SOLAR POWERED VAPOUR ABSORPTION SYSTEM

ME 352 GROUP PROJECT
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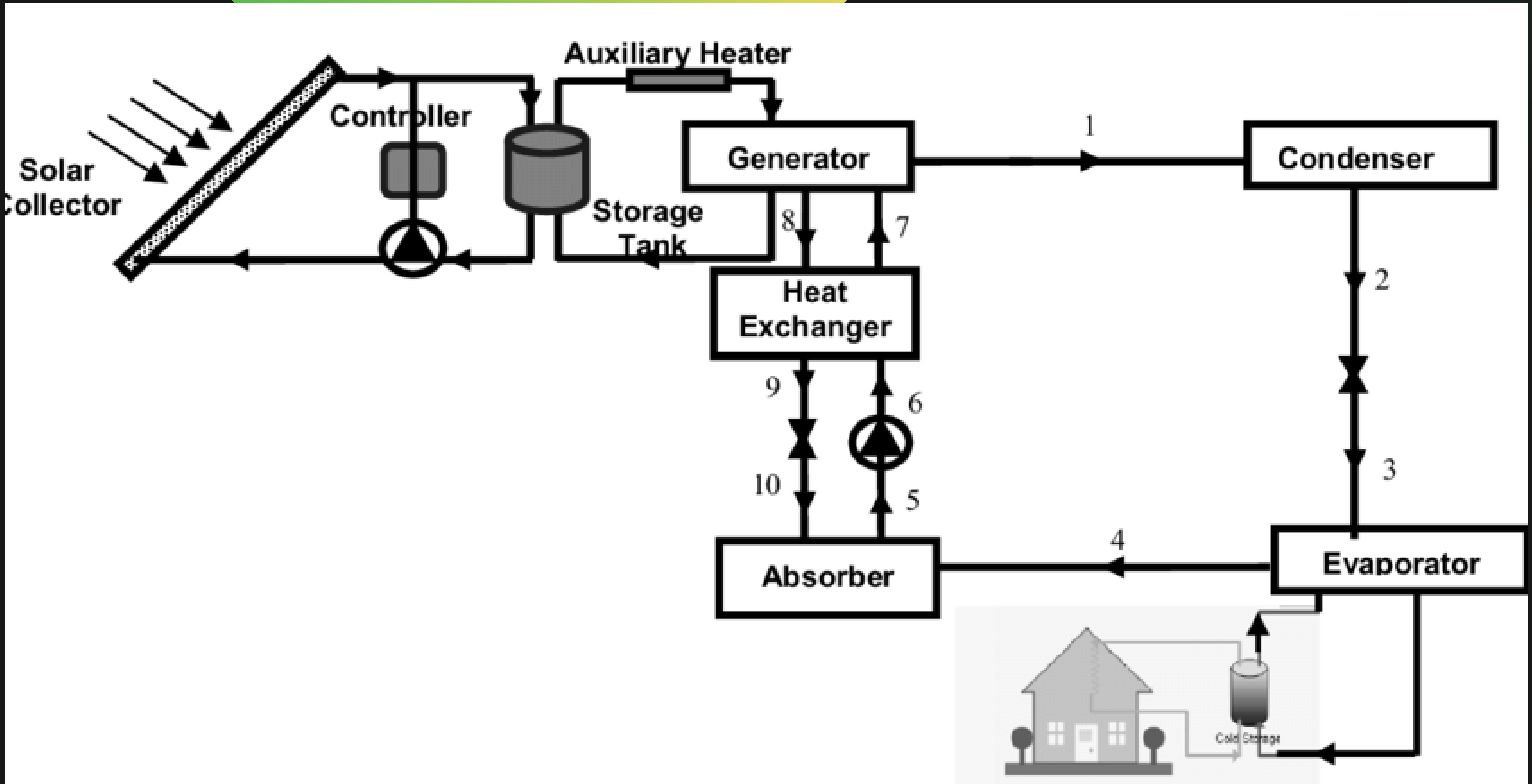
2023

INTRODUCTION

SOLAR ENERGY IS A VAST UNTAPPED ENERGY RESOURCE. ESTIMATES SHOW THAT THE EARTH RECEIVES 7,000 TIMES THE AMOUNT OF ENERGY THAT IS REQUIRED FOR HUMAN CONSUMPTION. CURRENTLY, WE USE SOLAR ENERGY TO FULFILL LESS THAN 1% OF ALL OUR ENERGY NEEDS.

SO, IN THIS PROJECT, WE WANT TO SHED LIGHT ON HOW SOLAR ENERGY CAN BE USED FOR OUR PROJECT TO REDUCE OPERATION COST AND IMPROVE SUSTAINABILITY.

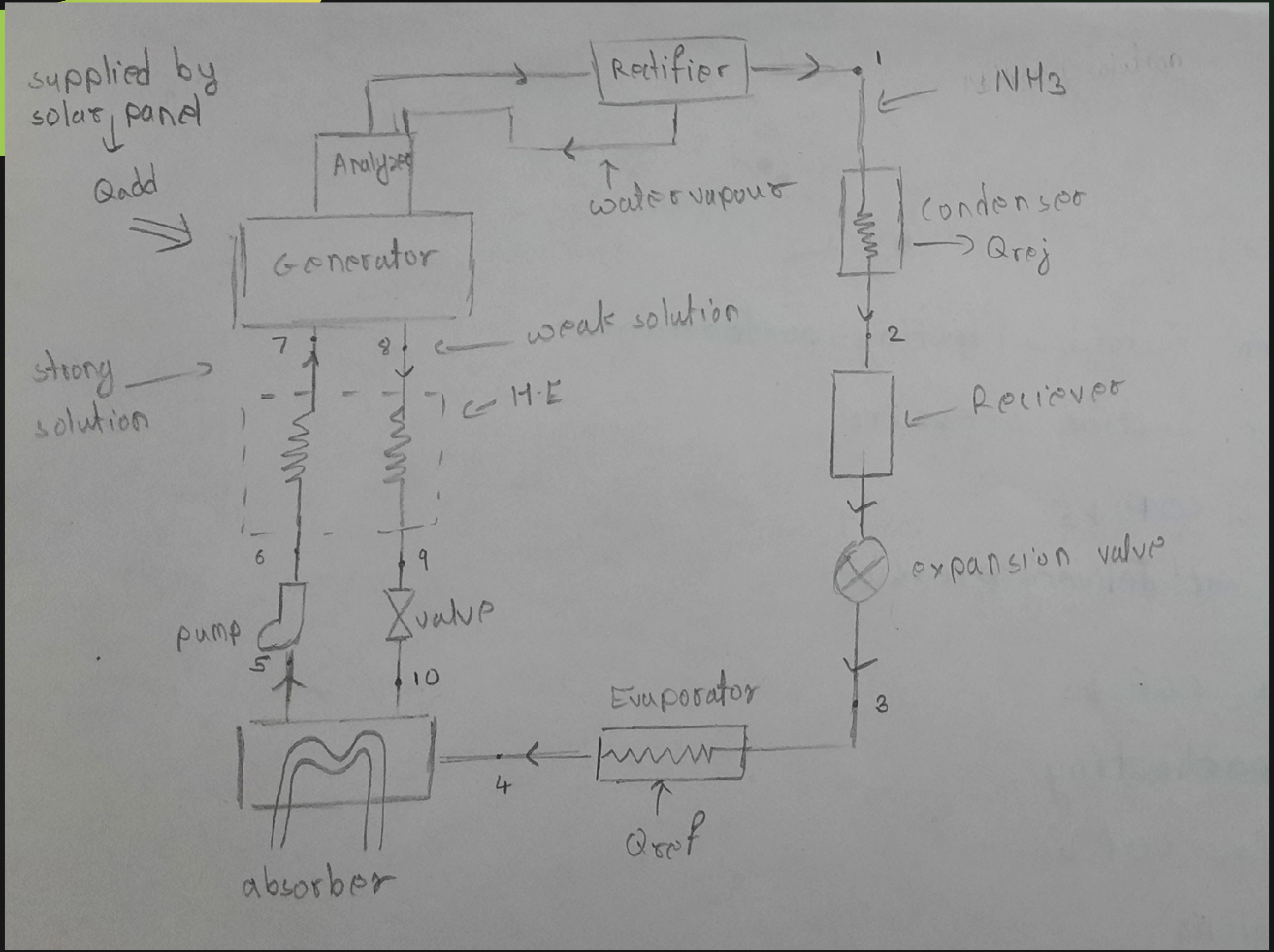
SCHEMATIC



SOLAR VAPOUR ABSORPTION REFRIGERATION SYSTEM

SCHEMATIC

THE SYSTEM



ENTHALPY-CONCENTRATION CHART

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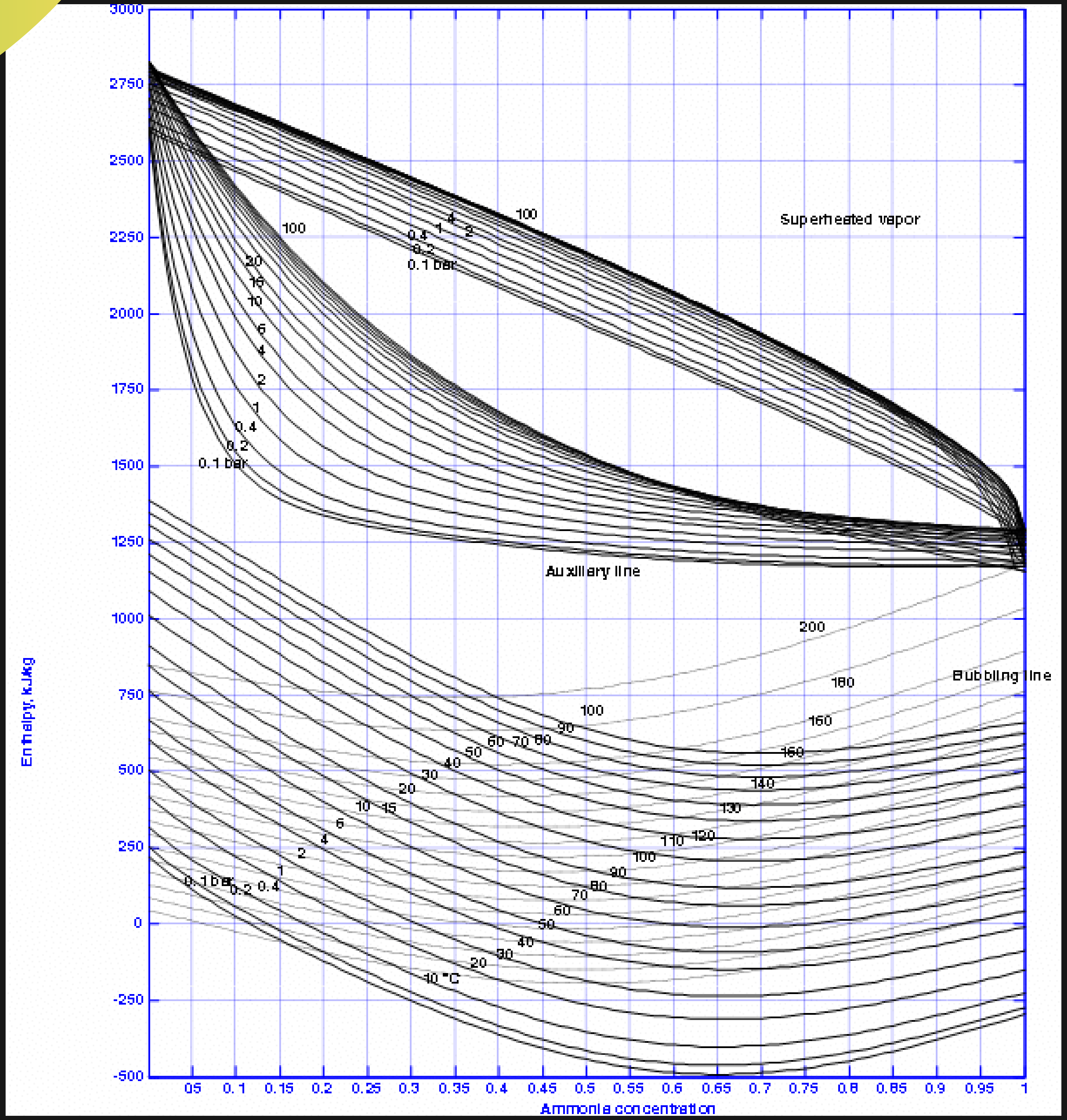
IT IS A GRAPHICAL REPRESENTATION OF THE THERMODYNAMIC PROPERTIES OF A MIXTURE OR SOLUTION. WHICH SHOWS THE RELATIONSHIP BETWEEN COMPOSITION, AND ENTHALPY



THEORY & ASSESSMENT

- WE ARE USING A 1 BHK HOUSE AS AN EXAMPLE. THE HOUSE HAS AN AREA OF 600 SQ.FT. WHICH MEANS THAT THE IDEAL AC STRENGTH IS 1 TR
- INITIAL WATER TEMPERATURE = 18 C
- CONDENSING TEMPERATURE = 25 C
- THUS, FROM REFRIGERATION TABLE OF AMMONIA (R 717) THE CONDENSER PRESSURE IS FIXED AT 10 BAR
- PRESSURE OF EVAPORATOR = 1 BAR
- THUS, SATURATION TEMPERATURE IN EVAPORATOR = -33 C

$Mr \times (h4 - h3) = 1$ TR

$Mr \times (h4 - h3) = 210$ KJ/min

Therefore, $Mr \times (1630 - 460) = 210$

It gives $Mr = 0.18$ Kg/min

Thus the mass flow rate of the ammonia through the evaporator ie

$$\boxed{M_r = 0.18 \text{ Kg/min}}$$

$$Qg - Qd = (h1 - ha)$$

$Qg - 23.4 = 0.18 \times (1630 - 70)$

therefore, $Qg = 304.2$ KJ/min

THEORY & ASSESSMENT

$$COP = \frac{Refrigeration\ effect}{Heat\ input\ in\ generator}$$

$$i.e.\ \ COP = \frac{Q_e}{Q_g}$$

Therefore, $COP = 210 / 304.2$

$= 0.69$

CALCULATIONS

FOR SOLAR WATER HEATER:

USEFUL ENERGY = Q = K X S X A

HERE, K = EFFICIENCY OF COLLECTOR PLATE

S = AVERAGE SOLAR HEAT FALLING ON EARTH = 6 KW

A = AREA OF COLLECTOR PLATES

NOW HEAT REQUIRED IN THE GENERATOR = 304.2 KJ/MIN

=304.2 X 1000 / 60

= 5070 W

THUS, AREA OF COLLECTOR PLATER = 5070 / (250 X K)

=24 SQ. M

COST OF 1 SOLAR PANEL (3 M X 2 M) = RS. 1,00,000

THUS, TOTAL COST = RS. 4,00,000

CALCULATIONS

HEAT INPUT AT THE COLLECTOR = SOLAR CONSTANT X AREA

= 250 W/M2 × 24 M2

= 6000 W

= 360 KJ/MIN

HEAT INPUT REQUIRED (AT GENERATOR) = 304.2 KJ/MIN

CONCLUSION

OUR SYSTEM IS SELF RELIANT IN NATURE AS THE SOLAR CELLS PROVIDE MORE THAN ENOUGH HEAT ENERGY FOR THE SYSTEM.

THE SYSTEM IS POSSIBLE WITH A COP OF 0.69 WHICH IS ADEQUATE.

IT CAN BE USED IN SMALL HOUSEHOLDS (600 SQ. FT.) LIKE MUMBAI AND ADAPTED FOR USE IN LARGER REGIONS.

REFERENCES

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