MODULE: 7
BESTPRACTICES, TECHNOLOGIES AND CASE STUDIES – ELECTRICAL AND THERMAL SYSTEM

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1 Introduction

Electrical	Thermal

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	• Heat pump
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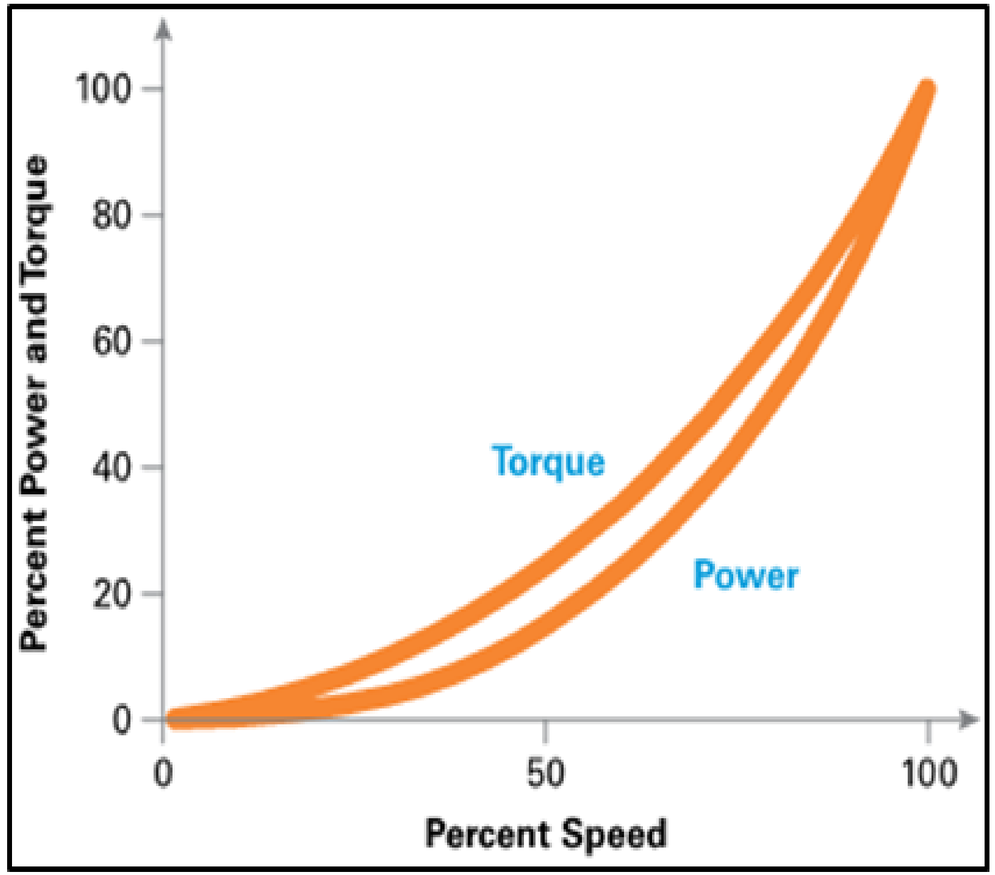
1 IE Classification

Class Type	Class Number
Standard efficiency	IE1
High efficiency	IE2
Premium efficiency	IE3
Super premium efficiency	IE4

VARIABLE FREQUENCY DRIVE (VFD) APPLICATIONS

FREQUENCY DRIVE (VFD) APPLICATIONS



1 Variable Torque Load

Variable Torque loads are typical of centrifugal fans and pumps and have the largest energy saving potential. They are governed by the Affinity Laws which describe the relationship between the speed and other variables:

- The change in flow varies in proportion to the change in speed: **Q1/Q2 = (N1/N2)**
- The change in head (pressure) varies in proportion to the change in speed squared: **H1/H2 = (N1/N2)2**

The change in power varies in proportion to the change in speed cubed : **P1/P2 = (N1/N2)3**

Where, Q = volumetric flow, H = head (pressure), P = power, N = speed (rpm)

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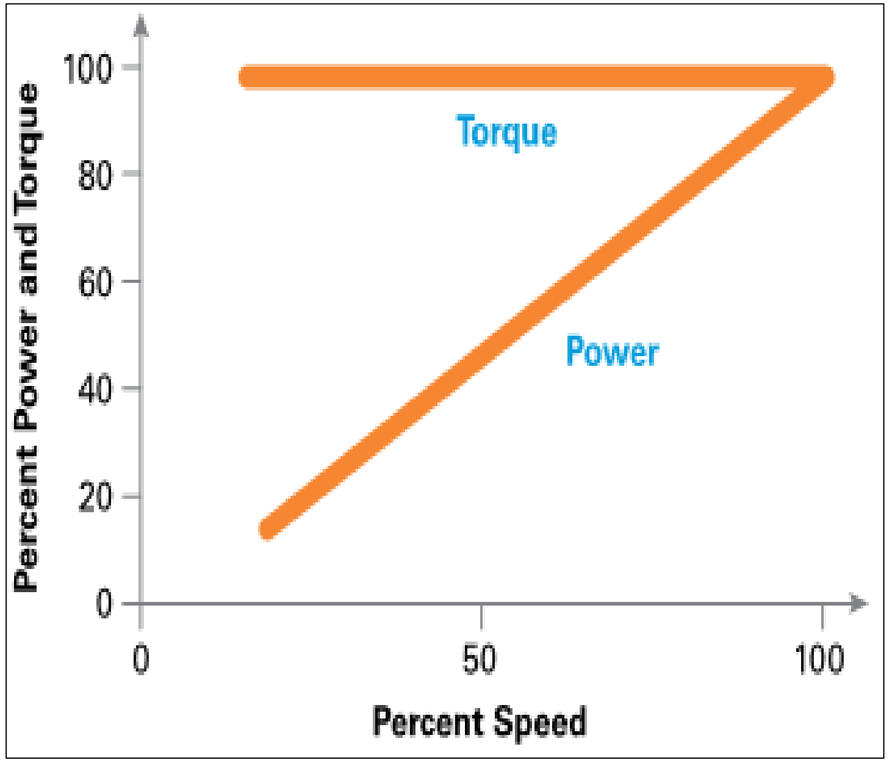
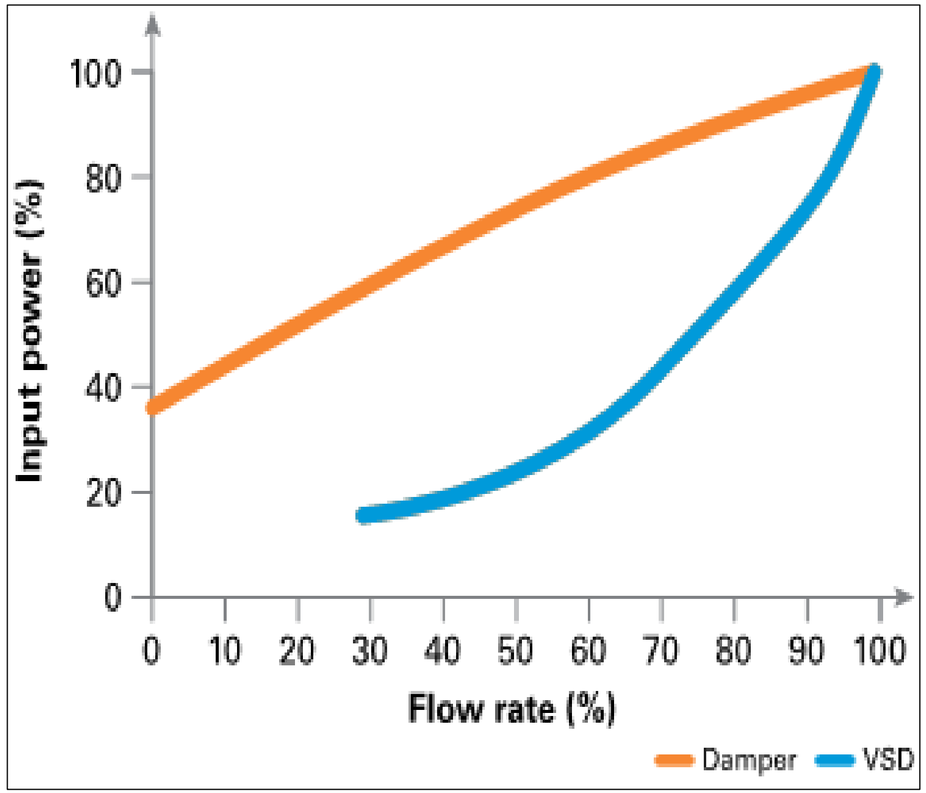
FREQUENCY DRIVE (VFD) APPLICATIONS



2 Constant Torque Load

Typical constant torque applications include conveyors, agitators, crushers, positive displacement pumps and air compressor. On constant torque loads the torque remains constant with speed and the power absorbed is directly proportional to the speed this means that the power consumed will be in direct proportion to the useful work done, for example a 50% reduction in speed will result in 50% less power being absorbed or consumed.

FREQUENCY DRIVE (VFD) APPLICATIONS



3 VFD for Fans

Dampers are often used to regulate the flow of fans in applications such as most kinds of ventilation systems, air extract systems, industrial cooling, and combustion-air control and flue gas evacuation systems for boilers. With damper control, the input power reduces as the flow rate decreases. If dampers are replaced with VFD control, input power is reduced much more significantly as per cube law.

HIGH COP CHILLERS

HIGH COP CHILLERS

1 Introduction

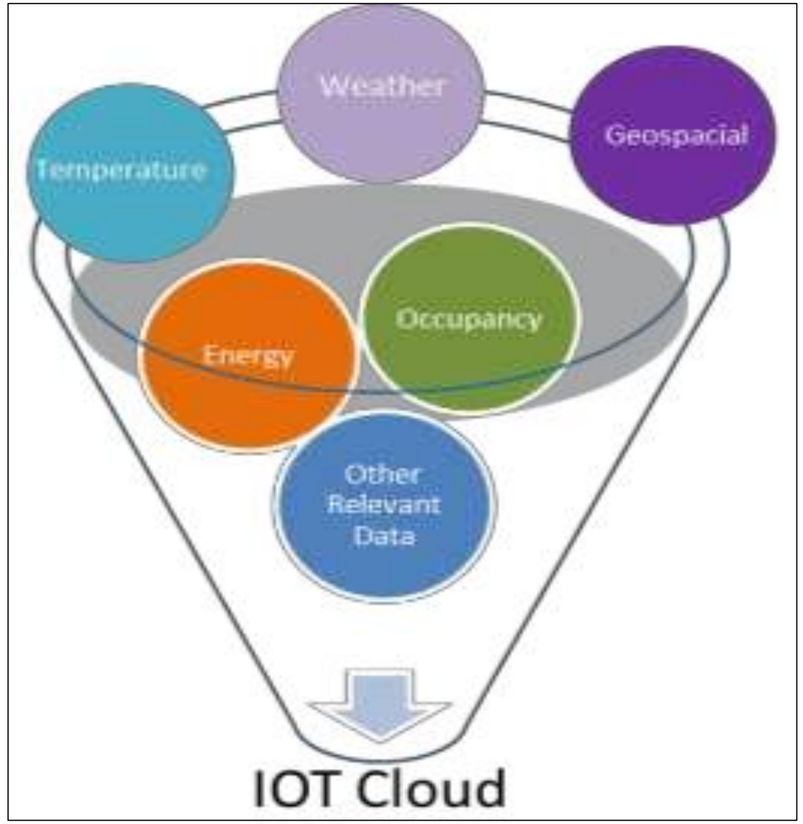
- Vapour compression chillers are used extensively for large facility space cooling and in industrial process liquid cooling.
- Improving chiller efficiency can significantly reduce energy usage.
- A liquid chilling system cools water or secondary coolant for air conditioning or process refrigeration.
- A chiller has four primary components: compressor, compressor drive, evaporator, and condenser.
- Chillers can be further categorized according to the type of compressor being used.
    - Reciprocating Compressor Chillers
    - Centrifugal Compressor Chillers
    - Screw Compressor Chillers
    - Scroll Compressor Chillers
    - Absorption Chillers

BEST PRACTICES AND TECHNOLOGIES IN THERMAL SYSTEM

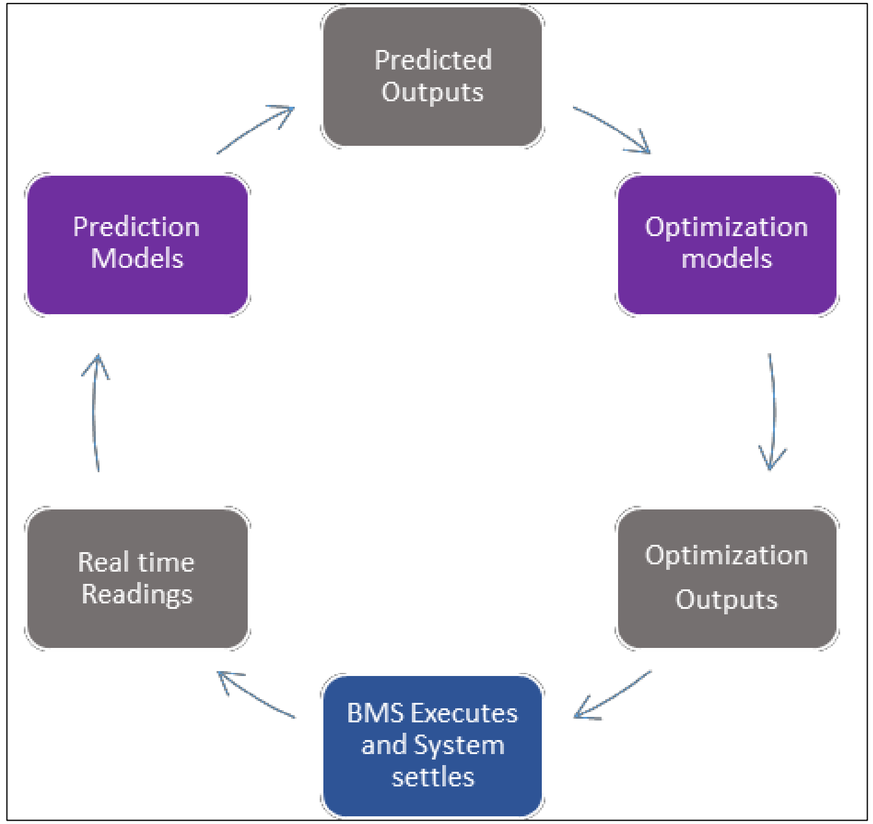
PRACTICES AND TECHNOLOGIES IN THERMAL SYSTEM

2

Internet of Things (IOT) Application for Chiller System



Multiple datasets from sensor networks



Optimization Approach Real Time Machine Learning Model

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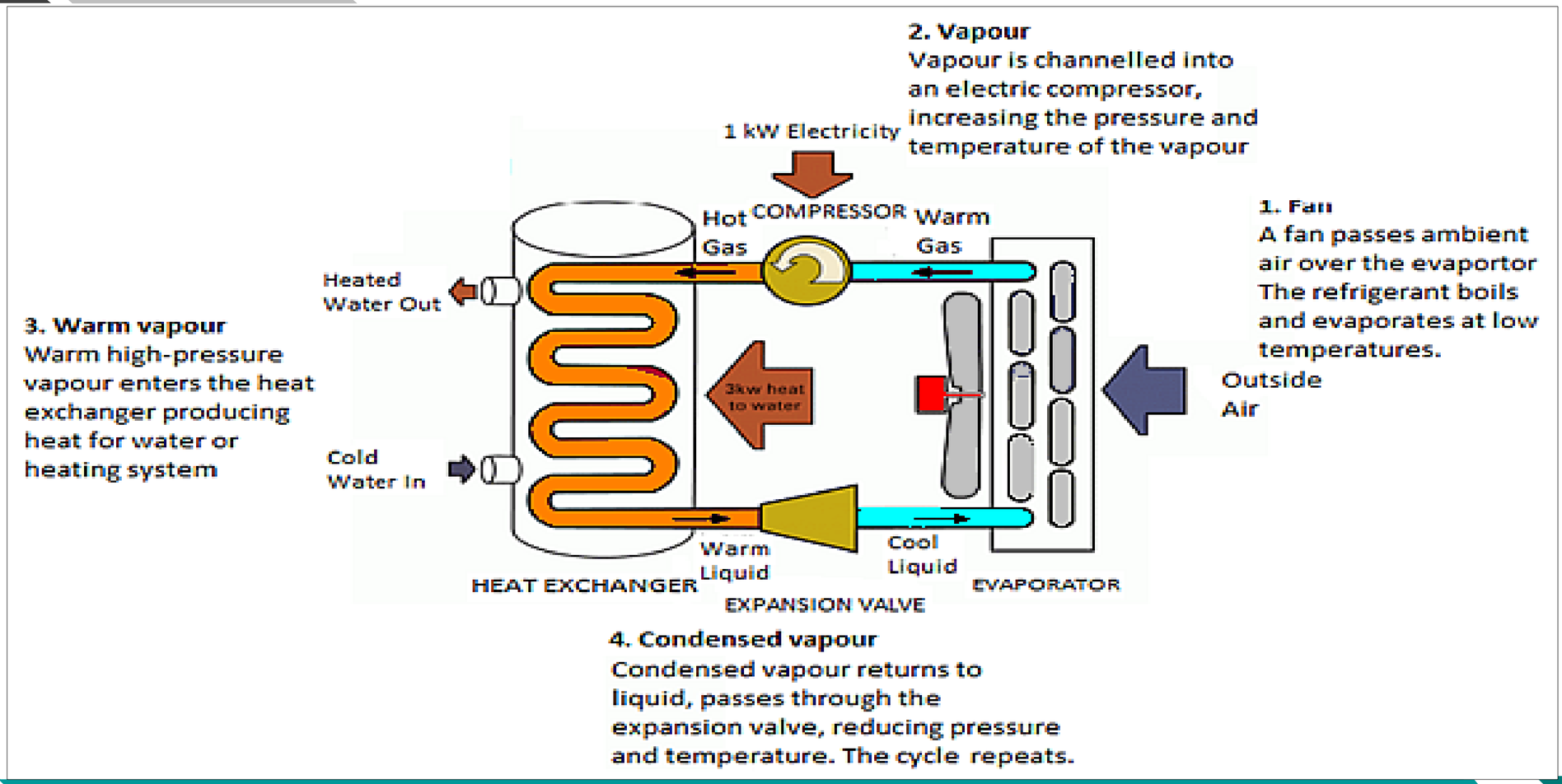
3 Heat Pump



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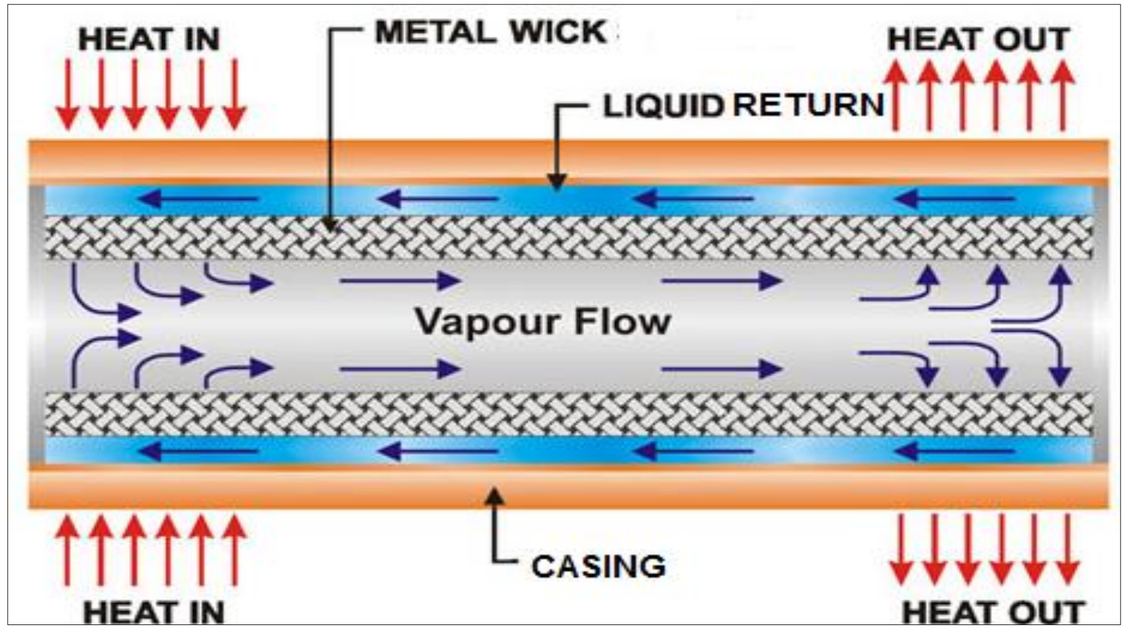
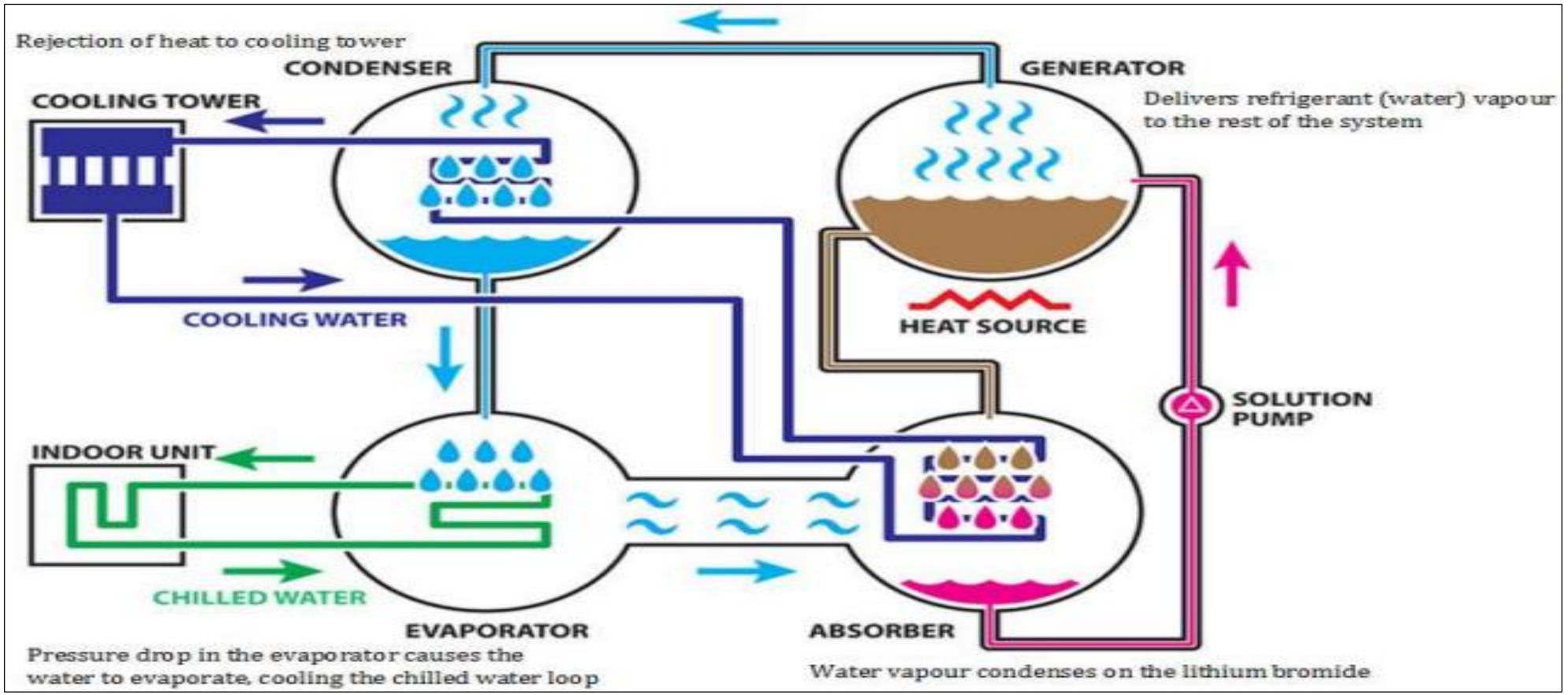
4 Heat Pipe



- Heat Pipes are devices which can transfer 1000 times more thermal energy than copper.
- Heat Pipe is basically a copper tube sealed on both ends with an internal wick or mesh along the interior of the pipe.
- The operating principle of heat pump is based on evaporation/condensing cycle.

5

VAM Absorption chiller Block diagram



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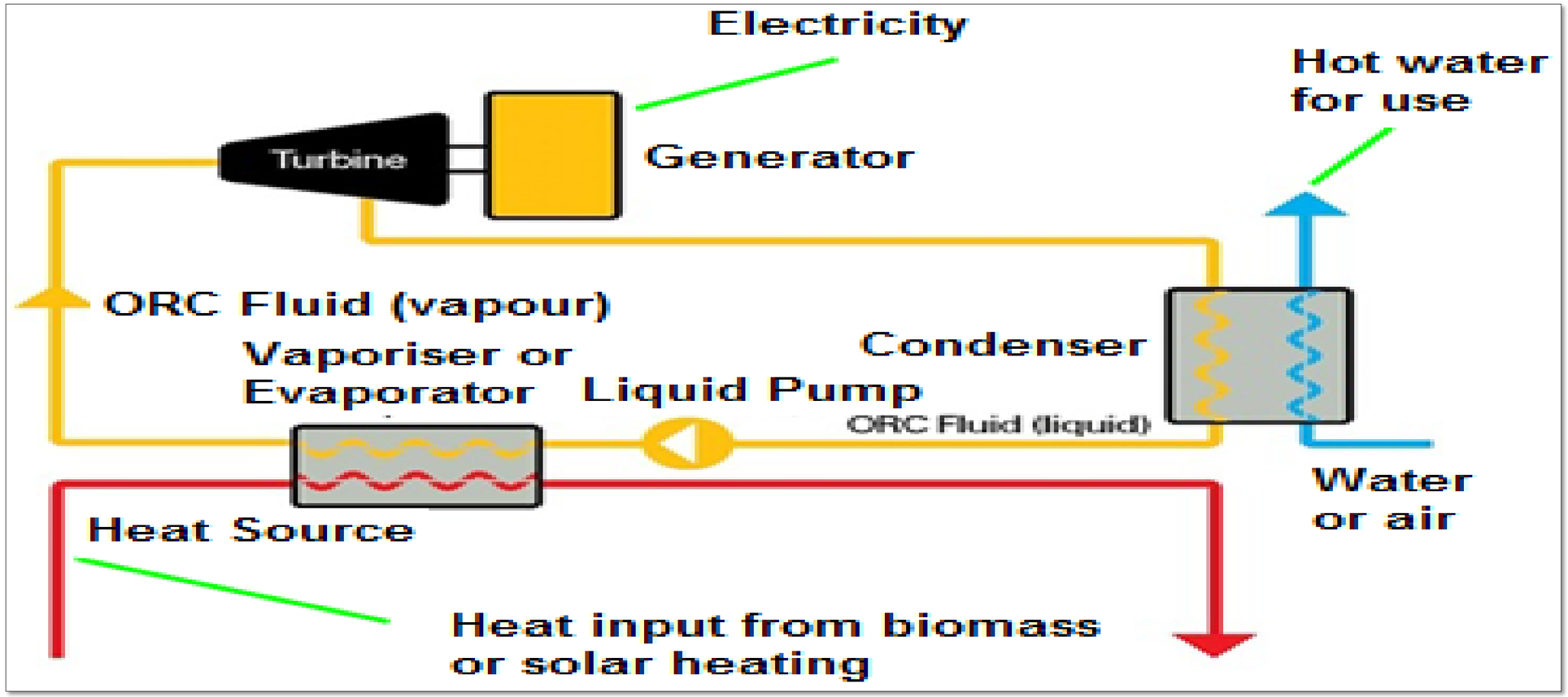
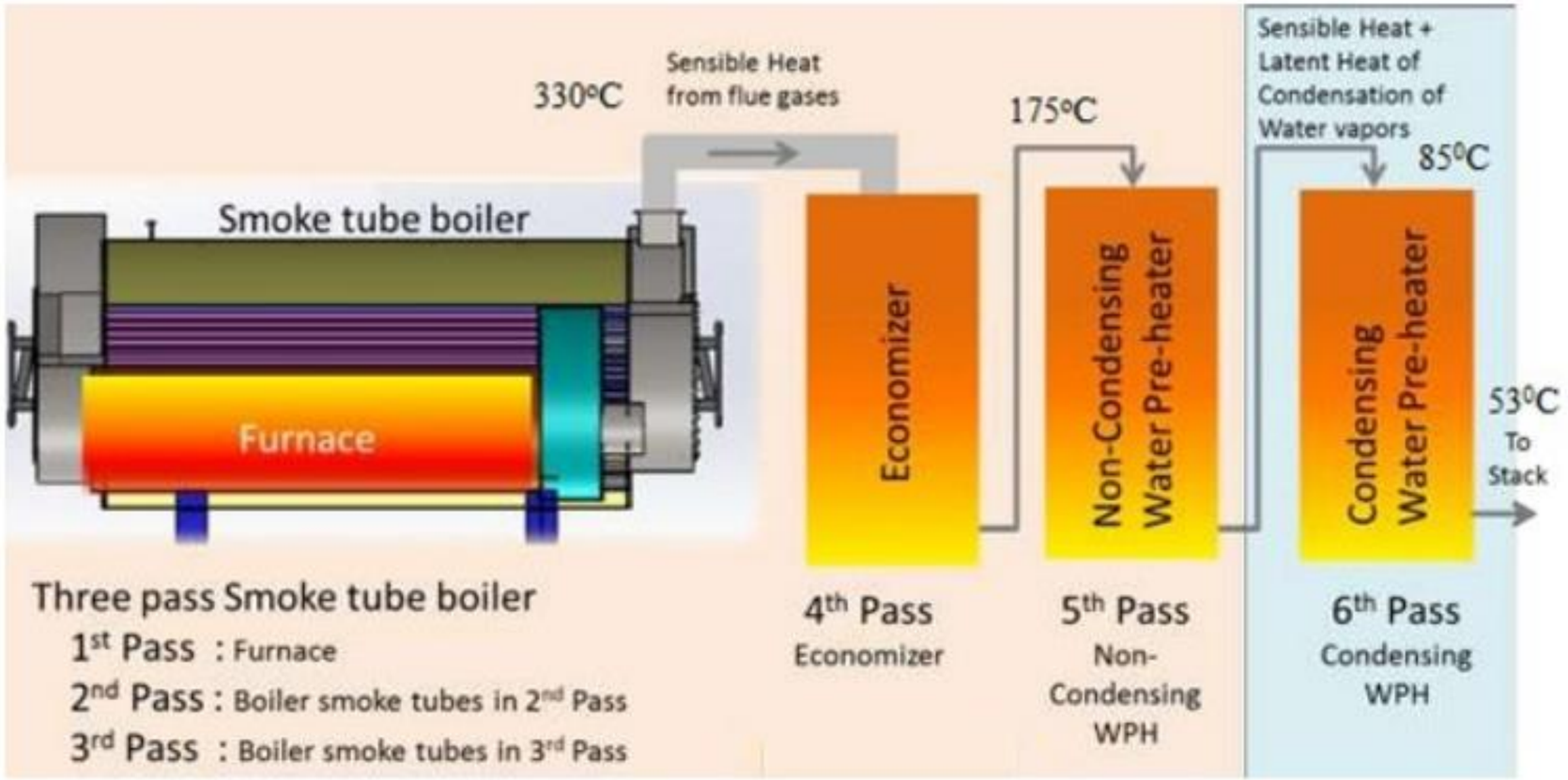
Organic Rankine Cycle



7 Condensing Boiler



8

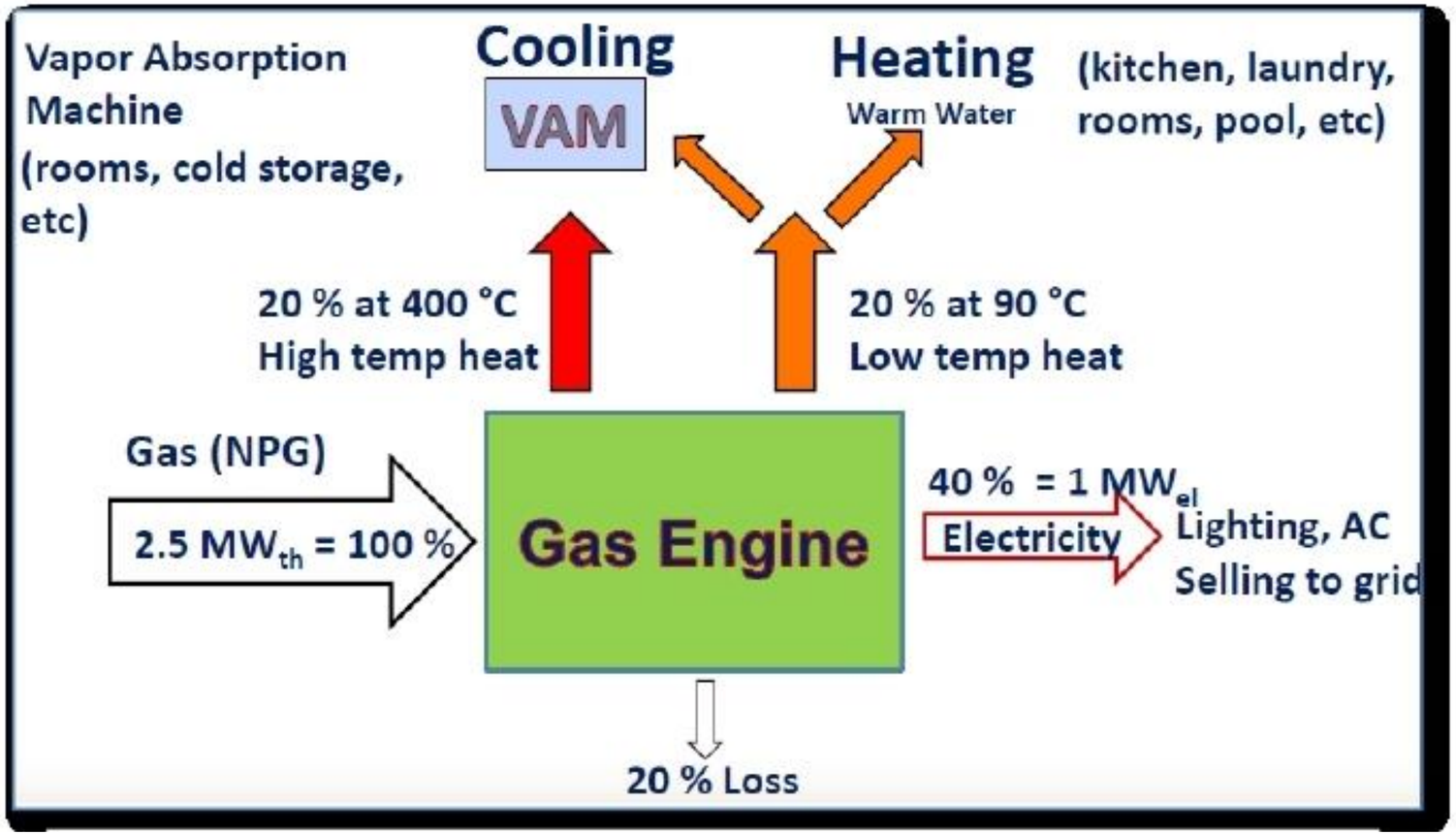
LHV and HVV Efficiency

Temperature of Flue Gas at the Outlet of Heat Recovery Unit (^{0}C)	Overall Thermal Efficiency, on LHV Basis (%)	Overall Thermal Efficiency, on HHV Basis in %
183	92	83.1
120	95	85.8
99	96	86.7
78	97	87.6
57	98	88.5
55	99	89.4
53	100	90.3
51	101	91.2

Performance test was carried out by Indirect Method as per BS-845-part I

9

Trigeneration



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