



HEAT PUMPS

HEAT PUMPS

A Key Component For Energy Efficiency and Low Carbon Future.

Energy Saved is Better Than Energy Produced because it Saves in Resources.

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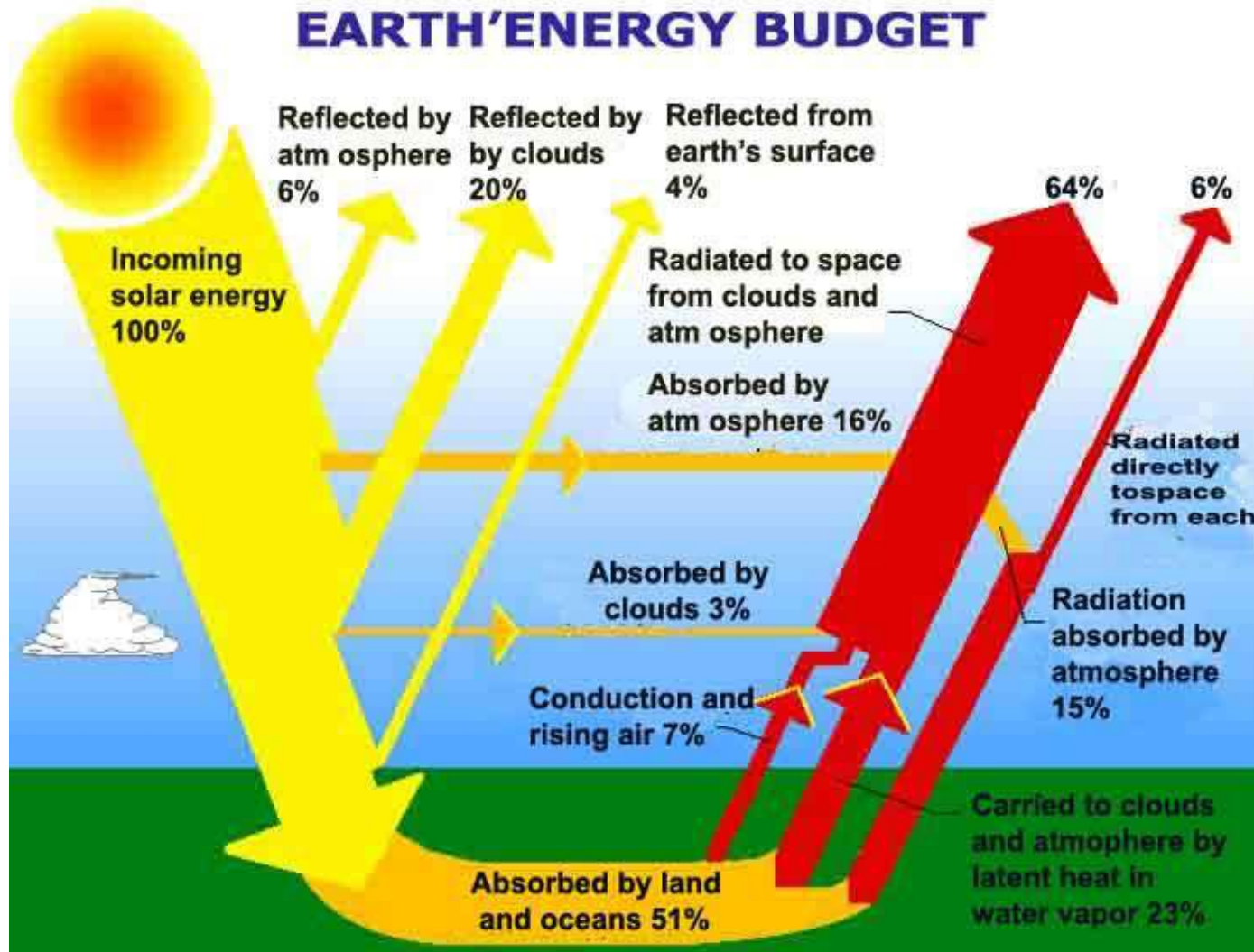
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EARTH'S ENERGY BUDGET





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INTRODUCTION



**Heat Pump offers triple dividend:
low carbon emission,
energy efficient
& renewable**



Gem in Energy Efficiency and Renewable Use

ORIGINAL EUROPEAN TECHNOLOGY

Tri Aqua Heat Pump System

Designed & Manufacturer :



Hi-Tech

Hi-Tech Equipments L.L.C.

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Hi-Tech Equipments Heat Pump System Cuts Your Heating And Cooling Costs Up To 70 %.





With Hi-Tech Equipments Heat pump

We can

- ◆ **Use** renewable energy from air, water and ground for heating and cooling and cut your heating cost by 70 %.
- ◆ **Integrate** a larger share of electricity from renewable source in to grid
- ◆ **Reduce** greenhouse gas emission,
Provide a stable affordable energy supply,
- ◆ **Contribute** to sustainable energy future.



Hi-Tech Equipments Heat pump

is only Equipment in which You invest for

Domestic water ,Swimming pool or

Industrial process heating and

get back your investment within three years

by saving energy and reap up benefit for 10

years



Company Introduction

- ◆ Hi-Tech Equipments Heat Pump system taps the constant temperatures of the earth or take energy from air to provide heating, cooling and hot water.
- ◆ Your rooms stays comfortable year around while trimming your energy use by up to 80%.
- ◆ Hi-Tech Equipments Heat Pump System are not only a good investment, They are cleaner choice for environment.

Application

Domestic Hot Water



Room Heating



Swimming pool heating & cooling



Domestic Hot Water



Room Heating



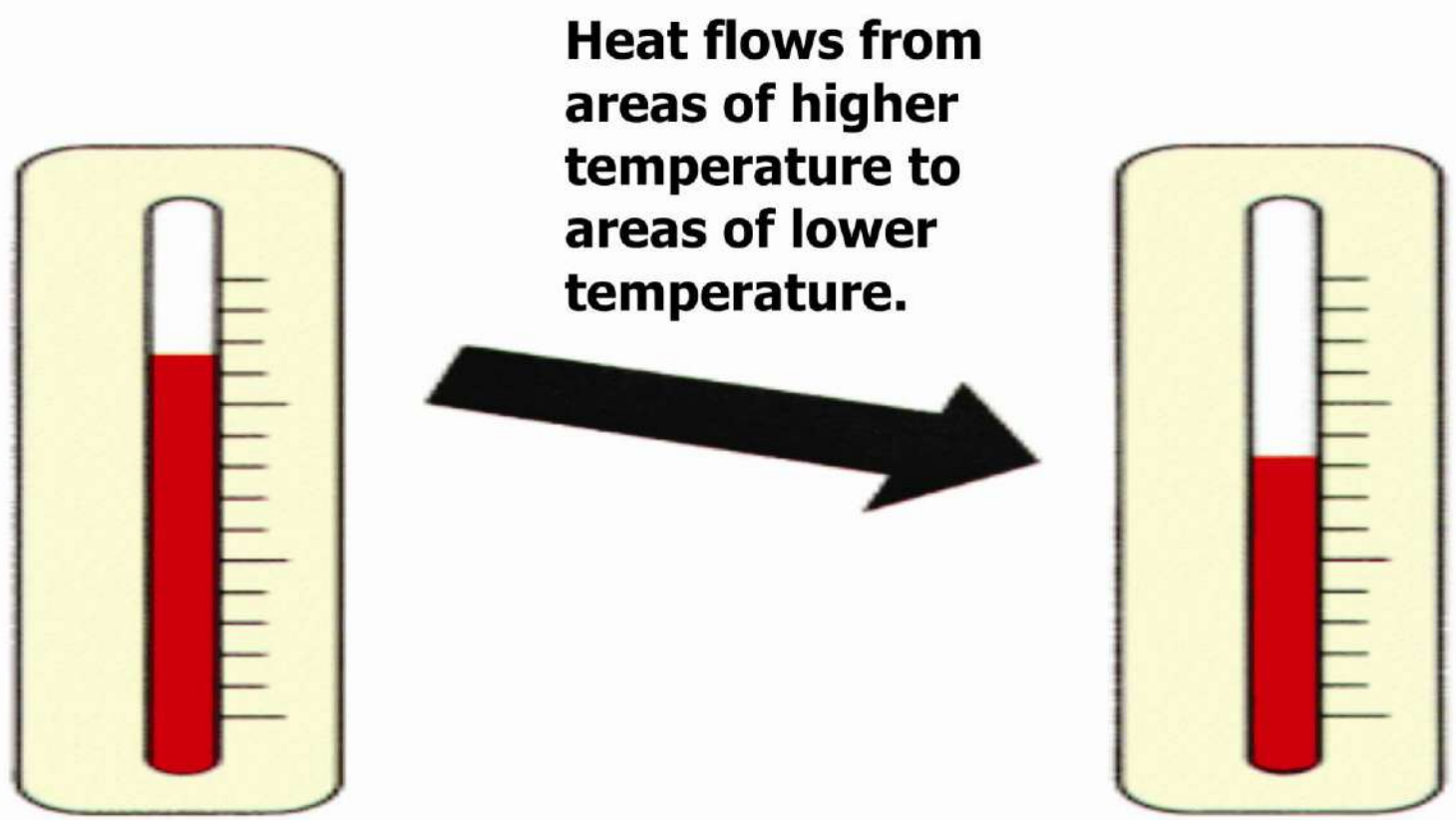
Room Heating



Room Cooling



We apply principle of thermodynamics



Conservation Of Resources With High Energy Content

It is not good for nation to burn resources, no matter if it is oil, gas, coal or wood, To heat water for domestic consumption for temperature 50 deg C

We should preserve our resources of high energy content for high temperature application , to increase industrial production of the nation

We do not need a 2000 Deg C hot flame to produce hot water of temperature of 50 deg C



The History of the Heat Pump



Heat pump is Discovery not Invention

The Principle of the "heat pump" or 'refrigeration machine' was discovered in 1824 by french scientist Sadi Carnot . In 1834, Jacob Perkins, an American engineer, designed an apparatus which artificially produced ice and was the forerunner of our modern vapor compression systems.

In 1850 British scientist Lord Kelvin put forward applying reverse Carnot cycle in heating system and then lot of engineers and scientist devoted time in to researching heat pump.

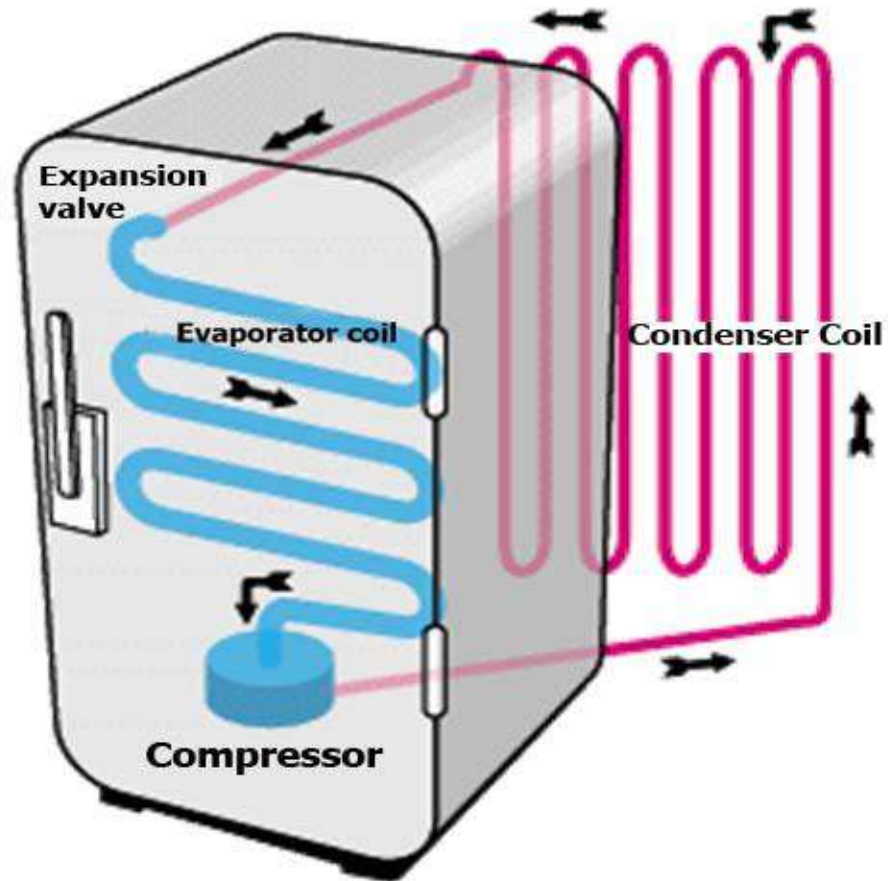
In 1921 , A set of river source heat pump was set up in Zurich, this was the first heat pump in the world . And in 1950 Heat pump started developing for commercial market .

In 20 th century oil prices getting higher heat pump became the best source of hot water heating

All Refrigerating Devices Produce Heating and Cooling Simultaneously, Principle of Heat Pump and Refrigerator is Same

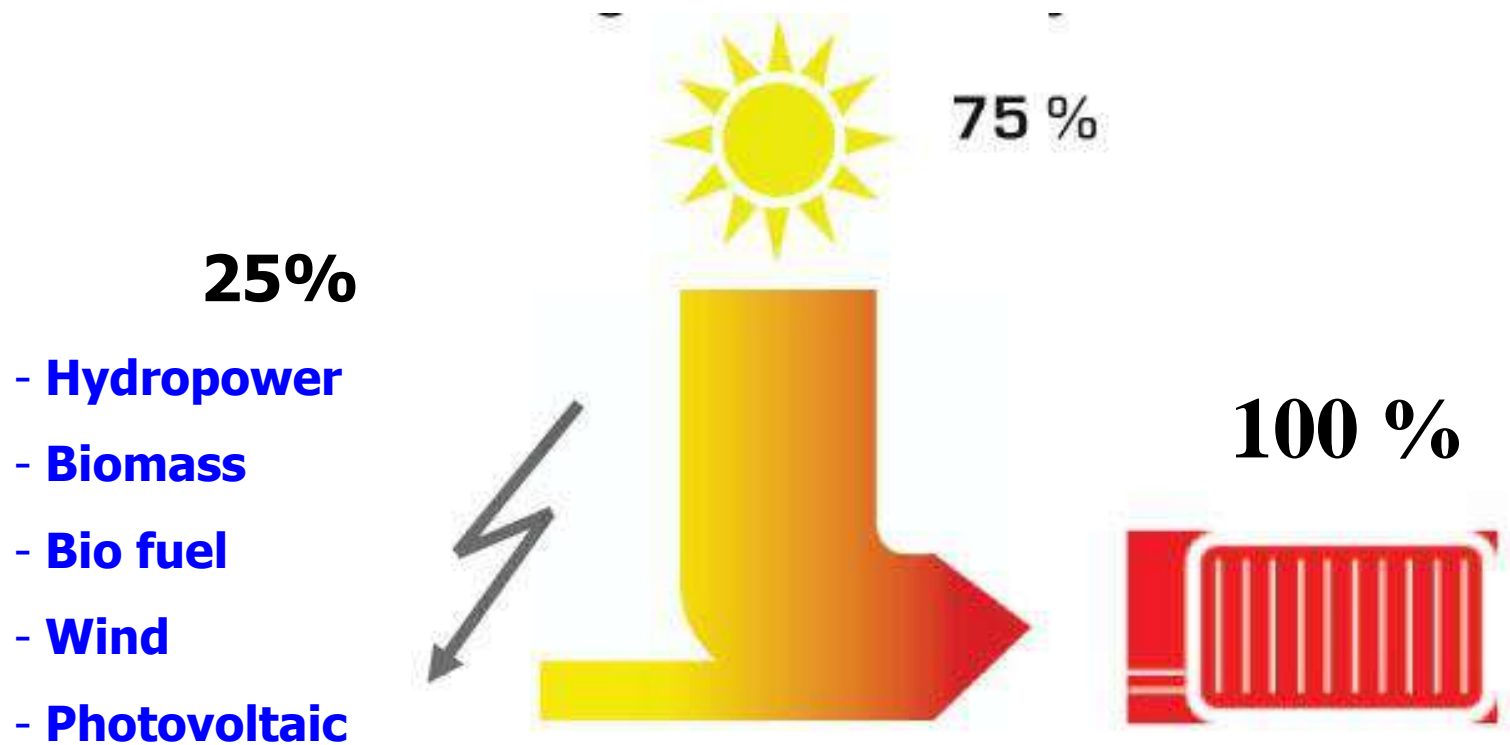


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Energy Flow of a Heat Pump

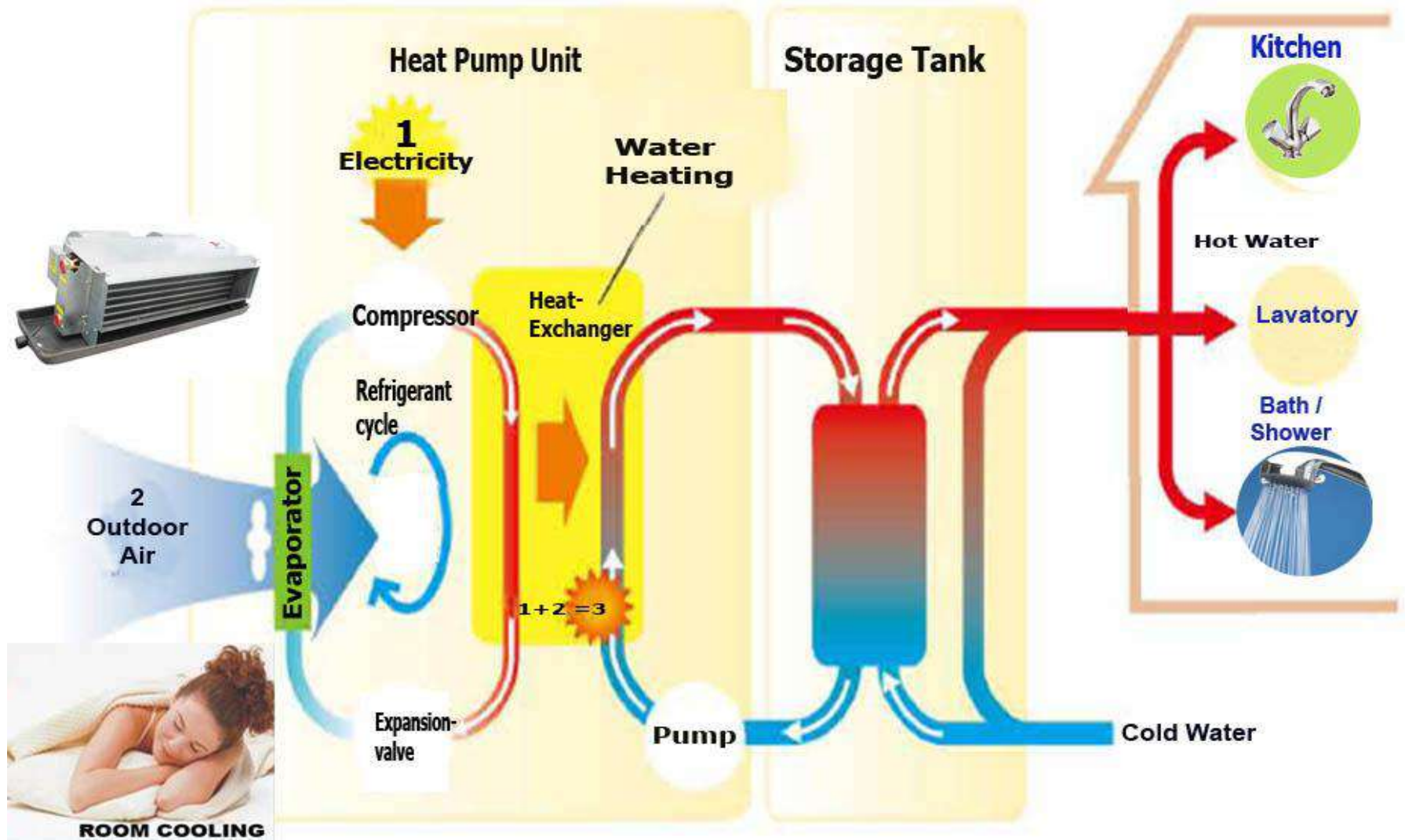
We utilize 25% energy from green-electricity and 75% from ambient heat (air, water , earth)



Working Principle of a Heat Pump

- A heat pump is device moving heat energy from one place with lower temperature to another place with higher temperature.
- Heat pump extracts heat from air, water or earth and upgrade to higher temperature before being delivered to central heating system or hot water tank.
- Heat pump also has ability to do reverse and provide a cooling system at warmer times of the year
- Heat pumps are very economical, capable of cutting your heating bill up to 70%

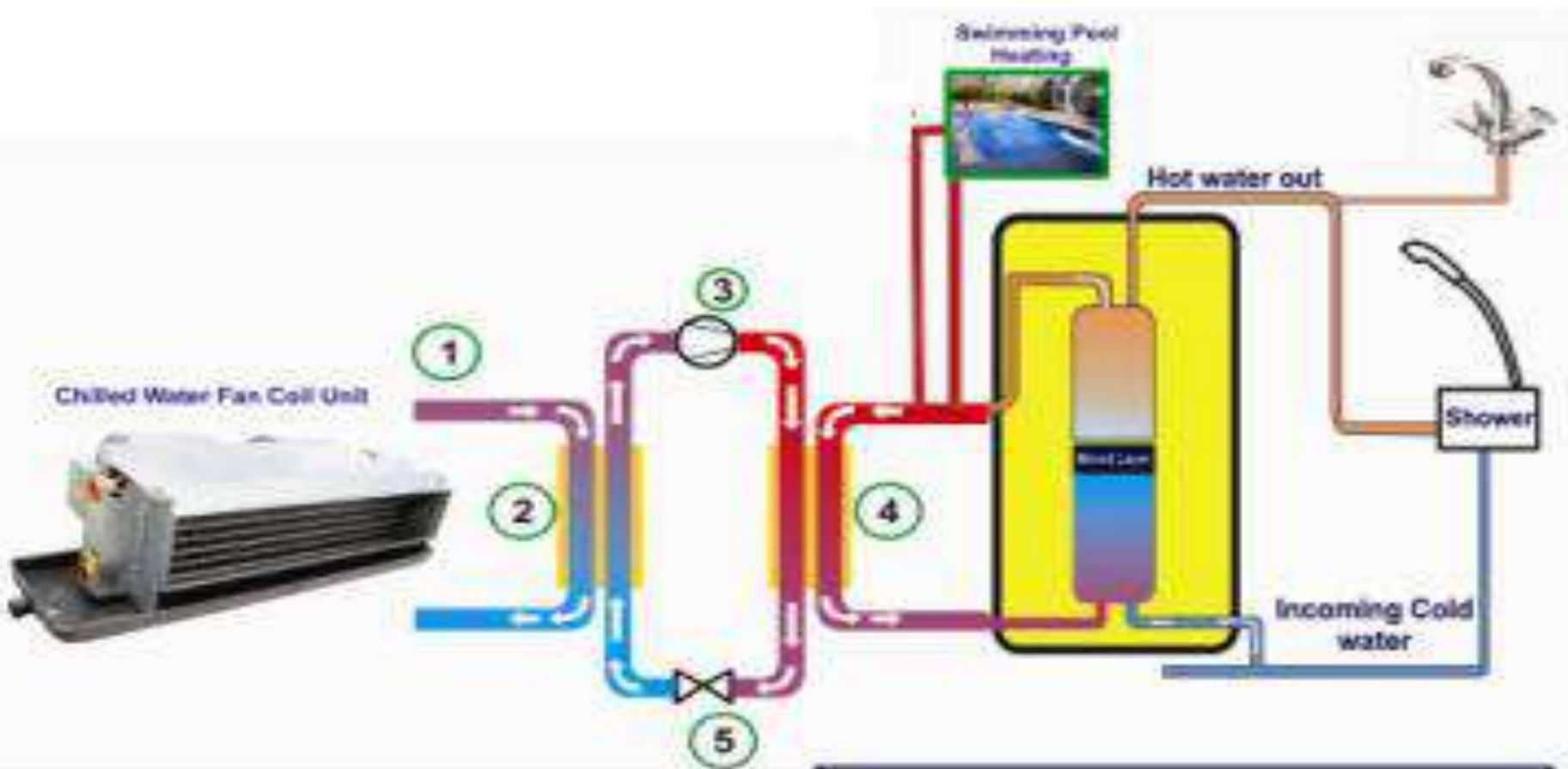
Working Principle of a Heat Pump



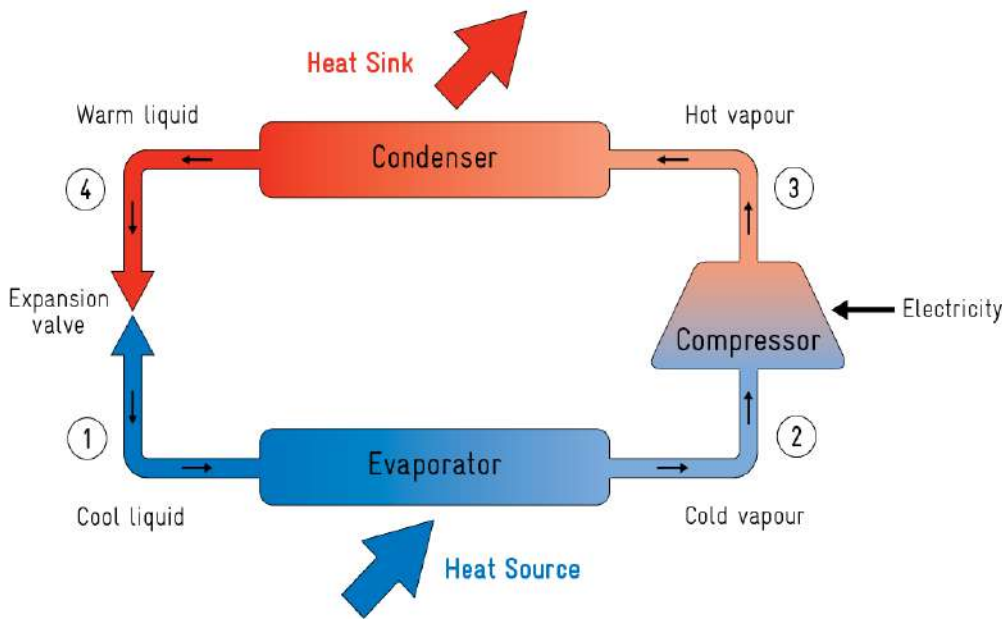
Working Principle of a Heat Pump

- (1) Brine circulates in a collector loop and absorbs heat energy from the bed rock, ground, air or water.**
- (2) In heat exchanger (evaporator) the brine in the collector loop meets the refrigerant circulating in the refrigerant loop. The refrigerant absorbs the energy, heats up and turn into gas.**
- (3) A compressor increases the pressure of the refrigerant by doing so temperature climbs to required heating level**
- (4) In a second heat exchanger (condenser) the refrigerant releases its heat to the heating system (hot water) in the house and refrigerant cool down.**
- (5) Refrigerant continues to circulate in an expansion valve its pressure falls , this reduces the temperature and refrigerant returns to liquid form
The process repeats when refrigerant again meets the brine.**

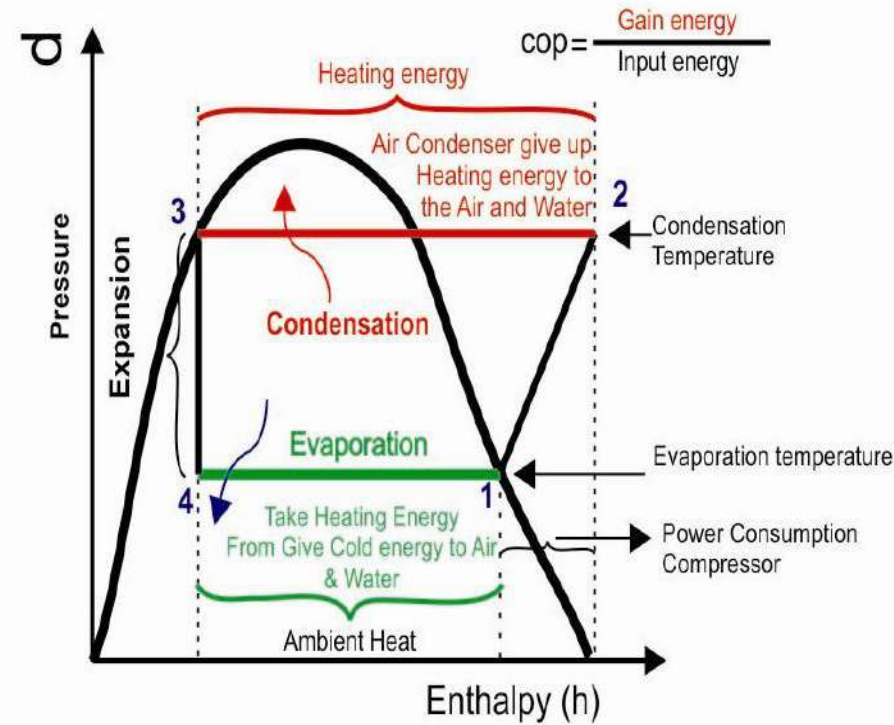
Working Principle of a Heat Pump



Working Principle of a Heat Pump

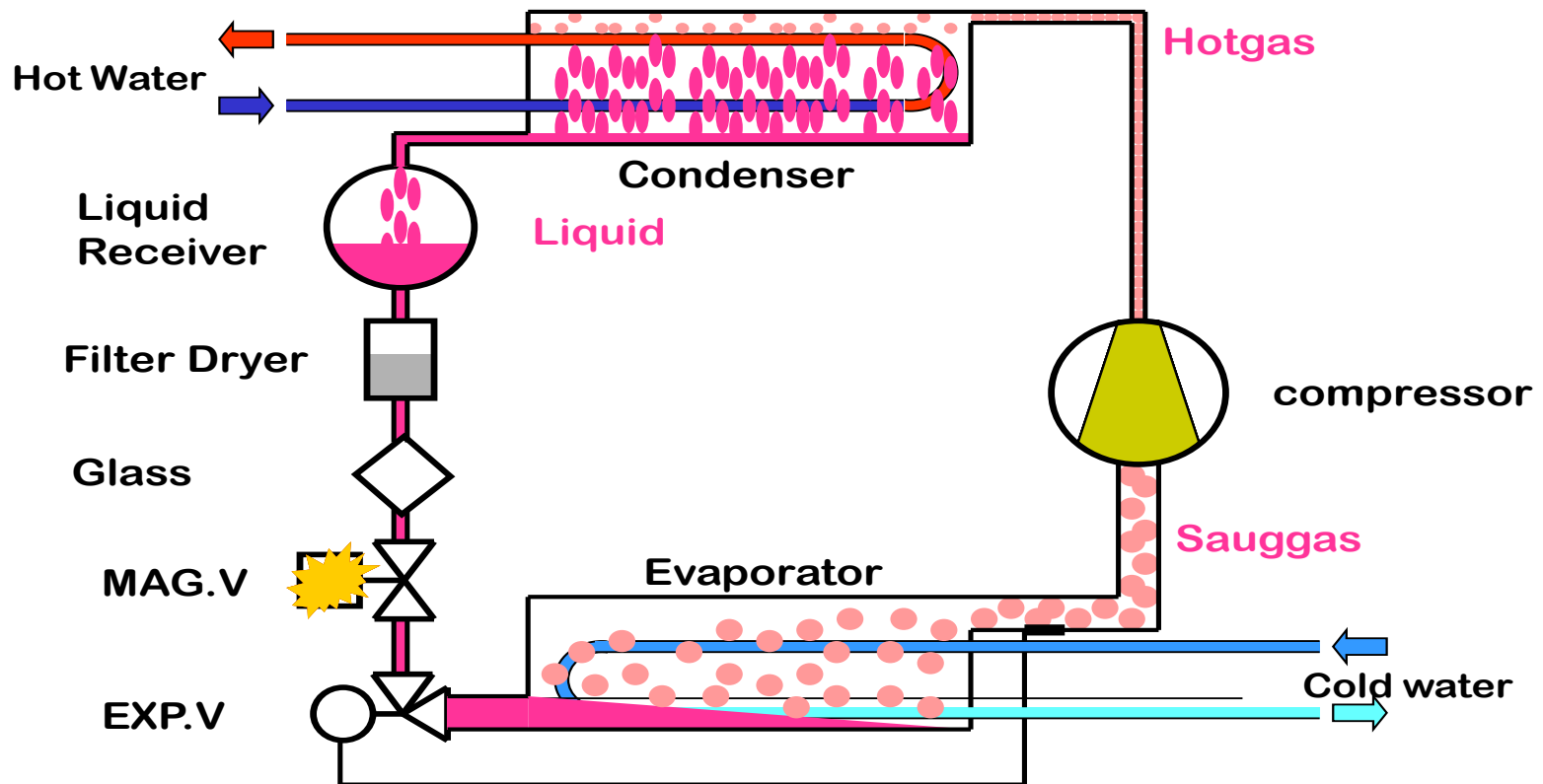


The workings of a heat pump



Smaller ΔT during evaporation and condensation \Rightarrow greater is COP

Working Principle of a Heat Pump



Economics of Heat Pump

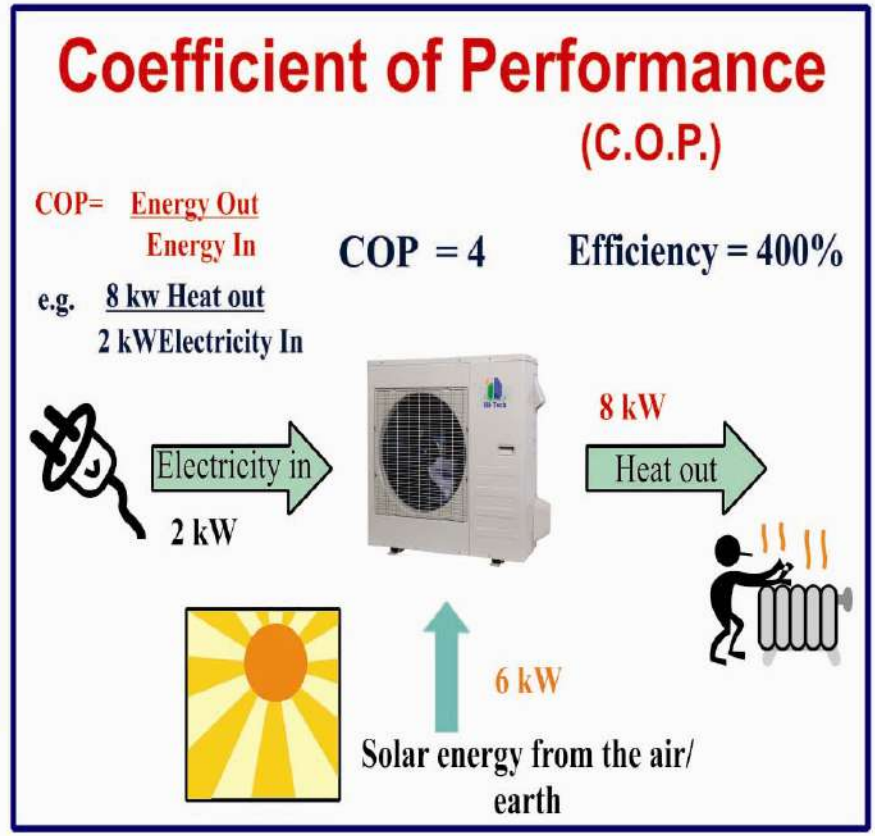
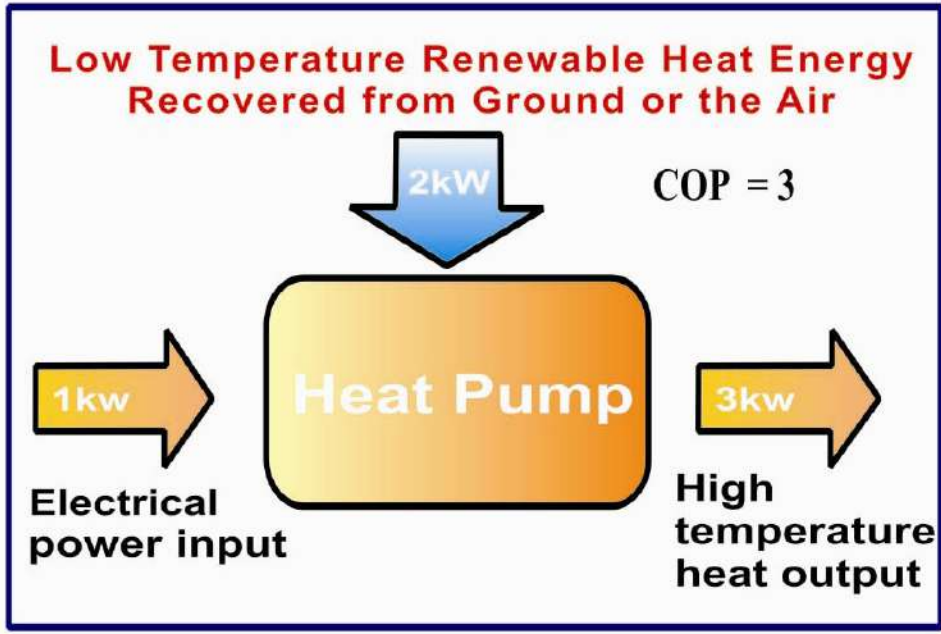
Coefficient of performance (COP)

The amount of heat the **heat pump** produces compared to the total amount of electricity needed to run it. The higher the COP, the less electrical energy is required to deliver a given amount of heat. A high COP is good performance, and a low COP shows poor performance.

System efficiency

The amount of heat the heat pump produces compared to the amount of electricity needed to run the **entire heating system** (including domestic hot water; supplementary heating; and pumps). This report's conclusions and recommendations are based on the measured system efficiency

C.O.P of Heat Pump



Heat Energy Output Ratio of Various Existing Heating equipments

Heat Energy Output Ratio of Various Existing Heating equipments

Electric Domestic Water Heater



Hi-Tech Equipments Heat pump



Gas, or Oil Fired Boiler



Huge Potential with High-Rise Buildings, Villa, Hotels & Laundries

- Presently conventional inefficient system
- heat pumps offers following benefits :
- Heating and cooling,
- Highly efficient,
- Safe recourses and protecting climate,
- Absolutely no emission at site,
- No supply of fuels needed,
- No storage of fuels needed,
- Dependable energy supply / independence of fuel supply crisis / Political influence
- Accountable operating costs



Our Solution To City Like Dubai,

- 1) Declare Dubai as heat pump city , Start making mandatory for building which are older than 10 years to convert existing domestic water heater in to heat pump water heating system , because they have already used for 10 years and Depreciated investment / asset of Electric water heater in ten years .
- 2) If you make conversion of 10 % of building in the city in first year You will start saving 260 MW power per day from the beginning of the second year and will save 2600 MW at the end of 10 years by implementing conversion of domestic electric water heater to heat pump or Solar water heating system with back up of heat pump .You can offer incentive for villa, individual apartments and real estate owners for lowering power consumption
- 3) Make mandatory for new building to implement heat pump and solar water heater combination as source or equipment for domestic water heating
- 4) Great reduction of power by Implementing over 10 years for converting residential buildings, commercial premises to use heat pump technology for heating of domestic and swimming pool water
- 5) carbon emission cut i.e. for every 100 MW saving you will cut carbon emission cut by 60,000 Kg
- 6) Consumer is getting back your investment with profit in 5 years time as per our calculation offered in subsequent pages above .



Heat pump V/S Electric heater for swimming pools & central air condition system.

Size of Pool = 5 x 12 MTR x @ 1.5 Meter depth, Volume of Water = 90m³
Heating capacity required = 85 kW

S.NO	Description	Electric	Heat Pump
1	Heating capacity	85Kw	85
2	Efficiency of system	95%	300%
3	Power input required	90kW	28kW
4	No. of Hours of operation	14	14
5	Power consumption per day KW	90x14 = 1260	28 x14=392

392 kW of input power to heat pump produces = 980 K.W if cooling load per day i.e. 278Ton of Cooling now if you are using central air conditioning for this capacity you will consume Electric power , which will be 323 K.W. hours per day (C.O.P. OF most efficient air conditioning cooling is 3.03 i.e. 1 K.W. of electric power produces 3.03 KW of cooling load)

Nett power consumed by heat pump per day 392-323 = 69 kW per day. After considering cooling benefit

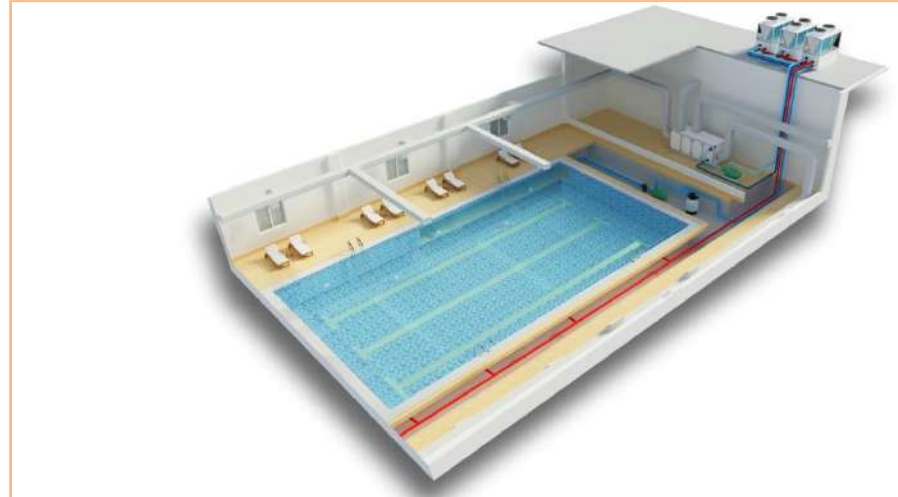
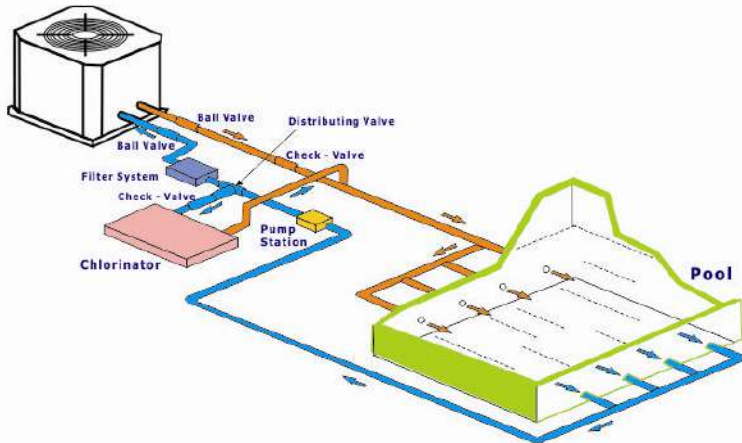
6	Net power consumption after considering cooling benefit Nett power consumption without considering cooling	1260	69 kw 392
7	Cost of electricity per day. 1 K.W.= \$0.11	\$ 138	7.59
8	Energy cost per year considering heating of pool required for 210 days (7 Months)	\$ 28980	\$ 1593
9	Cost of equipments with pipe work	\$ 2000	\$ 12000
10	Consider 10 %, Interest on capital 10 %, Depreciation for heater & 10% Depreciation for heat pump. yearly interest plus depreciation	400	\$ 2400
11	Total cost of operation per year with considering cooling benefit Without considering cooling benefit	\$29380	\$ 3994 \$11455
12	Net saving per year because of heat pump after considering cooling benefit net saving without considering benefit		\$ 25386 \$17925

Triple Benefit

- So you are Depreciating completely equipment in 10 year
- Yearly saving \$ 17925 /- per year i.e. within 1 ½ year you will receive your capital back
- And above this you can use heat pump for cooling water in summer and

Solution for Swimming Pool Application : Swimming Pool Heating in Winter & Cooling in Summer.

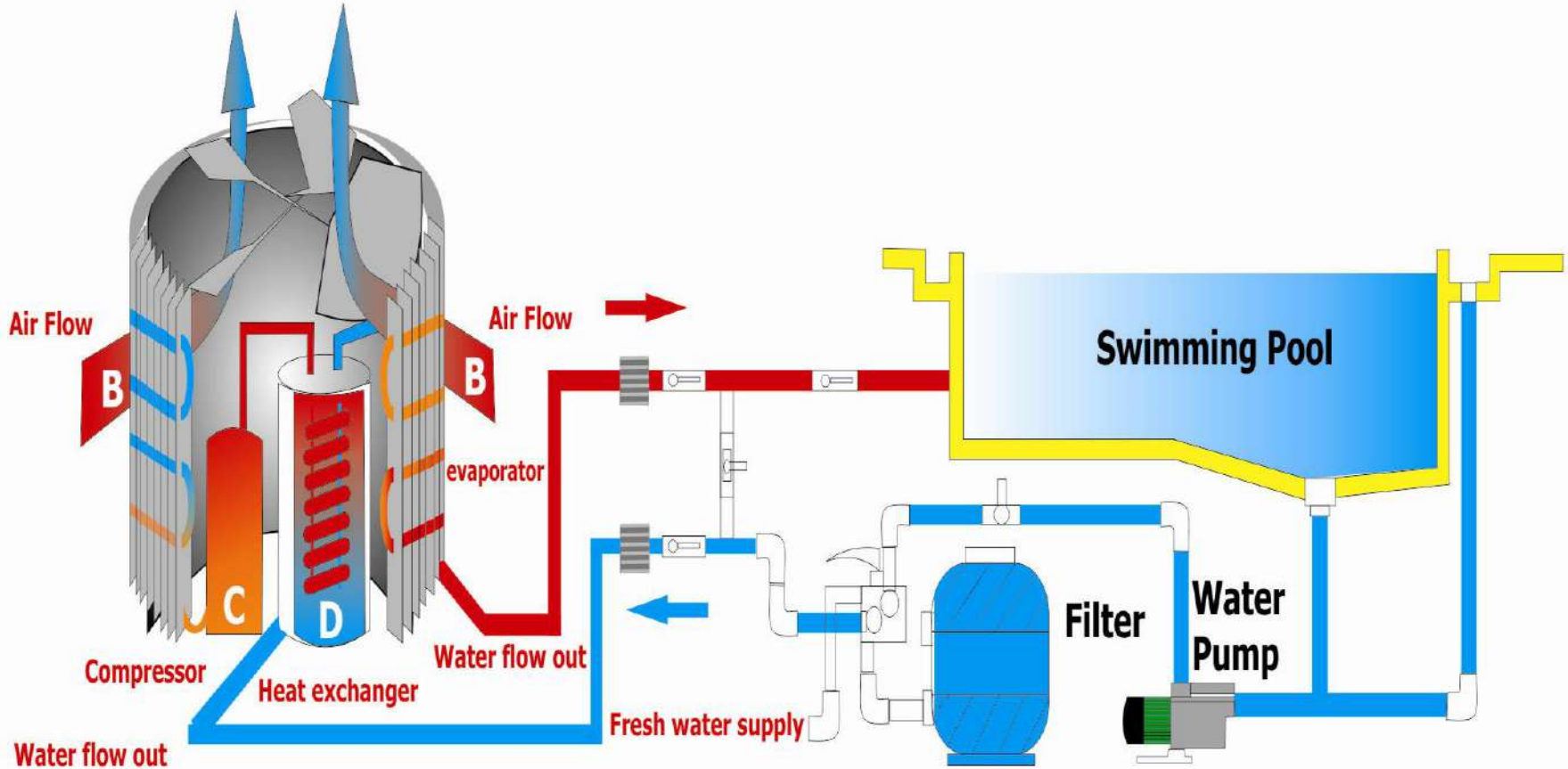
Layout of pipe line for Heat Pump for swimming pool.



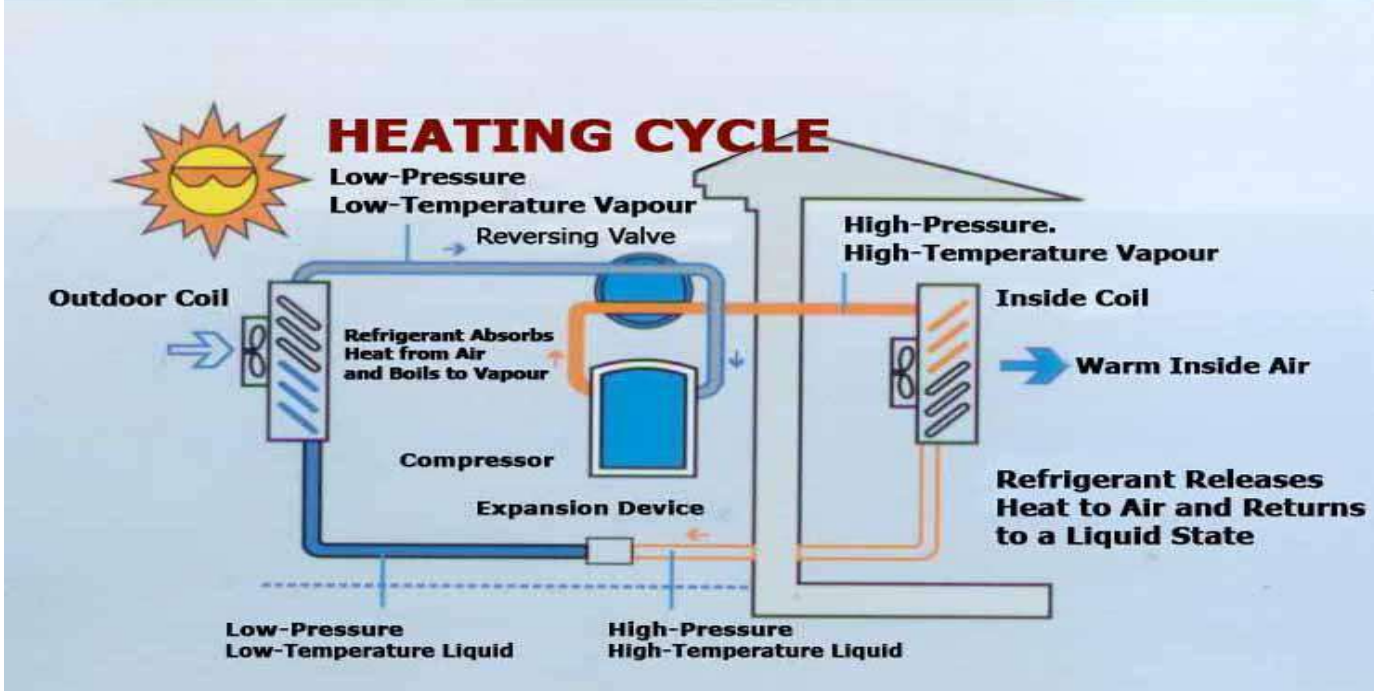
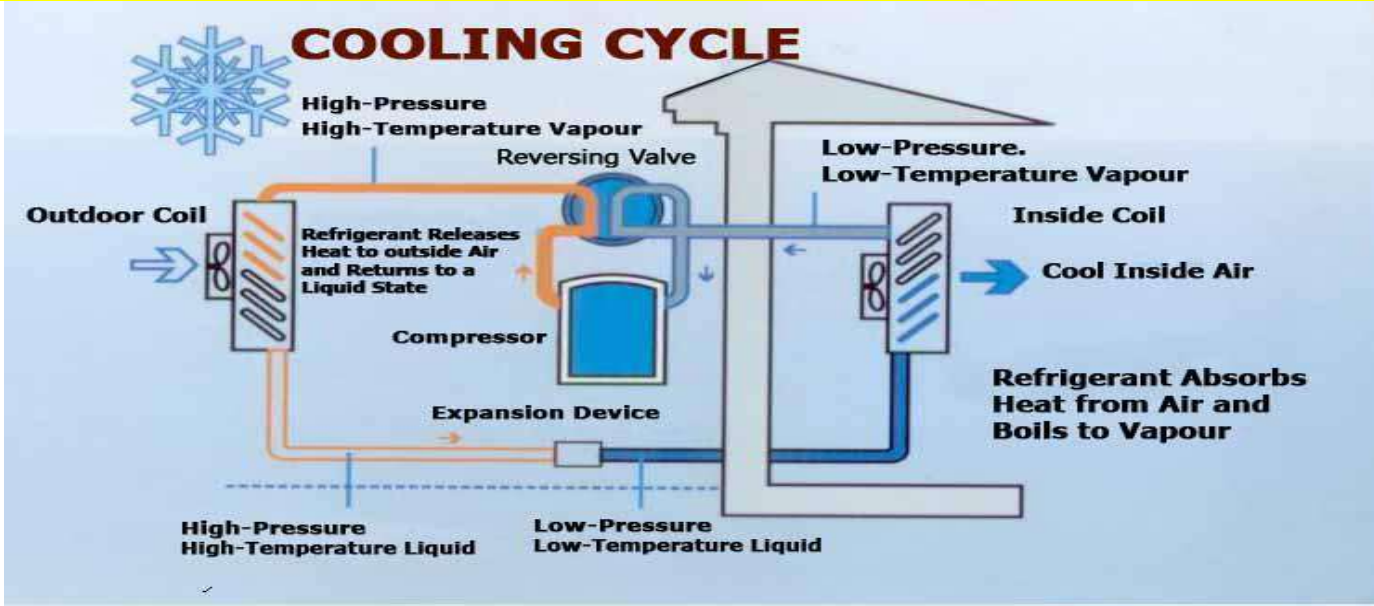


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HOW DOES HEAT PUMP WORK FOR SWIMMING POOL



How does heat pump works for swimming pool



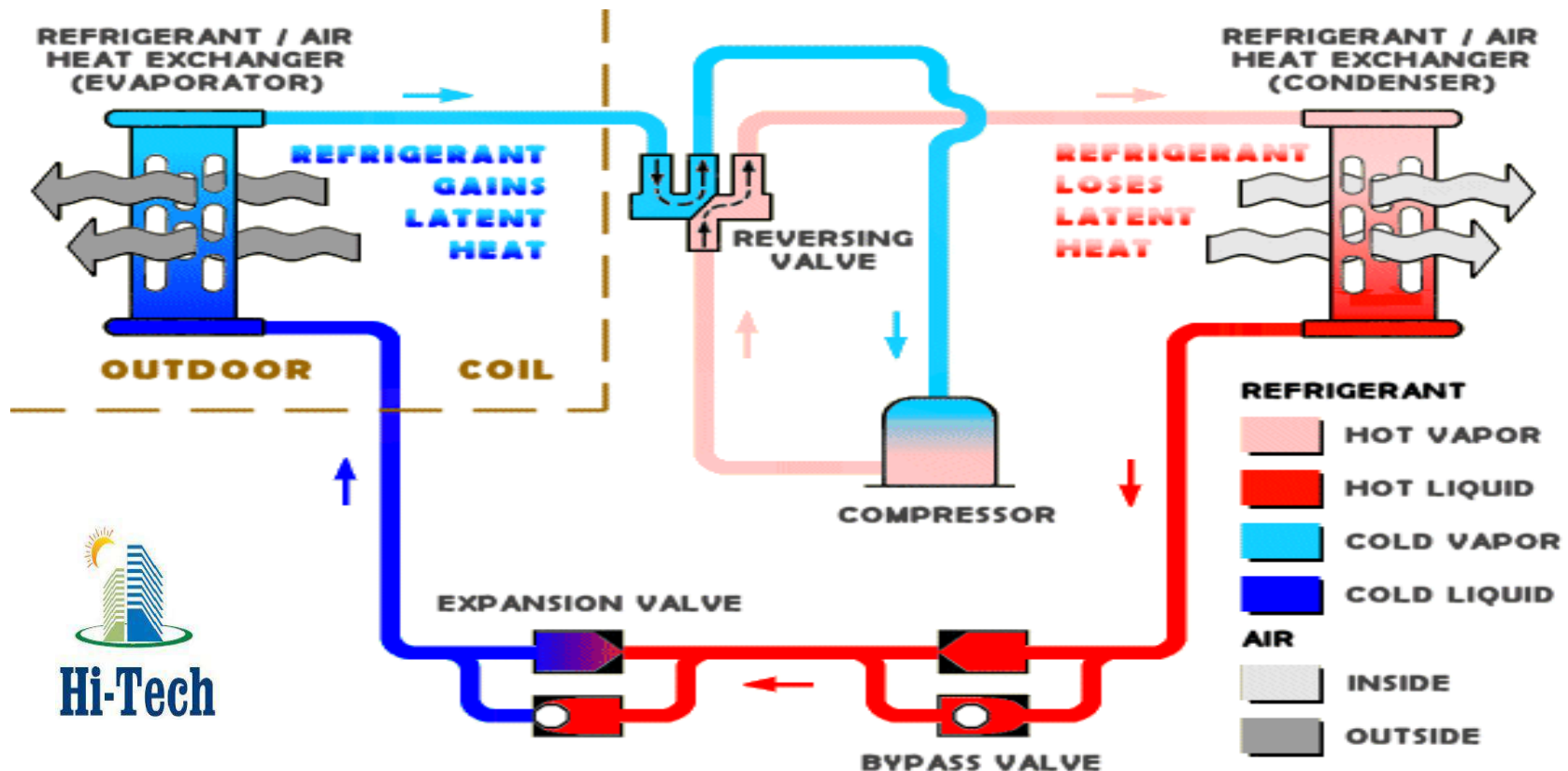
Our Solution for Apartments to solve space constrain,

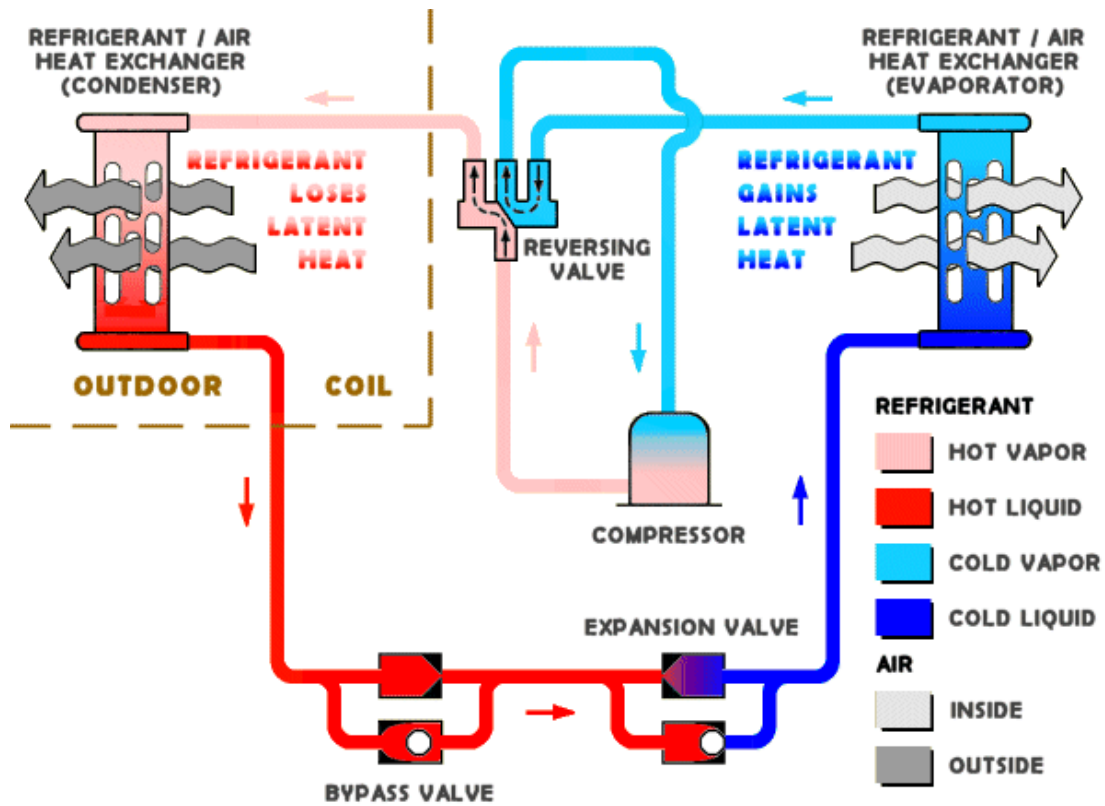
Hot water tank will be mounted in false ceiling & cool air will cool the lobby or kitchen till hot water is heated , i.e. free hot water heating ,when cooling the kitchen, or lobby



Air-source heat pump in cooling mode.

As shown in Figure 7, the reversing valve can be switched to heating mode such that the high-pressure output of the compressor is directed toward the indoor coil, which now acts as a condenser where the refrigerant gives up its latent heat to the room. It is then expanded in the reverse direction (compare with Figure 6) and vaporized in the outdoor coil, where it gains latent heat from the outside air. The refrigerant vapor then goes through a U-bend now on the other side of the reversing valve, and returns to the compressor where the cycle begins again.





Product photo of water to water Heat Pump



Photo of air to water Heat Pump





Hi-Tech

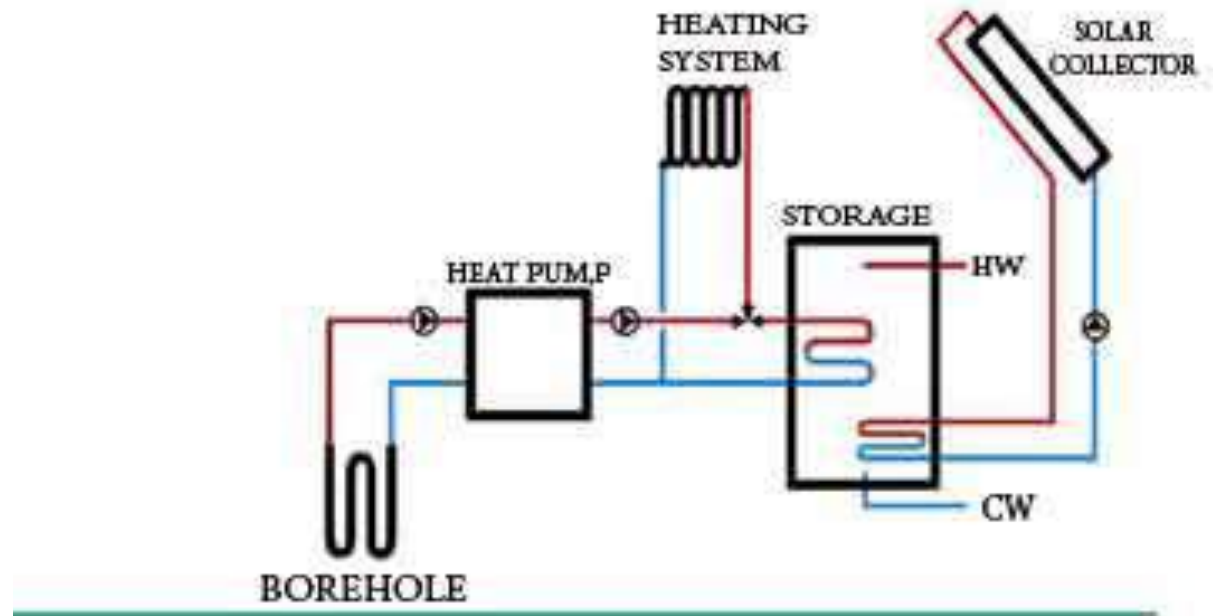
Solar + HP system Examples

Type 1 - One beside the other

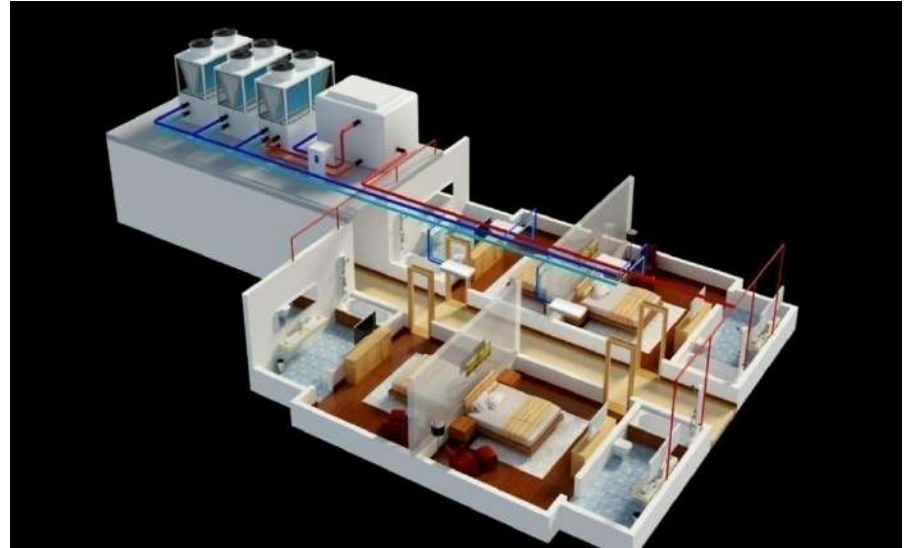
(Typically offered by producers of heat pumps and/or solar collectors like viessmann vaillant nibe bosch themotechnik..)

. System components do not directly interact

. Control systems " " " " " "

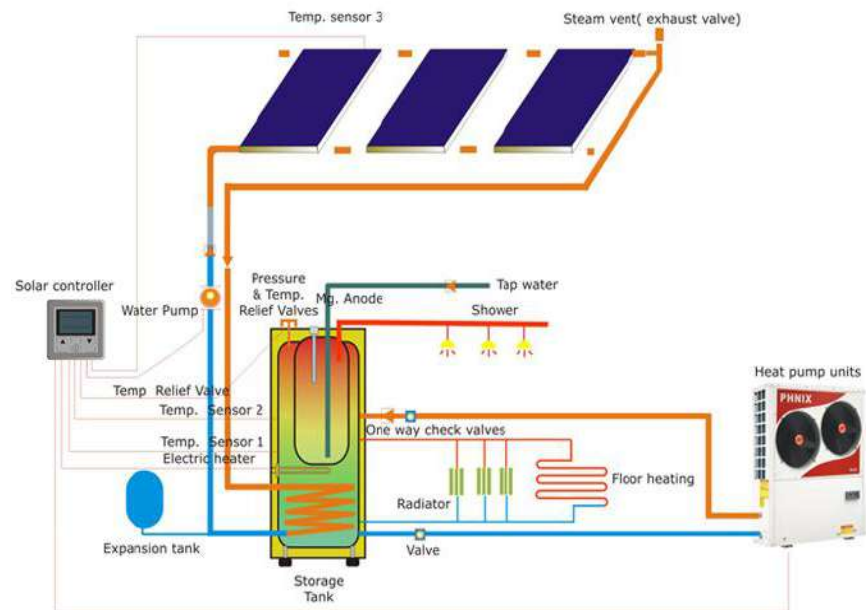


Our solution for Villa.

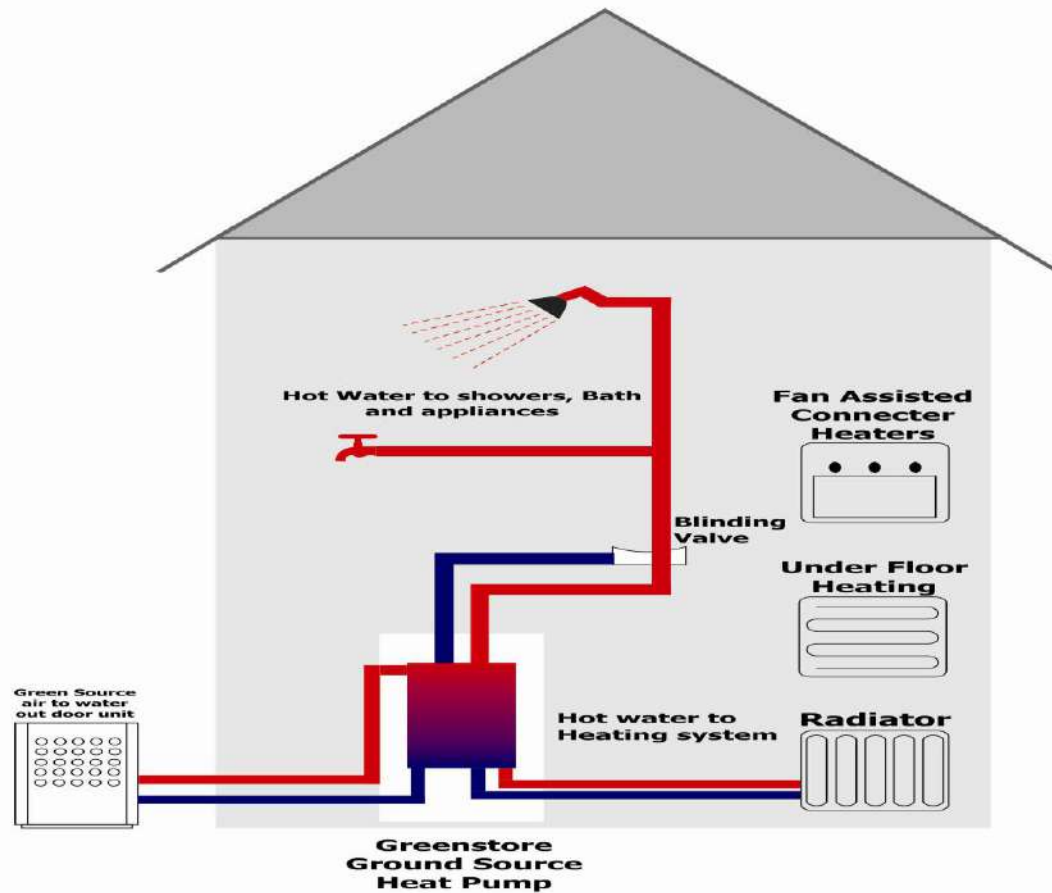




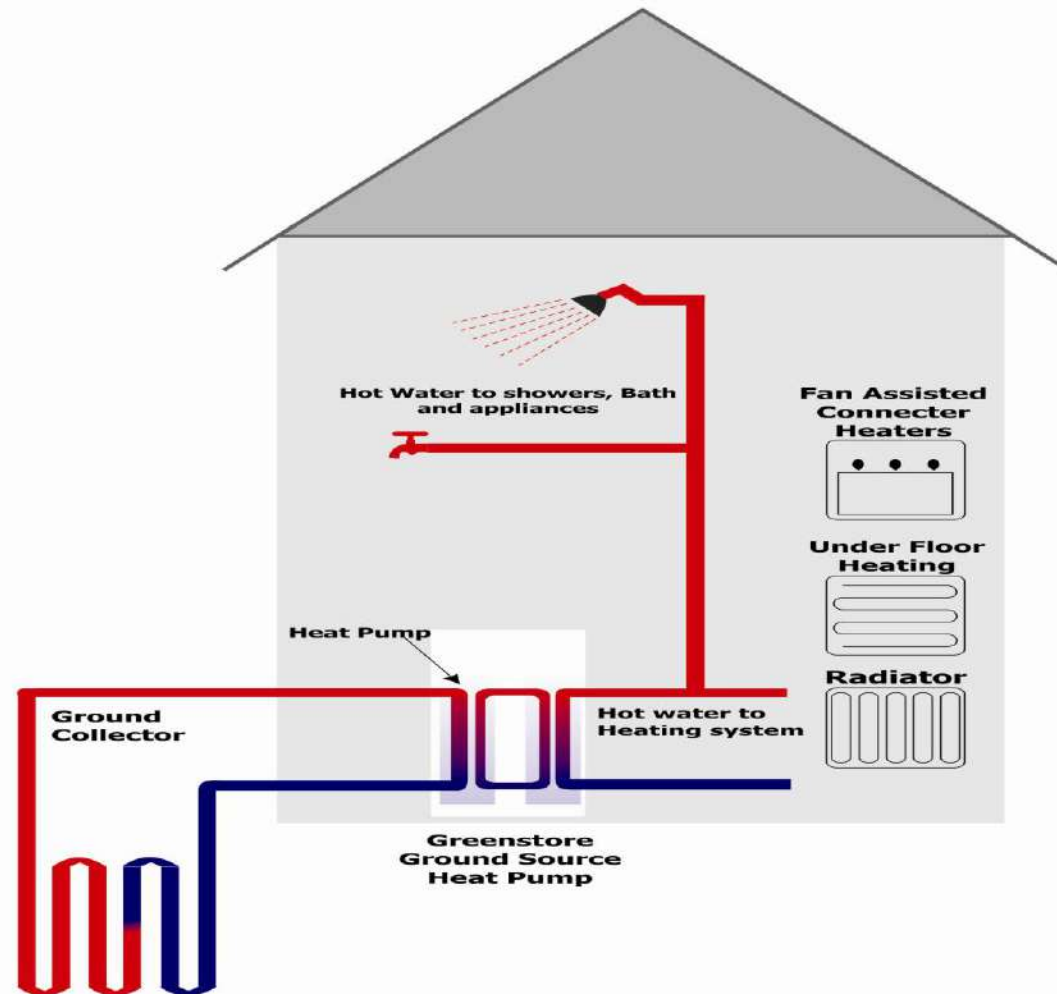
Our solution for villa along with solar water Heater



Layout Diagram For Air Source Heat Pump

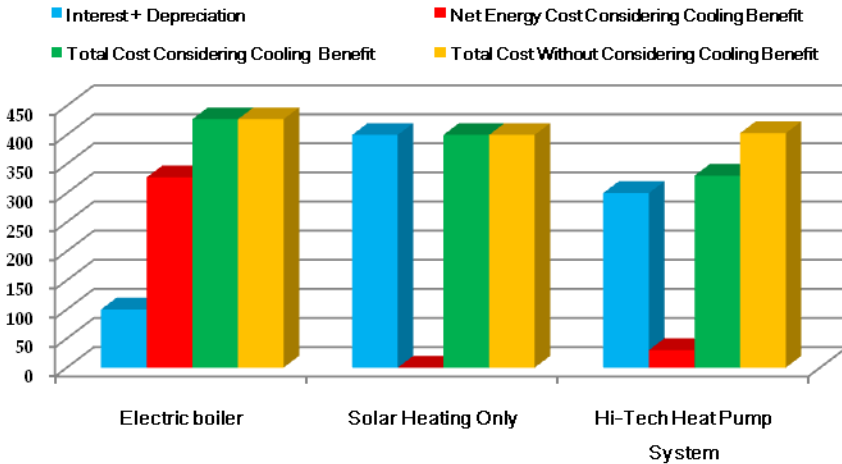


Layout diagram for Geo Source Heat Pump





Cost Comparison between Electric Heater, Solar Heater & Heat Pump for Villa/Large Apartments in Dubai



Advantages over electrical heating system

1. US \$ 95 saving per year per villa.
2. Return of investment in 5 years
3. Reduction in total electrical load of house by 2KW per heater
4. Pay back period of extra investment cost up to 2 years

Advantages over solar heating system

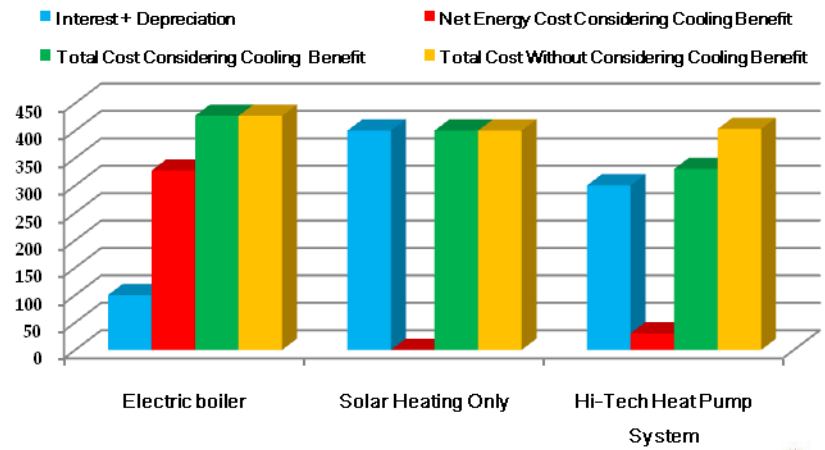
1. Guarantee of heating water during cloudy season
2. Low capital cost and return of capital within 5 years compared to solar for 10 years

All Cost Mentioned are in US \$

1	2	3	4	5	6	7	8	9	10	11	12
Electric boiler	860Kcal/Kwh	95 %	0.11/ Kwh	2974 Kwh	327	327	500	100	427	427	427
Solar Heating only								2000	400	400	400
Hi-Tech Heat Pump System	860Kcal/Kwh	300%	0.11/ Kwh	941 Kwh	941-784=157 kwh	17.27	103	1000	300	317.27	403

Cost Comparison between Electric Heater, Solar Heater & Heat Pump for Villa/Large Apartments in Dubai

1. Type of heating equipment.
2. Calorific Value of fuel.
3. Energy Performance Ratio of fuel (System efficiency)
4. Unit Price of fuel.
5. Nett fuel consumption per year (270 days) for heating 300 Liter of water from 20 deg C to 50 deg C. without considering cooling benefit = $300 \times 30 \times 270 / 860 \times \text{System efficiency}$
6. Nett fuel consumption per year (270 days) for heating 300 liters of water from 20 degc to 50 degc with considering cooling benefit and E.E.R. of heat pump 2.5 and E.E.R. of central air conditioning system 3.0
= $941 \times 2.5 / 3 = 784$.
7. Nett Energy cost per year (270 days) for above considering cooling benefit
- 8 Nett energy cost without considering cooling benefit .
- 9 Cost of equipment along with related pipe work
- 10 . Interest cost @10%p.a. + depreciation 10 % p.a. for all equipment except heat pump . For heat pump depreciation 20 % p.a.
- 11 Annual operation cost considering all the cost i.e. column 7+ 10
- 12 Annual operation cost without considering cooling benefit



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Project in U.A.E. : Heating & cooling of swimming pool (Sports city & Marina view),



Project in U.A.E. : Heating & cooling of Domestic water ARENCO Golden Sand No 3



Project in U.A.E. : Heating of domestic Water at Ladies club ,
Sharjah . 3 no heat pump with 340 liter water tank, heat output 6.22
K.W.,power input 1.66 K.W.



Traders Hotel in Dubai .

**Heat output 81k.w. cooling power out put 62k.w. Power input 21K.W.,
water to water heat pump , water heating and air conditioning at the same time .**



Nasma Tower Al Nahda dubai

heating capacity 35000 liter per day , 25 floor building 350 bed rooms

Air to water heat pump , water heating and air conditioning at the same time .



Nasma Tower Al Nahda Dubai

heating capacity 35000 liter per day , 25 floor building 350 bed rooms
Air to water heat pump , water heating and air conditioning at the same time,
we replaced LPG boiler



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Project in U.A.E. Grand Hyatt and Park Hyatt : Heating of Domestic water with 70 % energy saving and getting free cooling while heating water

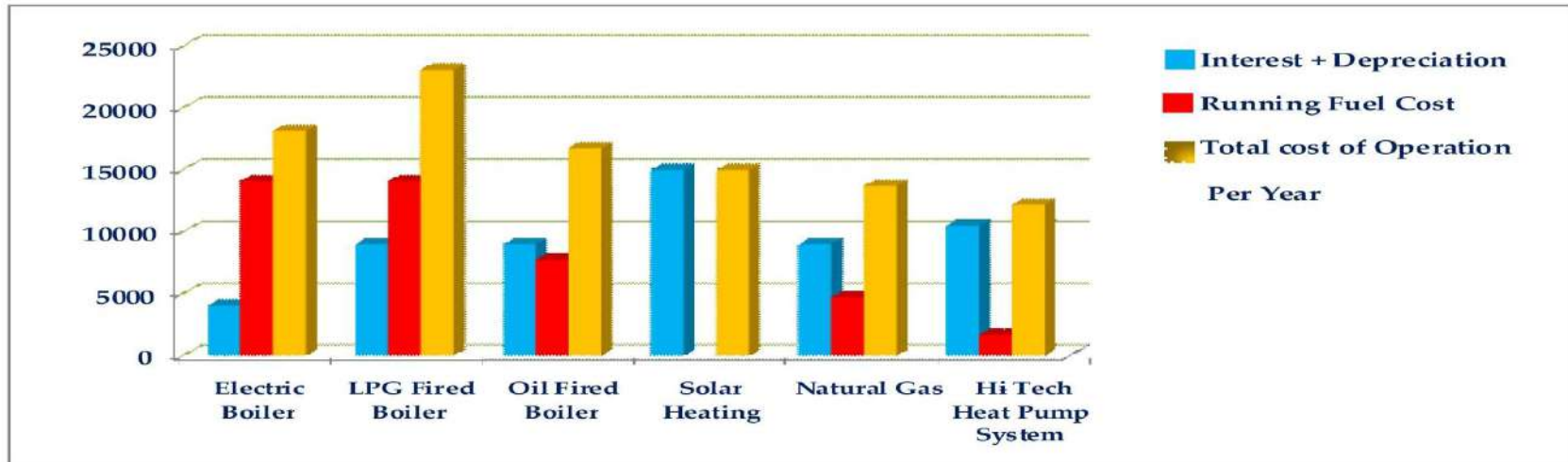




Comparison Table for heating cost of Hot water 10,000 liters per day

Hot water heating cost Comparison for 10,000 liters per day (Hotel with 75 Rooms.)

1. Type of heating equipment
2. Calorific Value of fuel.
3. Energy Performance Ratio of fuel (System efficiency).
4. Unit Price of fuel.
5. Fuel consumption per day for heating 10,000 Liter of Water from 20 deg C to 50 deg C.
= $10,000 \times 30 \times / 860 \times \text{System efficiency}$
- 6 fuel consumption per day for heating with above Parameter with considering cooling benefit (E.E.R of Heat pump is minimum 2.5) i.e. $116 \times 2.5 / 3 = 96$ Cooling energy available free from heat pump
- 7 Fuel cost per day for heating with above parameter With considering cooling benefit
8. Total fuel cost for One year for heating 10,000 liter Water per day for 300 days
9. Cost of equipments along with related pipe work
10. Interest cost @ 10% p.a. + depreciation @10 % p.a. For all the equipments except heat pump. For heat Pump depreciation 20 % p.a.
- 11 Annual operation cost considering all the Cost I.e. column 8 +10.





Comparison Table for heating cost of Hot water 10,000 liters per day

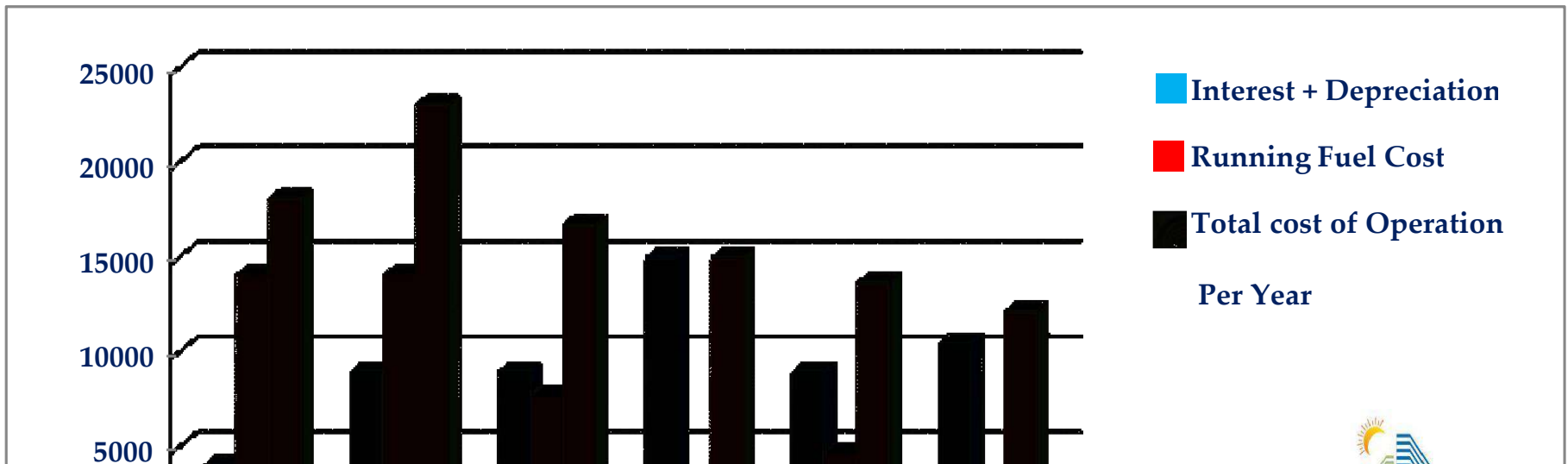
All Cost Mentioned are in US \$

1	2	3	4	5	6	7	8	9	10	11
Electric storage tank water heater	860Kcal/Kwh	95 %	0.11/ Kwh	367 Kwh	367 Kwh	40.37	12,111	17,750	3550	15,661
LPG fired boiler	10800Kcal/Kg (5923kcal/liter)	85 %	1.29 /kg (0.68 /liter	59 liter	59 liter	40.12	12,036	40,000	8,000	20,036
Oil fired boiler	9850Kcal/L	85%	0.63/L	36 L	36 L	22.68	6,804	40,000	8,000	14,804
Solar Heating only								75,000	15,000	15,000
Natural Gas	8898 Kcal/m ³ or 8650 Kcal/Kg	85%	0.34/m ³	39.6 6 m ³	39.66 m ³	13.48	4,044	40,000	8,000	12,044
Hi-Tech Heat pump System	860Kcal/Kwh	300%	0.11/ Kwh	116 Kwh	116-96 = 20 Kwh	2.2	660	30,000	9000	9660

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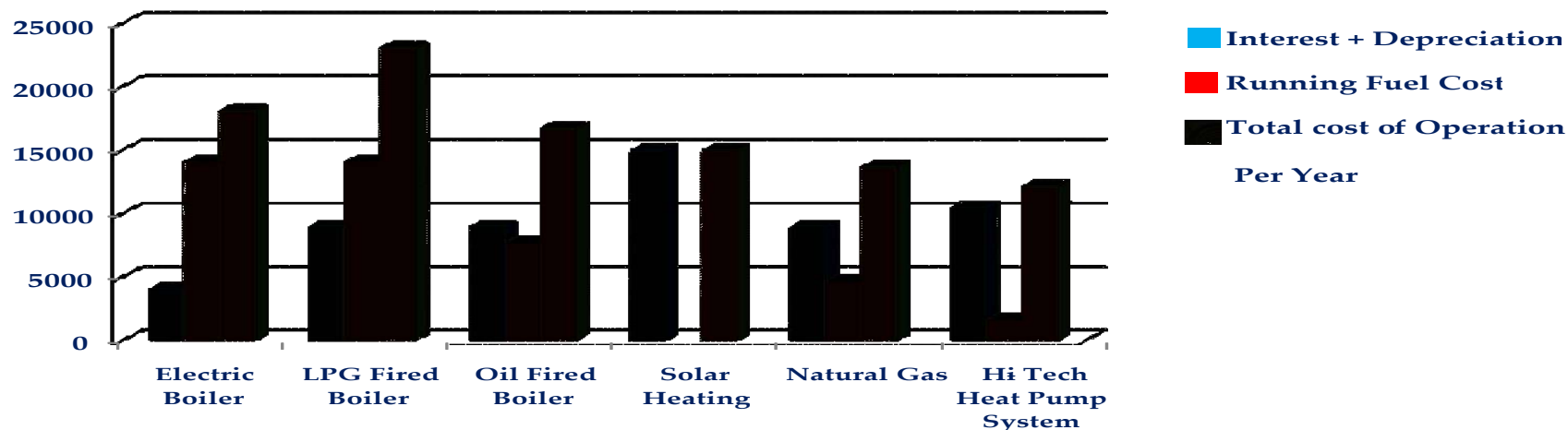
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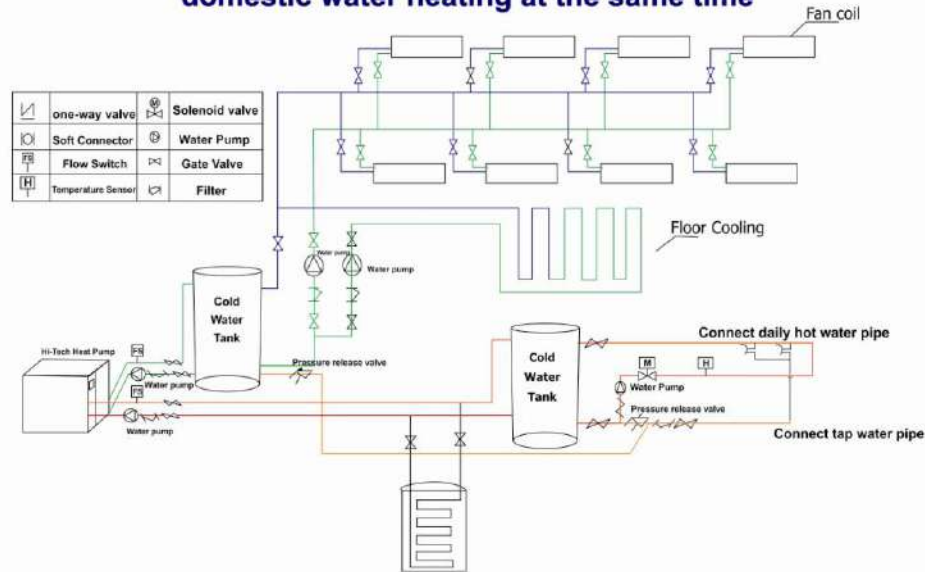
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



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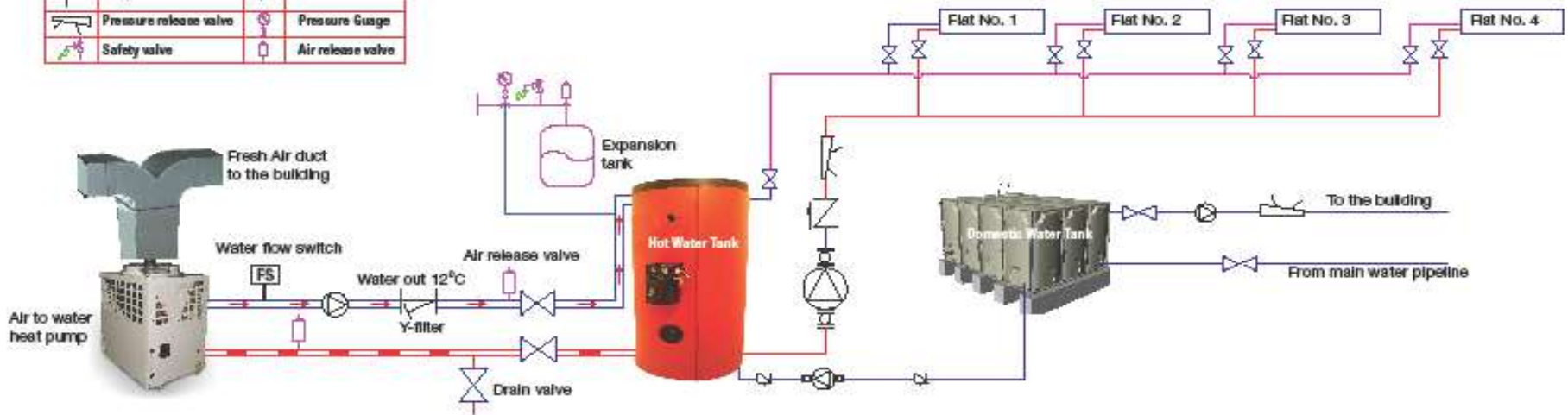
1	2	3	4	5	6	7	8	9	10	11
Electric storage tank water heater	860Kcal/Kwh	95 %	0.11/ Kwh	367 Kwh	367 Kwh	40.37	12,111	17,750	3550	15,661
LPG fired boiler	10800Kcal/Kg (5923kcal/liter)	85 %	1.29 /kg(0.68 /liter	59 liter	59 liter	40.12	12,036	40,000	8,000	20,036
Oil fired boiler	9850Kcal/L	85%	0.63/L	36 L	36 L	22.68	6,804	40,000	8,000	14,804
Solar Heating only								75,000	15,000	15,000
Natural Gas	8898 Kcal/m ³ or 8650 Kcal/Kg	85%	0.34/m ³	39.66 m ³	39.66 m ³	13.48	4,044	40,000	8,000	12,044
Hi-Tech Heat pump System	860Kcal/Kwh	300%	0.11/ Kwh	116 Kwh	116-96 = 20 Kwh	2.2	660	30,000	9000	9660

layout for water to water heat pump for air conditioning and domestic water heating at the same time



Layout of Air to water heat pump for centralised hot water system













	one-way valve		Solenoid valve
	Flexible connector		Water Pump
	Flow Switch		Gate valve
	Temperature sensor		Filter
	Pressure release valve		Pressure Gauge
	Safety valve		Air release valve

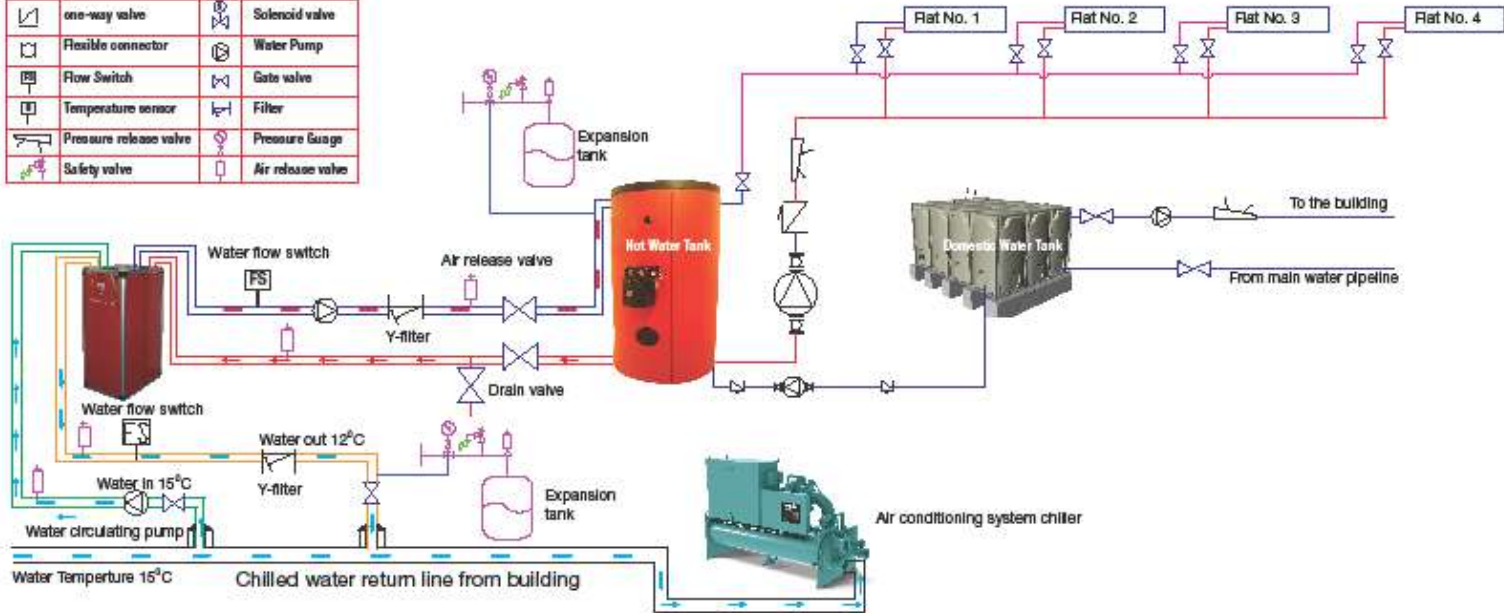


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Overseas installation of our
Technology partners .

Air to Water Heat Pump in UK



Our Tri aqua heat pump working well in snowing weather in UK during ambient temp -9°C .

Heat Pump Project in France



Heat Pump Project in France



Heat Pump Project in France



Heat Pump Project in France



Heat Pump Project in France



Heat Pump Project in France



Low Ambient Temp Heat Pump Working Excellent in Finland Snowing Climate



Our heat pump working in ambient temp -20°C .

Triaqua Heat Pump in Spain



Air conditioning project in Spain

Triaqua Heat Pump in Spain



Installation in the far East



Installation of heat pump along with solar water heater , heat pump act like backup support .



Good to know the facts and figures.



- ❖ Power consumption for domestic hot water heating by electric heating system per villa or apartment with 8 person living per year is 3470 KW/ year
- ❖ i.e. Power consumption per person per year is $3470 / 8 = 433 \text{ KW}$.
- ❖ Power consumption per person per day for domestic water heating = 1.8 KW
- ❖ Energy bill per person per day $1.8 \times \$ 0.11 = \$ 0.198 @ \text{Dhs } 0.7$
- ❖ Cost of energy consumed for heating Domestic water per villa, apartment or place of 8 person living
- ❖ is $433 \times \$ 0.11 = \text{US } \$ 381$ per year i.e. per person \$ 47 per year ,@ Dhs 172 /-
- ❖ Minimum connected load per villa or apartment with 2 electrical water heater is 6 KW
- ❖ So minimum connected load provided per person = $6 / 8 = 0.75 \text{ KW}$,
- ❖ For population of city like Dubai 2,000,000/- (two million) plus we have floating tourist population
- ❖ Connected load because of existing electric domestic water heater $2,000,000 \times 0.75 \text{ KW} = 1500000 \text{ KW}$
i.e. 1500 MW ,
- ❖ With our equipment connected load for city like Dubai for domestic water heating will be 500 MW
- ❖ Power consumption for above population per year is $433 \times 2,000,000 / 1000 = 866,000 \text{ MW}$
- ❖ Power consumption for above population per day is $866,000 / * 240 = 3608 \text{ MW}$ per day
Note : We have taken 240 days because we can say during summer 4 months we do not require water heater ,
- ❖ With our technology and installing our equipments all over the city , We can bring this POWER CONSUMPTION to 1000 MW per day plus free air conditioning cooling during use of this power , because C.O.P. of our equipments is 3.2 i.e. if it consumes 1 KW of energy it will produce 3.2 K.W. of heat energy of domestic water heating . And free cooling during water heating
- ❖ It Means SAVINGS OF 2600 MW PER DAY for city like Dubai ,
- ❖ Reduction in power generation load if we consider this power is consumed in maximum 6 hours 433 MW Per hour
- ❖ It is 50 % of one of the power generation station

GREAT SAVING

Policy recommendations for heat pumps

Renewable directive implementation:

Heat pumps must be emphasized in national renewable energy action plans

***Support :**

Member states should establish appropriate support mechanisms for heat pumps in line with subsidies for renewable electricity. Support should consist of just grants and subsidies but replacement of electric ,oil and gas fired heating.

***Create a level playing field :**

Taxation of gas and oil for heating Should be raised in line with carbon price in which electricity is subject

***Link heat pumps with renewable electricity :** Pilot projects incorporating heat pumps in line with subsidies for renewable also public - private partnerships. First TARGET should be the replacement of electric ,oil, gas fired heating for domestic water for hotels , laundries, spas , swimming pool



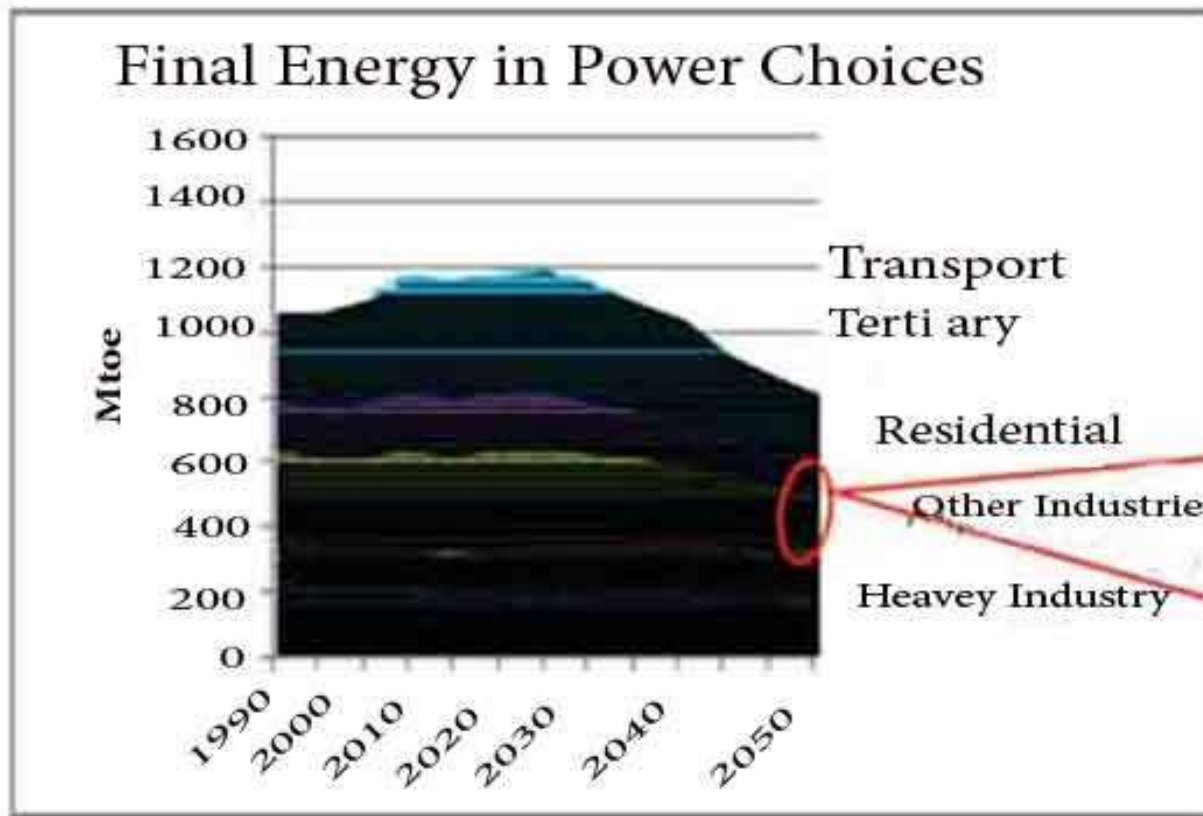
HEAT PUMPS IN SMART GRIDS



Heat Pumps have a key role to play

- 1. Decreasing Carbon emissions**
- 2. Increasing the penetration of renewable in the heating & cooling sector**
- 3. Acting as a flexible load in smart grid systems and therefore allowing for integration of intermittent renewable electricity**

Heat pumps lead to major reduction in final energy consumption in residential & hospitality sectors



SIGNIFICANT DECLINE IN ENERGY CONSUMPTION IN RESIDENTIAL & TERTIARY SECTORS DUE TO HEAT PUMPS AND OTHER ENERGY EFFICIENCY MEASURES



What is Needed to Facilitate Heat Pumps' Role in 2030 RES Targets

- * Resolution of outstanding issues on heat output measurement of various fuels available and heat pump seasonal performance factor**
- * Major role of heat pumps in member G.C.C state national action plans .and subsequent promotion of heat pumps through:**
 - Tax reduction**
 - Grants**
 - Information campaigns**
- * Above all, member countries should adopt a cost efficient approach to fulfilling RES targets and Heat pumps would play a major role as part of any cost - optimized strategy**



Advantages of Heat Pump Over Other Renewable heating & Cooling system Technologies

Technology	Can it be applied in all dwellings?	Can it be applied in urban and rural areas?	Can it supply all heating needs over whole year
HEAT PUMPS	YES	YES	YES
SOLAR THERMAL	HOUSES ONLY	YES	NO-10-50%
BIOMASS PELLET BURNER	ONLY WHERE SPACE	EMISSION PROBLEM IN URBAN AREAS	YES
RES DISTRICT HEATING (DH)	ONLY WHERE DH SYSTEM EXISTS	URBAN ONLY	YES



Advantages of Heat Pump Over Other RES H & C Technologies.

Technology	Fuel Availability issue?	Conclusion
HEAT PUMPS	NO	Can Be Applied in Almost all House Types and Locations- can Provide Heating and
SOLAR THERMAL	VARIATION IN SOLAR REGIME	POSSIBLE IN MANY DWELLINGS BUT LIMITED CONTRIBUTION TO HEAT DEMAND
BIOMASS PELLET	BIOMASS NOT AVAILABLE EVERYWHERE	GOOD FOR SINGLE HOUSES WITH LARGE SPACE FOR BURNER + PELLET STORAGE
RES DISTRICT HEATING(DH)	IF BIOMASS YES	GOOD WHERE EXISTING DH PLANT CAN BE CONVERTED TO RES. NEW HEAT GRIDS NOT VIABLE.



Heat Pumps as a Dispatchable Load

- **Switching of heat Pumps Could be controlled Centrally by Electricity supplier in Return for Heat Pump user Receiving Preferential Tariff**
- **Short switch-off of heat Pump will have little effect on building temperature, while large buffer tanks in Heat Pump system can allow rather longer curtailment**
- **Technology already available and in use for central control of switching and developing further could integrate with smart grid, smart metering concepts**



Why should heat pumps should get financial support from governments .

heat pumps offers low carbon emission because of saving in electricity

. Heat pump reduces connected load on account of domestic water heating & air conditioning of the city,

Heat pump will help to mobilise energy resources for industrial production , thus it will increase GDP of the city .

heat pump is perfect product for smart energy grid

Therefore: Heat pumps would justify, at the very least tax reductions, if not investment grants when taken in comparison to renewable electricity tariffs



Advantages of Solar + HP combinations

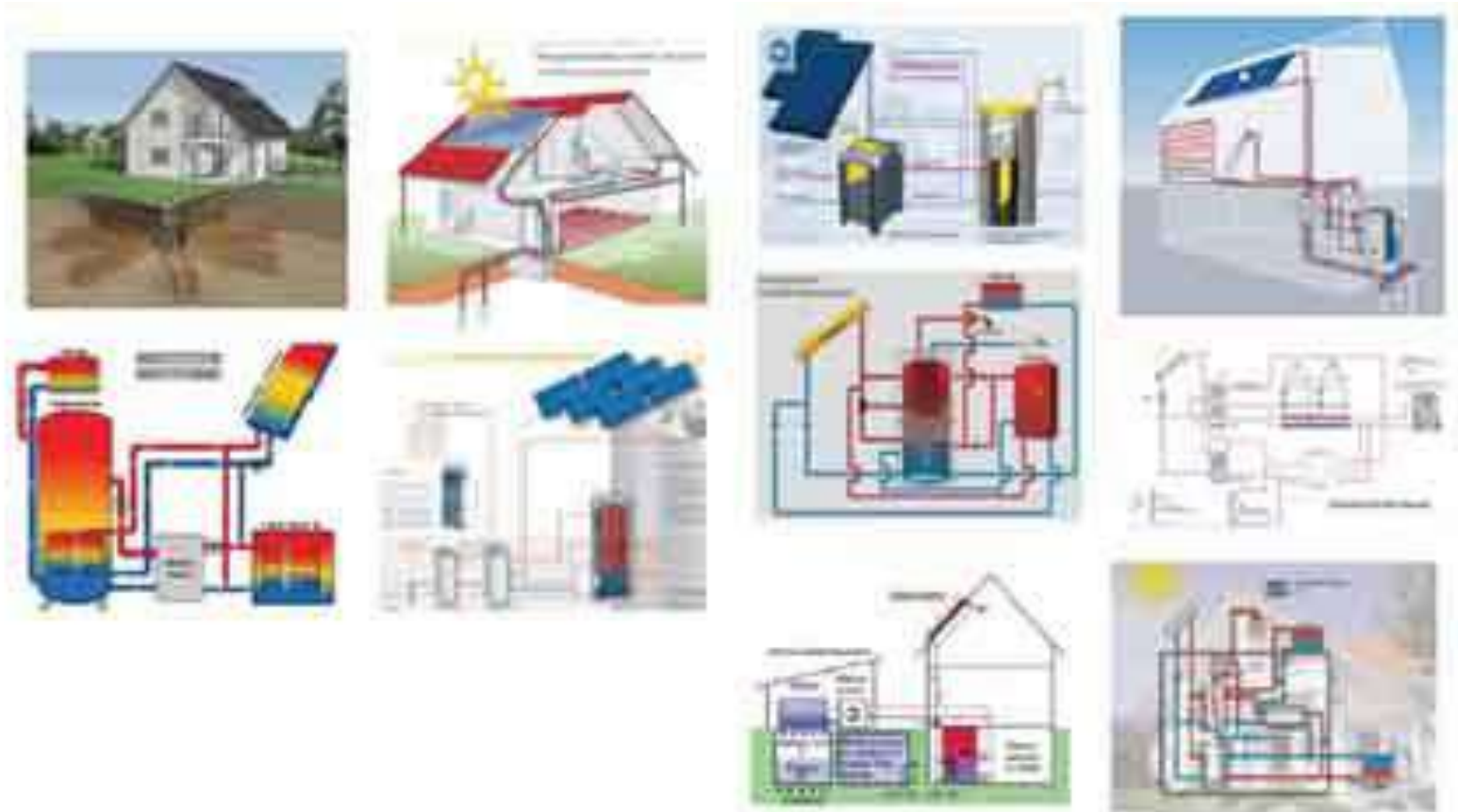
Solar companies

- . Increased solar fraction for heating and domestic hot water
- . Alternative to concepts using very large heat storages
- . Overall solar fraction > 50%
- . Overall solar fraction > 50%

Heat pump companies

- . Increased annual COP (above 5)
- . Direct use solar energy for domestic hot water or space heating if collector temperature is sufficient
- . No temperature decrease of the ground over many heating seasons

Various System Concepts for Solar + HP



With respect to the environment

Thanks ,

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Local Presence

Global Know How

**To Preserve Energy Resources
For Future Generation**