

MODULE: 7

BEST PRACTICES, TECHNOLOGIES AND CASE STUDIES – ELECTRICAL AND THERMAL SYSTEM



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INTRODUCTION

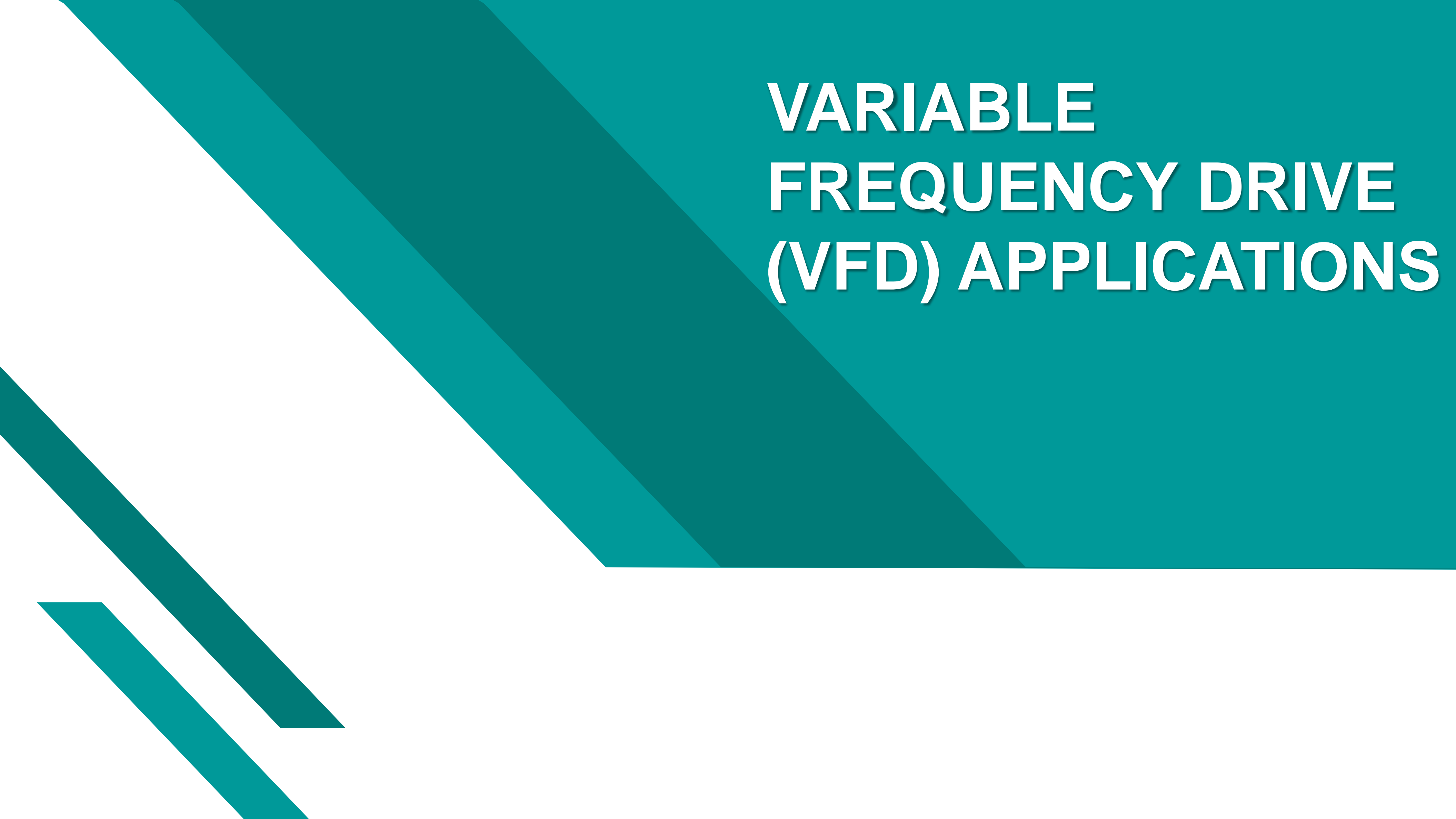
Electrical

- Energy Efficient Motors
- Applications of VFD
 - Fans
 - Pumps
 - Compressors
- High COP chillers
- Internet of Things (IOT) Applications for Chiller System

Thermal

- Pressure reducing turbine
- Heat pump
- Heat Pipe applications
- Condensing boiler
- Absorption chillers
- Trigeneneration
- Organic Rankine Cycle

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

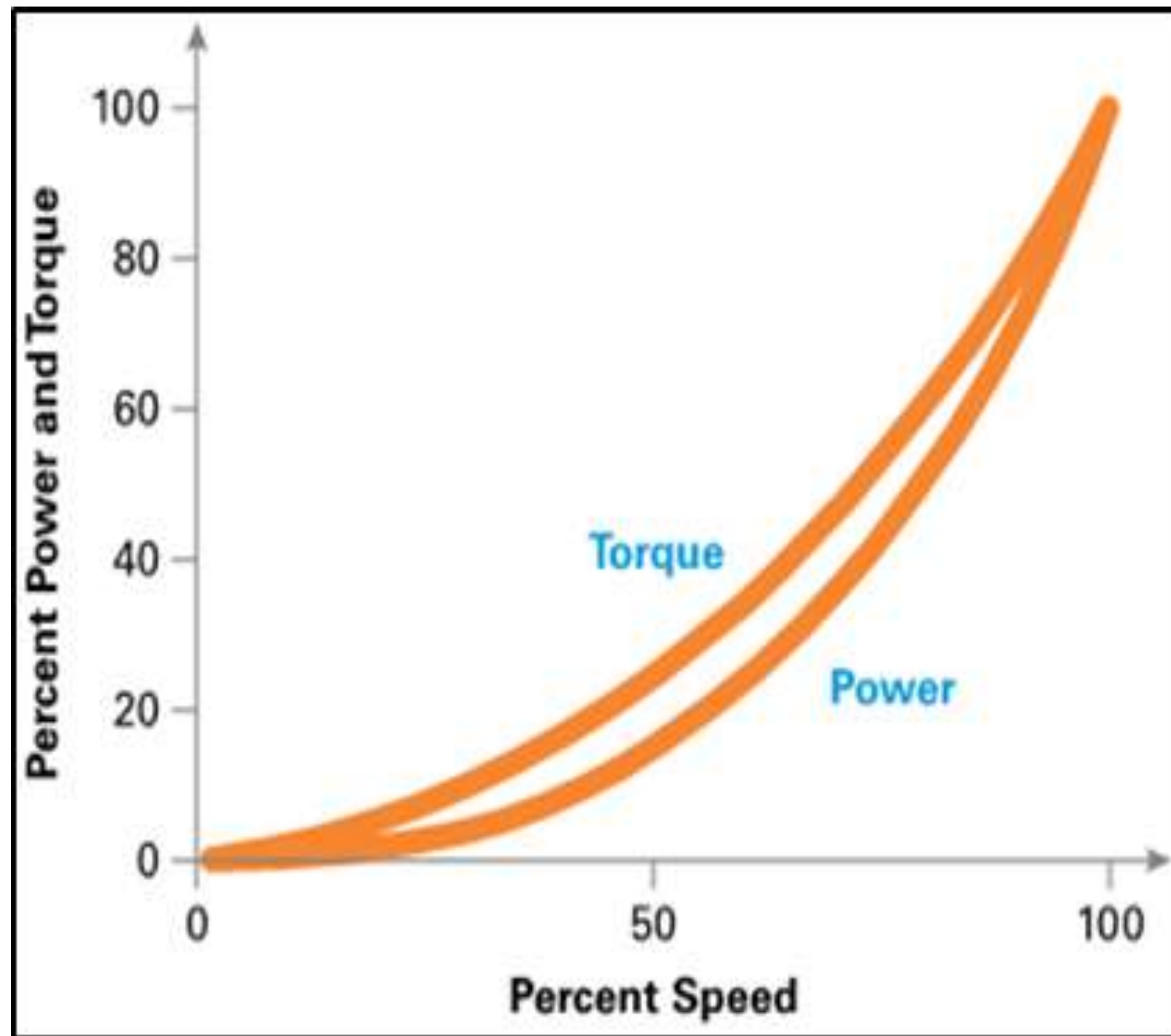
Variable Torque Load

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 : $P1/P2 = (N1/N2)^3$

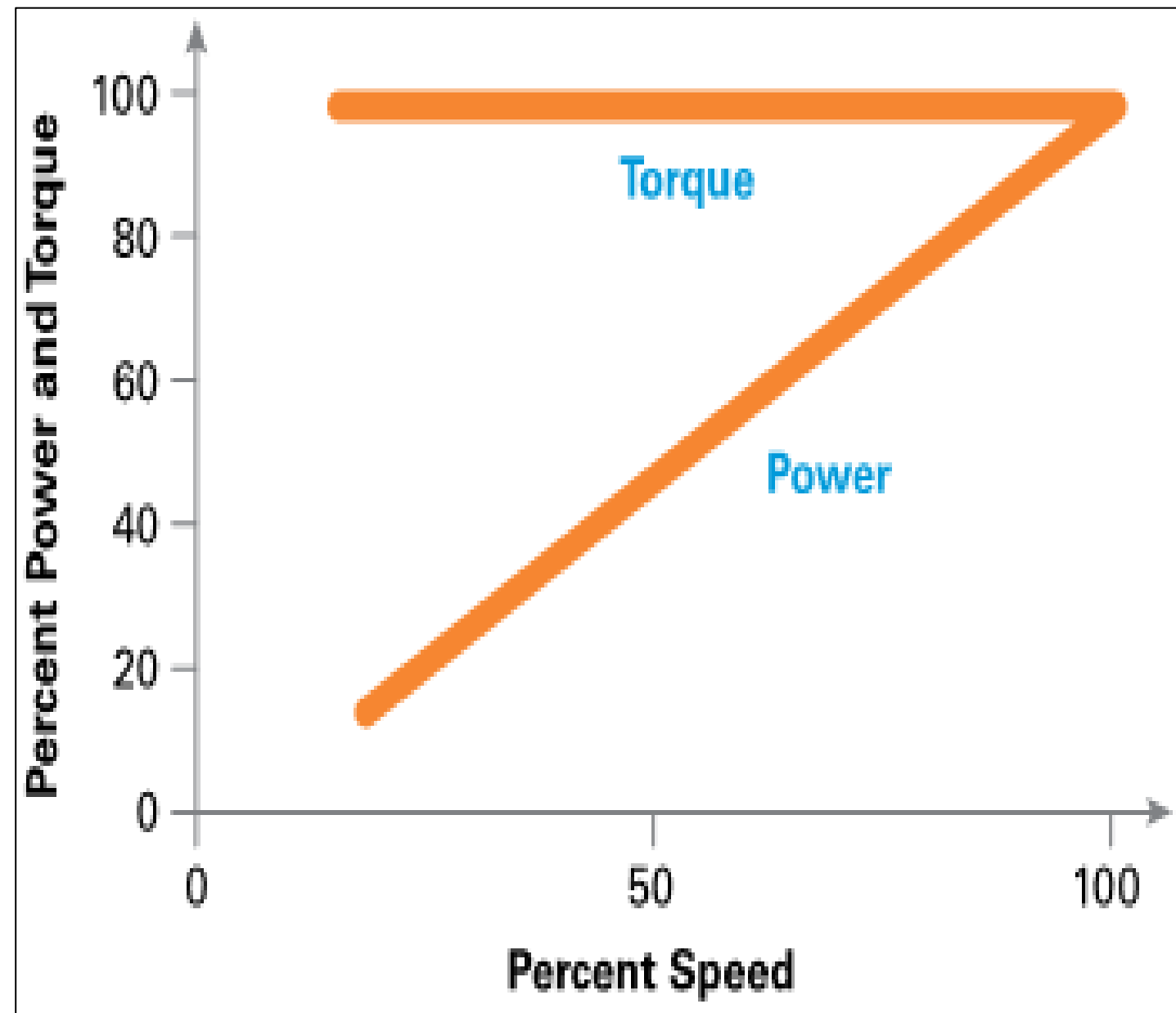
Where, Q = volumetric flow, H = head (pressure), P = power, N = speed (rpm)



FREQUENCY DRIVE (VFD) APPLICATIONS

2

Constant Torque Load



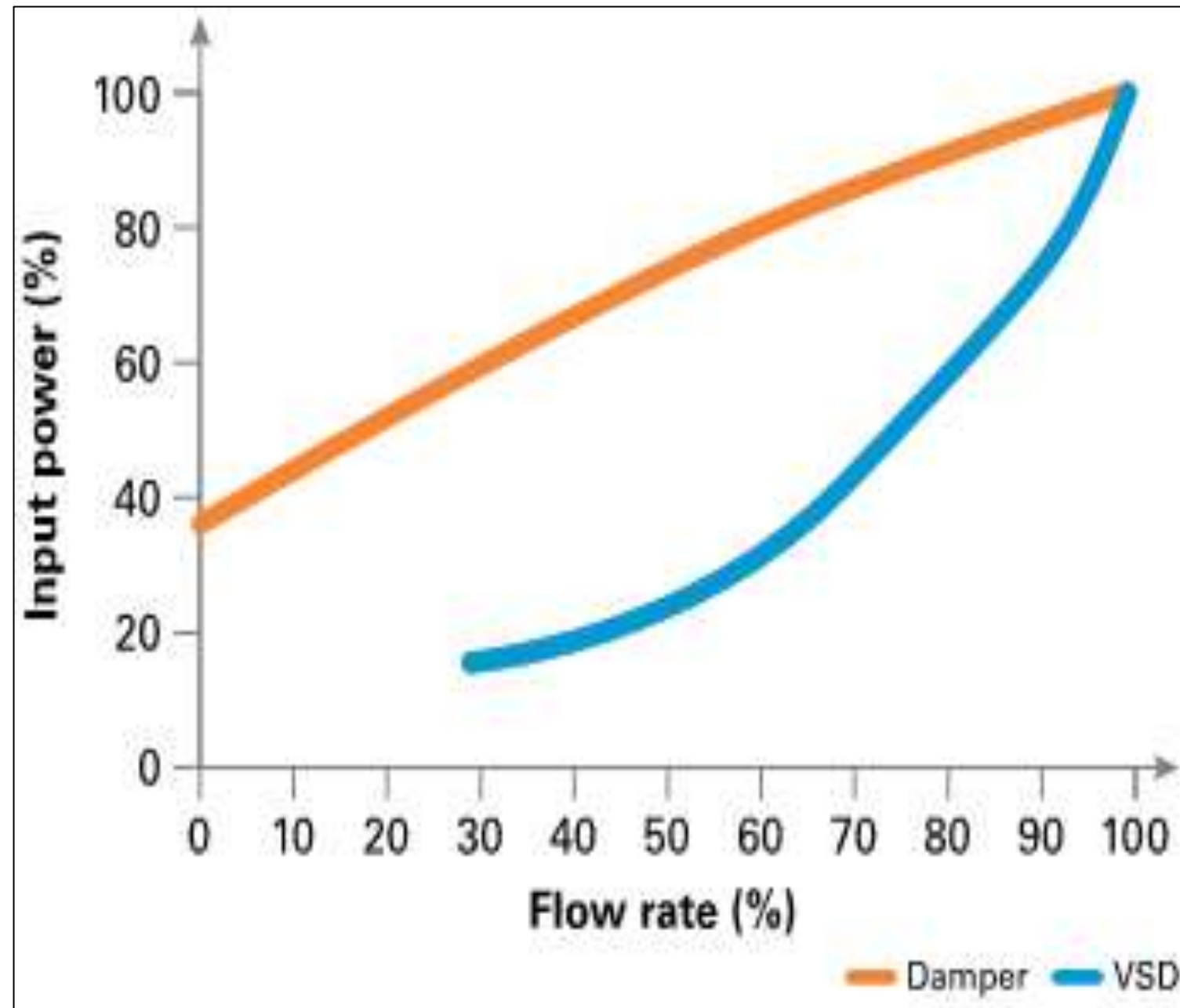
Typical constant torque applications include conveyors, agitators, crushers, positive displacement pumps and air compressor. On constant torque loads the torque remains constant with speed and the power absorbed is directly proportional to the speed this means that the power consumed will be in direct 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

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

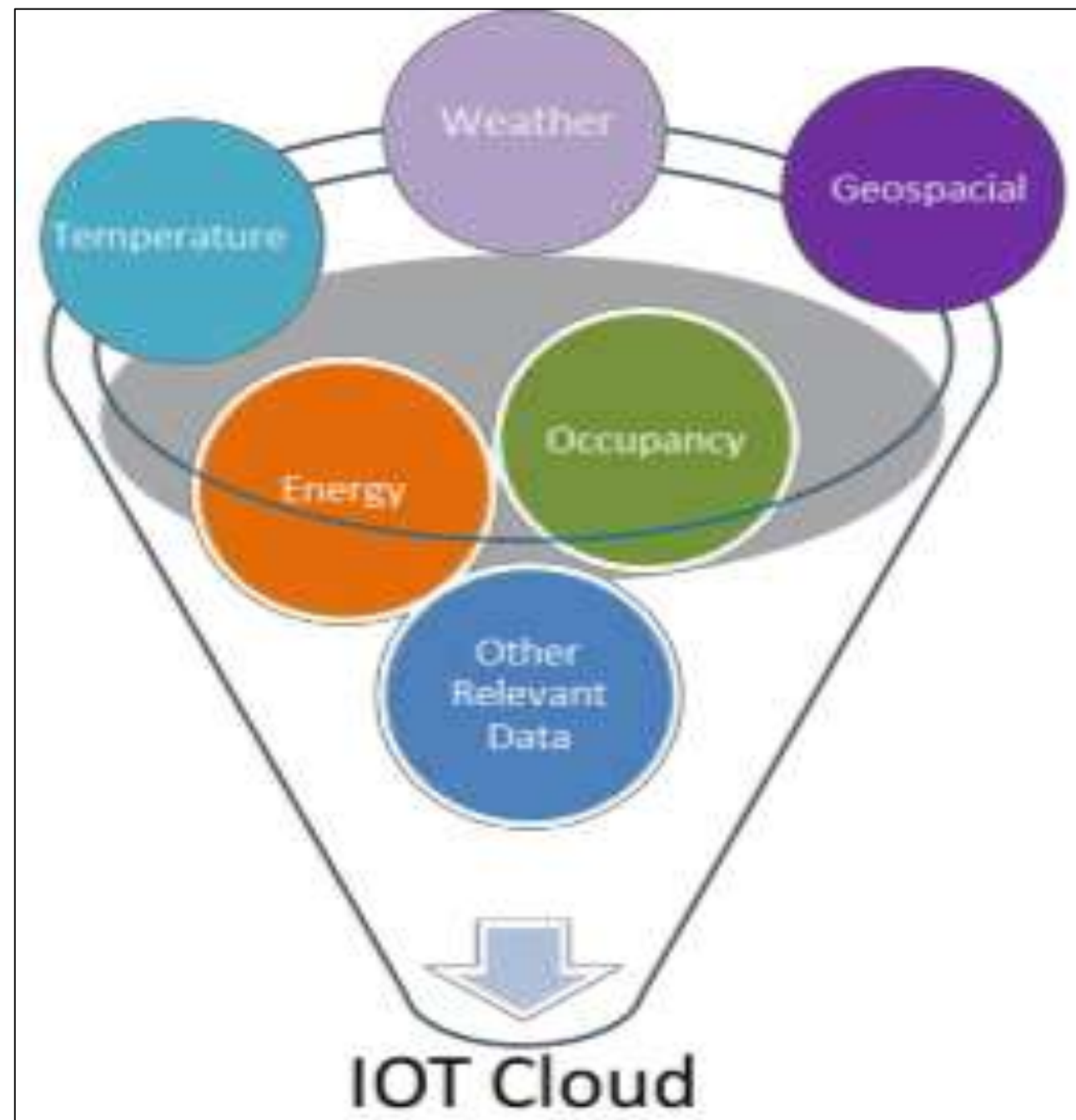


BEST PRACTICES AND TECHNOLOGIES IN THERMAL SYSTEM

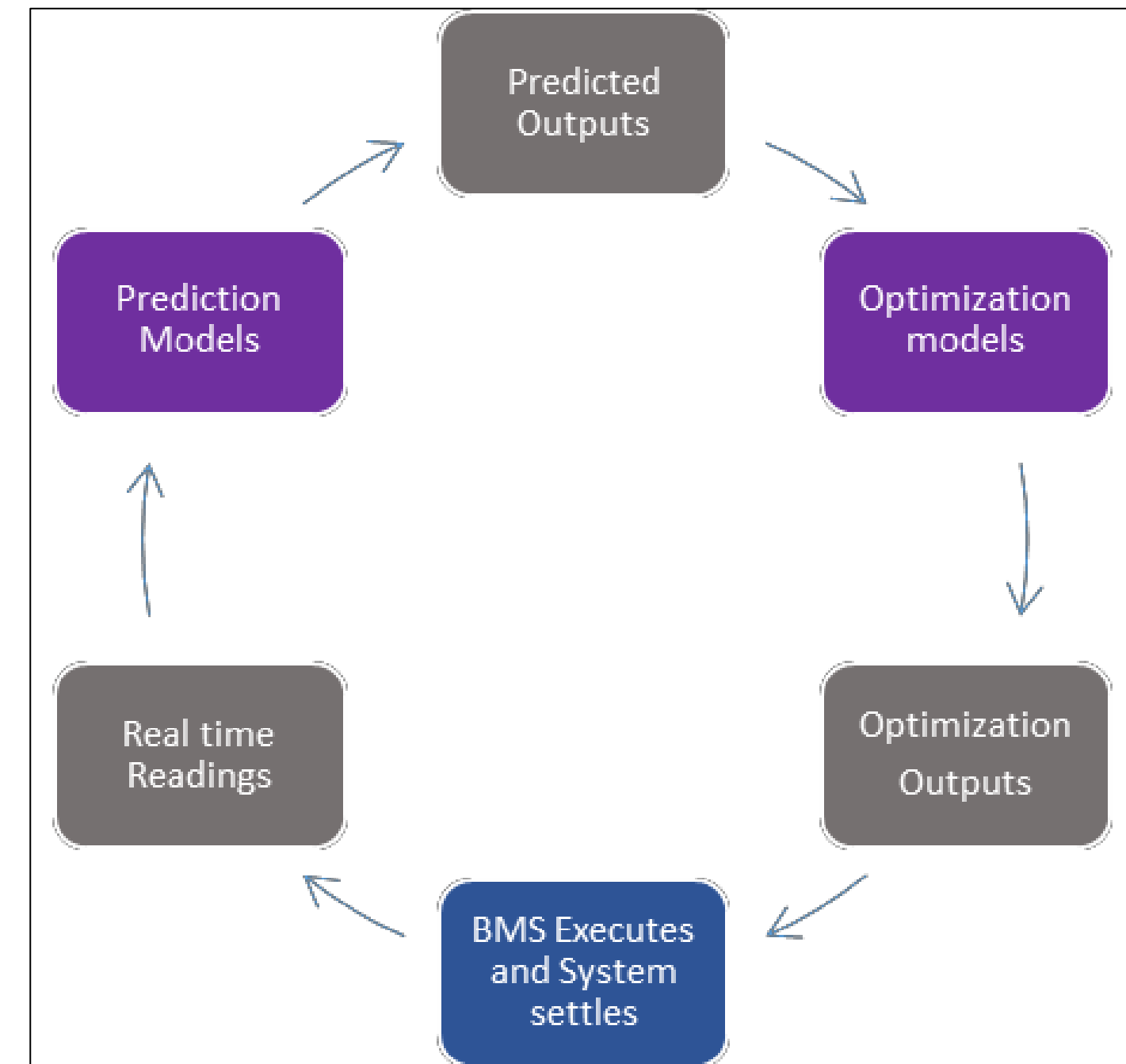
PRACTICES AND TECHNOLOGIES IN THERMAL SYSTEM

2

Internet of Things (IoT) Application for Chiller System



Multiple datasets from sensor networks

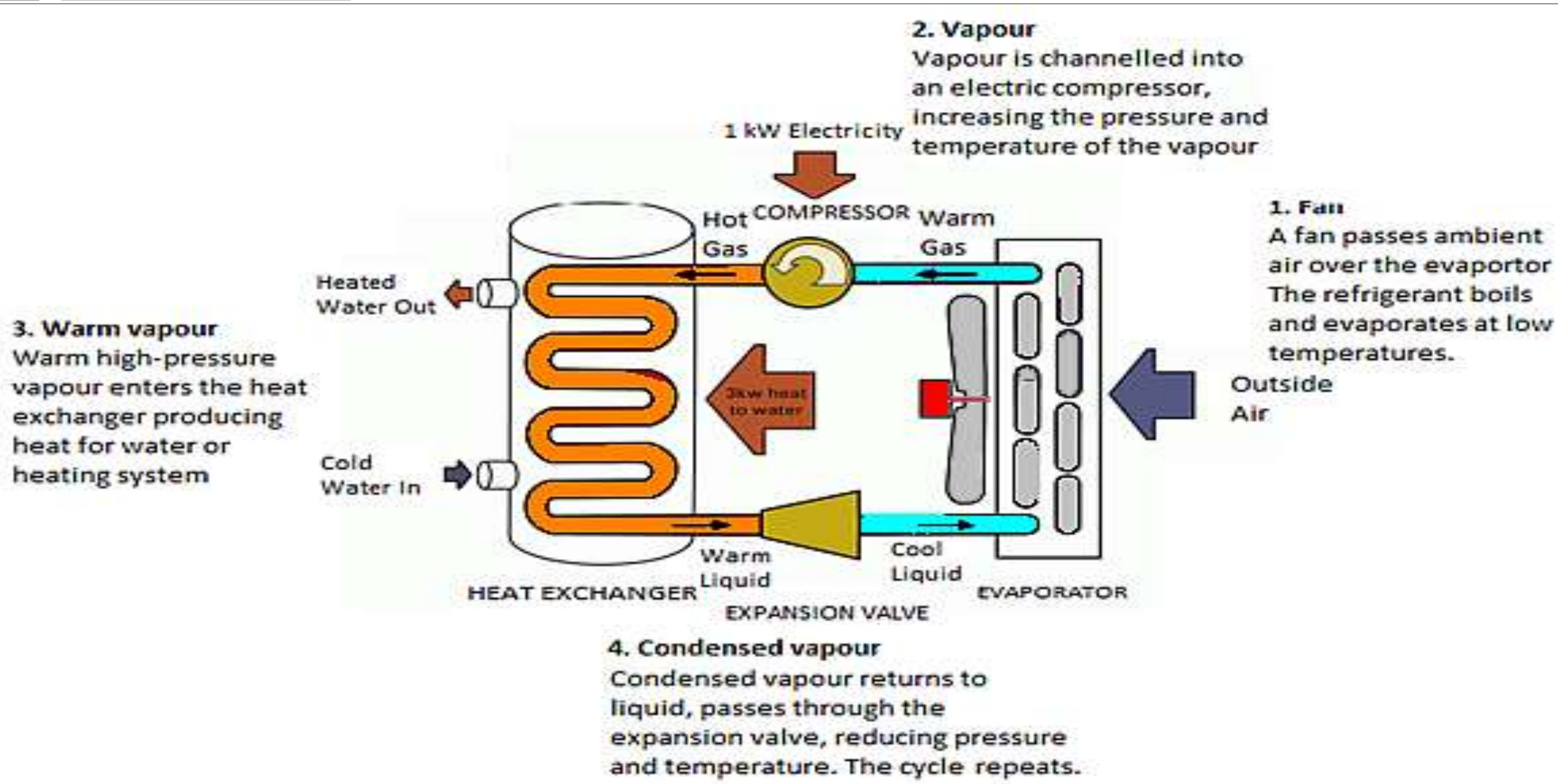


Optimization Approach Real Time Machine Learning Model

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3

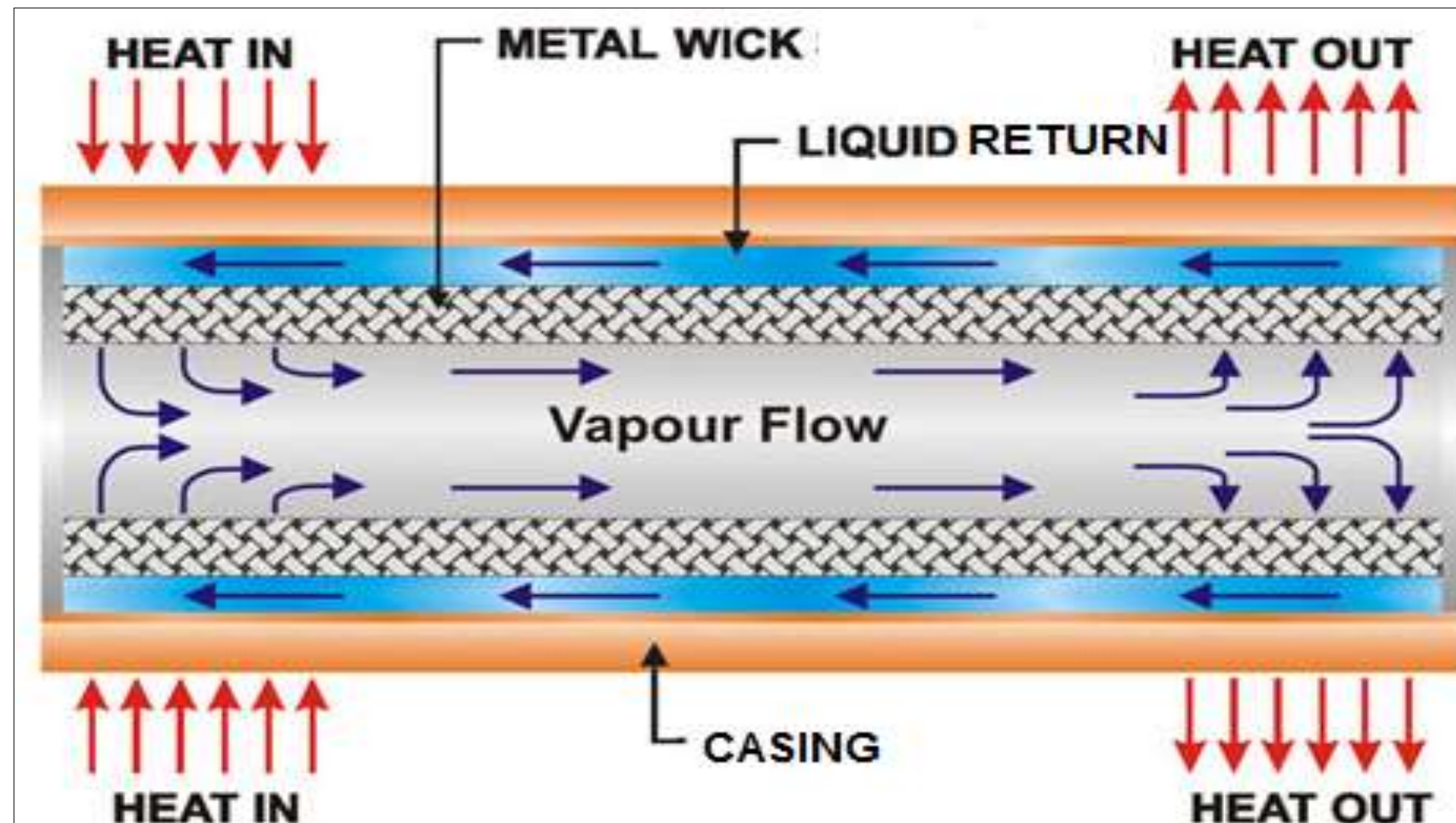
Heat Pump



PRACTICES AND TECHNOLOGIES IN THERMAL SYSTEM

4

Heat Pipe

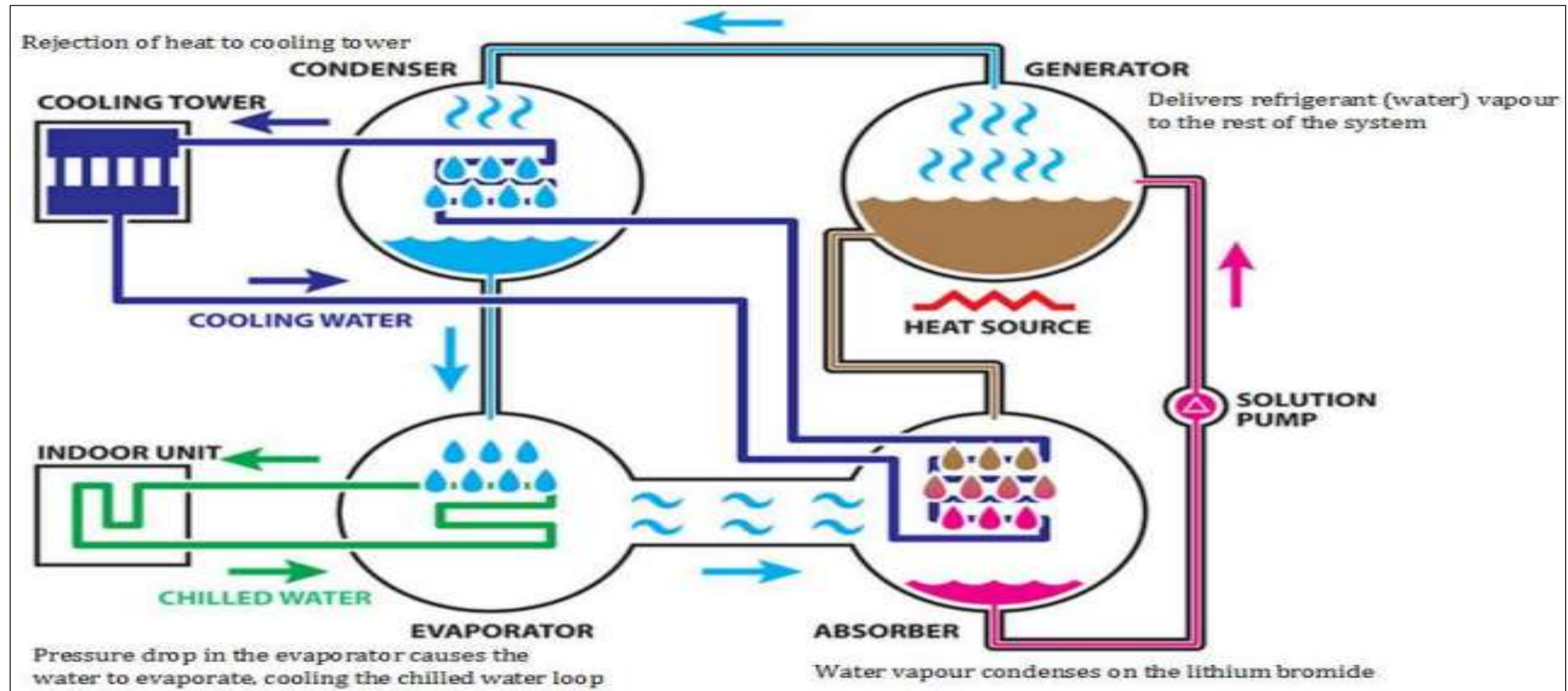


- Heat Pipes are devices which can transfer 1000 times more thermal energy than copper.
- Heat Pipe is basically a copper tube sealed on both ends with an internal wick or mesh along the interior of the pipe.
- The operating principle of heat pump is based on evaporation/condensing cycle.

PRACTICES AND TECHNOLOGIES IN THERMAL SYSTEM

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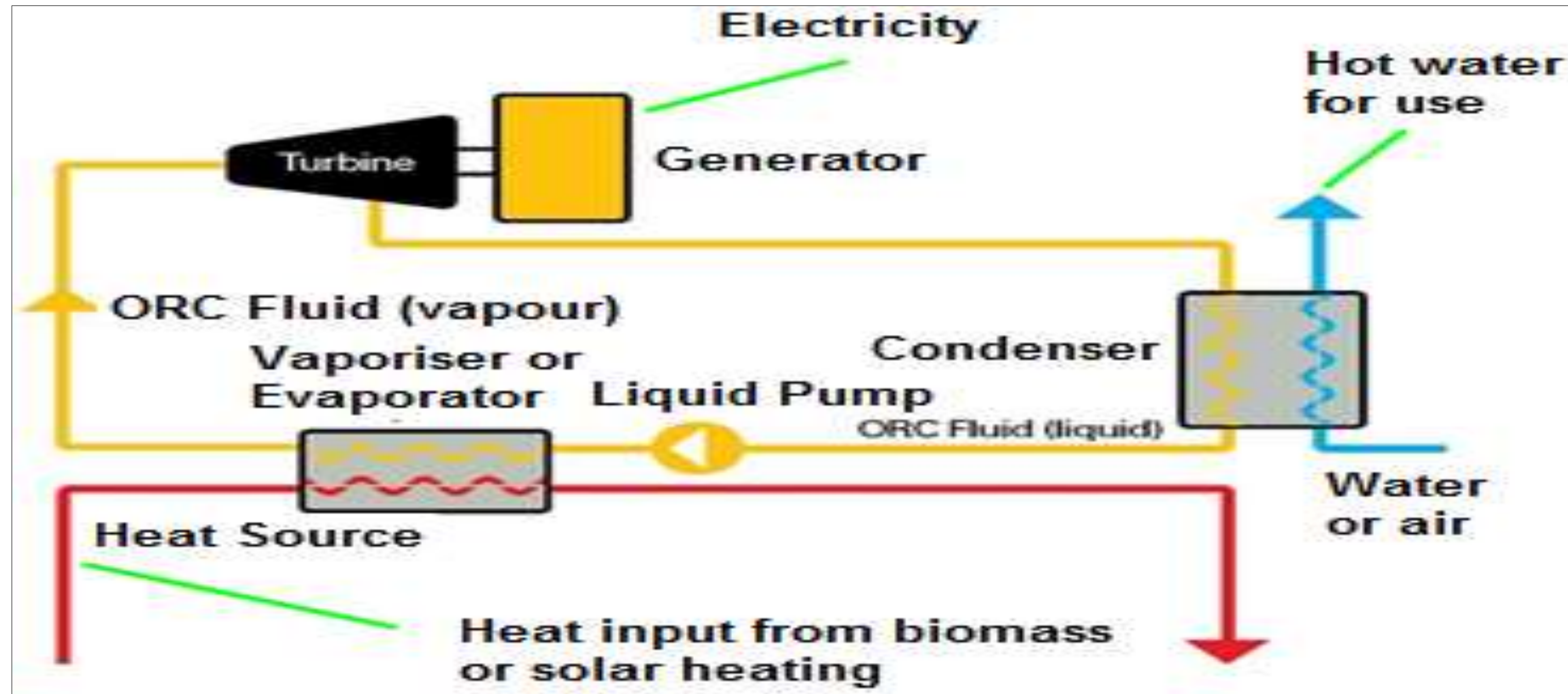
Trigeneration



PRACTICES AND TECHNOLOGIES IN THERMAL SYSTEM

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Organic Rankine Cycle



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