HEAT PUMP WATER HEATERS

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What is a heat pump water heater ?

How does it work ?

Alternative concepts

Performance

WHAT IS A HEAT PUMP WATER HEATER ?

OPERATION

A heat pump works by transferring heat not by converting electrical energy into heat.

A heat pump water heater removes energy from a low temperature source (ambient air or waste water) and moves it to a high temperature hot water tank.

Electricity is used to upgrade the quality (temperature) of heat energy not to generate heat energy

SIMILAR PRODUCTS

Reverse cycle air conditioner
Refrigerator.

EFFICIENCY OF A HEAT PUMP WATER HEATER

Efficiency of electric heating element = 100%

Efficiency of heat pump water heater = 250% to 400%

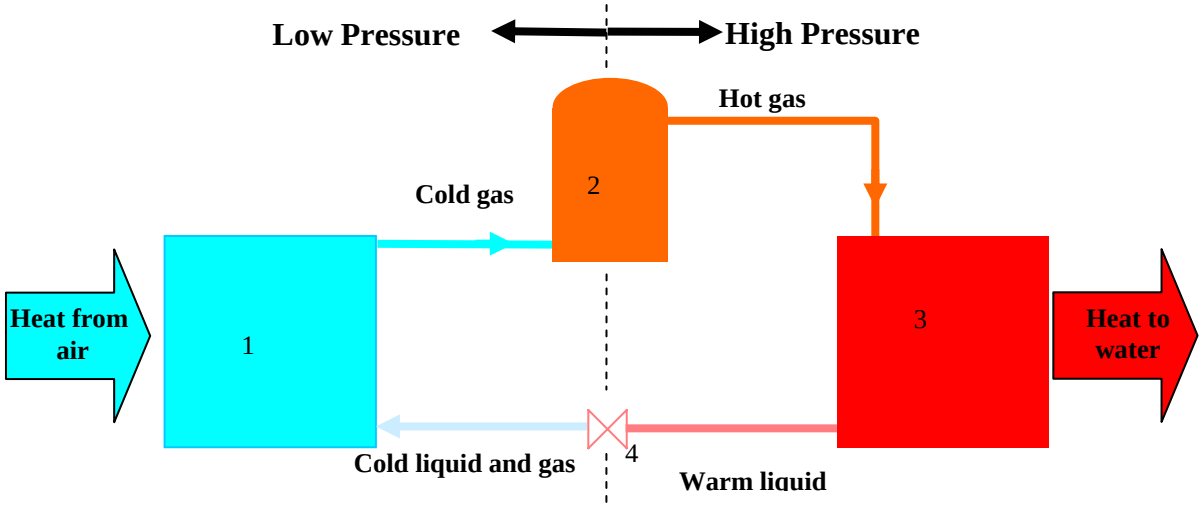
A heat pump seems to provide something for nothing !
(almost a perpetual motion machine).

ELECTRICAL DEMAND

Heat pump peak electrical power demand = 500 to 1000W

Electric water heater peak power demand = 2400 to 4800 W

HOW DOES A HEAT PUMP WATER HEATER WORK ?



1. **Liquid (refrigerant) boils at a low temperature in an evaporator. Output is low temperature and low pressure vapour.**

2. **Pressure and temperature of vapour increased in the compressor. Electric motor used to drive vapour compressor.**

   Output is high temperature and pressure vapour.

3. **Heat exchanger in water tank.**

   Output is heat transferred to water.

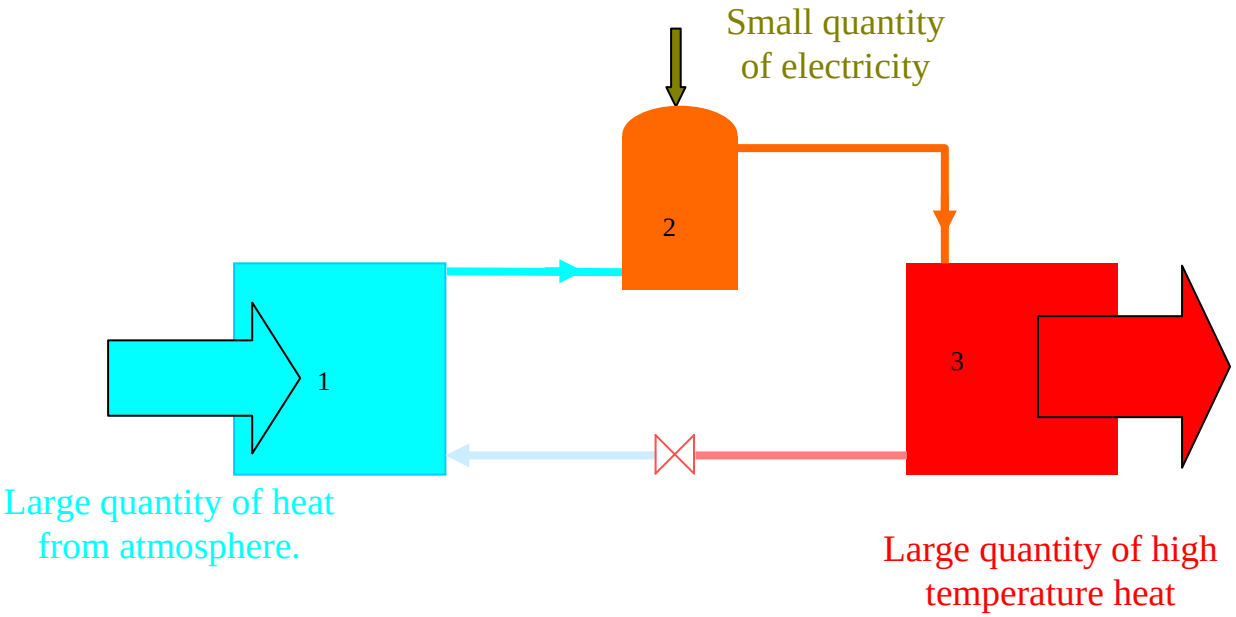
   On refrigerant side output is warm liquid refrigerant.

4. **Liquid is returned to the evaporator after passing through a partially open valve (TX valve or capillary tube).**

   Output is low pressure cold liquid ready to be evaporated again.

WHERE DOES THE ENERGY COME FROM ?

A heat pump water heater collects “free energy”, just like a solar water heater.



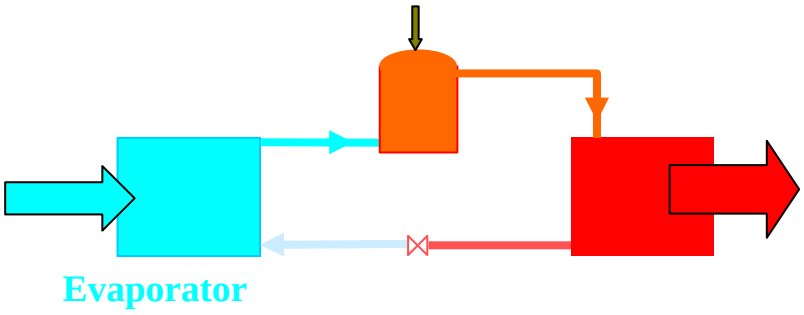
Energy is extracted from the air or from water condensing out of the air onto the evaporator.

A small amount of electricity required to operate the compressor.

Quantity of heat delivered to the water tank will be 3 to 5 times the quantity of electricity used.

“Free energy” extracted from the air.

ALTERNATIVE EVAPORATORS



Air source with fan

Standard air conditioner coil.

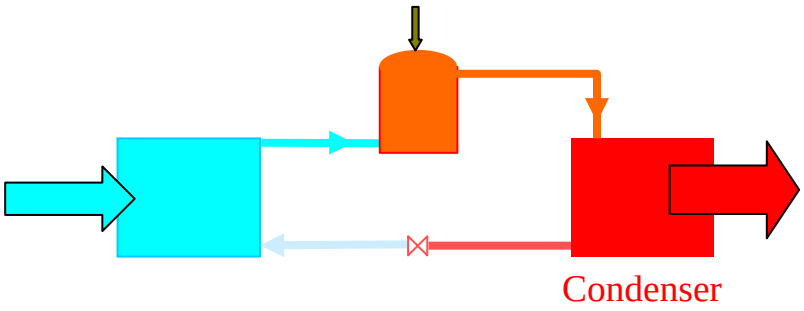
Air source without fan

Large plate with natural circulation air movement.

Solar boosted

Sun heats the evaporator.

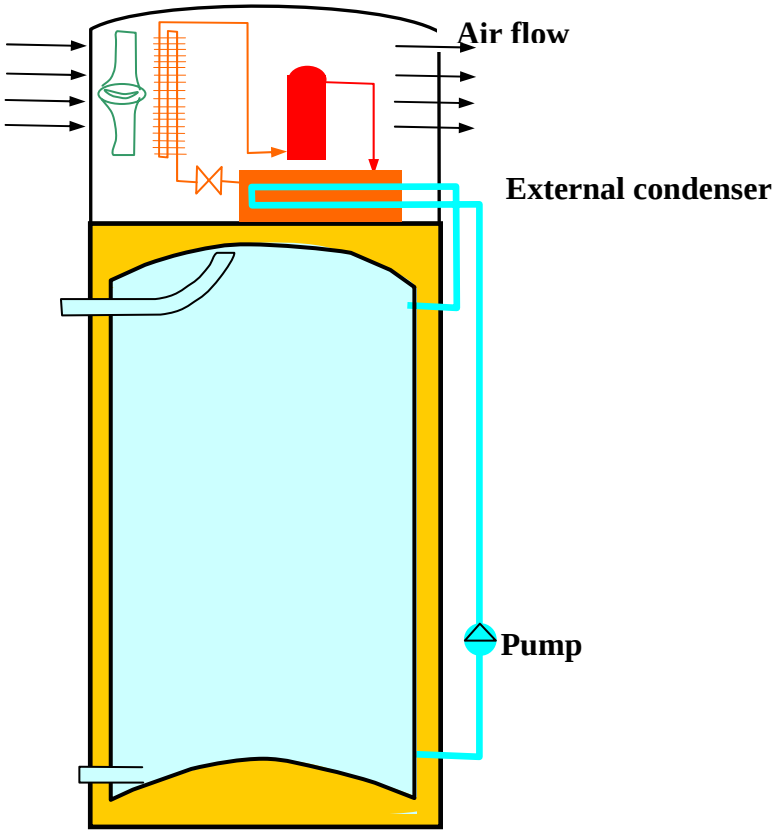
ALTERNATIVE CONDENSERS



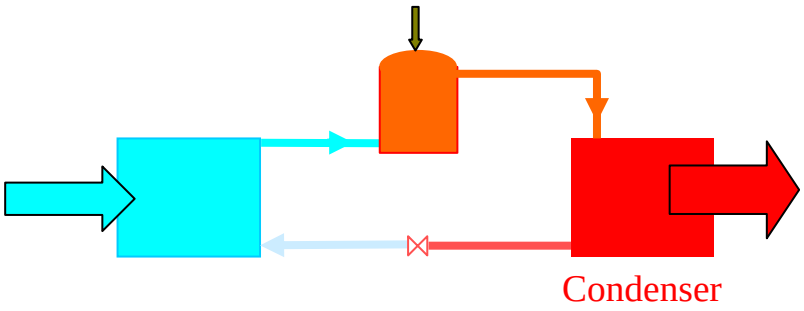
Condenser outside the water tank

Pump used to circulate tank water through the condenser or side arm heat exchanger with natural circulation.

Advantage – Heat pump completely separate from the tank.
Disadvantage – Requires a fan and a water pump.

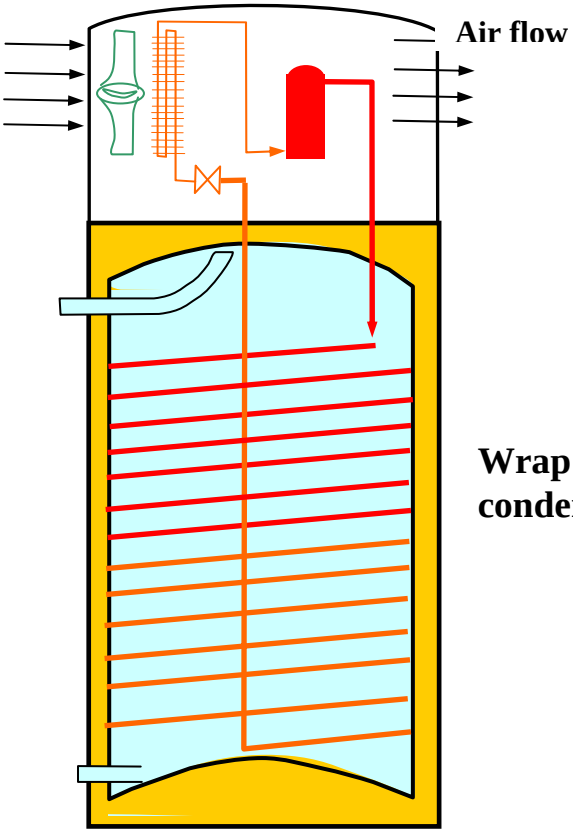


ALTERNATIVE CONDENSERS



Condenser tubing wrapped around the water tank.

Advantages – No water pump, good heat transfer to the tank.
Disadvantage – Tank and condenser are the one unit and must be replaced together.



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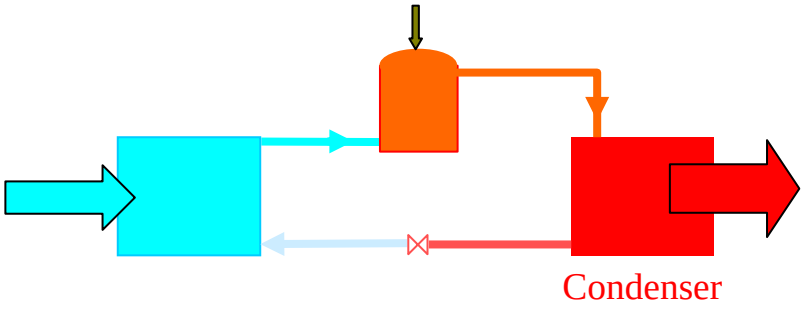
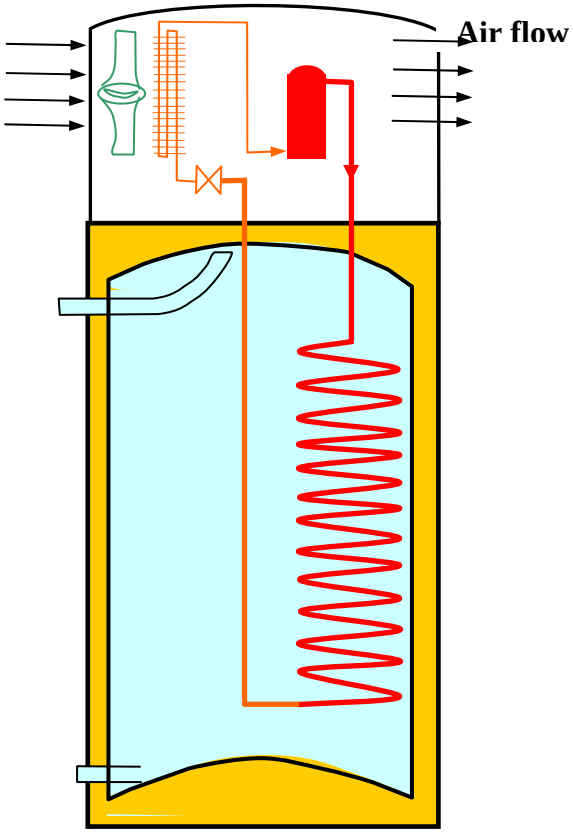


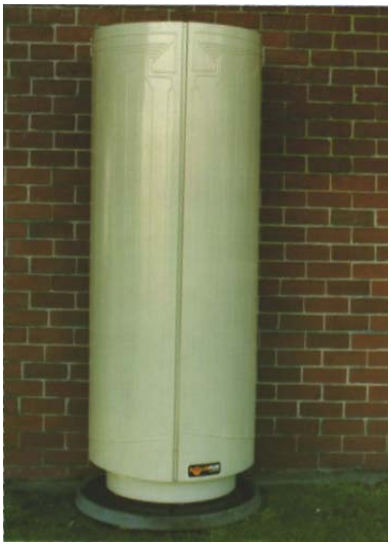
Condenser inside the water tank.

Advantage - Good heat transfer, no pump.
Disadvantage - Water side of condenser becomes coated with sludge.



ALTERNATIVE SYSTEMS

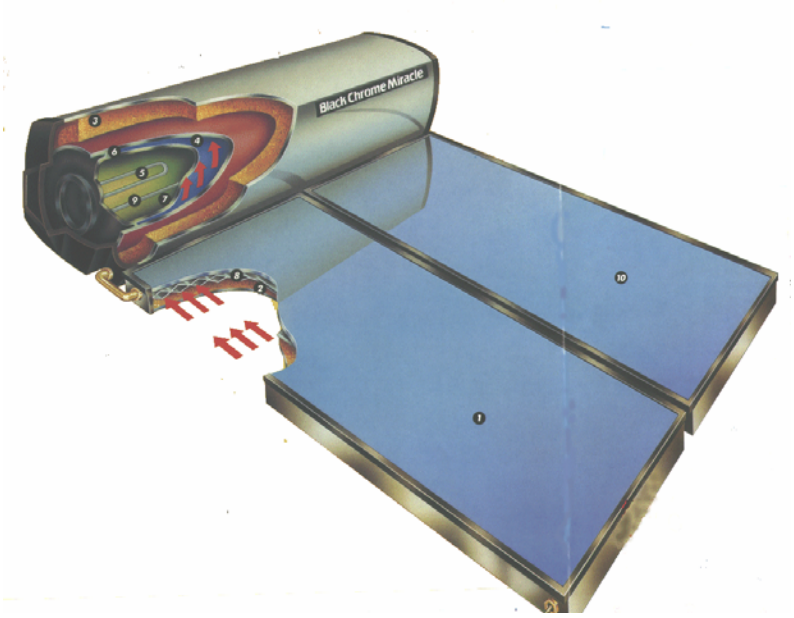
Air source systems with enclosed fan and evaporator on top of the tank.



Air source system with passive evaporator wrapped around the tank.

Solar boosted system with evaporator on the roof.

SOLAR OR HEAT PUMP WATER HEATER ?



SOLAR	HEAT PUMP
Totally free energy in summer, "Feel good factor".	Electricity required to make it work.
No moving parts.	Mechanical compressor and water pump required.
No polluting refrigerants.	Current R22 refrigerant must be replaced by a new low ozone impact refrigerant (Possibly propane based refrigerant).
	More expensive than solar.
Electric utilities do not like high power loading on rainy days.	Electric utilities will promote heat pumps due to low power loading on the grid.
No noise (unless it boils).	Possible noise from the compressor.

WHY WOULD A CUSTOMER CHOOSE A HEAT PUMP WATER HEATER IN PREFERANCE TO A SOLAR WATER HEATER ?

Easier installation.

Heat pump will work at night.

Heat pump can deliver more hot water over the day (continuous recovery).

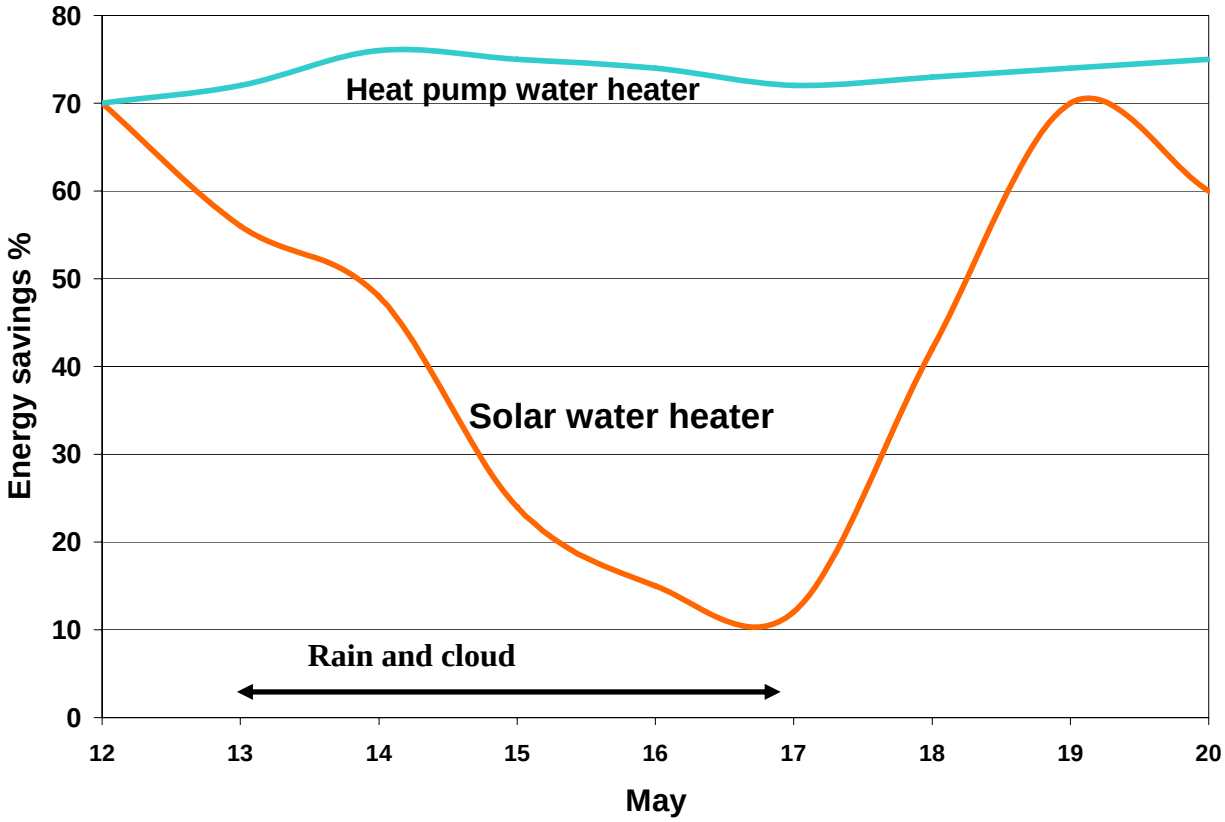
For a four person household the annual electricity use is similar to existing solar water heaters.

In a commercial installation the air duct can be connected to output of air conditioning system to give improved performance.

Heat pump works well in humid climates.
(Northern coastal Australia or Tropical parts of Asia)

HEAT PUMP PERFORMANCE ON RAINY DAYS

Heat pump works well on cloudy humid days.



BEST APPLICATIONS FOR A HEAT PUMP

In place of electric water heaters.

In residences occupied by 4 or more people where hot water use is high.

In warm climates where cooling may be also be of benefit (difficult to configure).

Where the evaporator can be combined with the outlet of an air conditioning duct.

In commercial applications where heat can be extracted from a hot plant room.

In locations with humid conditions.

Outdoors adjacent to a wall facing the equator.

WHERE NOT TO INSTALL A HEAT PUMP

In situations where hot water demand is low.

Unventilated cupboards or small rooms, unless a ducted air source is available.

In section of house that will be heated in winter.

Outdoors in climates that experience extreme freezing conditions.

Where noise from the compressor may be a problem.