



# *SunChiller*

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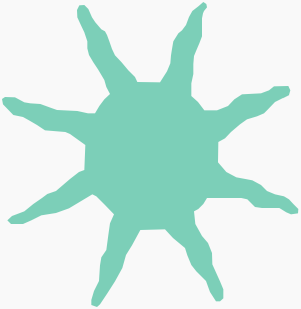
## **Solar Thermal Energy Combined Systems for Alaska**

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Glendale, CA 91205-1671  
Tel: (818) 240-4500 web: [www.sunchiller.com](http://www.sunchiller.com)

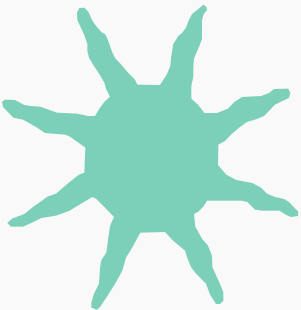
May 2012



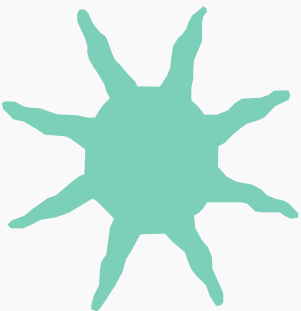
# *Solutions to Energy Price and Climate Change Challenges*



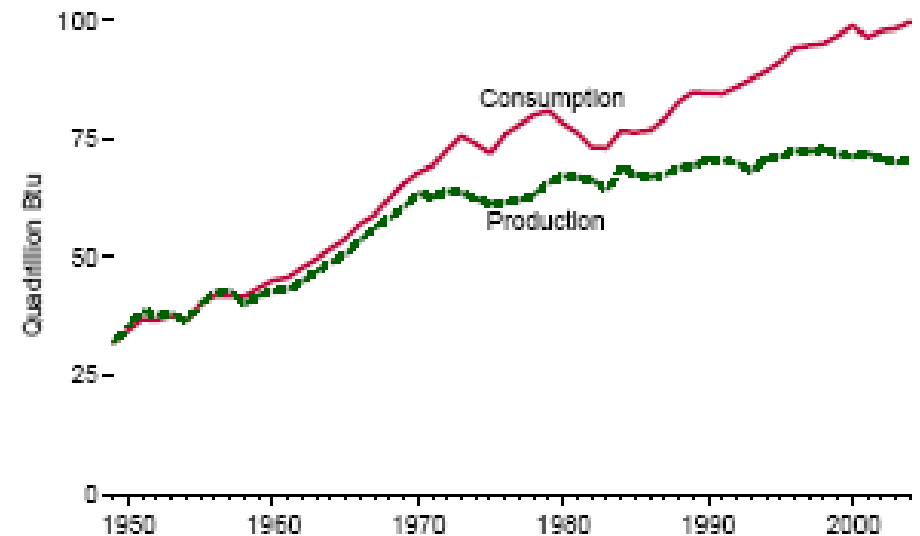
★ Use less energy



★ Diversify to non fossil



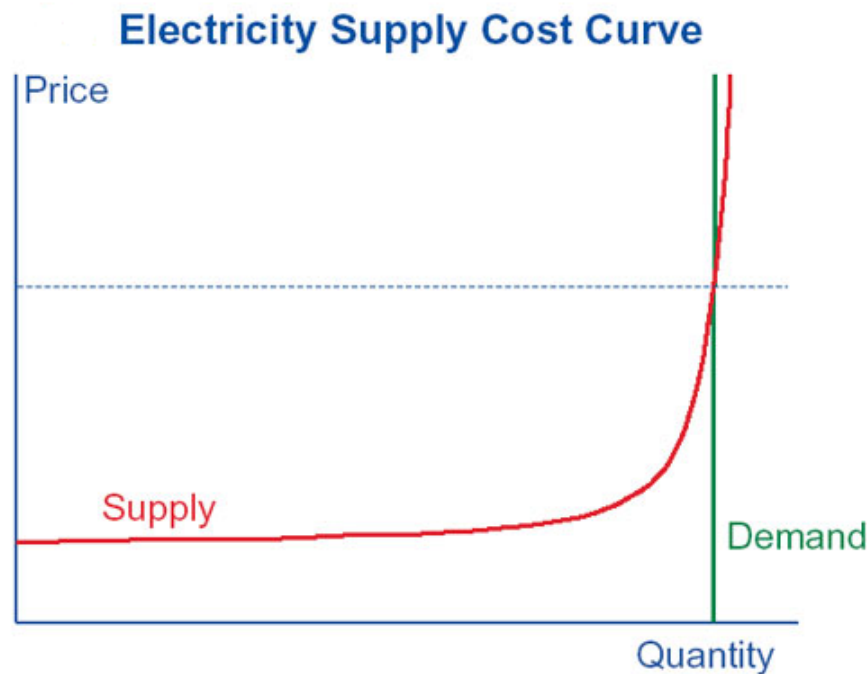
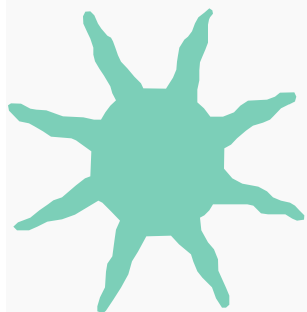
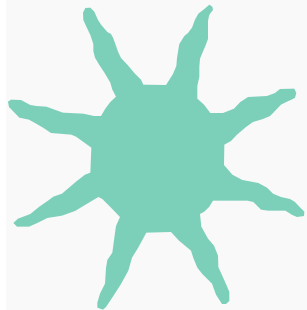
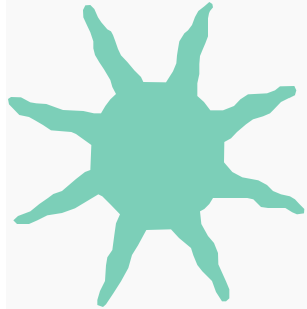
Production and Consumption, 1949-2004



© Gary Braasch Photography



# *Non-Linear Behavior of Energy Price During Tight Demand-Supply Balance*

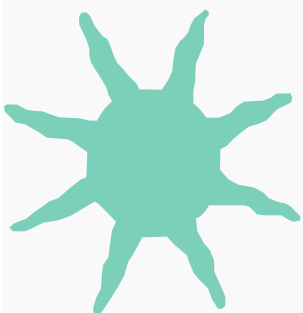
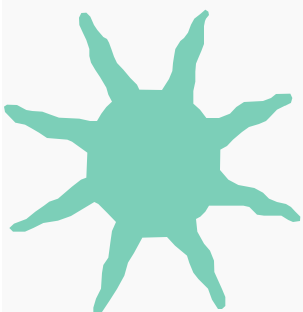
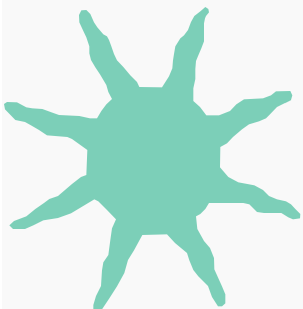


Source: Energy Information Administration



# *Climate Change*

## *Enormous Risks*



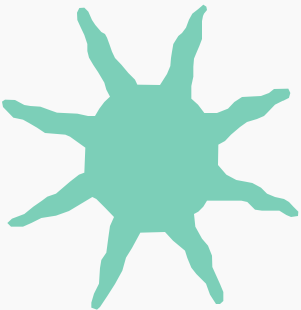
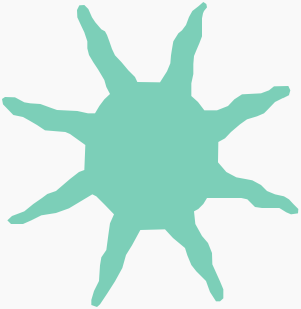
- ★ Fossil fuels - millions of years of storage of solar energy in biomass and concentration
- ★ More GHG released than absorbed - potential for non-linear response
- ★ Solar Energy – “No Regrets” Strategy





# *Cooling, Heating, and Water Heating*

## *Major Demand for Energy*



- ★ About  $\frac{1}{2}$  of energy used in residential and commercial buildings is for space cooling, heating, and hot water
- ★ Alaska - Heating demand huge

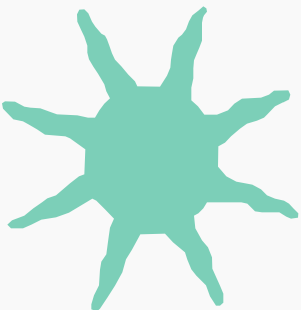
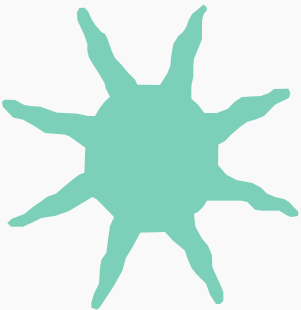
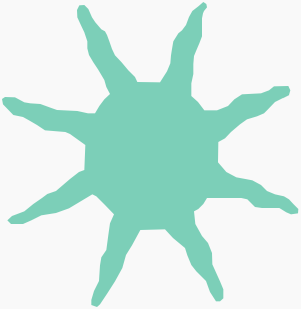






# *Solar Thermal Energy*

*“low hanging fruit”*

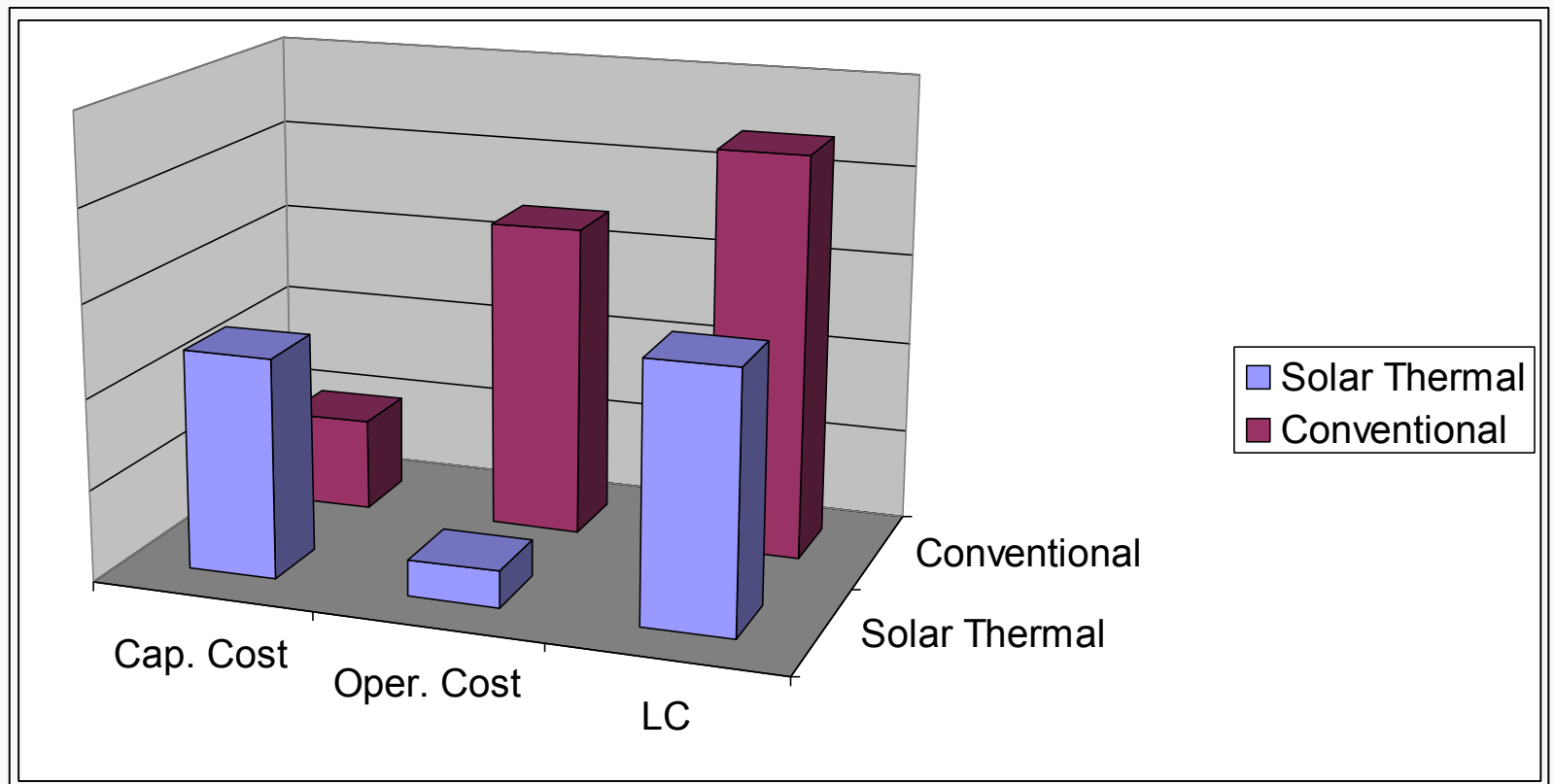
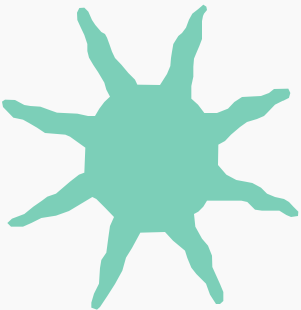
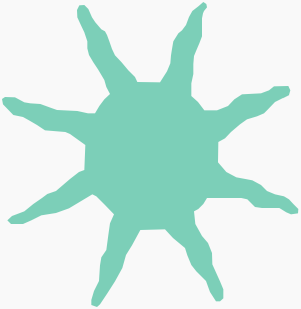


- ★ Roofs and southern walls are underutilized real estate



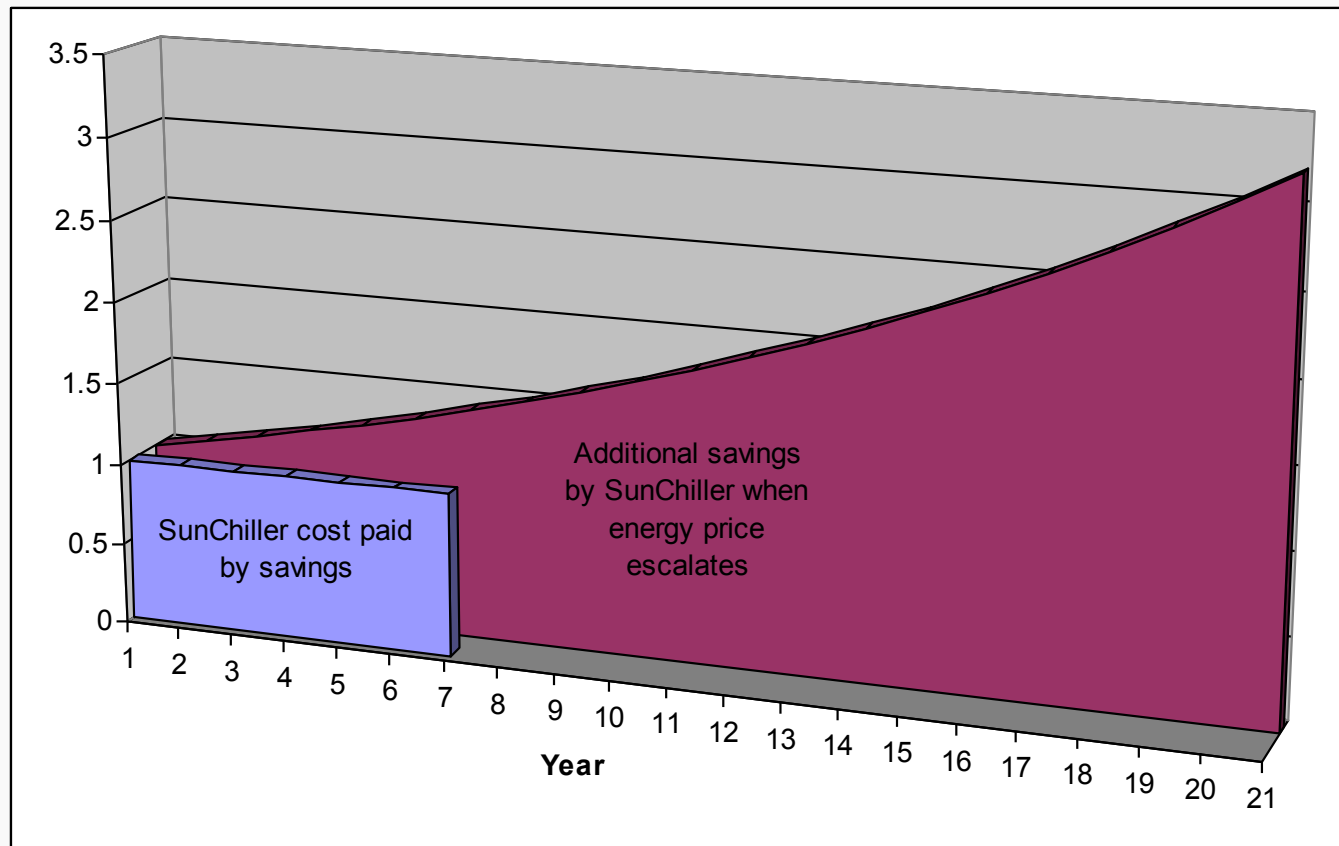
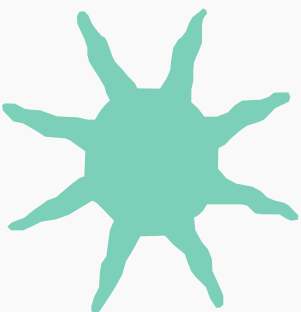
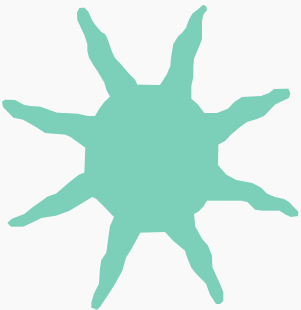
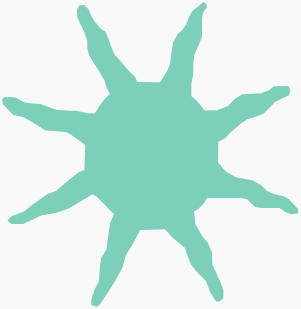


## *Lifecycle Cost Comparison of Solar Thermal with Conventional – Sustainable Method*





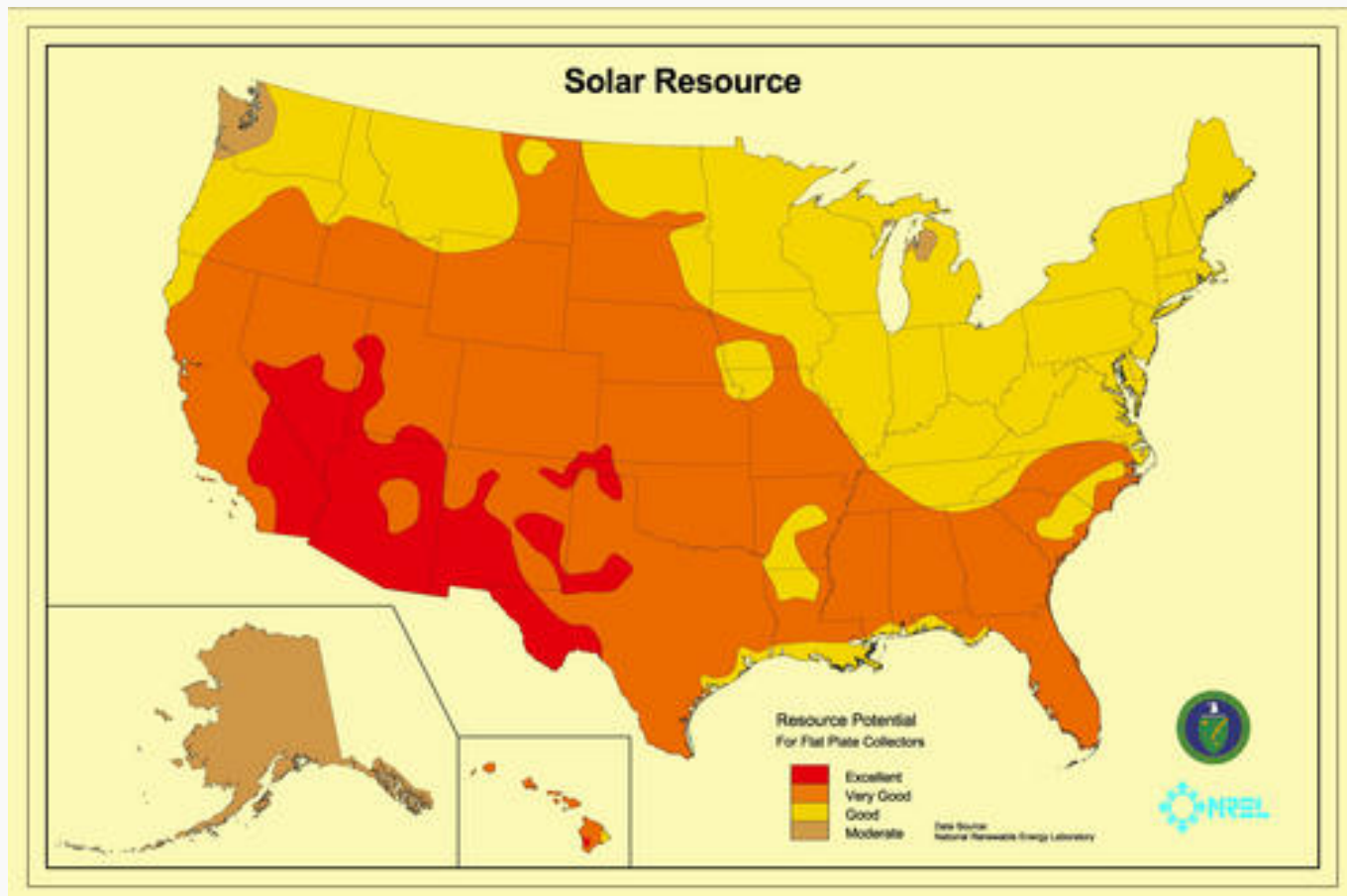
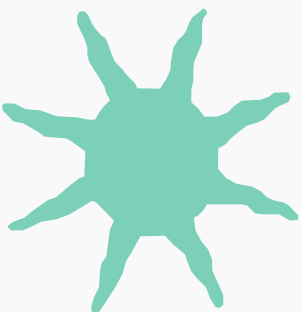
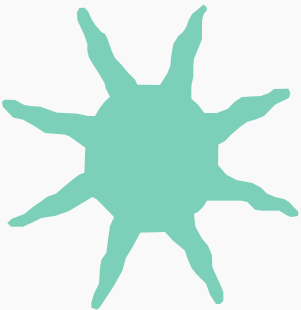
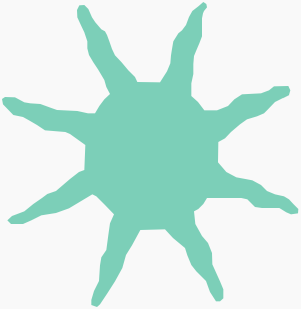
## *Hedge Against Energy Price Escalation*







# *US Solar Resource*



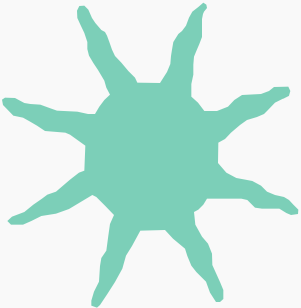


## *Features of Sun's Energy*

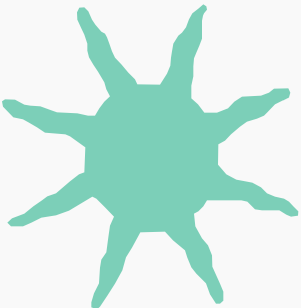
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- ★ Delivered wireless to user (alternative grid)
- ★ No end in supply
- ★ No “externalities”



- ★ More supply in summer
- ★ Challenge/opportunity for long-term storage
- ★ “Smart storage” important
- ★ Dilute and intermittent

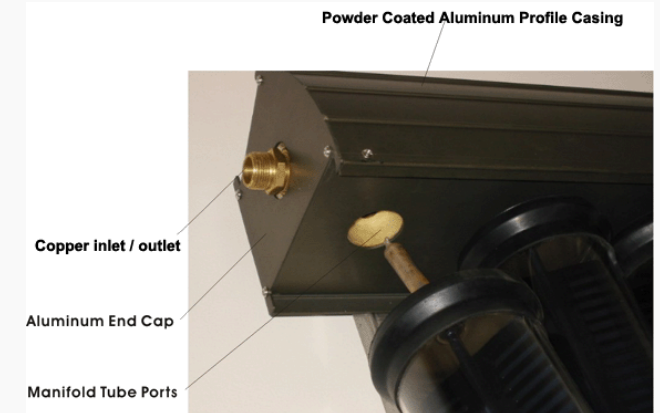
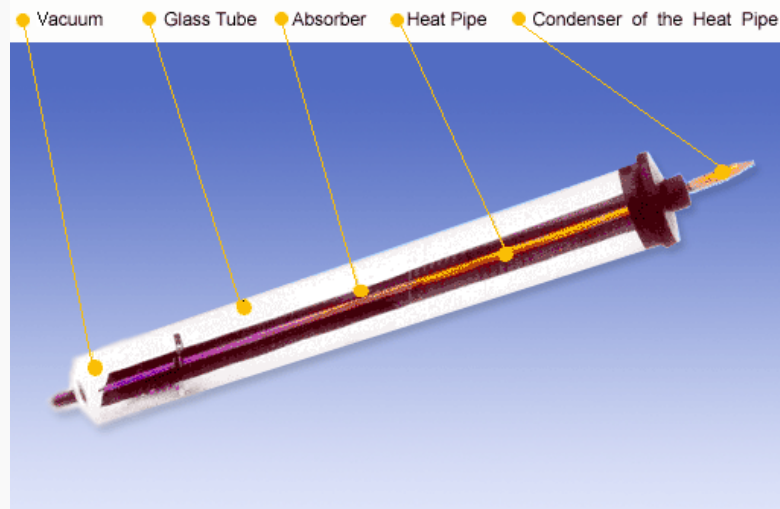
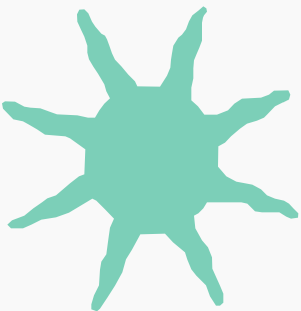
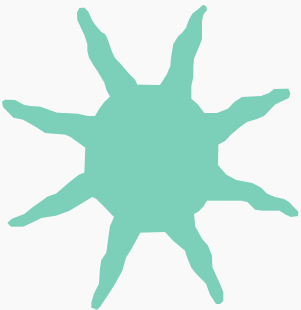
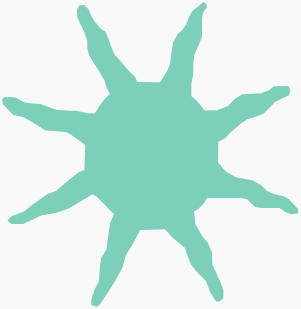


- ★ “Smart receiver” necessary to harvest
- ★ Advancing technology - “smart receiver” getting more efficient and simpler



# *“Smart Receiver”*

## *Simple, Efficient, “Plug and Play”*

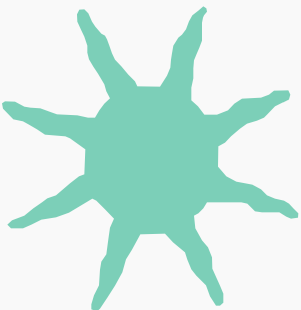
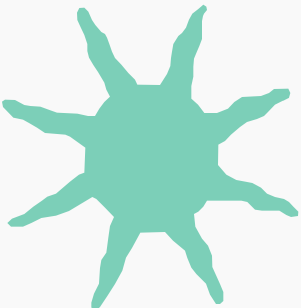
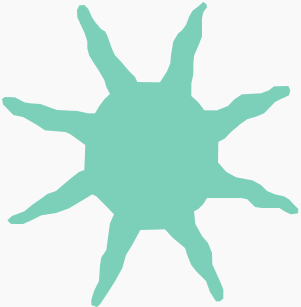


SUNDA Solar Thermal Collectors



## *Advantages of Evacuated Tube*

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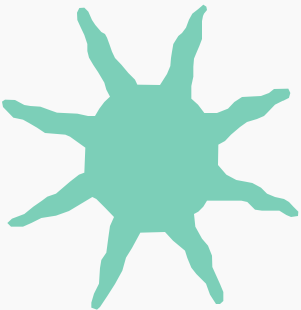
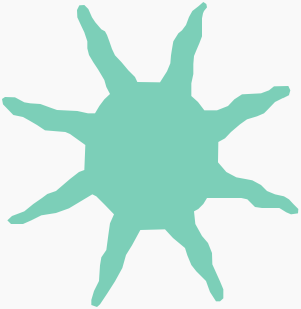


- ★ Easier installation
- ★ Superior insulation – vacuum – more heat collection in winter and windy conditions
- ★ Easier servicing
- ★ Longer life
- ★ Higher efficiency
- ★ Better fit for combined space heating and DHW
- ★ Better collection early and late in the day plus during cloudy conditions



# *Advantages of SUNDA Evacuated Tube Collectors*

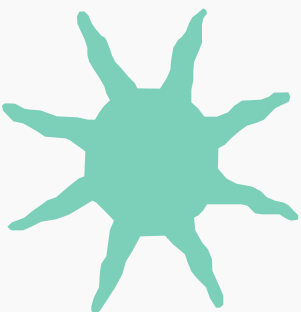
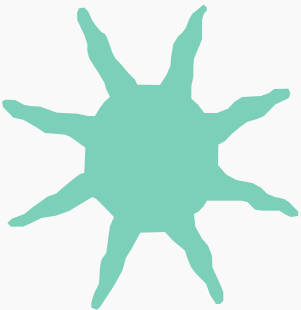
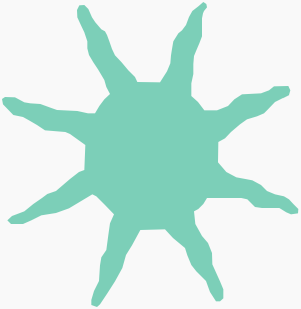
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- ★ Proprietary IP for glass metal fusion
- ★ Longevity
- ★ Single glass yields higher efficiency
- ★ 20 years of track record with millions of tubes installed worldwide
- ★ R&D department
- ★ Wide range of products



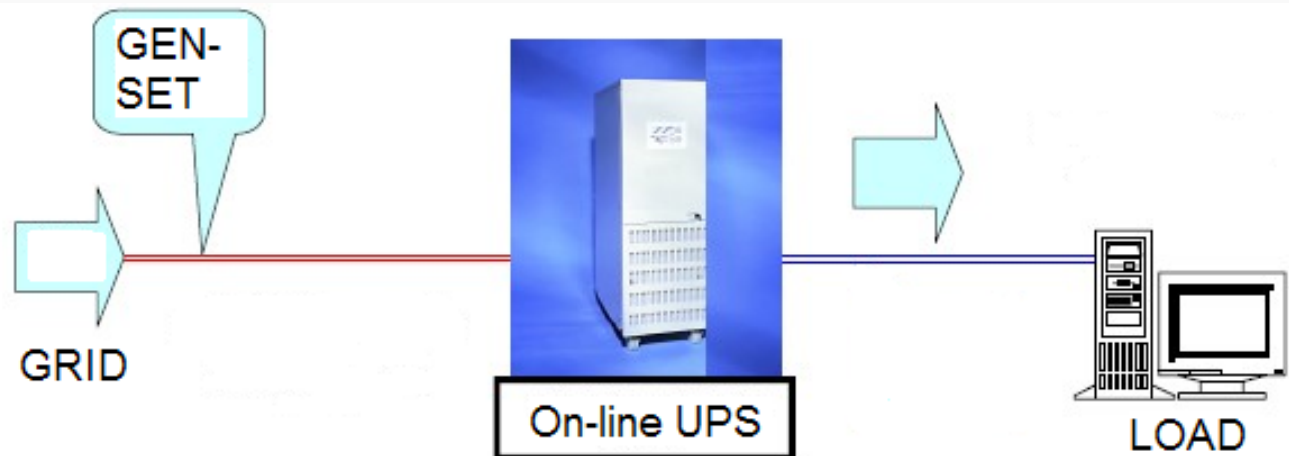
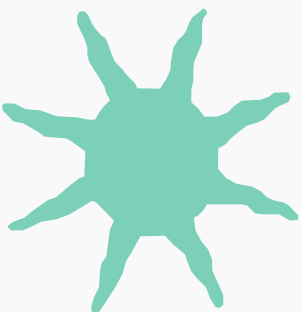
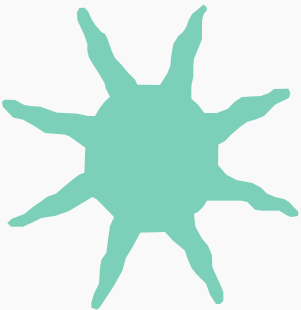
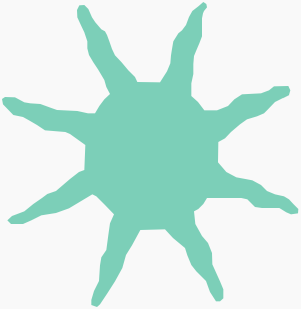
## *SEIDO 5-8 in South Pole*







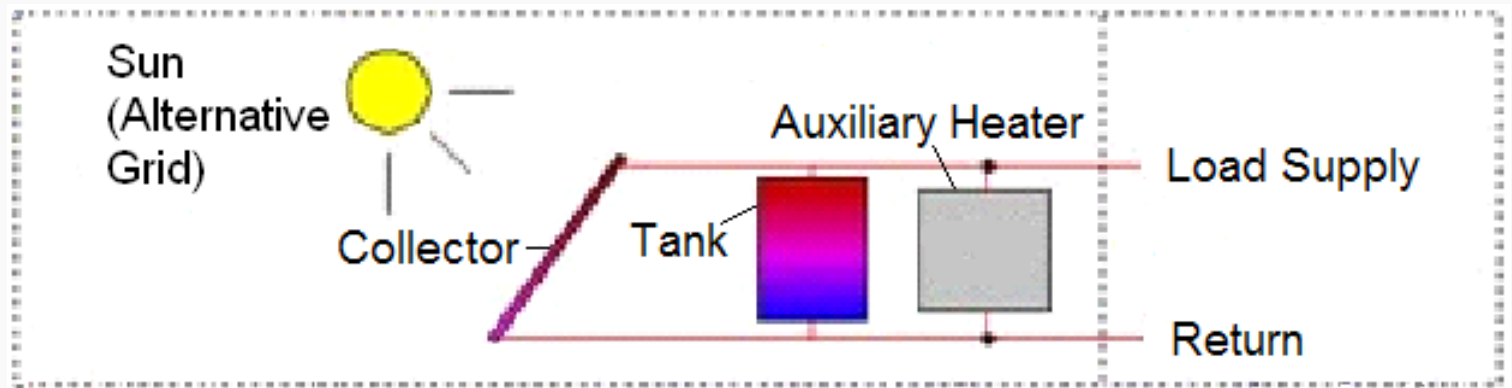
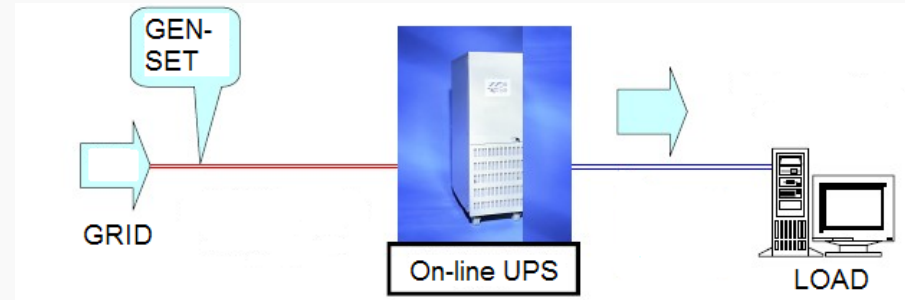
# *Solar Thermal Analogous to On-Line UPS*





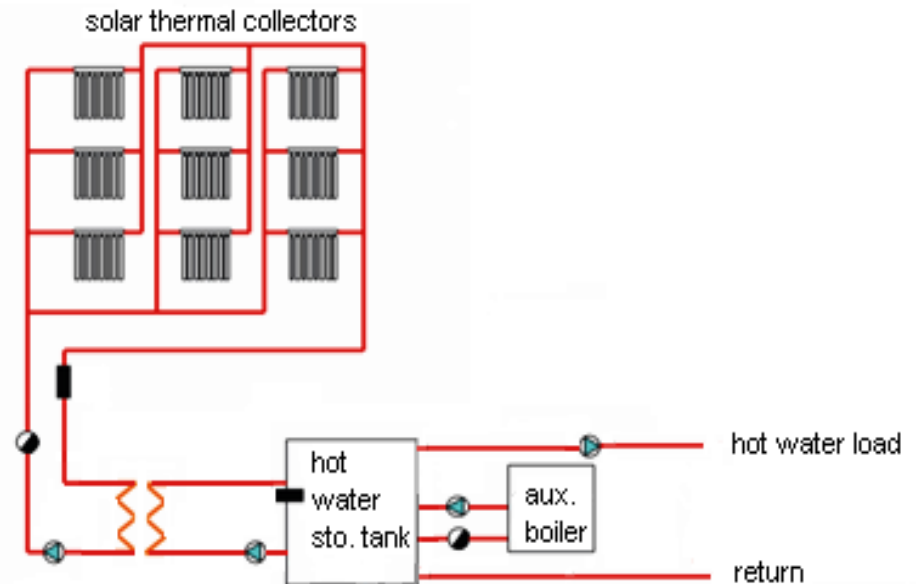
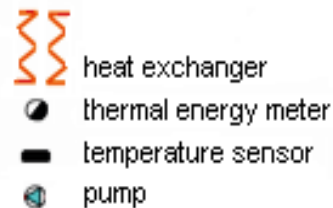
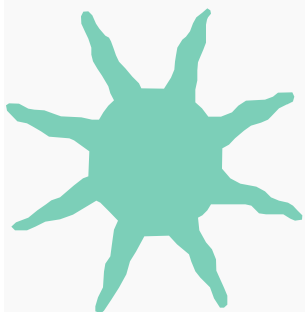
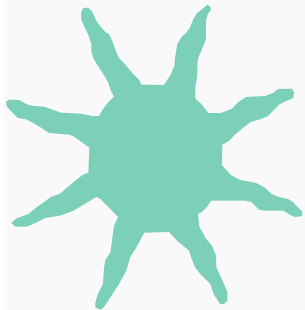
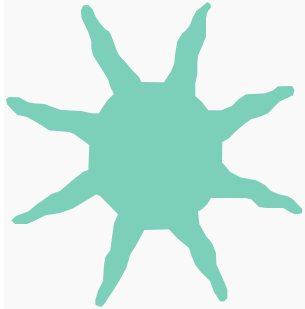
# *Solar Thermal Tank*

## *Analogous to On-line UPS Battery*



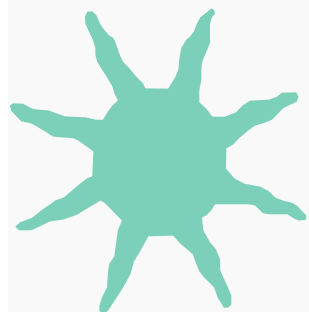
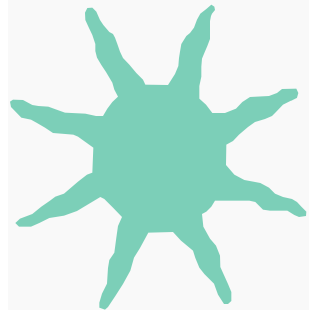
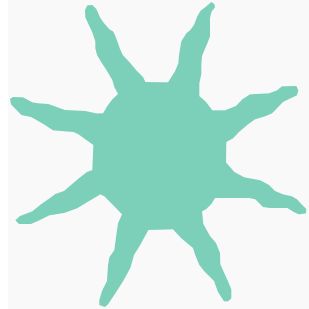


# *Solar Thermal Collector Array Works Similar to Boiler*

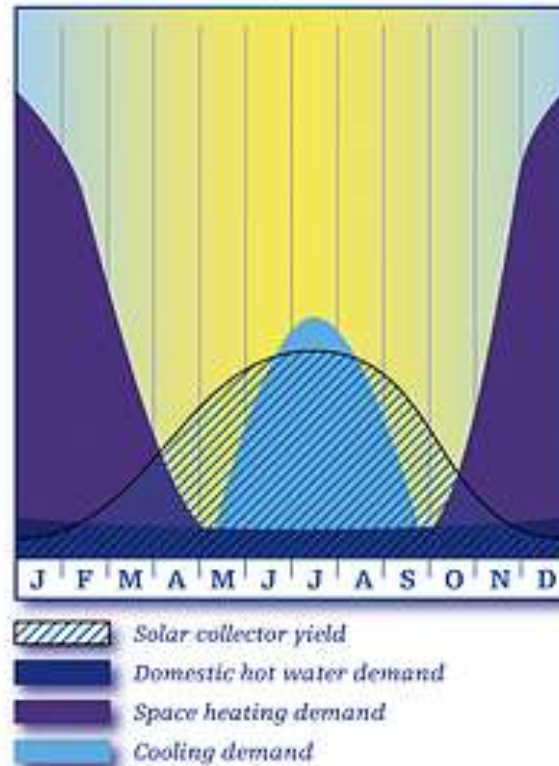




## *Solar Energy Supply and Thermal Loads*



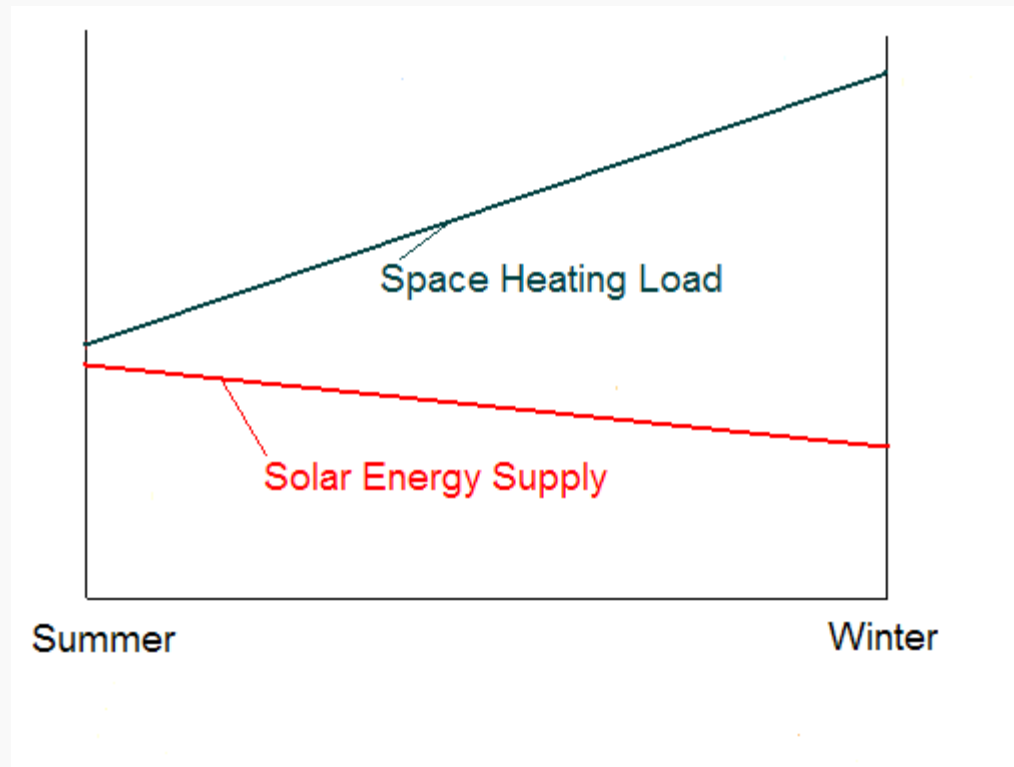
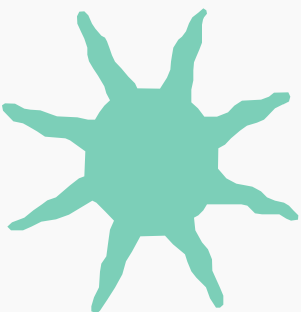
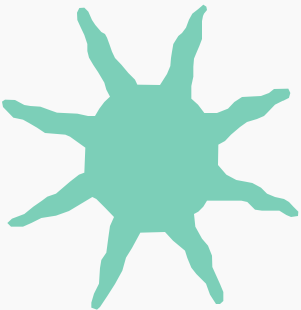
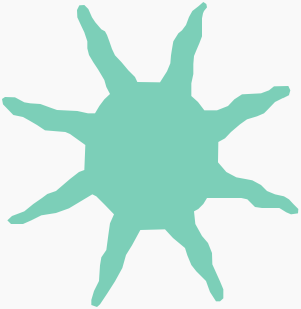
Solar cooling & heating system: demand & supply



Solar thermal can cover a substantial part of the heating and cooling demand in a typical Central European building.

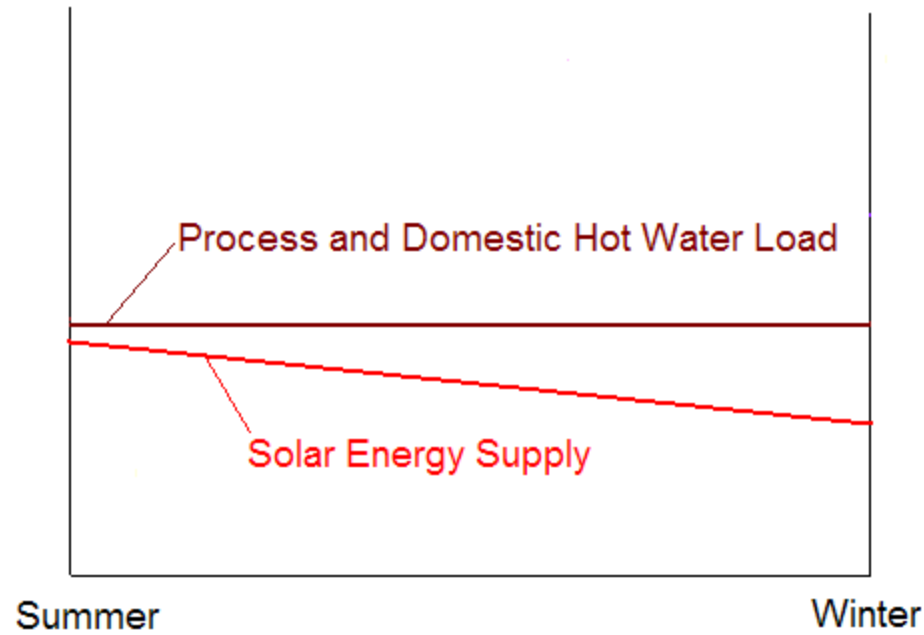
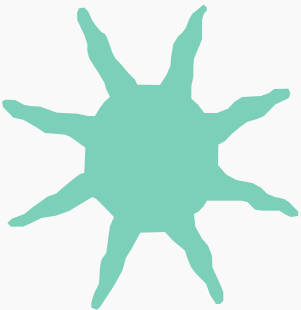
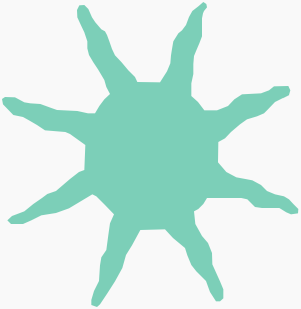


## *Space Heating Load and Solar Energy Supply*





## *DHW Load and Solar Energy Supply*



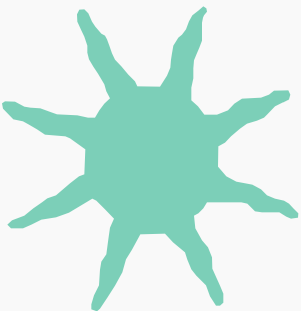
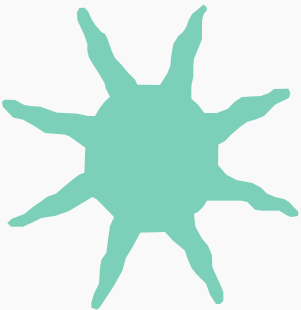
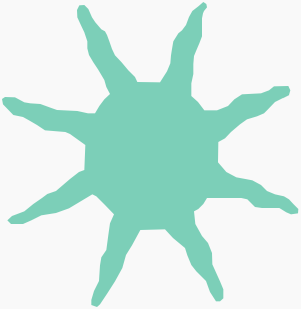




# *SEIDO 5-16AS*

## *Right Collector for Alaska*

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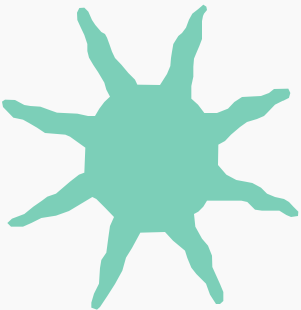
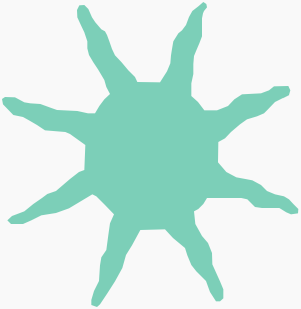
- ★ Concave absorber plate
- ★ Better collection
  - More capture early and late in the day without tracking
  - More capture in cloud
  - More capture in winter





## *Certification of Solar Thermal Collectors*

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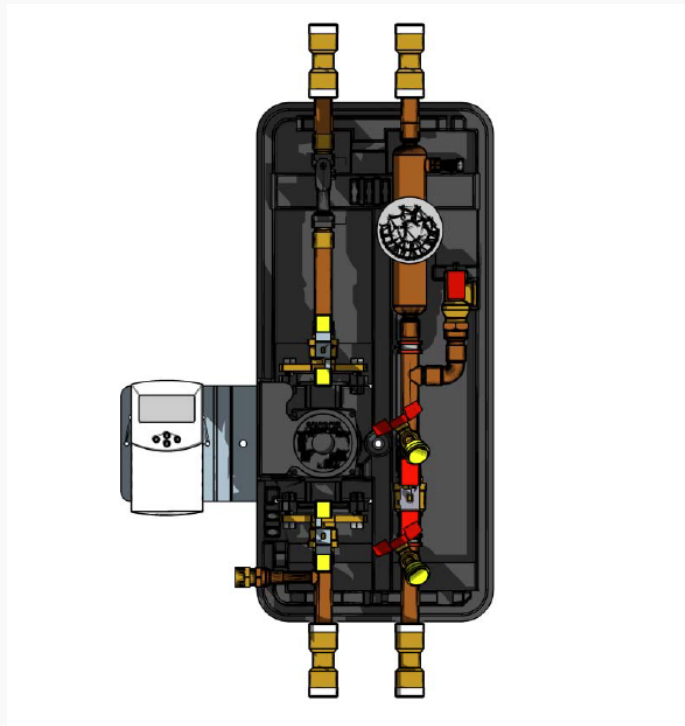
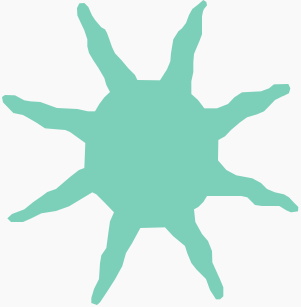
- ★ Solar Rating and Certification Corporation SRCC
- ★ Tests with single collector
- ★ Tests under laminar conditions
- ★ Impact of wind not incorporated
- ★ Evacuated tube collectors perform superior to SRCC data in real conditions



# *SunChiller Pump Station*

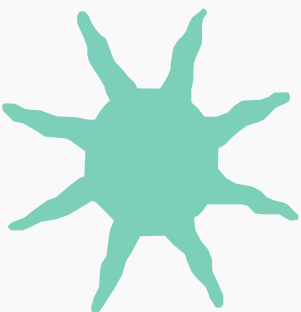
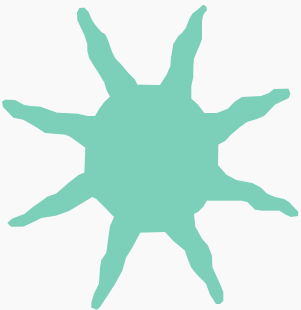
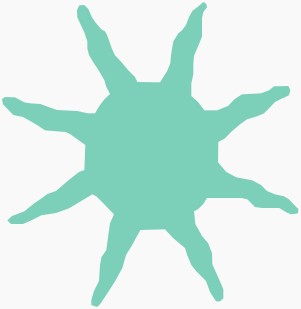
## *1 or 2 Collectors*

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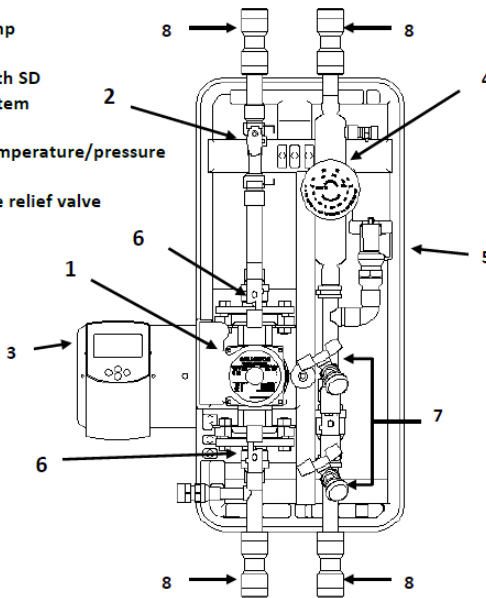




# *Features of SunChiller Pump Station*



1. Grundfos UPS 15-58FC pump
2. Grundfos VFS flow sensor
3. Advanced Solar Control with SD Card and DataViewer / system configuration software
4. In-line air remover with temperature/pressure gauge
5. 75 psi ASME rated pressure relief valve
6. Pump isolation flanges
7. Fill and purge valve set
8. Brass quick-connect/push fitting

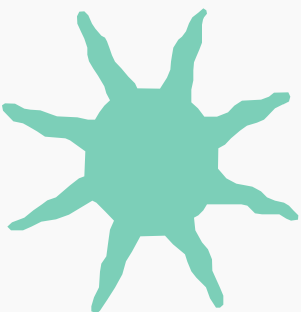
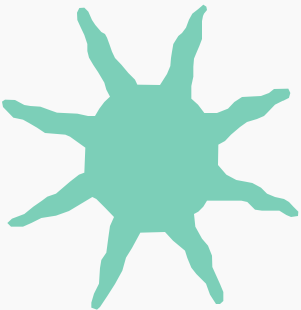
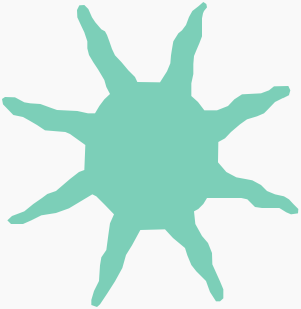


9. Expansion tank with bracket and connection kit





# *SunChiller Pump Station Specifications*

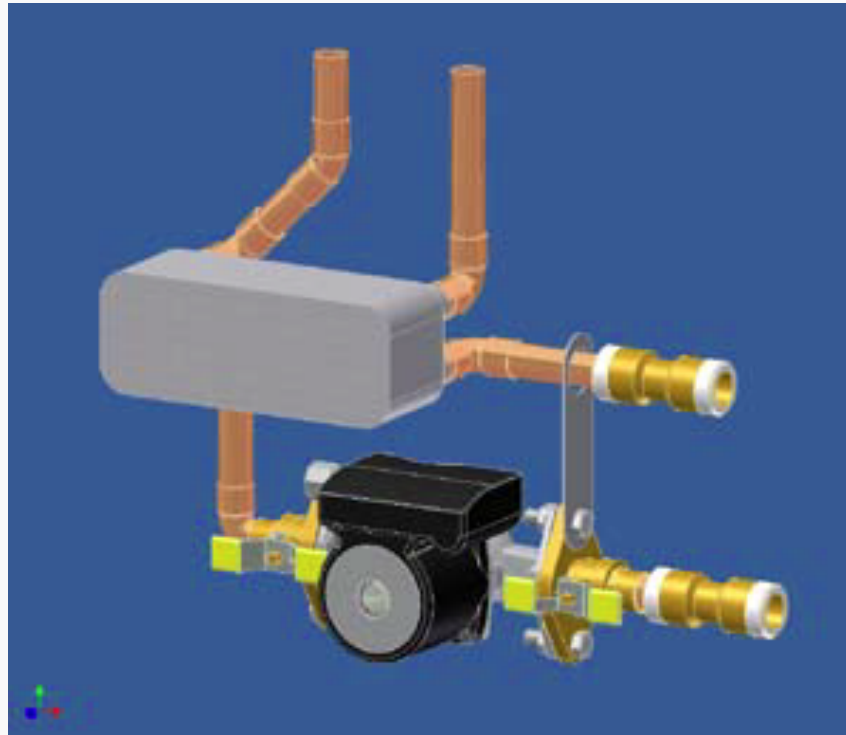
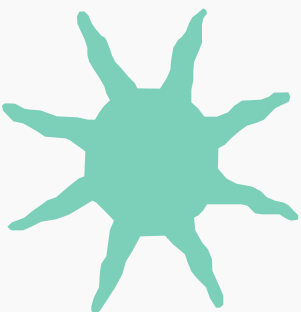
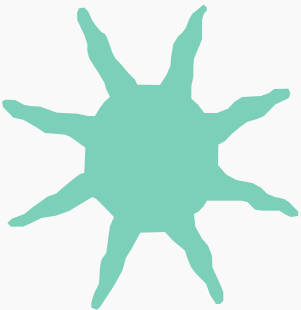
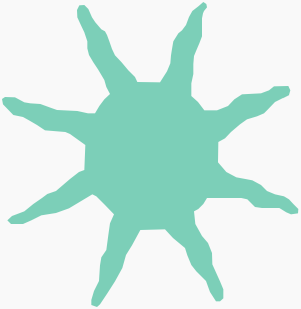


Specifications	
<b><u>Pump Station</u></b>	
Dimensions	Height = 24"; Width = 17.65" (inc. control); Depth = 8.5"
Pump	Grundfos UPS 15-58FC *
Solar Control	Advanced Solar Differential Control
Flow sensor	Grundfos VFS 2-40
Supply and Return connections	Watts 3/4" Brass Quick -Connect
Expansion tank	Watts ETX-30
Maximum operating temperature	230° F
Maximum operating pressure	75 psi (5.17bar)
Maximum current consumption per pump	0.75 A
Solar fluid	Inhibited propylene glycol/water mixture (No greater than 50% glycol solution)



# *Heat Exchanger Module*

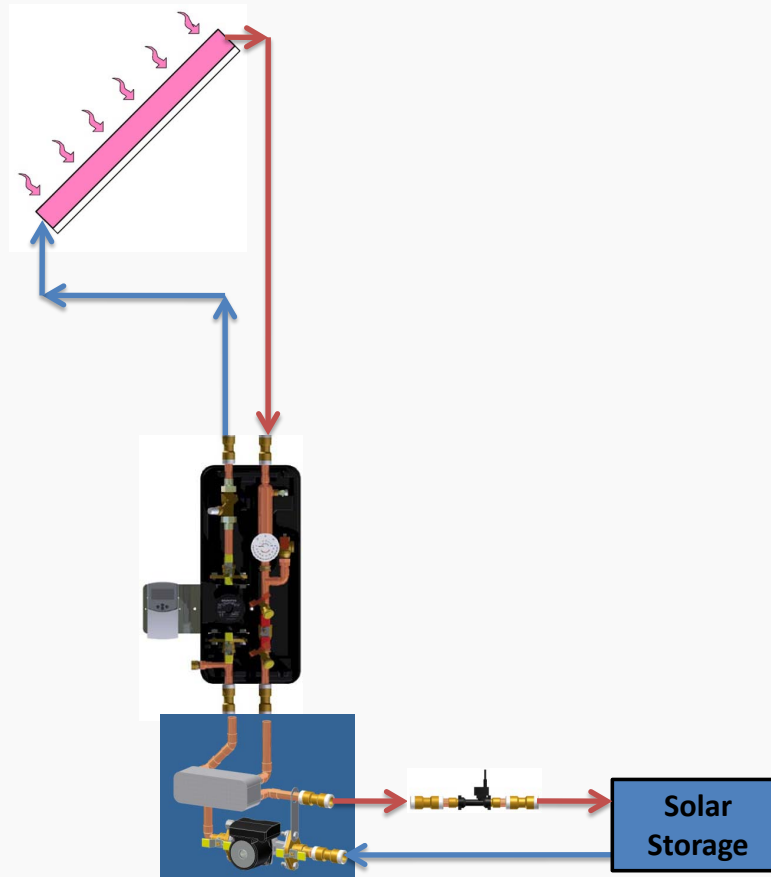
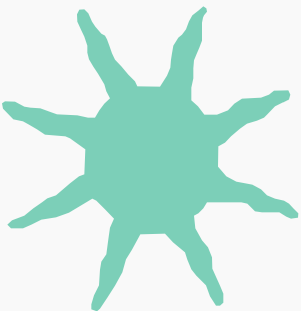
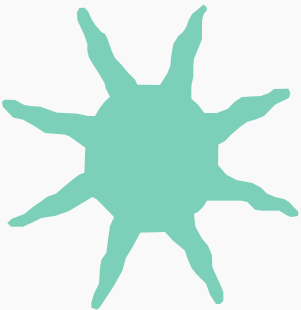
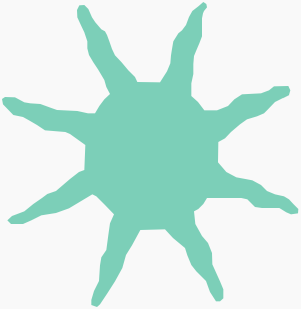
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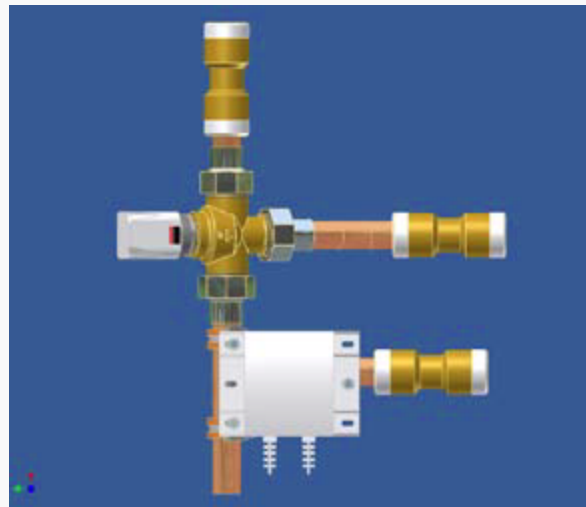
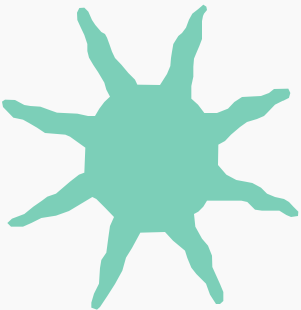
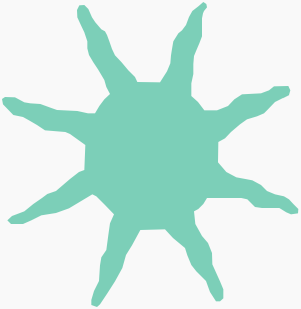


## *Pump Station with Heat Exchanger Module*





# *Heat Dump Modules*



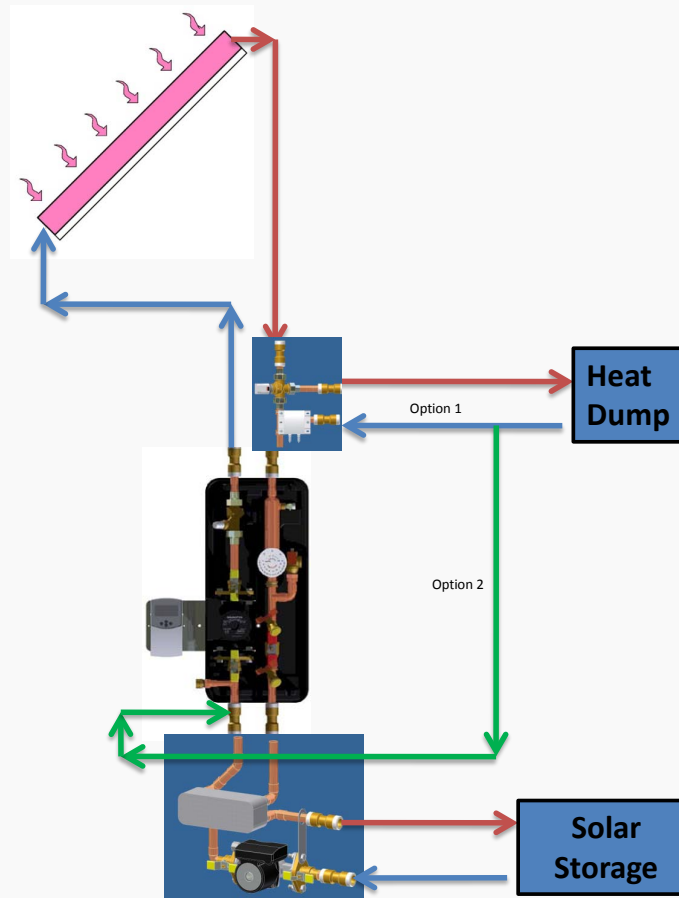
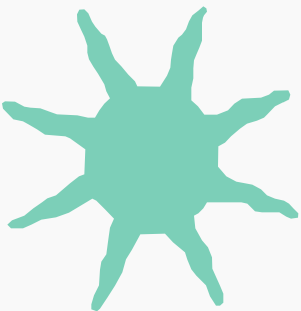
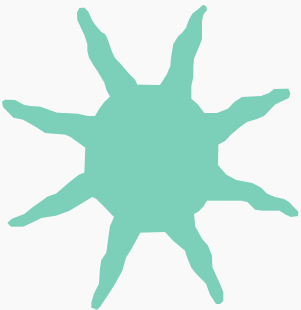
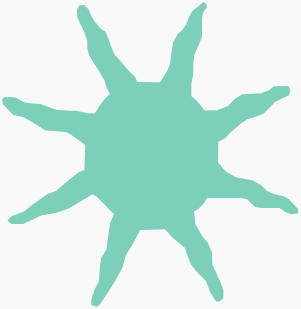
with 3-way valve

with pump



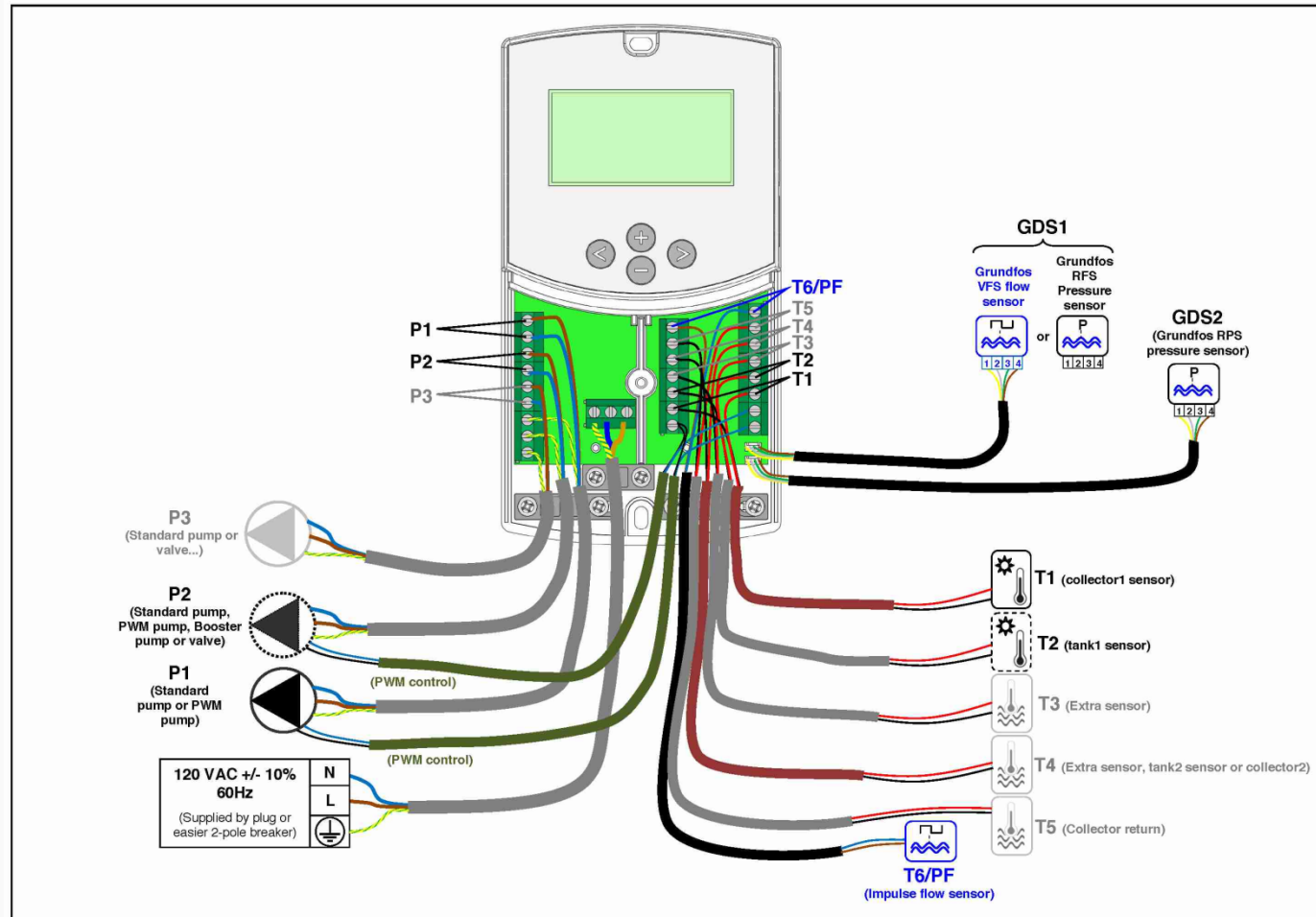
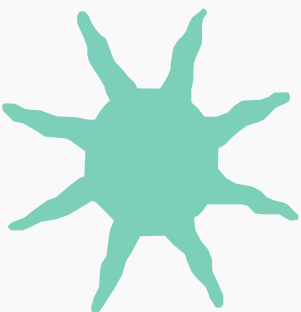
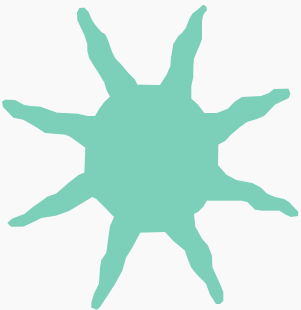
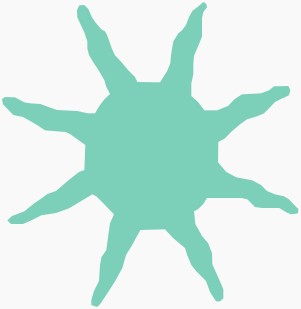


# *Pump Station with Heat Dump and Heat Exchanger Modules*





# *SunChiller Solar Controller*



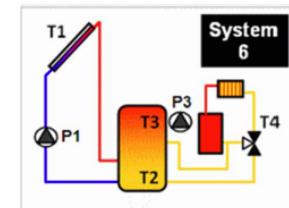
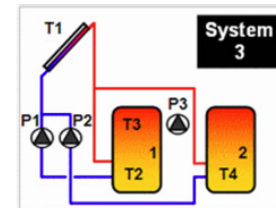
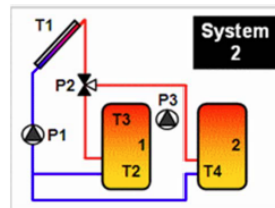
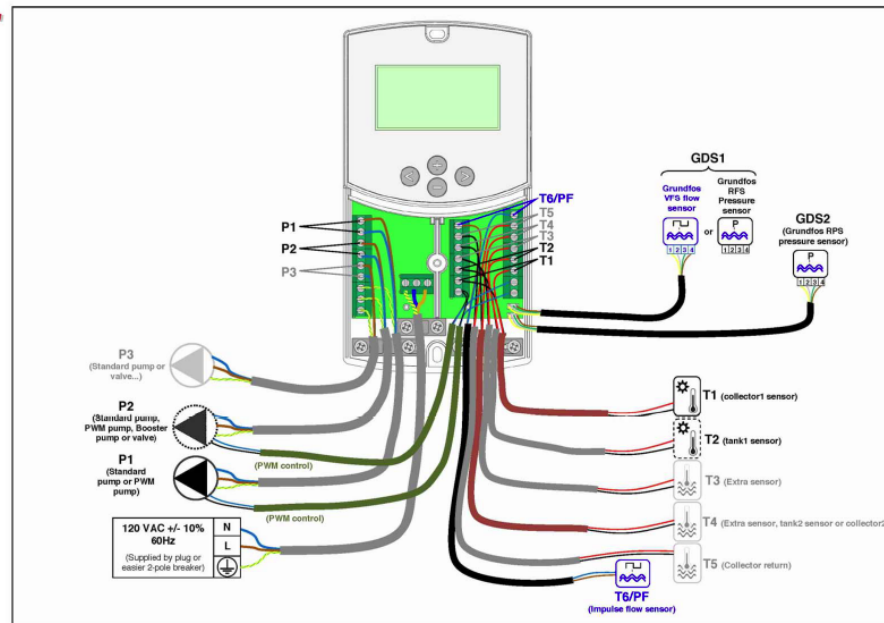


# SunChiller Solar Controller Features



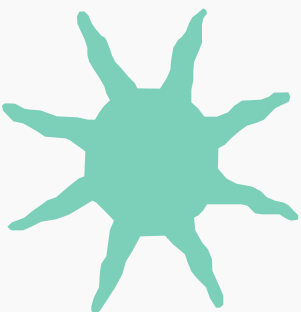
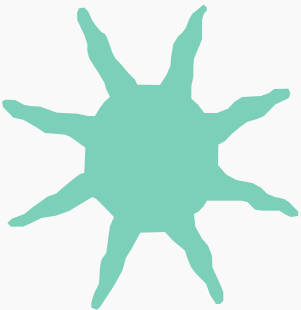
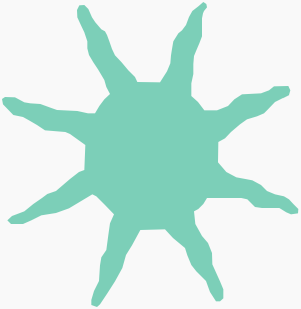
## Advantages

- Well suited to radiant systems
- 8 pre-configured systems
- Easy system set-up and data storage via SD card
- Multiple sensor inputs including flow (energy measurement) and pressure
- Extra functions include anti-stagnation, back-up heat, cooling, freeze protection and drain back
- Compatible with web module (coming soon)
- Has appropriate UL listings required for US and Canada
- Cost effective!





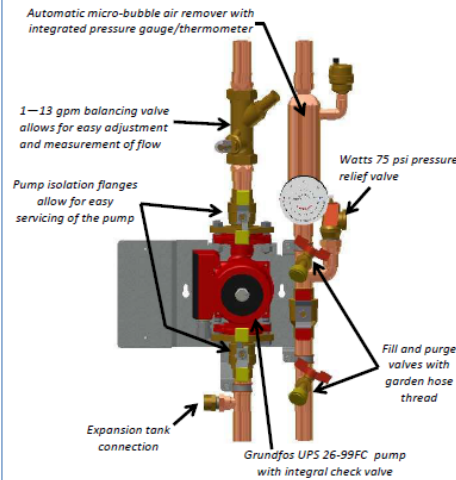
# SPS 7000 Solar Pump Station for 3 to 12 Collectors



## WATTS SPS 7000 Solar Pump Station

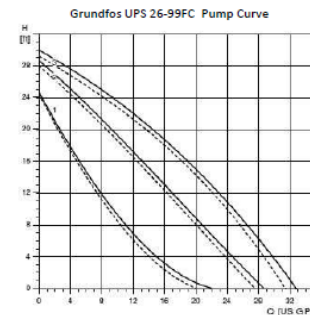
### Features

- Complete Solar Pump Station ready for connection to system
- Grundfos UPS 26-99FC, 115V three-speed pump with integral check valve
- Wattflow balancing valve for adjustment and measurement of flow (1 - 13 gpm)
- Watts 75 psi pressure relief valve
- Connections are 1" copper
- Automatic micro-bubble air remover with integrated pressure gauge / thermometer
- Integrated fill and purge valves with garden hose thread
- Pump isolation flanges for easy servicing of pump
- 100% of the stations are submitted to functional electric and hydraulic pressure tests
- Packaged in carton



### Pump Station Specifications

Dimensions and Shipping Weight	Height = 25.5"; Width = 15.5"; Depth = 7.5"; Weight = 20 lbs
Pump	Grundfos UPS 26-99FC
Flow meter	Wattflow 1-13 gpm
Piping/components	Brass/Copper
Temperature/pressure gauge	60 - 240°F/0 - 75psi
Maximum operating temperature (inc. Pump)	230° F
Pressure relief setting	75 psi (5.2 bar)
Maximum current consumption per pump	1.8 A
Connections	Supply and return: 1" Copper Expansion tank: 1/4" male BSP
Solar fluid	Inhibited propylene glycol/water mixture (No greater than 50% glycol solution)

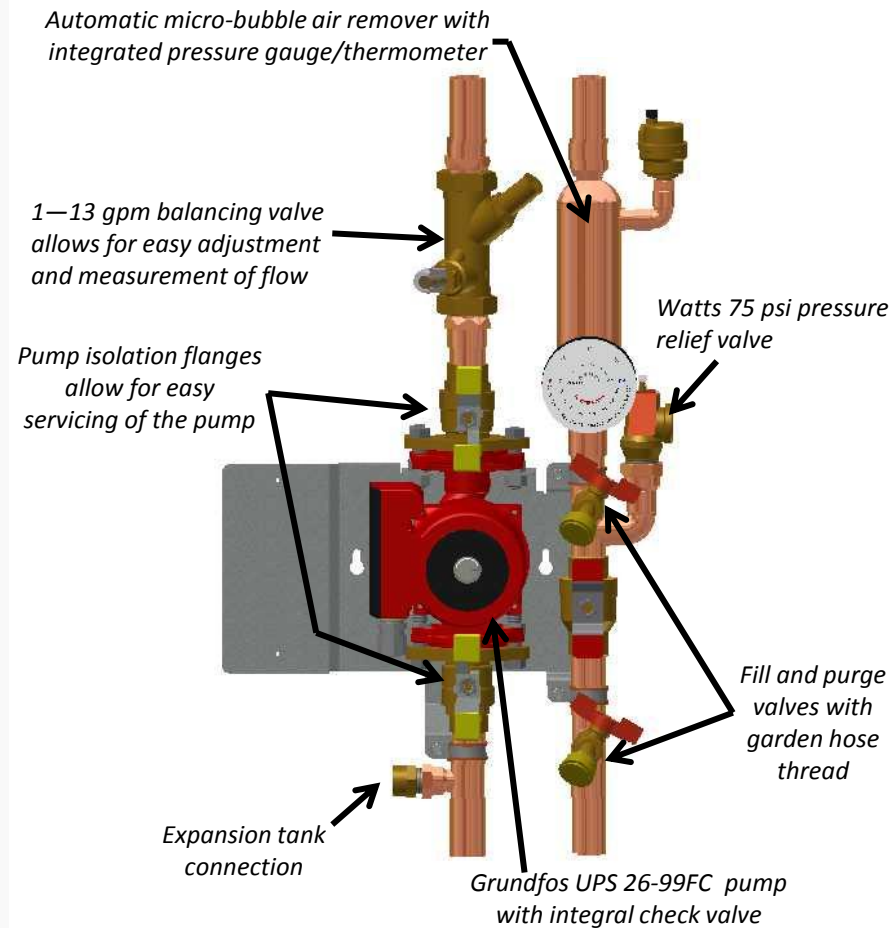
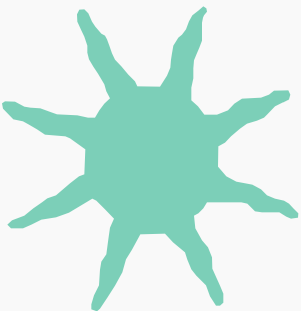
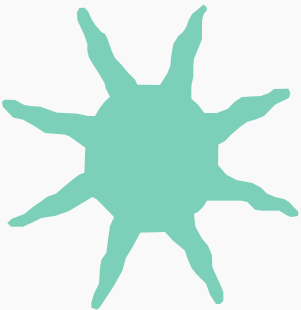
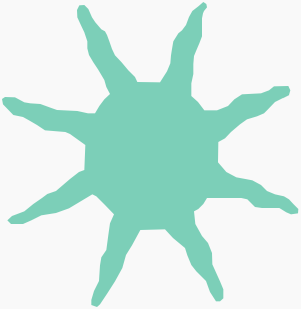


USA: 815 Chestnut St., No. Andover, MA 01845-6098; [www.watts.com](http://www.watts.com)  
Canada: 5435 North Service Rd., Burlington, ONT. L7L 5H7; [www.wattscanada.ca](http://www.wattscanada.ca)





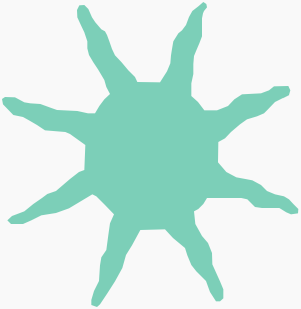
# *SPS 7000 Solar Pump Station*



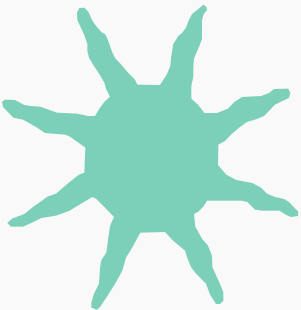


# *Incentives for Solar Thermal*

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- ★ Federal Investment Tax Credit – 30% until 12/31/2016



- ★ Will revert back to 10% after 12/31/2016

- ★ 5-year Accelerated Depreciation for Commercial

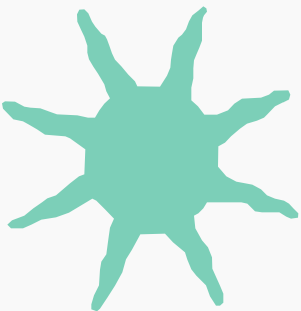
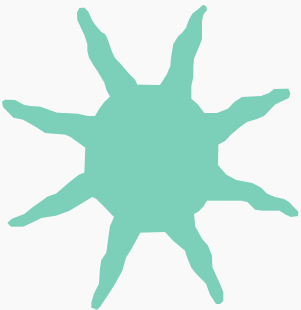
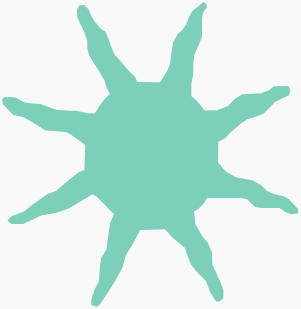


- ★ Collectors, tanks, pump station, mounting racks, and lines - “Solar Property”



## *Managing Heating Costs in Alaska*

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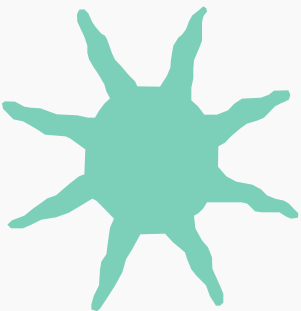
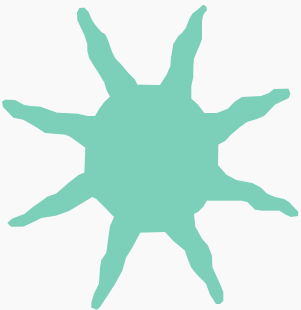
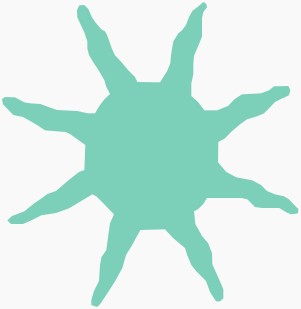
- ★ Thermally efficient building – can reduce heating load by half or more
  - Super insulation
  - Window placement
  - Windows – insulated shutter
- ★ Solar thermal energy combi system
- ★ Protect collector from snow
  - 80 deg. tilt angle
  - Overhanging eave
- ★ Long-term thermal energy storage



# *Managing Heating Costs in Alaska*

## *Solar Thermal Combi System*

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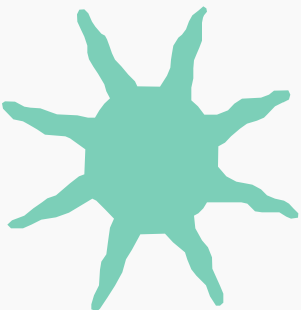
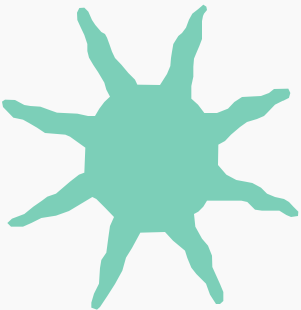
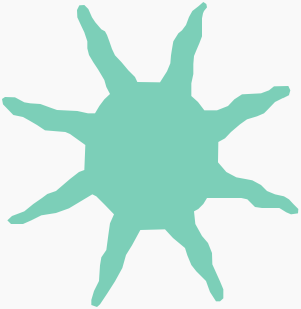


- ★ Combi system can achieve 10-20% solar fraction in meeting combined DHW and space heating loads
- ★ Space heating >> DHW
- ★ Increased solar fraction possible – challenge: excess heat in summer
- ★ Long-term thermal energy storage will increase solar fraction



# *Storage of Solar Thermal Energy*

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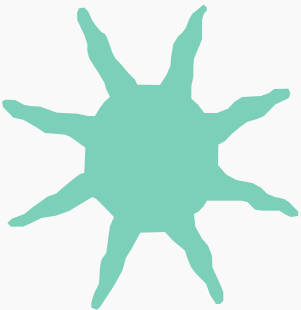
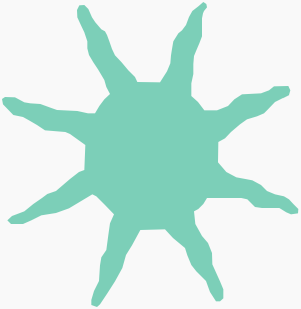
- ★ Diurnal (daily)
  - Domestic hot water
  - Space heating
- ★ Seasonal (long-term)
  - Space heating



# *Storage of Solar Thermal Energy*

## *Daily*

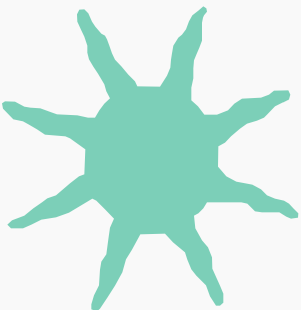
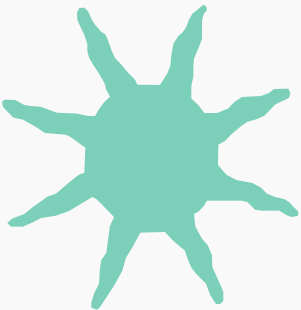
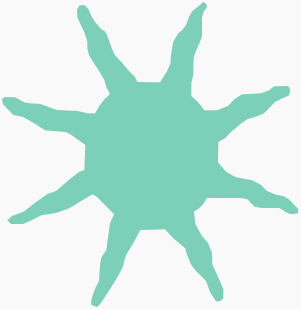
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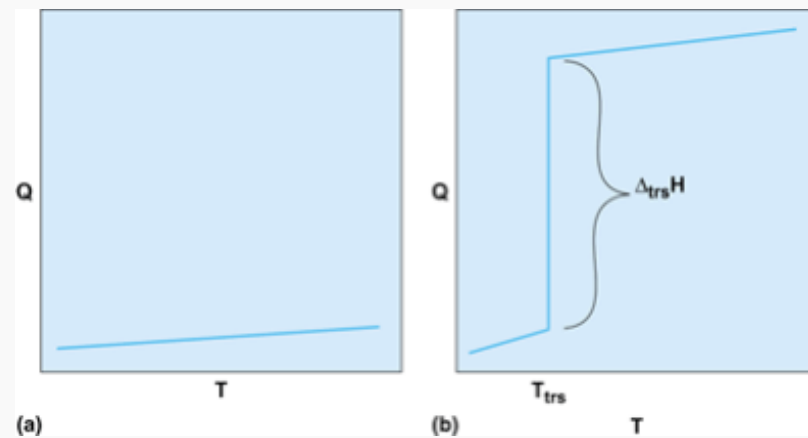
- ★ Insulated hot water tank – DHW
  - 120-125 deg. F
  - 1.3 to 2.2 Gal/gross sq.ft. collector area < DHW load
  - 1.3 for Alaska <DHW load
- ★ Insulated hot water tank – space heating
  - 140-180 deg. F
  - 0.7 to 1.2 Gal/gross sq.ft. collector
  - 0.7 for Alaska



# *Storage of Solar Thermal Energy Long-term*



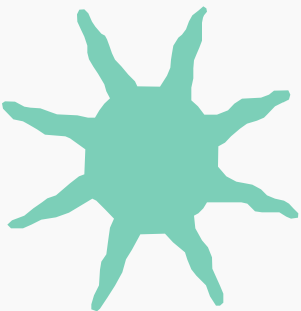
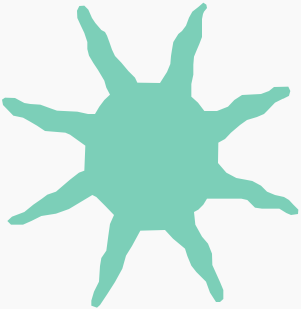
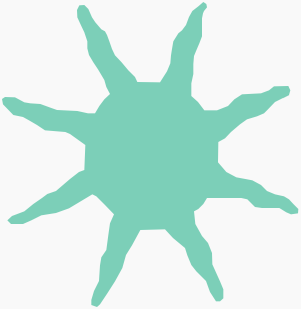
- ★ Economics limits to 200-300 Gal/collector
- ★ Need for phase change material
  - High fusion heat density
  - Melting point above operating temperature





## *Storage of Solar Thermal Energy Long-term Cont'd.*

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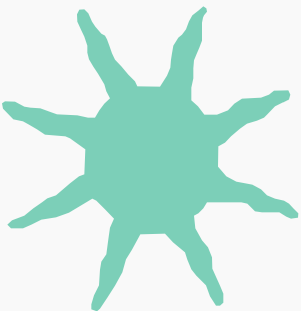
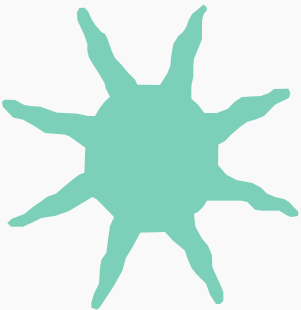
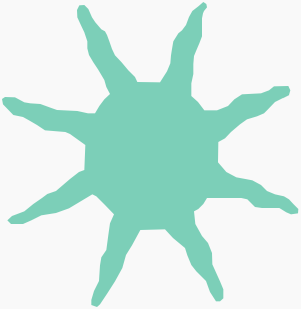


- ★ Practical for 1 to 1.5 months
- ★ No impact in 4 coldest months – 60% of load
- ★ Can increase solar fraction by 1/3 to 1/2
- ★ Commercial products not readily available
- ★ Testing in Alaska necessary



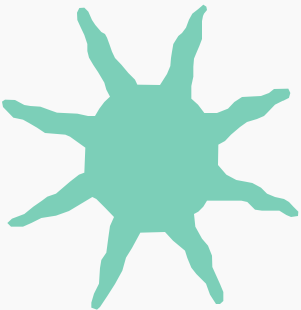
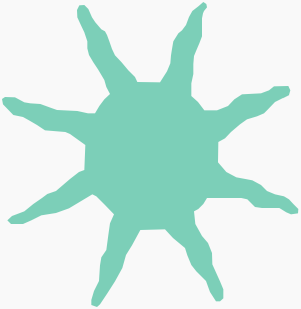


# *Radiant Floor Space Heating and Domestic Hot Water in WI*





## *Residential System with Collectors on Balcony Facade*



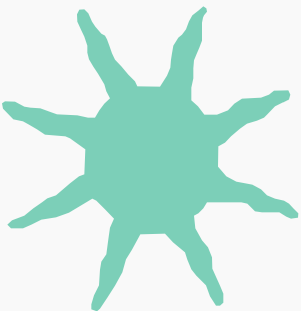
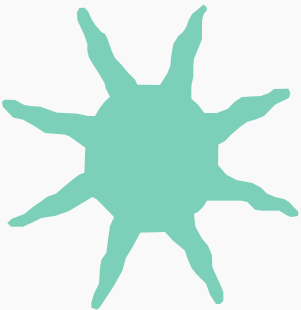
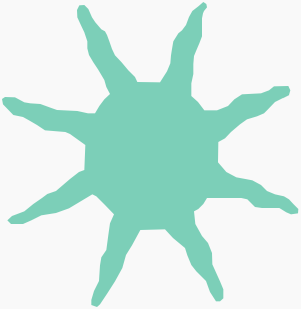




# *Combi System in Alaska*

## *Mounting with 80 Degrees Tilt*

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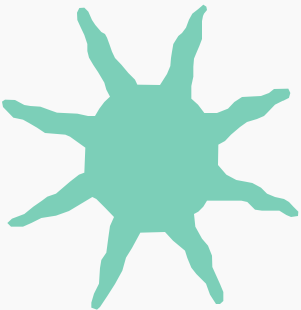
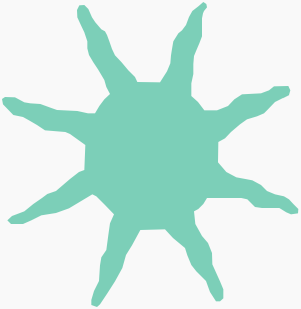




# *Alaska Cottage*

## *Mounting with 80 Degrees Tilt*

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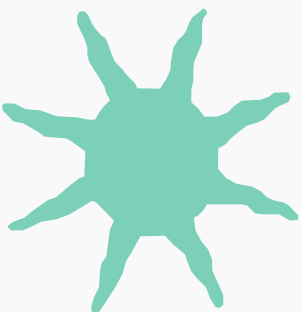
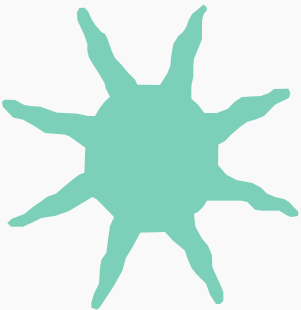
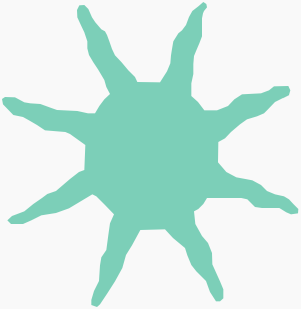






# *Wall Installation in Alaska with Overhanging Eave*

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*Thank You*

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