



# Solar Water Heaters

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# What is Solar Water Heating?

- A solar water heater heats water using the sun. No electricity is involved; the sun's energy simply heats water.



Example of small scale split solar water heater system.

# solar water heater panels

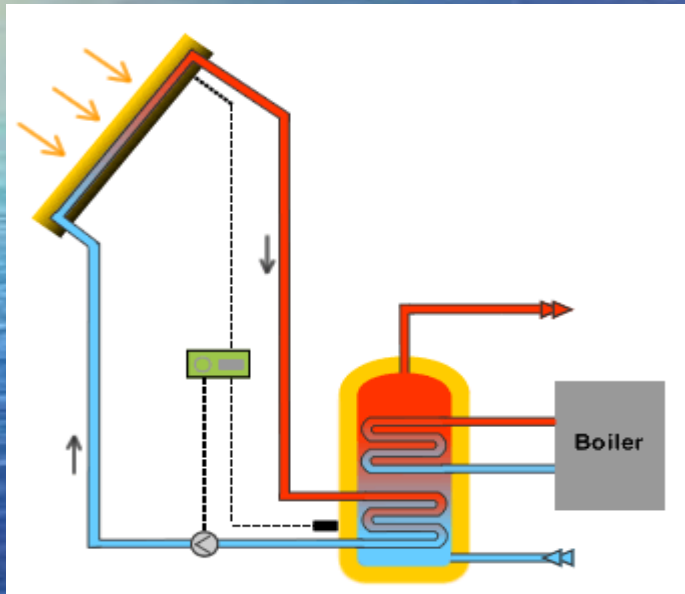


- economical large-scale split system

# *Why use a solar thermal water heater?*

- save money
- avoid pollution, global warming
- guarantee future energy costs
- visible use of renewable energy
- satisfy law
- independence from power grid

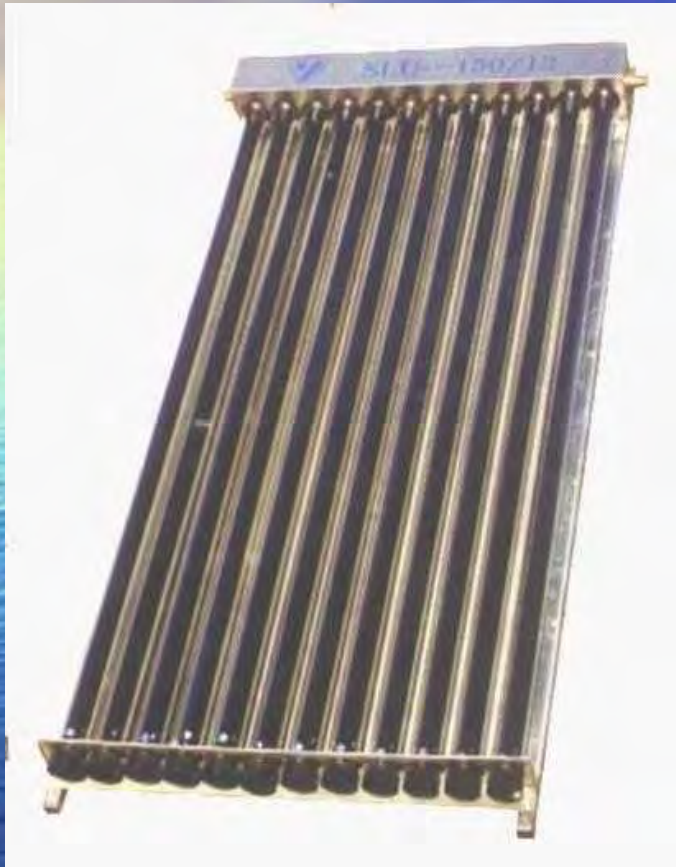
# How does it work?



All Solar Heaters Have:

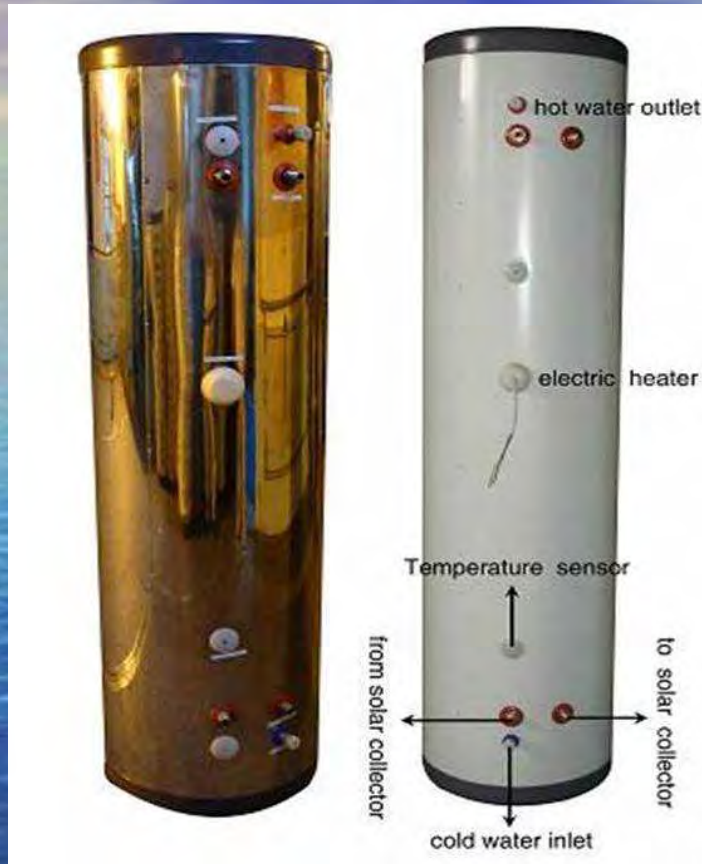
- Collector
- Storage
- Controller

# Solar Collector



Absorbs energy of the sun, transfers heat to water.

# Solar storage



Stores the hot water

# Solar Controller



Regulates system. Could be simple physics of hot water rising or large scale with many pumps.



# What is a vacuum tube?

evacuated tube, low-iron glass

- outer wall allows nearly all light
- inner sputtered high absorption coating
- vacuum means no heat can escape



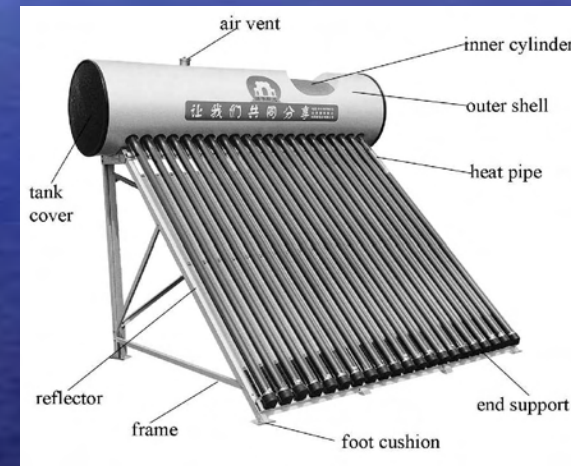
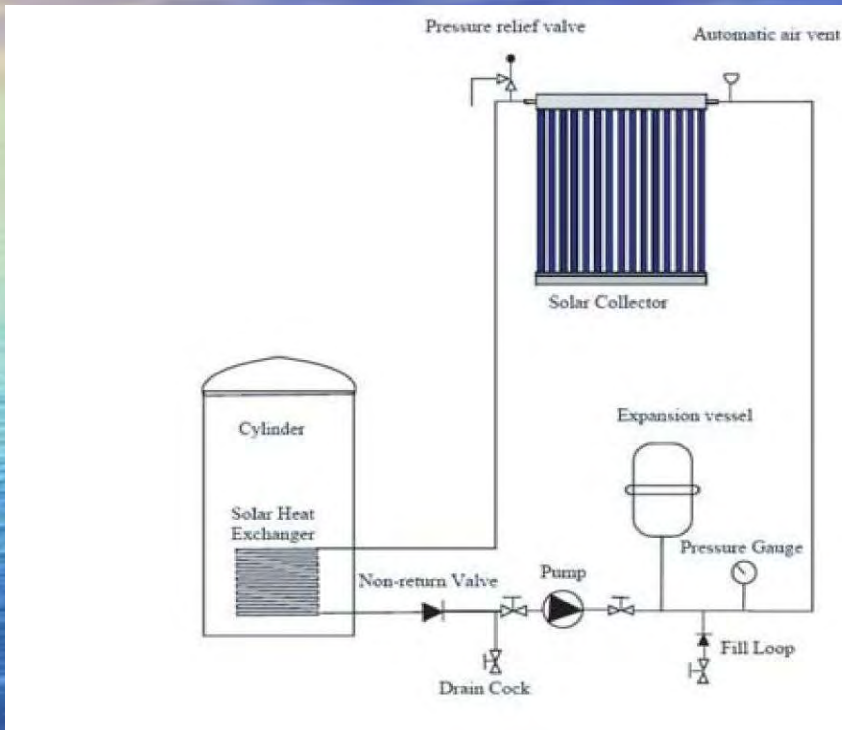
# Tricks of the Vacuum Tube

- Quasi-tracking
- No Heat loss
- Freeze protect



- New technology, replacing flat plates

# Kinds of solar water heater systems

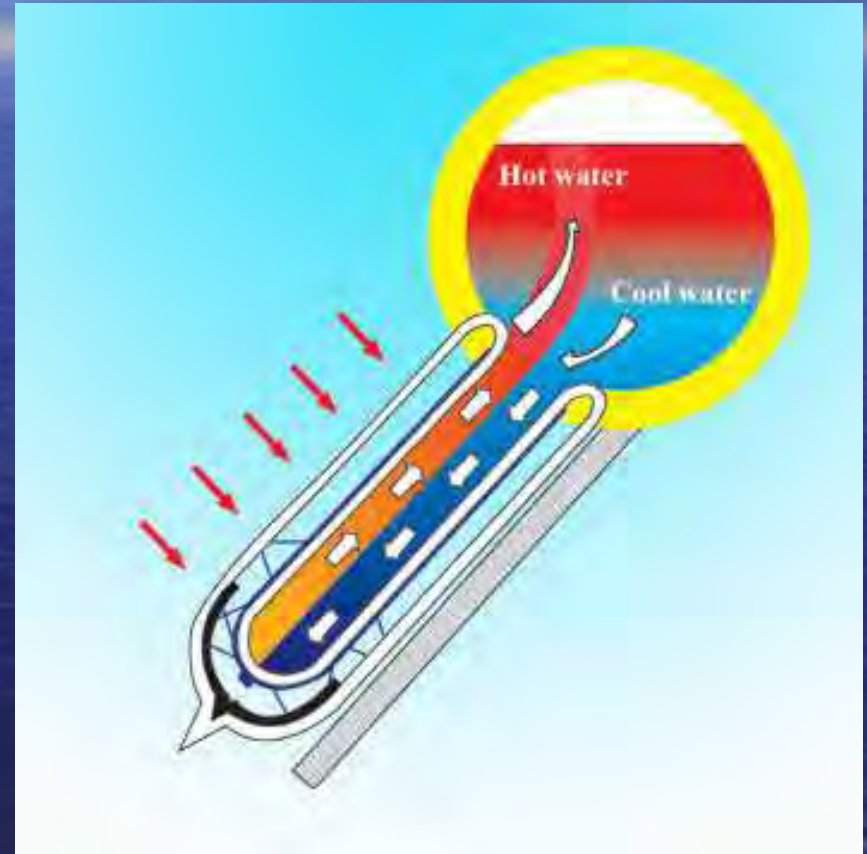


1. SPLIT the collector, storage and control
2. INTEGRATE the collector, storage and control

Closed loop (indirect)=use heat exchanger. Open loop=use water directly

# Simplest Integrated System:

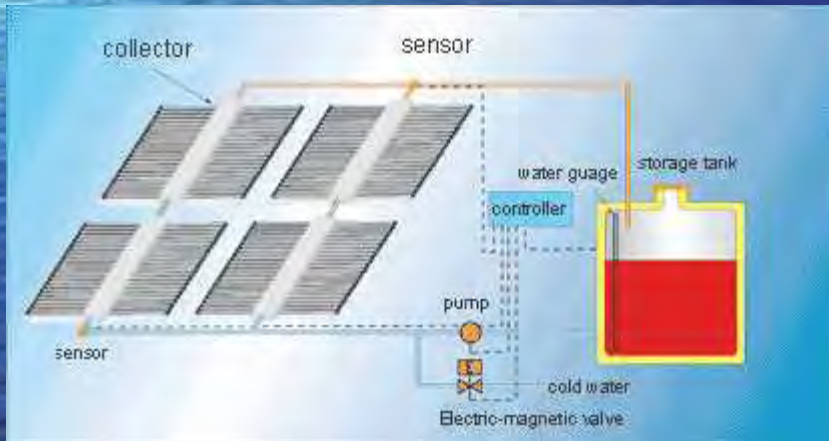
- No controller needed
- Hot water rises slowly
- Water in tube (freeze?)
- Tank on roof
- Break tube, create flood



# Simple Split Solar System

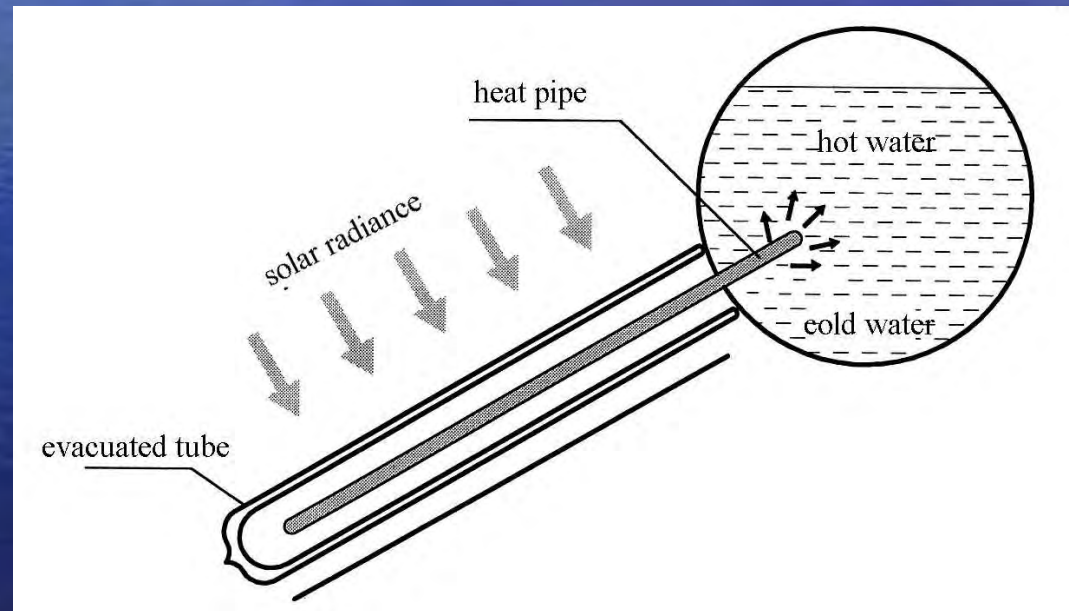


- Water in tube (open loop direct)
- storage tank vented to outside
- Break one tube = create flood
- Dirty water = dirty tubes
- Slow water movement
- Slow heat movement



# Solution: Heat pipes

- More efficiency
- Freeze protection
- Break tube, no leak
- No water in tube



Sealed pipe with salt of potassium boils, condenses

Latent heat of vaporization larger than conduction heat transfer.

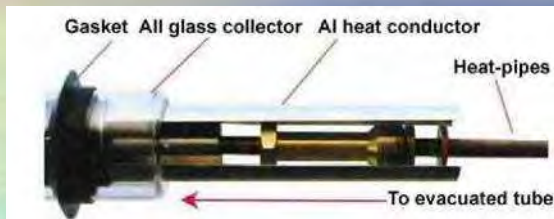
Faster to move heat in a vapour than in liquid.

# Copper Heat Pipes

- High efficiency
- High pressure
- High cost
- Corrosion risk



# Heat Pipe insertion

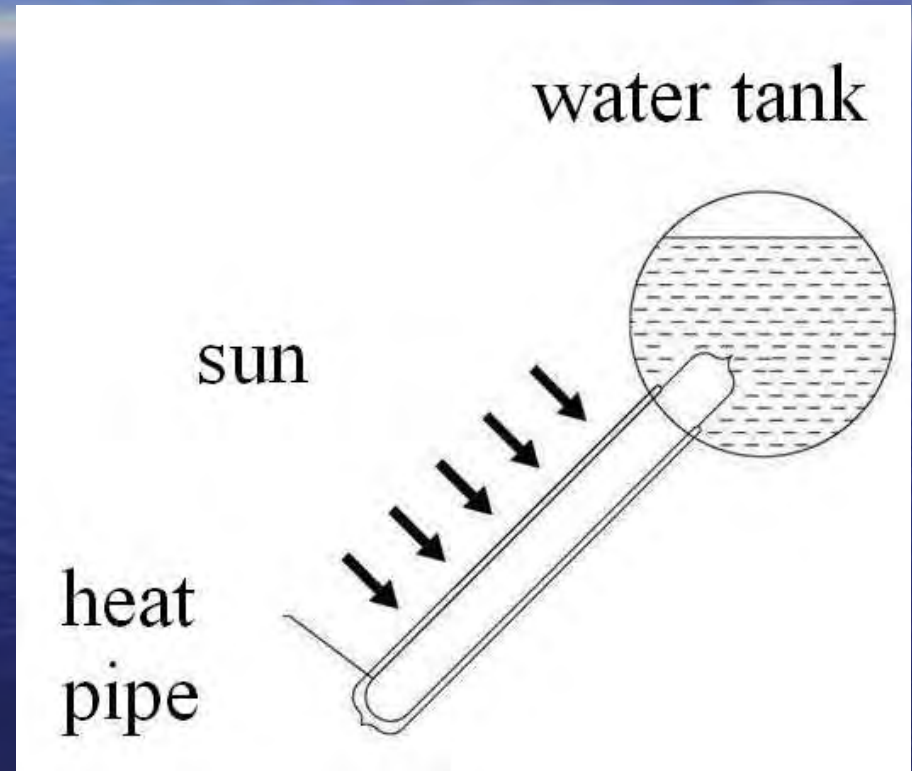


Hot condenser end of heat pipe into cold water flow

Plate end of heat pipe with chrome for corrosion protection



# Glass Heat Pipe



Cheaper than copper, but low pressure only

Keeps advantage of freeze protection, no water leak from broken tube

# Integrated System insulation



Water stays hot overnight in tank.

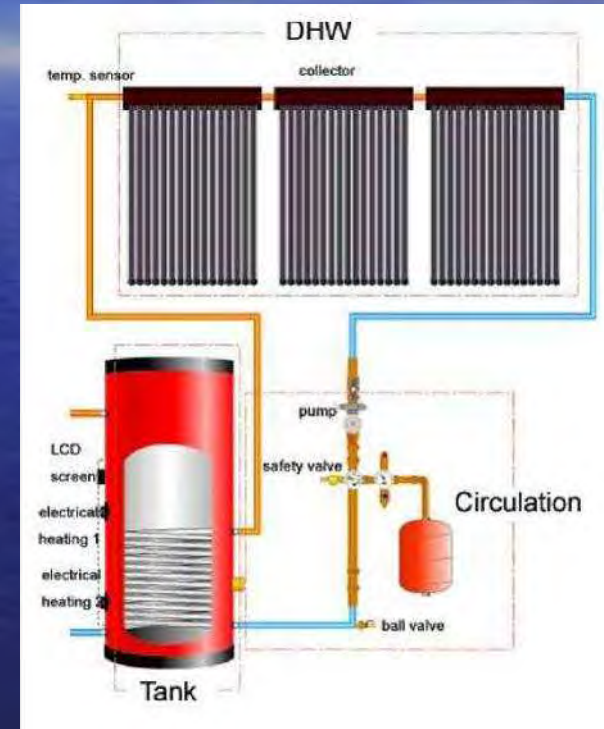
# Integrated Solar Water System Installed on Roof



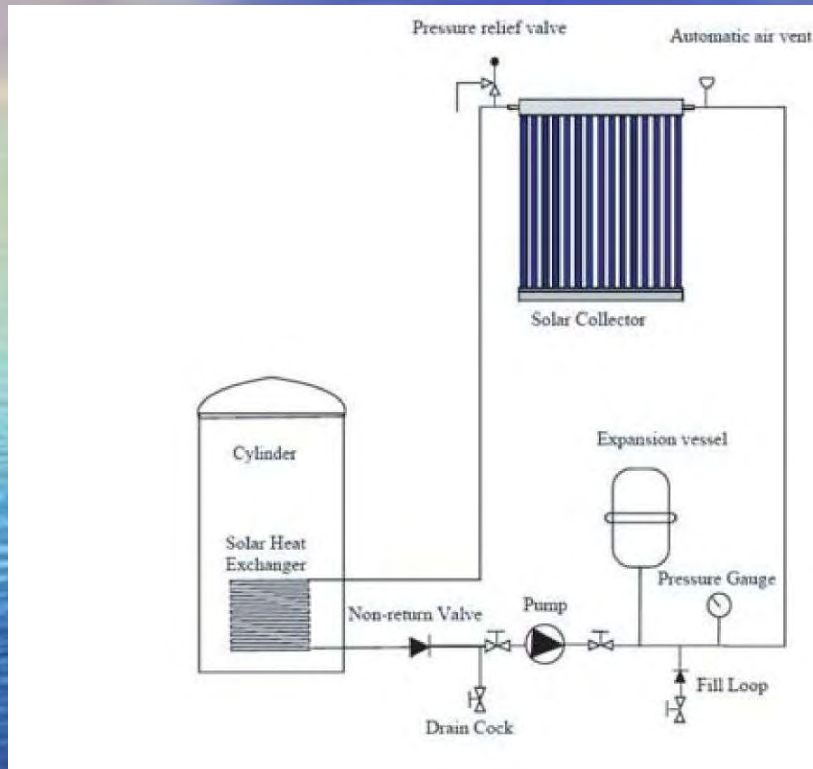
Simple to install, economical, portable, scalable.

# Split Systems

- Panels flat on roof
- Tank any location
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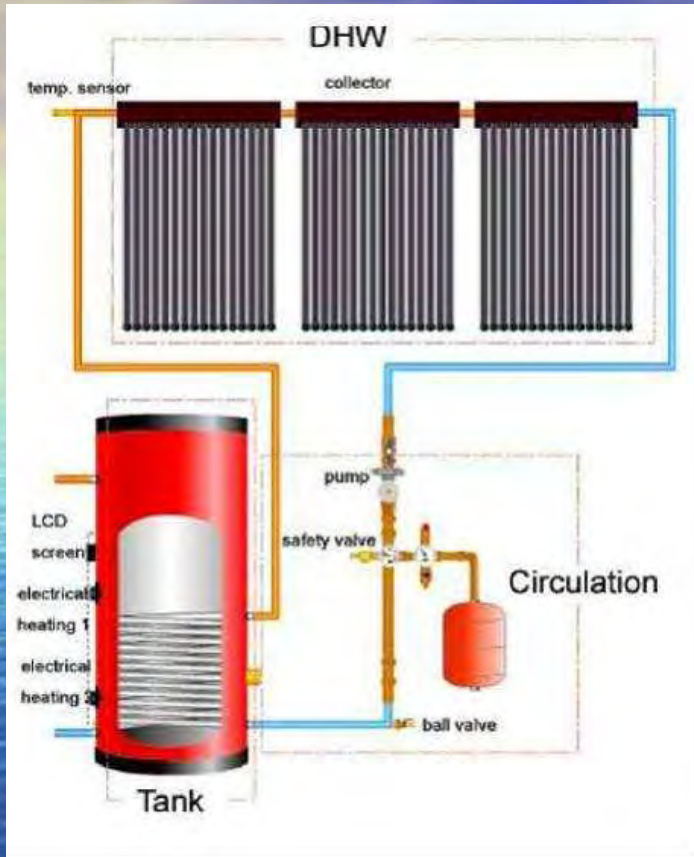


# Split Systems



- Circulation Pump needed
- Closed loop=heat exchanger
- Open loop=no heat exchanger

# Split System Layout



Closed loop, indirect, maybe glycol in loop

Lose efficiency with the heat exchanger

Use open loop if you can, cheaper.

Glycol means 100% freeze protection

# Which system to use?

Rule #1:

Keep it simple as possible, but not simpler.

Avoid moving parts and electronics, as these have been proven to fail first.

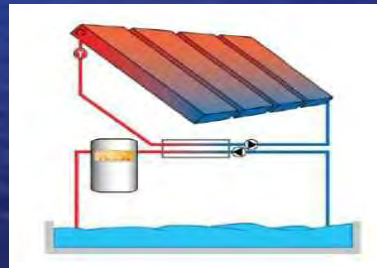


170 litre integrated solar water system kit.  
Most simple, reliable and economical  
choice.

# Why use a split system?



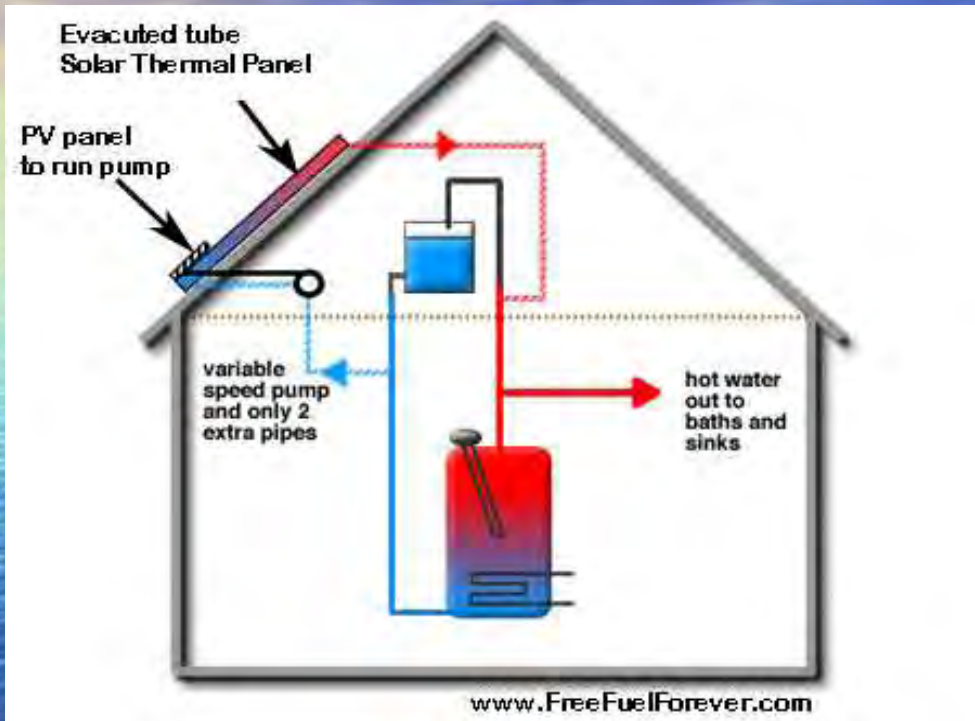
No tank on roof, less weight.  
Better looking panels.



Pool heating, in-floor heat.  
Apartment space constraints



# If you wish to use a split system, keep it simple



Use a circulation pump connected to a small PV panel. Pump runs when sun is out. Eliminate the controller and temperature probes, which are affected by corrosion, dirty water and voltage spikes.

# Simple Solar

- Scalable
- Redundant



- No moving parts
- Most economical

# What does it cost?



- 3 years heating bills = integrated system
- 5 years years heating bills = split system
- After this time, system is free, forever.
- What you use now is never free

**Seabird Solar**



**Solar Hot Water**