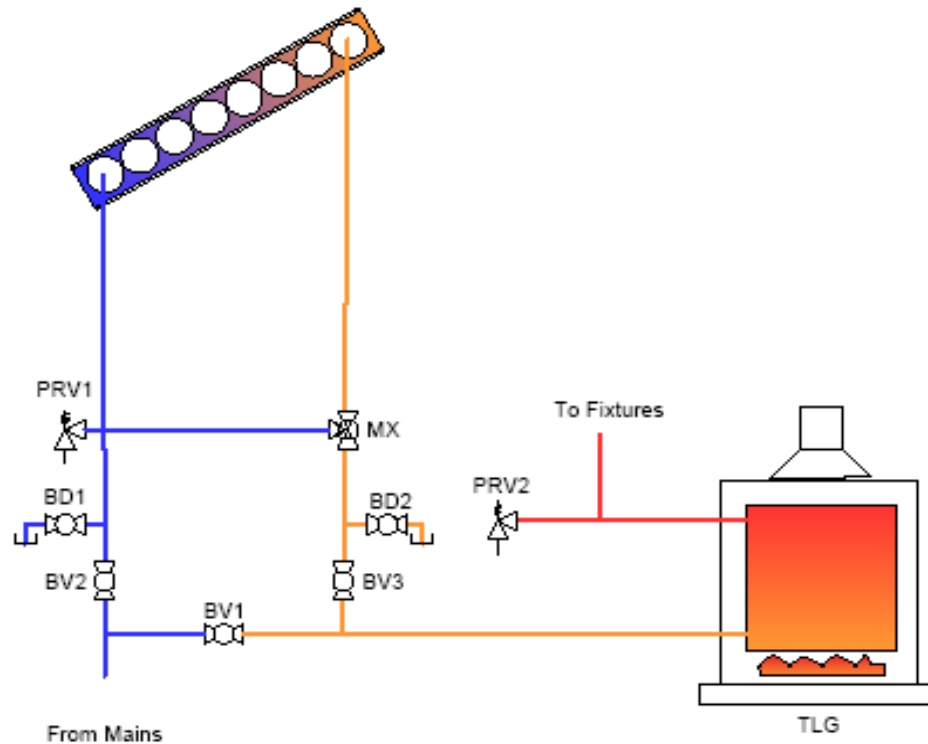


PART	DESCRIPTION
BD	Boiler Drain
BV	Full Port Ball Valve (3/4" Minimum)
MX	Mixing Valve
PRV	Pressure Relief Valve
TLG	Tankless Gas Water Heater

Solar Enabled	
Valve	Status
BV1	Closed
BV2	Open
BV3	Open

Solar Bypassed	
Valve	Status
BV1	Open
BV2	Closed
BV3	Closed



**Disclaimer**

This is a conceptual drawing for guidance only. It is up to the designer and installer of the system to ensure that the actual installation is in conformance with all local codes.

**System Description**

COPPERHEART WITH TANKLESS GAS WATER HEATER

SunEarth Inc. 8425 Almeria Avenue, Fontana, CA 92335  
Phone: 909-434-3100 Fax: 909-434-3101 www.sunearthinc.com



**EXAMPLES OF  
COPPERHEART  
INSTALLATIONS**



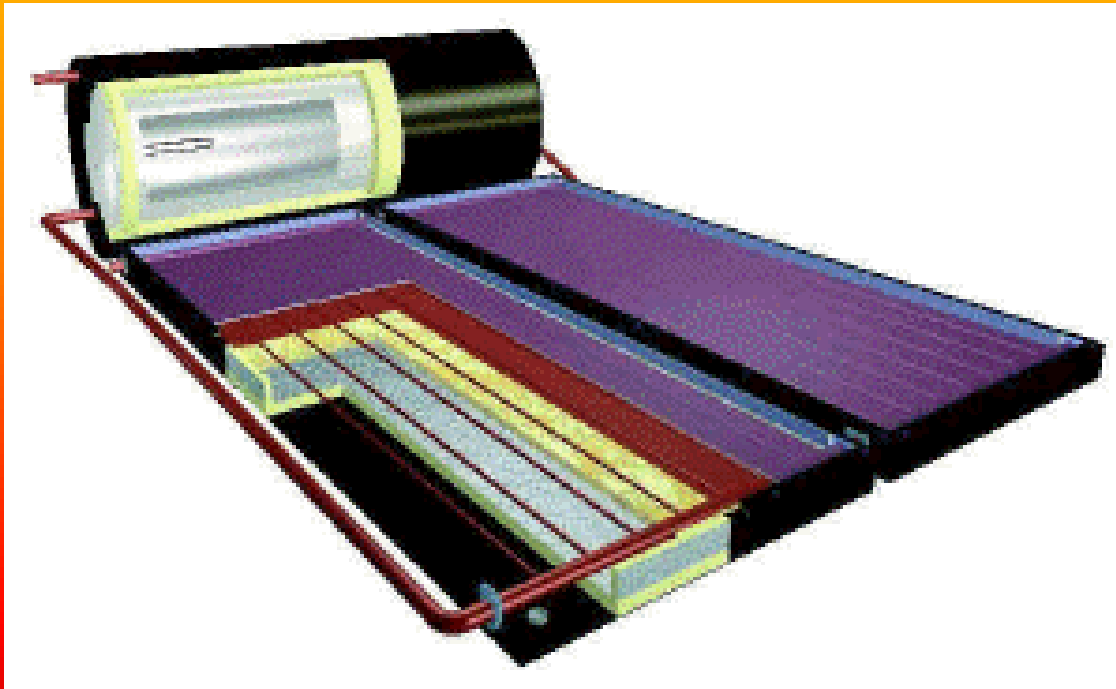


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# Passive Systems: Thermosiphon Systems

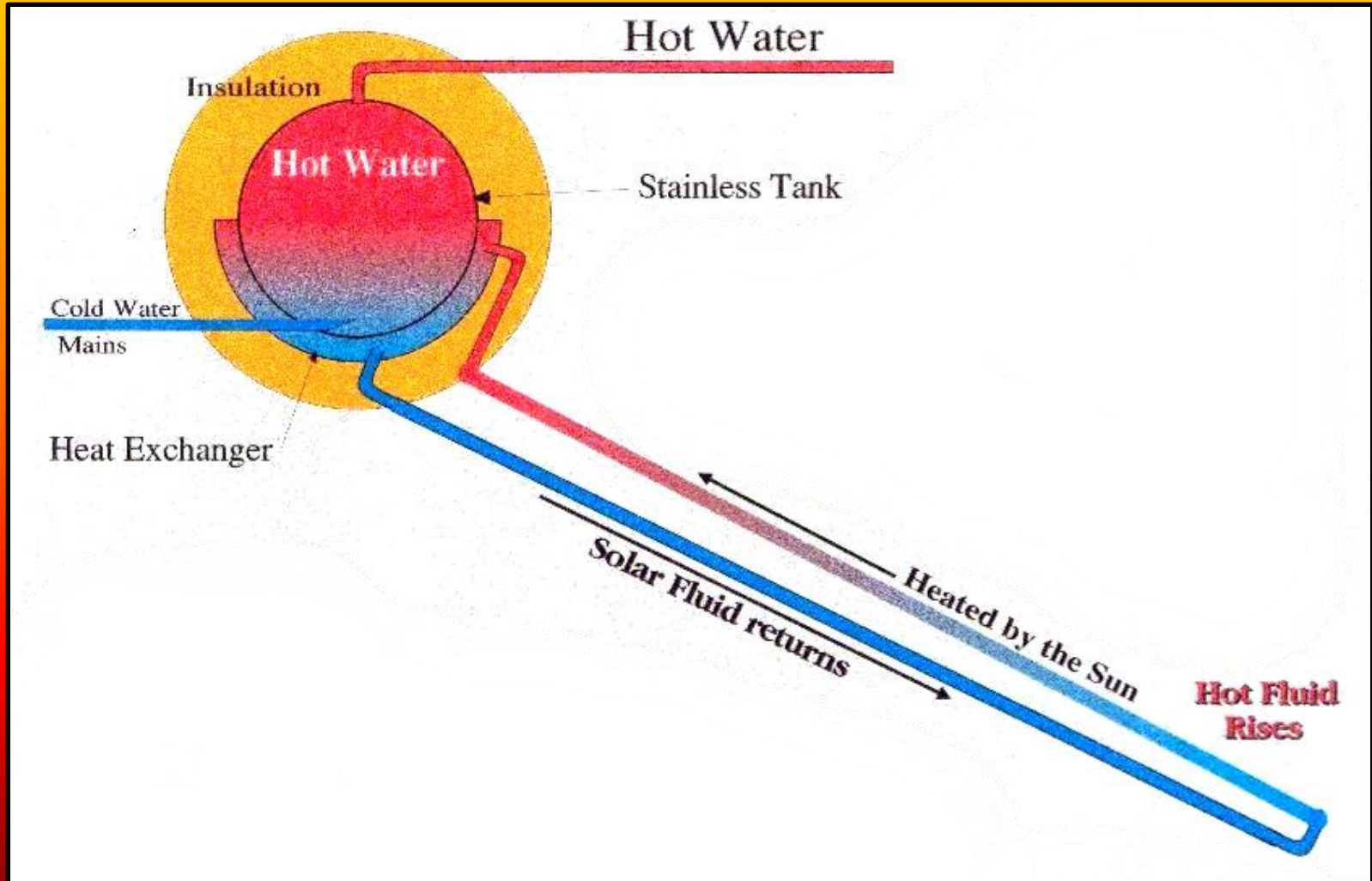
## BLACK TANK ON ROOF



VERY SIMPLE  
NO MOVING PARTS  
NO CONTROLS  
LESS SENSITIVE TO  
AMBIENT TEMP

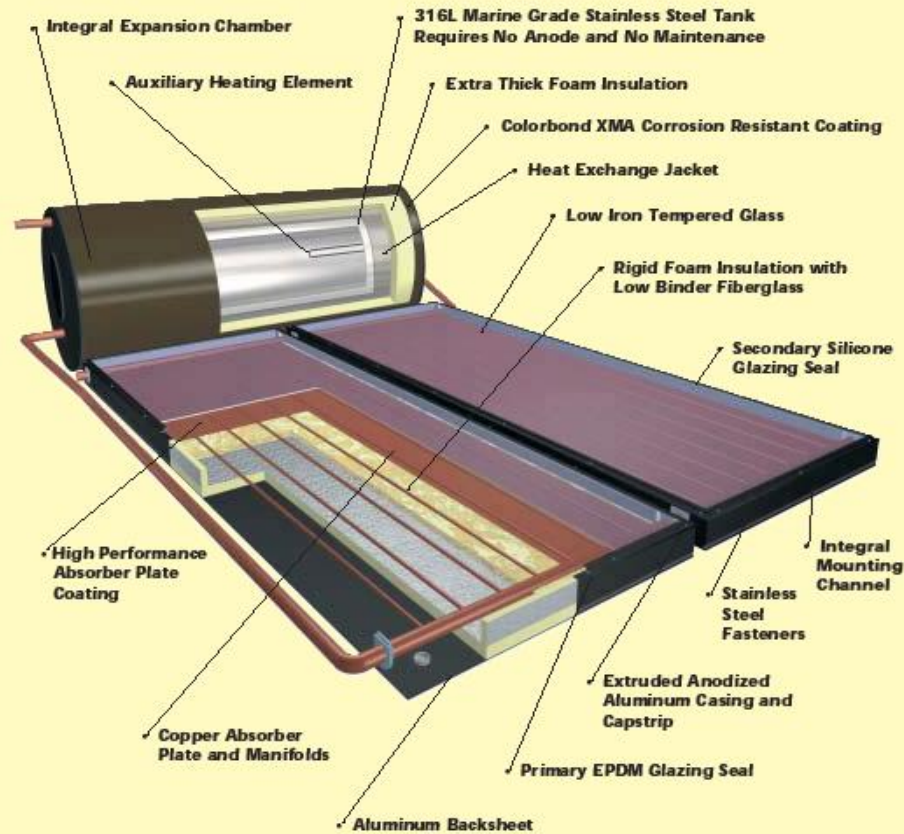
ROOF DEAD LOAD  
GET THAT TANK OFF  
MY ROOF!

# SUNSIPHON – THERMOSIPHON SYSTEMS





## THE PERFORMANCE LEADER IN THERMOSIPHON SOLAR TECHNOLOGY



**PROTECTING OUR ENVIRONMENT—SINCE 1978**

# Residential Thermosiphon System



# Commercial Thermosiphon System





# Thermosiphon - Turkey





# Active Systems

INTELLIGENT SYSTEMS: PUMPS and CONTROLS  
HIGHEST THERMAL PERFORMANCE  
FREEZE PROTECTION TO  $-60^{\circ}\text{F}$

## GLAZED LIQUID FLAT PLATE COLLECTORS

LOW PROFILE

LIGHTWEIGHT  $< 4\text{lb}/\text{ft}^2$

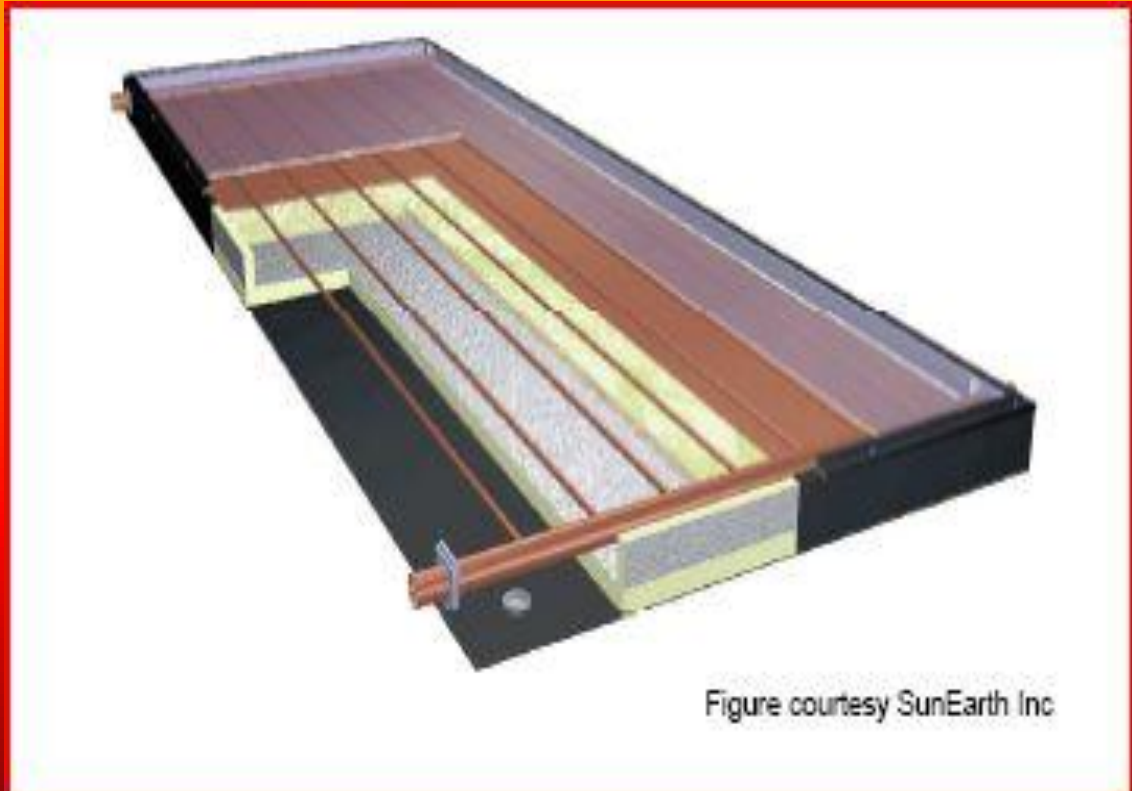
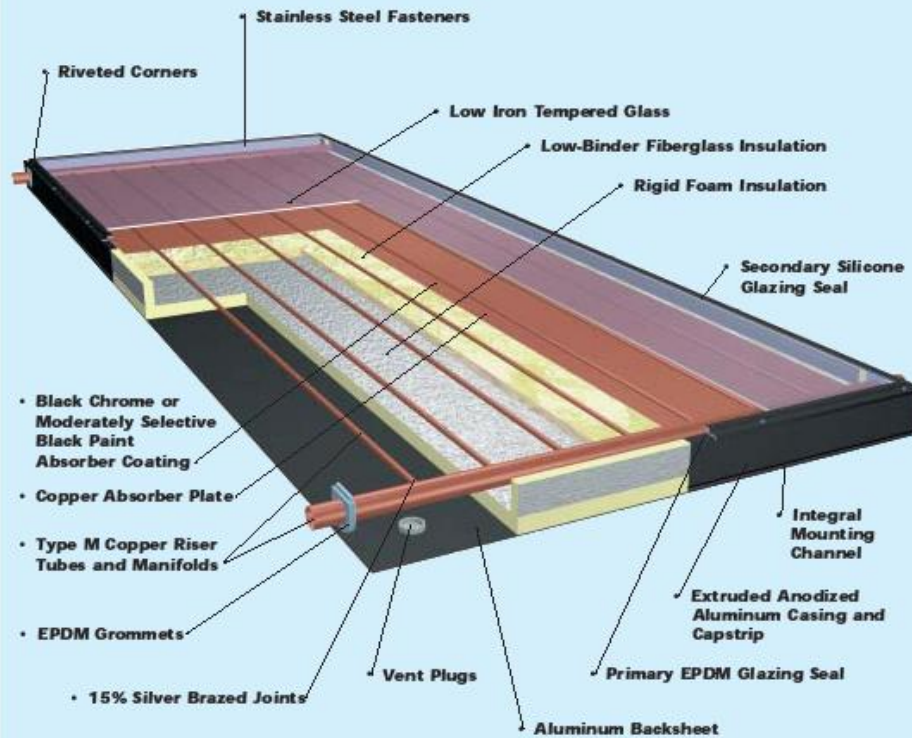


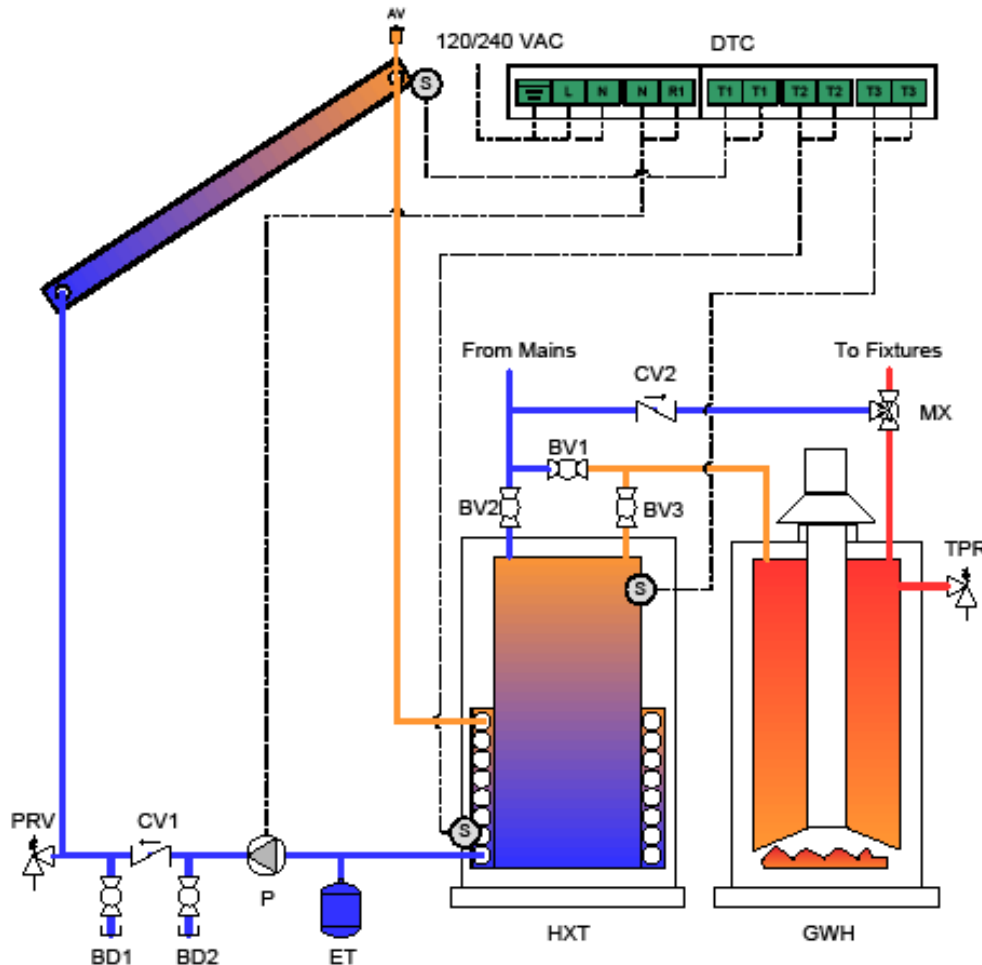
Figure courtesy SunEarth Inc



## THE VALUE LEADER IN SOLAR WATER HEATING TECHNOLOGY



PROTECTING OUR ENVIRONMENT—SINCE 1978



PART	DESCRIPTION
AV	Air Vent
BD	Boiler Drain
BV	Full Port Ball Valve (3/4" Minimum)
CV	Check Valve
DTC	Steca TR0301 Differential Controller
ET	Expansion Tank
GWH	Gas Water Heater
MX	Mixing Valve
P	Centrifugal Pump
PRV	Pressure Relief Valve
HXT	Ruud/Rheem Heat Exchange Tank
S	1000 $\Omega$ RTD Temperature Sensor
TPR	Temperature Pressure Relief Valve

Solar Enabled	
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**System Description**
**SOLARAY WITH STORAGE GAS WATER HEATER**

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# Tract Homes with Closed Loop Glycol Solar Hot Water









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# Closed Loop Glycol System



Pressure  
Relief  
Piped to  
Drain



Pressure Relief Location?



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# Dallas Convention Center: Closed Loop Glycol



# SunEarth Tilt Mount Rack



# Barstow Mount





# The Market

# Solar Water Heating in the USA

- 20,000 – 30,000 Systems per Year  
(Approx. 500,000 p.a. installed in Germany)
- SunEarth 25% - 30% of US market.
- 3 of the 4 Biggest Solar Hot Water Collector Manufacturers are in California.

# CSI Thermal Program Incentives

- Gas Displacing Incentives \$205.0 M
- Electricity Disp. Incentives \$100.8 M
- **Total Incentive Budget \$280.8 M**

# Total Incentive Allocation by Program Administrator (\$M)

PA	Natural Gas		Electric	
	Budget Allocation	Total Incentives	Budget Allocation	Total Incentives
PG&E	39.0%	\$70.2	43.7%	\$44.0
CCSE	10.0%	\$18.0	10.3%	\$10.4
SCE	-	-	46.0%	\$46.4
SCG	51.0%	\$91.8	-	-
<b>TOTAL</b>	<b>100.0%</b>	<b>\$180.0</b>	<b>100.0%</b>	<b>\$100.8</b>

# Program Goals

- Rebates for 300,000 SWHS by 2017
  - Gas: 205,000
  - Electric: 100,800
- Expand market for other solar thermal technologies
- Reduce SWHS costs by 16%
- Market Facilitation
  - Reduce market barriers
- Increase consumer confidence

# Why Use Natural Gas?

Q. When does a gas heater fire?

A. When you want it to.



Q. When does a solar water heater heat?

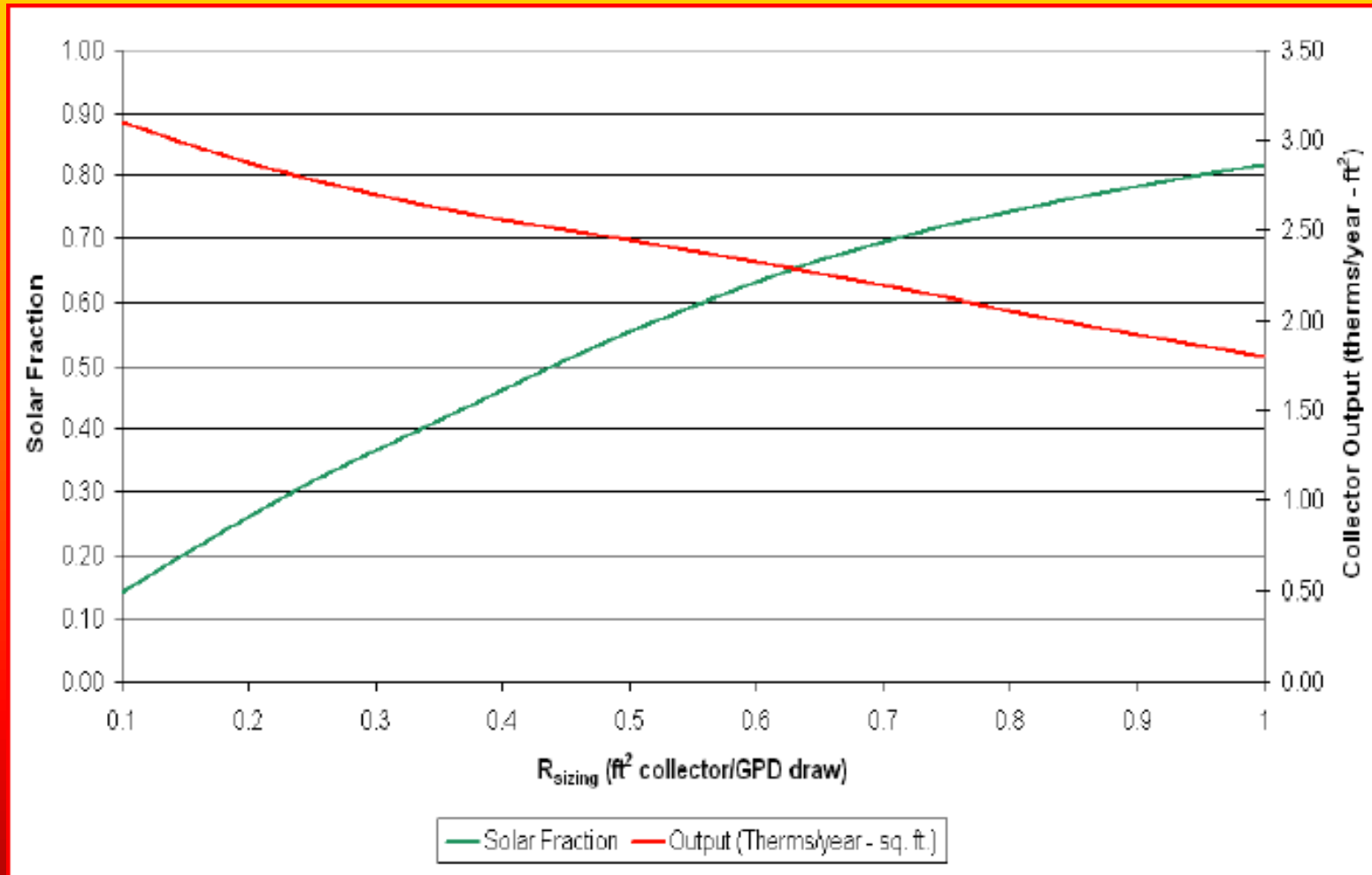
A. When the Sun wants it too.



Q. How much solar heat can we store?

A. How much money do you have?

# Effect of Array Sizing on Performance



# Solar HW Design Considerations

- Hot water demand varies with time.
- Solar energy supply varies from day to day.
- Energy storage comes at a cost
  - *There is no Hot Water Grid*

Good system design includes:

Supply / Demand / Storage & Cost



## Renewable Fun



## Fossil Fun



- Which is more Challenging?
- Which is more Expensive \$\$ ?
- Which is more Fun?

# Solar Heater or Gas Heater

## Solar Water Heater

- High Capital Cost per Installed Btu/h
- Diminishing Returns as Solar Fraction Increases
- Heat Availability not “Firm”
- Free Fuel Forever
- Renewable Resource

## Gas Water Heater

- Low Capital Cost per Installed Btu/h
- Manufactured for range of Btu/h Capacities.
- On demand availability.
- Energy Costs more than Capital Cost over lifecycle.
- Finite Resource

# Stand Alone Solar?

Your Options Are:

- Have Loads of Money
- Have a few Cold Showers



# Solar with Natural Gas

Solar System sized for 70% Solar Fraction with Natural Gas Auxiliary Heater:

- Fuel Savings of Solar (70% savings)
- Reliability of on demand Natural Gas.

Solar with Natural Gas



A Match Made in Heaven!