# Presentation on Heat Pump

## By
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12th ENERGY EFFICEINCY SUMMIT
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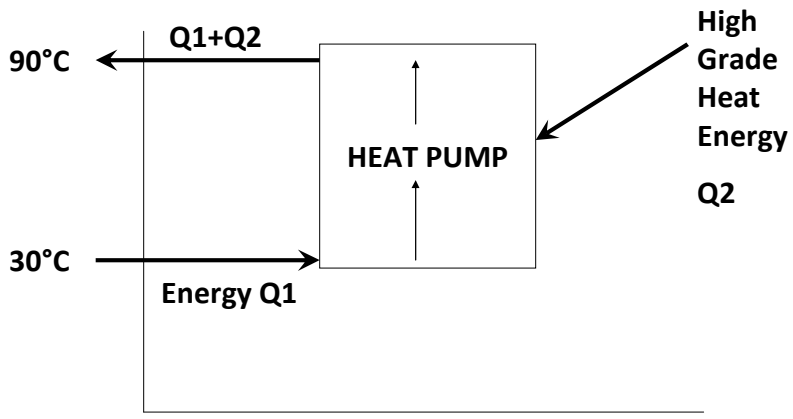
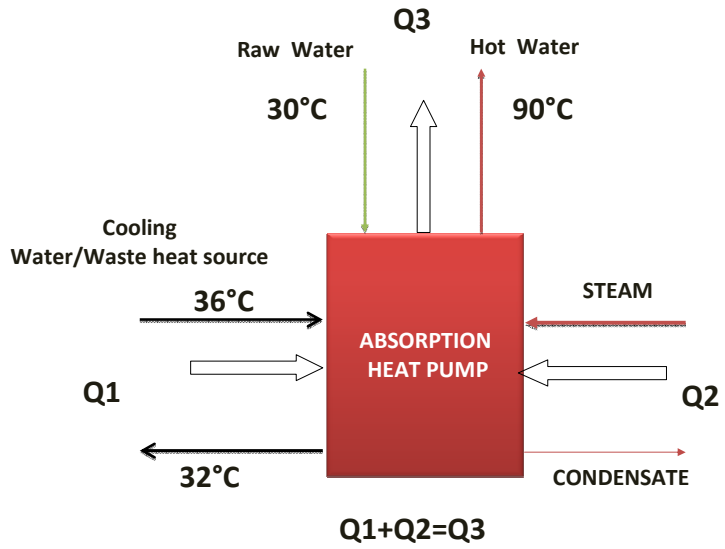
# Heat Pump

- It is a device which pumps heat from low temperature to high temperature using high grade energy

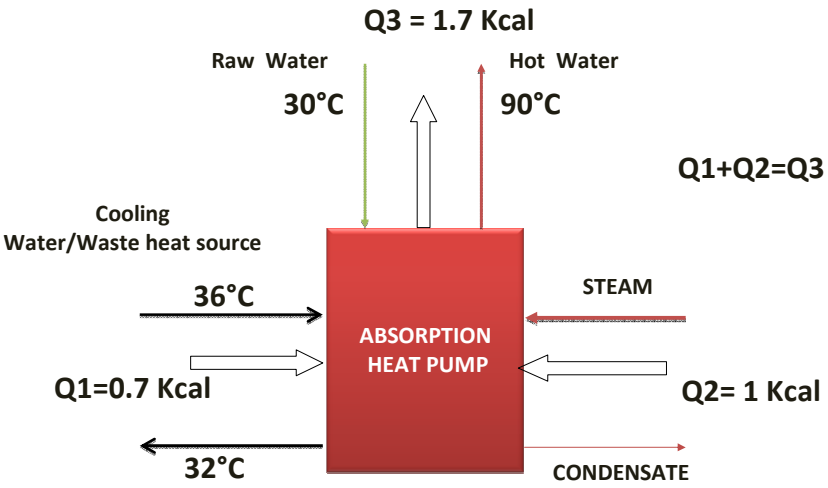


# Basic Operation






# Energy Saving Rule




**For every 1.7 Kcal of heat given by heat pump 0.7 Kcal is free**

# Applications

Processes requiring

**low temperature heating**

can be addressed by **Heat Pump and can reduce the Live energy consumption by**

**40%**



# Applications

- **Drugs & Pharmaceuticals**
  - Maintaining RH in formulation Units – HVAC
  - Generating hot air for Drying/Coating applications
  - Hot water for process in Bulk Drugs (reducing steam consumption – conventional process)
  - Boiler Feed water/Raw water heating for Process Boilers/Power plants
- Waste heat can be
  - Cooling tower water
  - Effluent
  - SRP condensers (for steady waste heat input)

# Formulation Application

- Installation year : 2010
- Location : Chennai
- Heating Capacity : 4 Lac Kcal/Hr
- Temperature Outlet : 56 Deg C
- Application : Humidity Control



# Applications

- **Chemical Process**
  - Feed pre-heating to reduce load on Steam
  - Drying (hot air generation using 90 Deg C HW)
  - Mixing hot water in feed to reduce Rxn time
  - Boiler Feed water/Raw water heating for Process Boilers/Power plants
- Waste heat can be
  - Cooling tower water
  - Effluent
  - Can be identified based on process

# Applications

- **Process Industry**
  - Drying, Hot water for Pulp cooking – Pulp & Paper
  - Hot air – Malting Process (for germination)
  - Paint heating – Automobile Paint booths
  - Chocolate heating – Confectionary Plant
  - Boiler Feed water/Raw water heating for Process Boilers/Power plants
- Waste heat can be
  - Cooling tower water
  - Effluent
  - Can be identified based on process



# Process Application - 1

- Installation year : 2010
- Location : Kashipur (UK)
- Heating Capacity : 64 Lac Kcal/Hr
- Temperature Outlet : 80 Deg C
- Application : Hot Air Generation

# Process Application - 2

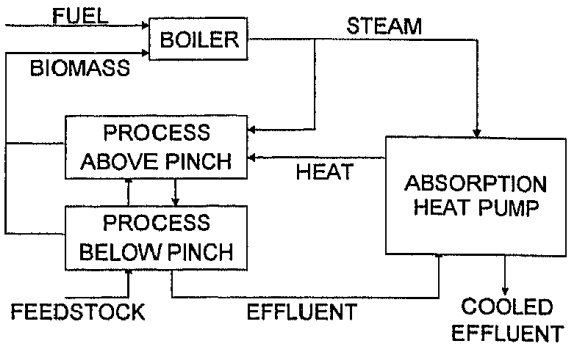
- Installation year : 2011
- Location :Aurangabad
- Heating Capacity : 7.5 Lac Kcal/Hr
- Temperature Outlet : 91 Deg C
- Application : Feed Heating



# Process Application - 3

- Installation year : 2008
- Location : Chennai
- Heating Capacity : 20 Lac Kcal/Hr
- Temperature Outlet : 84 Deg C
- Application : Paint Heating

# Typical Process Application




**This is possible if AHP can be incorporated during design stage**



# Other Applications

- Refinery feed heating
- Slaughter house
- Textile processing – Dyeing House
- Edible Oil
- Syrup Heating/CIP – Beverage Bottling Plants

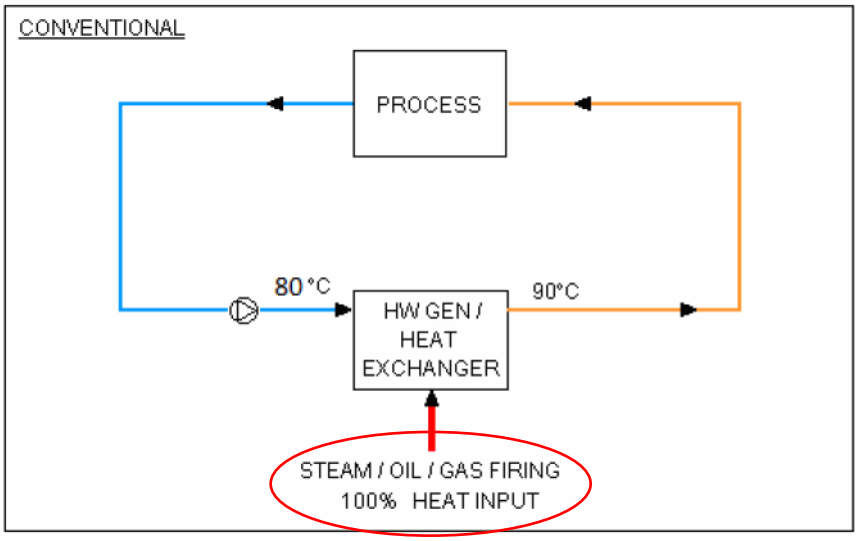
# Variation of Heat Pumps



# Chiller Heater – Thermax Patent

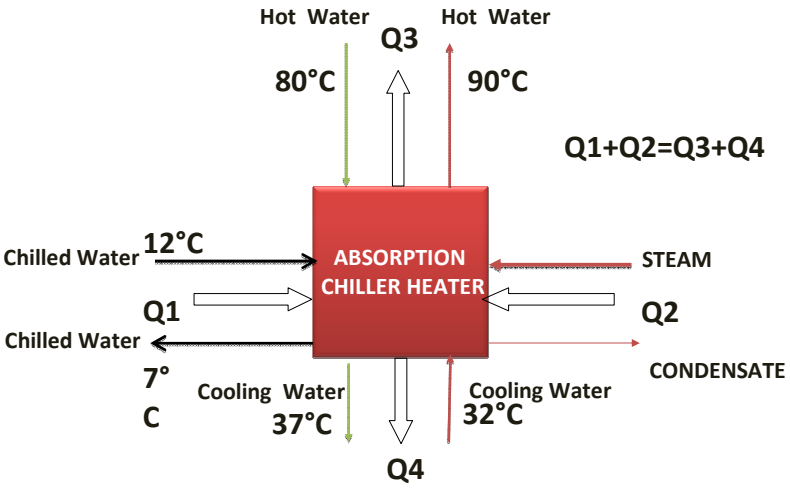
- Provides simultaneous chilling & heating
- **40%** saving in heating energy
- For every 100 KW of cooling , 75 KW of heating can be generated
- Maximum heating capacity in simultaneous cooling and heating mode - 75-80% of the cooling load
- In the absence of cooling load, 100% heating capacity can be produced after change over to heating mode

# Conventional System






# Chiller Heater System




**40% of the fuel consumption required for hot water generation (Q3) is recovered from refrigeration cycle**

# Comparison

**For Steam based operations**

| Sr. | Description | UOM | Compression Chiller + HW generator | Thermax Chiller Heater |
|---|---|---|---|---|
| 1 | Chilling Capacity | TR | 100 | 100 |
| 2 | Heating capacity | kW | 260 | 260 |
| 3 | Energy Source for Chilling | | Electricity | Steam |
| 4 | Energy Source for Heating | | Steam | Steam |
| 5 | Steam Consumption for chilling | kg/hr | - | 380 |
| 6 | Steam Consumption for Heating | Kg/hr | 391 | 235 |
| **7** | **Total Steam consumption** | **kg/hr** | **391** | **615** |
| 8 | Cooling Tower duty | kW | 432 | 498 |
| 9 | **Electrical Power requirement** | | | |
| | Cooling tower fan | kW | 3.0 | 3.7 |
| | Chiller power | kW | 70 | 3 |
| | **Total Power** | **kW** | **73** | **6.7** |
| 10 | Steam cost | Rs/kg | 0.75 | |
| 11 | Electrical Power rate | Rs/kWhr | 6 | |
| 12 | **Hourly Operational cost** | | | |
| | Steam Cost | Rs./hr | 293.25 | 461.25 |
| | Electrical power cost | Rs./hr | 438 | 40.2 |
| | Total hourly operational cost | Rs./hr | 731.25 | 501.5 |
| | Hourly saving | Rs./hr | 229.75 | |



# Partial Installations – Heat Pump

**Jönköping, Sweden**
**4 MW**

**Copenhagen District Heating, Denmark**
**27.5 MW**

**Karlstad, Sweden**
**9.5 MW**

**Thisted District Heating**
**10.5 MW**

**Bjerringbro, Denmark.**
**2.5 MW**

**Vestforbraending, Sweden**
**21 MW**

# Reference Installations- Heat Pump

| Sr.No. | Customer | Country |
|---|---|---|
| 1 | Thisted District Heating | Denmark |
| 2 | Karlstad | Sweden |
| 3 | Uppsala | Sweden |
| 4 | Copenhagen District Heating | Denmark |
| 5 | ViVo | Germany |
| 6 | Jankoping | Sweden |
| 7 | Ackermann | Germany |
| 8 | vestforbiding | Sweden |
| 9 | Bjerringbro | Denmark |
| 10 | Erding | Germany |
| 11 | Halmstad | Sweden |
| 12 | Egger plant | Denmark |



# Reference Installations- Heat Pump

| Sr.No. | Customer | Country |
|---|---|---|
| 13 | Ford India | India |
| 14 | Malt Company | India |
| 15 | Stadwerke Munchen | Germany |
| 16 | L&T Hazira | India |
| 17 | Caithness Heat & Power | UK |
| 18 | Helsingborg | Sweden |
| 19 | Skagen | Denmark |
| 20 | SEG | Europe |
| 21 | SEG | Denmark |

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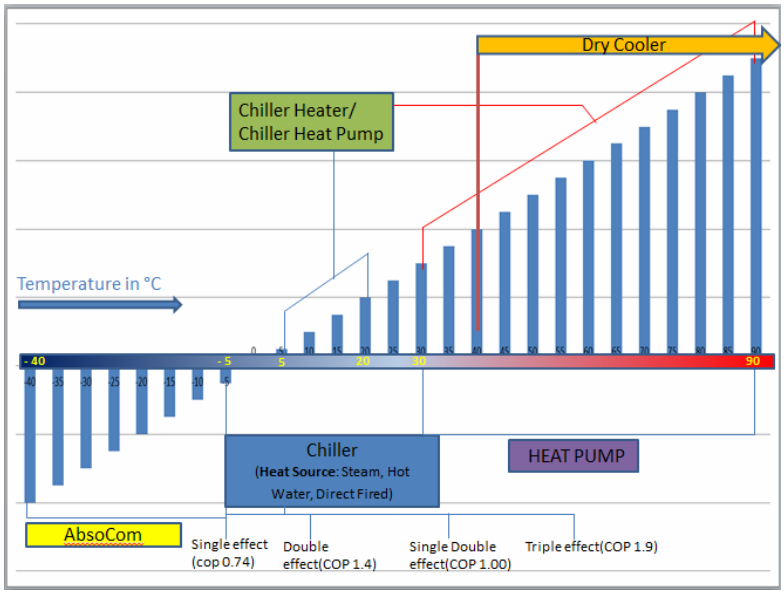
Dry Cooler
Chiller Heater/
Chiller Heat Pump
Temperature in °C
- 40
- 5
5
20
30
90
Chiller
(Heat Source: Steam, Hot
Water, Direct Fired)
HEAT PUMP
AbsoCom
Single effect
(cop 0.74)
Double
effect(COP 1.4)
Single Double
effect(COP 1.00)
Triple effect(COP 1.9)



# Heat Pump

# Thank You…

*Happy Saving..*

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