Technology

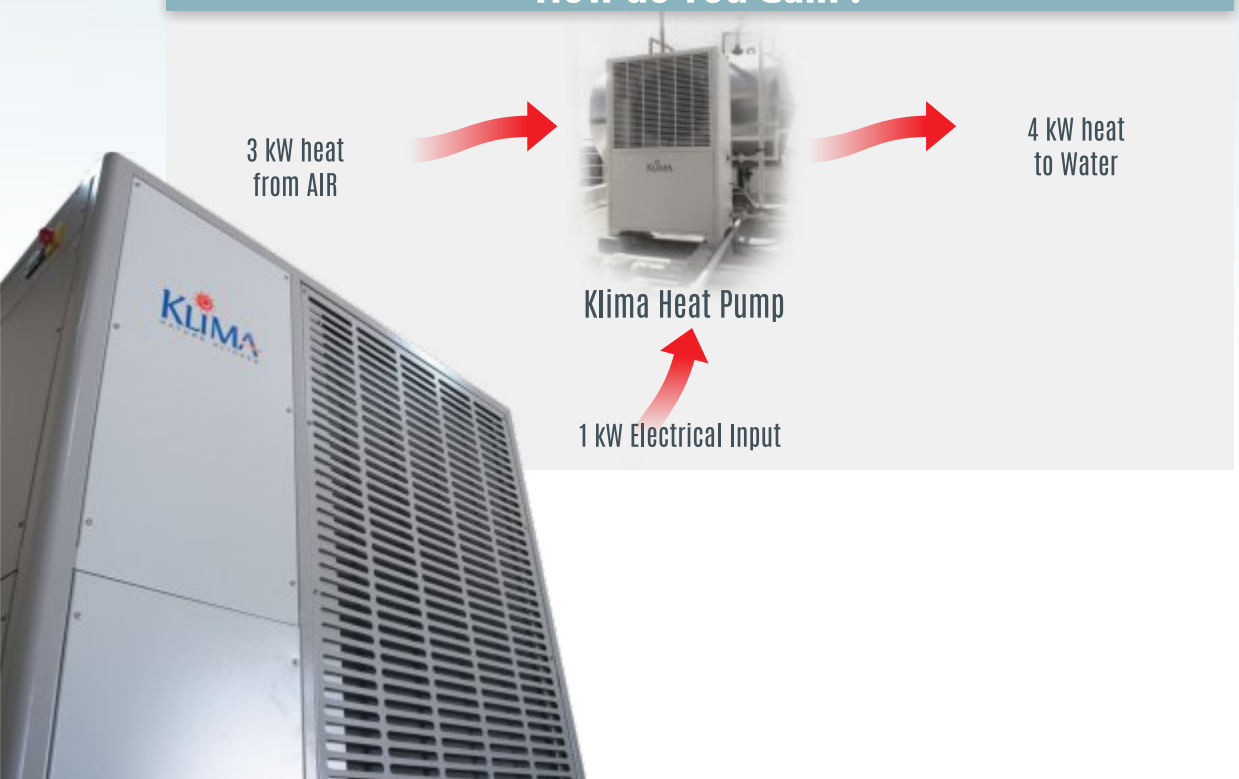
Heat Pumps extract solar energy from the atmosphere and use this energy to Heat Water. In this regard, they are very similar to solar water heating systems- the key difference is that the energy needed to heat water is extracted from the atmosphere and not from direct sunlight. This helps the heat pump to perform its duty throughout the year irrespective of weather conditions.

Ambient air at all temperatures above "absolute Zero" has inherent heat .The technology employed in heat pumps helps in harnessing this energy for productive purposes- one key application being heating of water for residential and commercial purposes. The principle on which a heat pump works is the vapour compression cycle of refrigeration.

The heat pump captures the atmospheric heat by circulating the air through an evaporator coil. The heat content in the air helps in vapourising an environmentally friendly refrigerant that is present in the evaporator. The refrigerant vapour is passed through a compressor where the refrigerant temperature is significantly raised. The hot gas is then moved around a heat exchanger through which the water is also circulated. The refrigerant undergoes a phase change and becomes a liquid. In this process the latent heat is transferred to the water and it gets heated to the desired temperature. The liquid refrigerant is passed through an expansion valve, where the pressure drops significantly and is send back to the evaporator. The cycle gets continued till the water reaches the desired temperature.

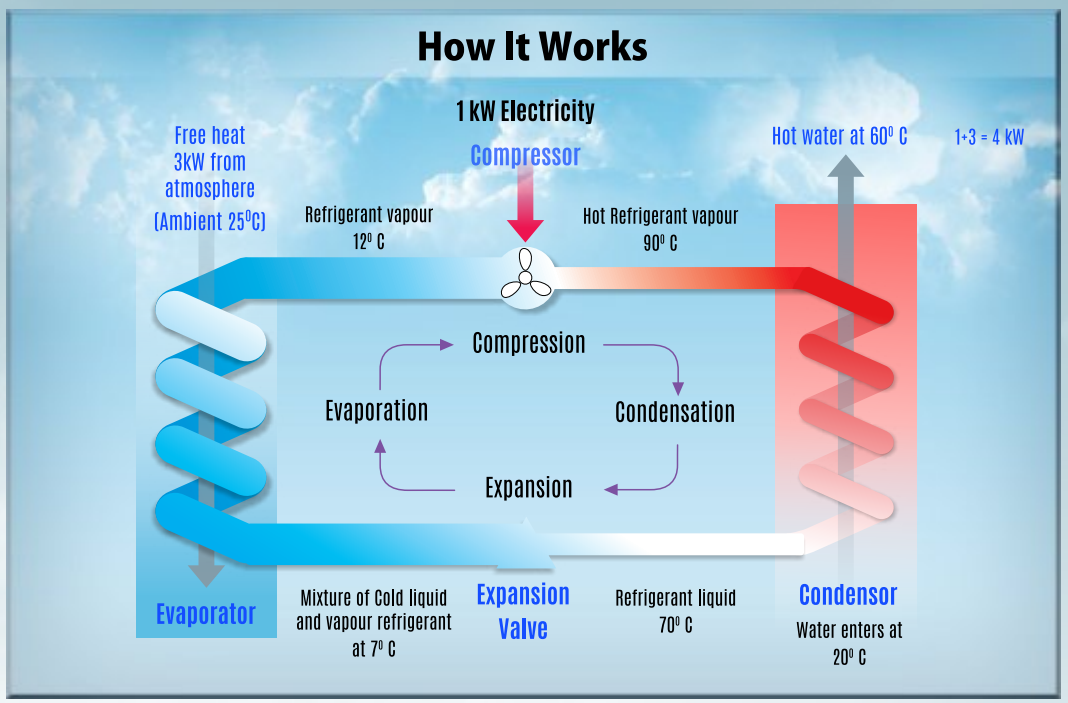
A heat pump can be viewed as a refrigerator working in the opposite direction.
Since energy is moved from the atmosphere to heat the water, the input energy needed is minimal. The resultant efficiency (COP) is very high as depicted in the illustration below.

How do You Gain ?



Refrigeration Cycle

The basic law governing the operation of a heat pump is the Boyle's law which states that Pressure and Volume are proportional to the Temperature. In a heat pump the volume is well defined and hence the variables are the pressure and temperature. This means that the temperature of the refrigerant in the circuit will increase if the pressure is increased.



Evaporator
In the evaporator, the heat absorbed from the atmosphere converts the liquid refrigerant to a gaseous state. The refrigerant is vapourised at a low temperature..

Compressor
The low temperature, low pressure gas is compressed to a very high pressure in the compressor. This results in the temperature of the gas being raised.

Condenser
In the condenser, the high temperature refrigerant transfers the heat to the water that circulates across the heat exchanger. In the process the refrigerant undergoes a phase change and becomes a liquid. By changing the pressure of the refrigerant, heat pumps allow large quantities of heat to be transferred specially at the condenser.

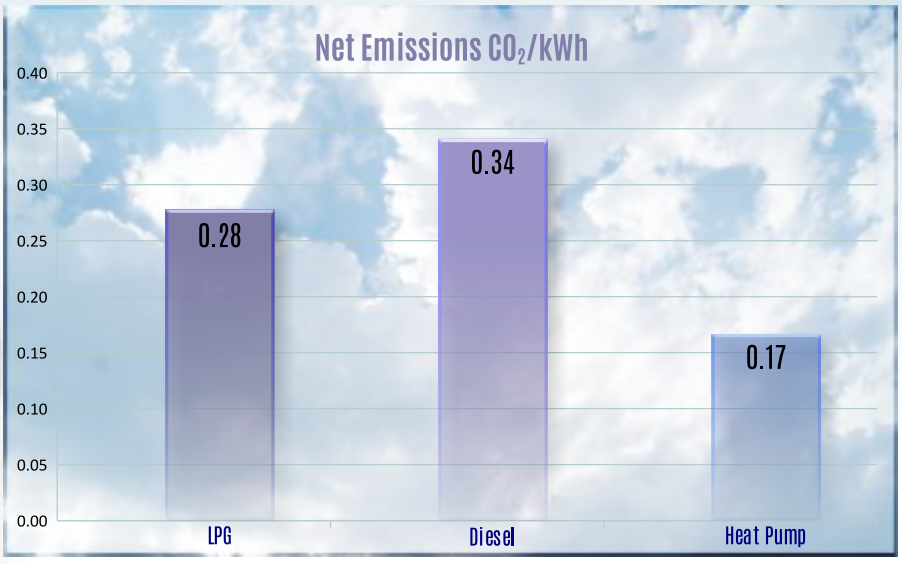
Expansion Valve
The high-pressure refrigerant liquid from the condenser enters the expansion valve and leaves it in a liquid state at a very low pressure. This low pressure ensures that the refrigerant can boil at very low temperatures as it enters the evaporator.

Energy Efficient & Environmentally Friendly Choice

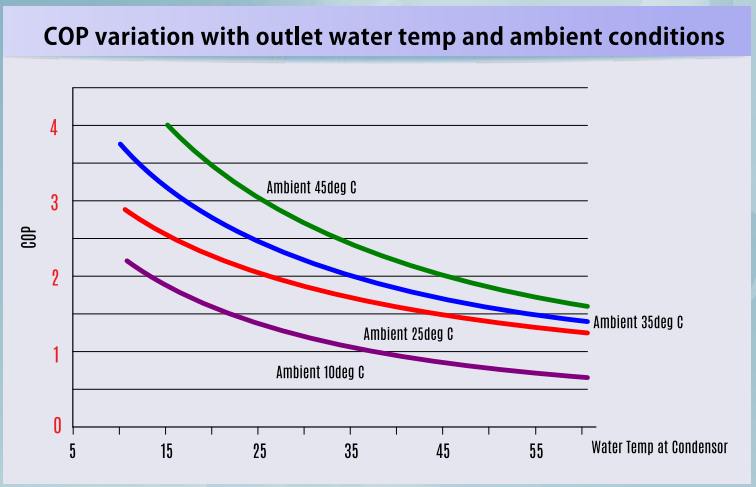
As explained in the working principles of the heat pump, it is evident that for every 1 unit of electric energy input that is provided to the heat pump, the machine is capable of delivering 4 units of heat energy to the water. Compare this to efficiency levels of <1 of most traditional heating systems, heat pumps offer a unique approach for reducing the energy consumed in heating water. On a global level this amounts to a large reduction in energy consumption (and subsequently energy generation), as water heating is one of the most energy intensive processes both for residential and commercial applications. Given below is a comparative chart that provides easy comparison between the various forms of heating for heating 1000 litres of water.

Heating Method	Wood Boiler	Diesel Boiler	LPG Heater	Electric Geyser	Solar with electric Hybrid	Heat Pump
Heat Source	Wood	Diesel	LPG	Electricity	Solar+electricity	Atmospheric Heat+Electricity
Green rating	Very low	Low	Low	Moderate	Moderate	High
Safety	Low	Moderate	Low	Moderate	Moderate	High
Cop value	0.7	0.8	0.8	0.96	NA **	4
Heat content	3500 kCal.kg	10150 kCal/kg	11100 kCal/kg	860 kCal/kWh	860 kCal/kWh	860 kCal/kWh
Heat available	2450 kCal/kg	8100 kCal/kg	8900 kCal/kg	817 kCal/kWh	2838 kCal/kg	3440 kCal/kg
Unit energy cost(Rs)	8	56	55	8	8	8
Energy consumption	12.25kg	3.7 kg	3.4 kg	37 kWh	37 kWh	8.7kWh
Annual Energy cost(Rs)	35770	75628	68255	108040	46990	25404

In addition to the positive aspect of being significantly efficient compared to traditional water heating systems, heat pumps also offer a environmentally friendly choice for heating water. In a heat pump, fossil fuels are not used to heat water- resulting in a direct reduction of the carbon footprint. Moreover, the refrigerant that is employed in our systems is R134a which is considered environment friendly.



The efficiency of a heat pump is a function of various factors including the ambient temperature, relative humidity and the temperature at which the hot water is desired. This is illustrated in the diagram shown here. These factors need to be kept in mind while sizing the hot water system.



Tips to save hot water

Ensure that hot water pipe lengths are kept to the minimum by installing the system as close as possible to the point of usage.
Ensure that the heat pump is sized correctly for the application
Use efficient showerheads for optimal flow rates
Insulate the storage tank and hot water pipelines properly
Set the hot water temperature at optimal levels
Ensure that the heat pumps and storage tanks are serviced regularly

Technical Information

Model Description	KLIMA HP 180	KLIMA HP 250	KLIMA HP500	KLIMA HP 750	KLIMA HP 1000
Heating Capacity (Litres/Hr)	180	250	500	750	1000
Heating Capacity(kW)	6	9	18	26	36
Power Input(kW)	1.8	2.5	4.5	7	9
Power supply	230V 1Ph 50Hz	230V 1Ph 50Hz	400V 3Ph 50Hz	400V 3Ph 50Hz	400V 3Ph 50Hz
Rated Current	9	11	8	12	18
Unit Dimension(mm) H*W*D	1100*600*460	1200*700*460	1200*700*460	1500*1200*600	1500*1200*600
Floor space needed(sq.ft)	3	4	4	8	8
Weight(kg)	150	150	180	280	300
Refrigerant	R134a	R134a	R134a	R134a	R134a
Compressor type	Scroll	Sroll	Scroll	Scroll	Scroll
Heat Exchanger Type	SS Plate	SS Plate	SS Plate	SS Plate	SS Plate
Fan	Direct Drive, 4 blade	Direct Drive, 4 blade	Direct Drive, 4 blade	Direct Drive, 4 blade	Direct Drive, 4 blade
Number of fans	1	1	1	2	2

Rating Conditions: Capacity ratings are at 25 degree C, 55% RH, water entering Heat exchanger at 35degree C. Maximum water temperature is 60 degree C.
Specifications are subject to change due to continuos product development activities

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