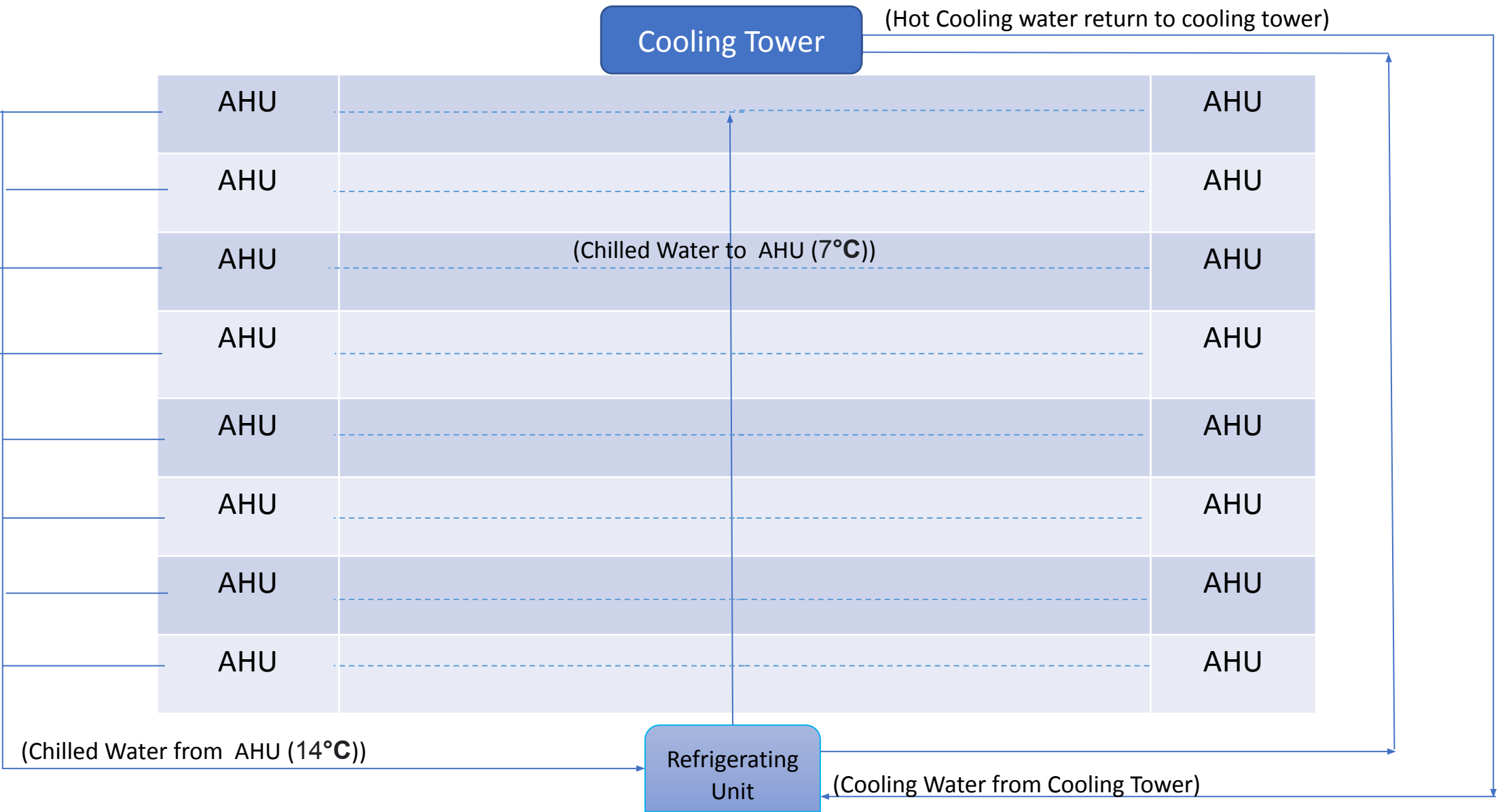


# ENERGY AUDIT:— ISM LIBRARY AIR CONDITIONING UNIT

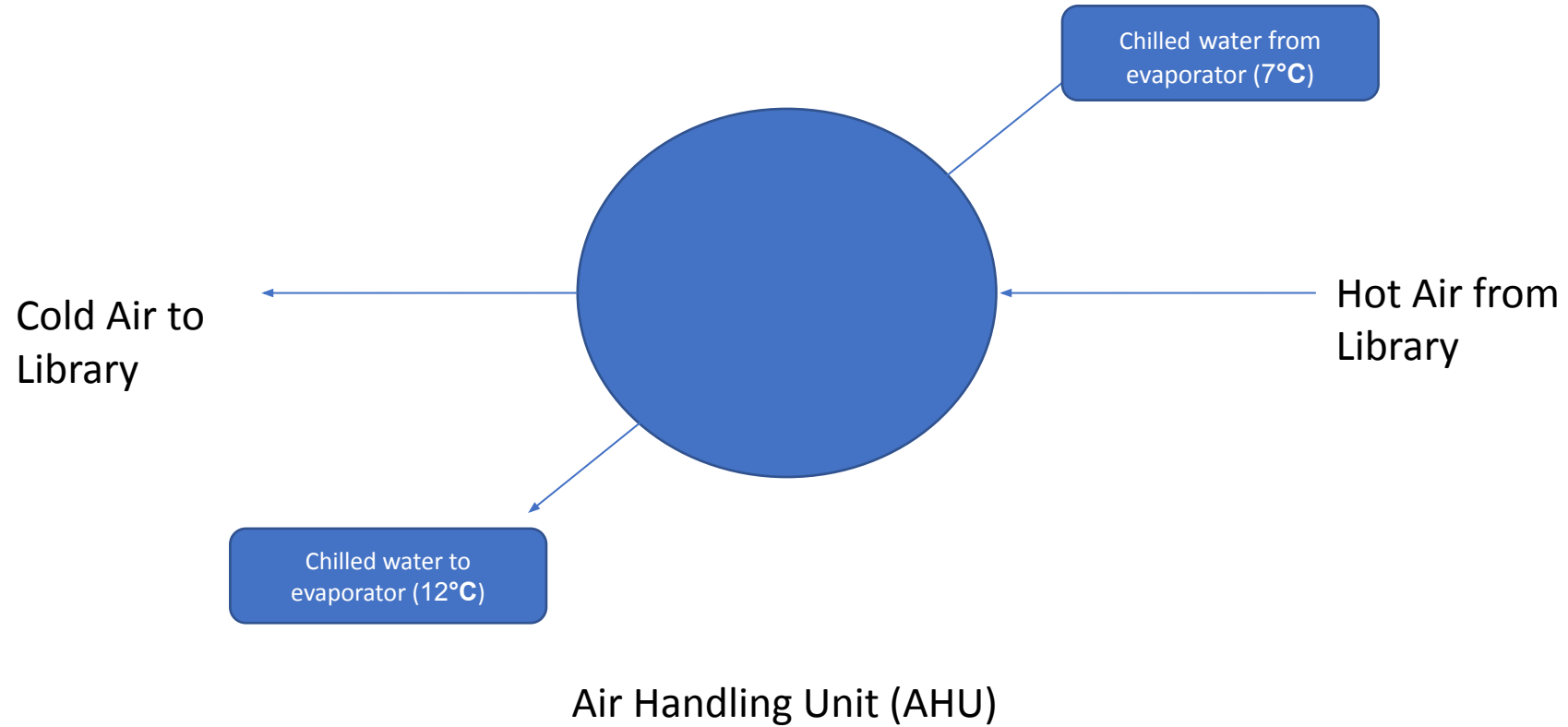


(AHU :- Air Handling Unit)

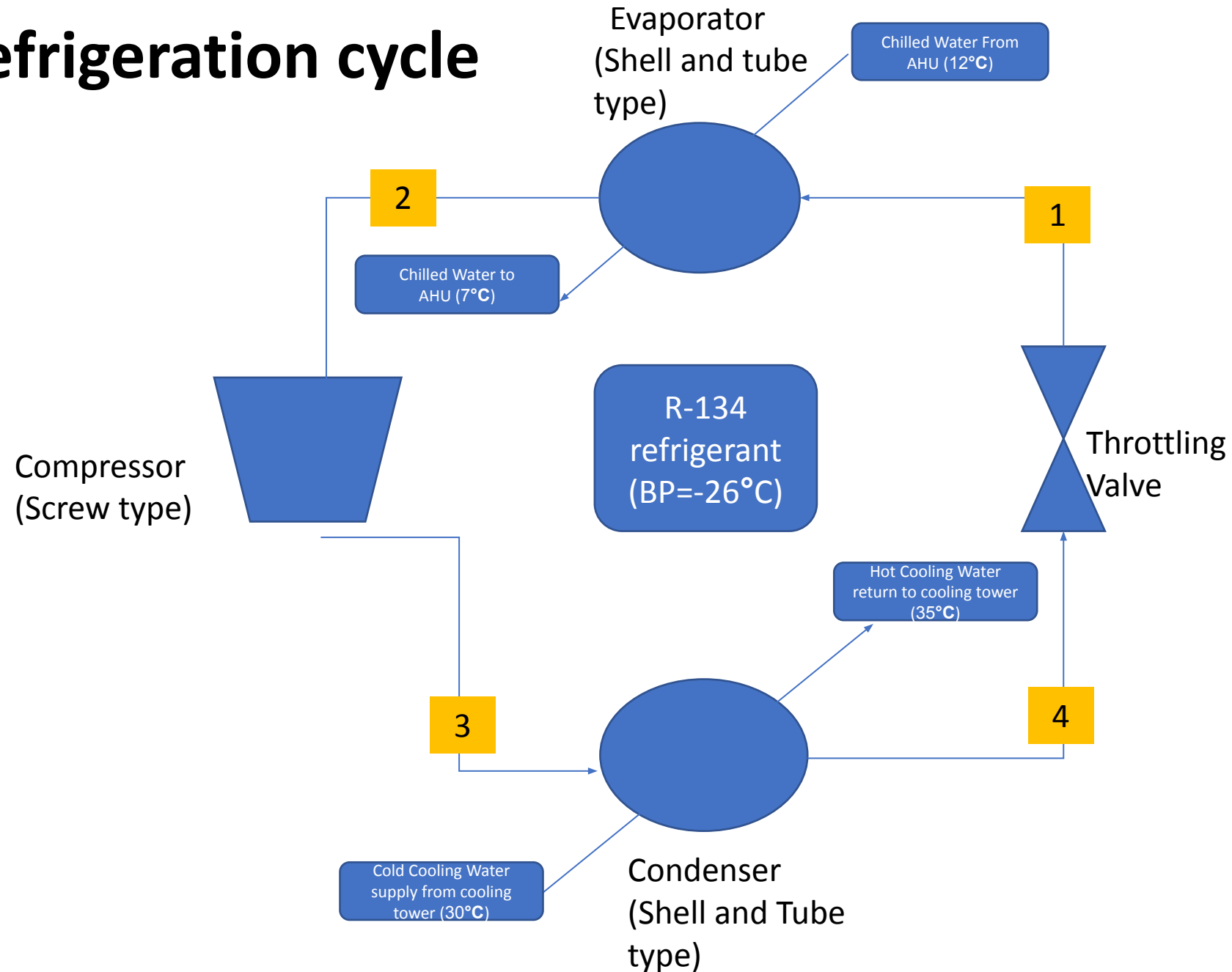
**BLOCK DIAGRAM OF REFRIGERATING SYSTEM**



# Air Handling Unit



# Refrigeration cycle



# ENERGY BALANCE in ASPEN Plus V.14

		Material			
Stream Name	Units	1	2	3	4
Description					
From		THROTTLE	EVAP	COMPRESS	COND
To		EVAP	COMPRESS	COND	THROTTLE
Stream Class		CONVEN	CONVEN	CONVEN	CONVEN
Phase			Vapor Phase	Vapor Phase	Liquid Phase
Temperature	C	-17.13222719	-2.418242941	64.10736601	38.18484697
Pressure	bar	1.5	2.68	12	9.68
Molar Vapor Fraction		0.361908164	1	1	0
Molar Liquid Fraction		0.638091836	0	0	1
Molar Enthalpy	cal/mol	-218163.1687	-214666.6162	-213566.5118	-218163.1687

# Coefficient of Performance – Carnot

$$\bullet \text{ COP} = \frac{\text{Heat absorbed at lower temperature}}{\text{Net Work}} = \frac{Q_c}{W} = \frac{T_c}{T_h - T_c}$$

- Operating Temperature

- Condenser = 38 °C = 311K =  $T_h$
- Evaporator = -2°C = 270K =  $T_c$

$$\bullet \text{ COP} = \frac{270K}{(311 - 270)K} = 6.58$$



# GAP ANALYSIS

- Controller 1<sup>st</sup> and 2<sup>nd</sup> floor AHU is non operational
- AHU blower belts needs replacement
- Cooling water pressure drop across the condensers 0.4kg/cm<sup>2</sup> more than the rated pressure drop.



# EFFECT AND COSTING

$$\text{Power consumed by centrifugal pumps(Watts)} = \frac{\text{Flowrate}(\frac{m^3}{s}) * \text{pressure drop(Pa)}}{\text{Efficiency of the pump}}$$

## Assumptions –

- Typical velocities of Process cooling water = 1.5 – 2.5m/s
- Typical Efficiencies of centrifugal pumps = 55 – 70%
- Days of operation per annum = 300
- Working hours per day = 15
- Cost of electricity = 12 Rs/Unit

## Measurements –

- Pressure drop readings across Supply and Return lines of cooling water = 1.1Kg/cm<sup>2</sup>
- Rated pressure drop = 0.7kg/cm<sup>2</sup>
- Line diameter = 10 inches



# Sensitivity analysis

Velocity▼	Power▼	Energy▼	Cost▼
m/s	KW	Units	Lakhs/annum
1.5	4.257072	19156.8	2.3
1.7	4.824681	21711.1	2.6
1.9	5.392291	24265.3	2.9
2.1	5.959901	26819.6	3.2
2.3	6.52751	29373.8	3.5
2.5	7.09512	31928.0	3.8

# THANK YOU



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