Comparitive Analysis Of Different Condensors For A Vapour Absorption Refrigeration System Using Solar Energy

Mrityunjay Kapadia[1], Prof.Pankaj Badgaiyan[2], Prof.Amit khare[3]
[1]Dept of Energy Technology
[2, 3]Professor, Dept of Energy Technology
Dept of Energy Technology
[1, 2] Truba Institute of Engineering and Information Technology, Bhopal, Madhya Pradesh 462038.

Abstract- *Solar resource, which itself is today's most plentiful source of power, yet we need effective technologies to access this energy supply into a variety of applications. As a result, the major purpose of the project would be to use solar energy to build and research an ecologically responsible absorption cooling system. The vapor absorption refrigeration system consists of two fluids, ammonia and water, and has three phases: vapor, absorb, and regeneration. When boiling points point refrigerant evaporates in this chiller, it carries some heat away with it, giving a cooling effect, and changing gas solid to a liquid. In this system, the expander is replacing by such a producer and absorbers energy, that is the most plentiful form of electricity in Asia, but we need effective technology can tap into this energy source for a variety of applications. As a result, the major objectives of this work would be to use solar energy to build and research an ecologically responsible absorption cooling system. The vapour absorption system is composed of two fluids, ammonia and water, and has 3 stages: dissipation, absorption, and regeneration. When boiling points point refrigerant evaporates inside this chiller, it carries some heat away with it, giving a cooling effect, and changing gas back to a liquid. The expander is supplemented in this arrangement by a generation and also an absorption.*

Keywords- Absorber, Aqua-Ammonia Vapour, Coefficient of Performance, Generator, Solar Energy, Tonnage of Refrigeration.

I. INTRODUCTION

Vapor Absorption

A radiant heat (for example, sunlight, a petroleum & energy flame, waste gas from businesses, or district heaters) also is used to power the chilling operation in an absorbing refrigerator. This system includes dual heat exchangers, the first of which conducts evaporation before even being consumed by the other; heat is necessary to restore the dual chilled water to their initial states. The same idea is used to wind buildings by utilizing hot air from a gas turbine or a water heater. Using warm air from a gas turbine boosts the turbine's effectiveness because it first generates electricity, then hot water, and last air conditioning. [1]

Regeneration, which is a process. Absorption refrigerators are used in motorhomes (raves), tents, and caravans since the heat required to operate them may be provided by a propane gas burner, a decreased dc heat (from a battery or car electrical system), or even an electricity electric heater. Unlike more popular vapor refrigeration systems, an absorption refrigerator may be built with really no moving parts other from the coolants. [2]

Solar Vapor Absorption Refrigeration System

Solar refrigerator is used in areas with significant solar radiation; when cooling is required but grid electricity is too costly. Vapor absorbing refrigerated systems work on process heat generated by a generator. Numerous industrial units create thermal energy via the combustion of fossil fuels, while others use indirect heat through steam. Following the procedure, heat is discharged into the surrounding environment as waste. This waste may well be gathered and used to power refrigerator systems that is heat-based, such as an absorbent refrigerator cycles. The purpose of this research is to evaluate the absorp- tion using renewable radiation as the principal type of power for an inconsistent refrigeration system. Such technologies make it simple to harness the energy released by the Sunlight is composed of heat. [3]

An absorbance refrigerator is one that utilizes a source of heat (such as solar, a hydrocarbon burner, waste gas from industries, and district heaters) to produce the energy required for chilling.

In this system, the mechanical compressing component of vapor compression was replaced by a thermal compressing mechanism. Thermal compression is done through the following process

A simple pump is used to pump this solution to the pressurized cycle.

Creating vapor from a solution by warming it (thus, cooling)

Various Definitive Terms

Refrigeration: It is the way of eliminating heating or reducing the temperature while maintaining it below the ambi- ent temperature. The refrigeration unit is tons of refrigeration. Freezer is the practice of reducing the temperature of a place or material just below air temp. Cooling was done mostly using similar technology to those outlined above until Nicholas Twining invented the commercialized refrigerator in 1856. In 1805, the first cooling machine, a refrigerator, was designed by Oliver Evans, it was John Gorrie who created the first functioning model. Gorrie created a chilly temperature by compression a gas, chilling it using radiating coils, and then releasing it to drop the temperatures even more. This technique of chilling, known also as steam process, is perhaps the most extensively utilized now. [1]

The technical advances achieved out over previous century were nothing short of astounding, yet the foundations of the refrigeration system have stayed practically unchanged. Modern progress has provided us with different methods of conducting this refrigeration, as well as increased its efficiency. Despite this, John Gorrie's original technique of refrigeration via vapor compression refrigeration is by far the most often employed. We would want to investigate as part of the ongoing research, useful alternatives to the standard vapor-compression approach hunt for newer technologies in the realm of science. As a result, the goal of this project is to find, evaluate, and build a functioning model of another freezing mechanism, such as a system of vapour compression refrigeration. [3]

Features of Solar Vapor Absorption Refrigeration System
VARS often are categorized as heat-driven systems. They are particularly useful whenever at temperatures numbered from zero to 200◦C, there seems to be a limited supply of infrared radiation.

The idea may be utilized to air-condition buildings by utilizing a source's accessible waste heat. Ars are typically utilized in big commercial and industrial systems, as well as in recreational rvs for storage.

Geothermal power, solar energy, waste gas via combined cycle or process steam facilities, and sometimes even oil and gas when it is reasonably cheap are some examples.

Utilizing excess heat from a gas turbine, for example, makes it incredibly efficient since it first creates power, then hot water, then ultimately air conditioning (a process known as cogeneration/regeneration).

COMPONENTS

Refrigeration Components

1. Evaporator
2. Absorber
3. Generator
4. Condenser
5. Receiver
6. Expansion

Solar Vapor Absorbance Refrigerator Systems Benefits:
Compressor technique for the refrigeration: The compressing of a refrigerant is one of most crucial aspects of any refrigeration system since all subsequent activities rely on it. The refrigerant enters the A compressor in either a vapor compression system that might be piston, rotating, or centrifugal. In an absorption cooling system, the absorbency absorbs the chilling. Compresses the refrigerant. As the refrigeration is absorbed, its volume decreases as it transitions from the vapor to the liquid form.[8]

Power consumption devices: The compressors are the primary energy consumers in the vapor compression refrigeration system, whereas the compressor used to transport refrigerant absorb solutions is the primary energy consumer in the liquid absorption cycle.

The amount of power required: The compressor in the compressor unit requires a significant amount of power to operate, which rises in terms of the size of either a refrigeration system. In the case of a domestic refrigerator, the compressor uses very little power and remains almost constant (or slightly rises) even while chilling capacity is raised. As a consequence, the absorption cooling system uses much more energy than just the vapor compression cycle method.

Running cost: The Electricity is used to power refrigerating technology, which uses a lot of that though. Because electricity is so expensive these days, the running expenses of the evaporative cooling system are significant. A refrigerating system requires just a submersible pump and a little quantity of power. Most process plants that utilize absorb freezing have some excess steam from the furnace that could be used to supply energy. As a result, an evaporative cooling system requires no extra pure electric power, and also the energy that otherwise would be Waste is used in the factory. As a result, the cooling system's operating cost is substantially lower than the vapor compression cycle.[9]

Capacity control of the system: The During the compressor unit, the compression manages the efficiency. In order; in most cases, a gradual approach to dealing the with present situ- ation is achieved. When no workload is present on the network, an absorber fridge may reach steeples sustainability practices or zero performance.

Though constant speed approach suitable turbines have become obtainable, they consume Even if the cooler wasn't in operation, it consumes as lot of energy. The energy consumption in an adsorbed is minimal there is no tension.

Leakage of the refrigerant: That there were no (or very few) refrigerant leaks in the refrigeration systems, or the nitrogen itself is quite inexpensive. As a result, there are essentially no refrigerant recharge charges. In the case of vapor compression systems, there are many refrigerant leaks, necessitating constant refrigerant recharging, which is quite costly.

Greenhouse effect: The greenhouse effect is produced by the majority of the halogenated refrigeration systems used in compression refrigeration systems. According the Paris Agreement, its usage must be totally phased out by year 2020.

II. LITERATURE REVIEW

"**absorption cooling systems – review of various techniques for energy performance enhancement"**

Rasoulnikbakhtiand and xiaolinwang et al. (2020) [01] In this paper, the goal is to look at different technologies that have been used to improve the efficiency of uptake refriger-ation. Cycle layout advancement, reheat technique, additional functional pairs, more sub-components, including improved operating parameters are all effective and promising ways to increase a fellow officer of uptake refrigeration, this work says. A new technology called absorption refrigeration was invented to solve some big problems, like the energy crisis, rising fuel costs, and ecological disasters with traditional compression refrigeration systems. A lot of people are interested in it because of its advantages, like being able to use reduced heat sources and working fluid pairs that are good for the environment. Because of these two big problems, absorption systems can't be used in the real world because they are too big and don't work very well. Many research projects have been done to come up with ways to increase the competitiveness of absorbance refrigerants relative to compressing refrigerators. That's because the refrigerating innovation is cheaper than compression refrigeration systems.

"**concentrated solar energy system and cold thermal energy storage"** Bahram ghorbania and mehdimehrpooya et al. (2020) [02]

This paper develops and examines a hybrid photovoltaic refrigerated system with cold thermo storage. As a cooling system, an absorbency air conditioning system with only a temperatures range of 23.5 ◦c is employed. The cycle has been adjusted for usage in a combined construction. Solar dish collectors are used in the absorbing refrigeration system generator to provide the needed duty. This combined process may generate 373.7 kilowatt of refrigeration. With fact, During the day, a portion of the cooling provided by this technique is used immediately in freezers.

While the remainder is kept in an includes areas (p.m.) system. Furthermore, the quantity of refrigeration held there in low-temperature pcm overnight is pumped into the freezer.

In this study, the tools Ansys, & mat lab were used to simulate an integrated system that is based on meteorological data from the port city of Basra, Iran. Solar collectors have a positive effect on the system's energy efficiency, according to exergetic analyses. have the highest exudation rate (77.33 percent) and hx3 has the lowest (5.07%). The preservation of refrigeration generated by the refrigeration system during non-peak hours and its usage during peak hours may be an effective strategy to lower the cost of the system in the industry sector.

"**proposal and 3e (energy, exergy, and exergoeco- nomic) assessment of a cogeneration system using an organic Rankine cycle and an absorption refrigeration system in the northeast brazil"**

Souza and c a c Dos Santos et al (2020 [03]: The research proposes a combination cycle systems capable of meeting all of a public college campus's electricity and heat demands. This system is proposed to have an engines (ice), a Rankine cycle (orc), with sinking equipment. Two types of equipment were selected for the latter: refrigerating column and a refrigerating system (Ars). The institute of innovative resources (is) at the community college of Paraba (ufpb)in northwestern Brazil will demonstrate the combined cycle system. The system's energy and electrical performances were evaluated.while it operated in two unique Orc simple (orc-s) & orc combinations are the two modes (orc-c). The power density of an ice engine's exhaust is connected to both procedures. Thermodynamic equations for both modes of operation have been created. utilising additional and secondary thermodynam- ics principles and input variables such as expansion inlet, fric- tion coefficient, and chilled or frozen tank output temperatures. The economic feasibility technique was developed using the spec method (specific exergy price) and thermosiphons. The orc proposed method utilises a scroll expander and is powered by The working fluid is r-134a, and the sole source of Arsenic is an irrigation combination. According with statistics, the imp function can deliver between 18.9 and 37.5 percent of total power usage, while a orc-s mode may provide between 12.4 and 24.5 percent. As according dynamic simulation, the orc-c allowed a 33.6 percentage effect on physical power production, a 4.5 to 34.5 percent gain in effectiveness, a nearly 40% improvement in efficiency, and a decrease in total lost exergy. Exergy-wise, the price of The effect of cold water is negligible effect on the entire cost of the items, but the price the warm air has a large impact on the cost cost of both (about 46% for a different heat source)

“**novel and efficient integration of a humidification-dehumidification desalination system with an absorption refrigeration system”**

Naef a. And qasem et al. (2020) [04]

The research develops and assesses a unique humidifier (hdh) desalination system coupled with that double evaporative cooling system to generate a large volume of freshwater.

The saltwater stream of the hdh technology is utilized to cool the refrigerating program’s compressor and absorbers while providing enough warmth to run the system hdh. The effect of operating factors on the effectiveness of the connected approach is explored. As performance metrics, the obtained converting effectiveness, efficiency (cop), energy analyses, fresh - water production, and fresh cost are used. The facility has a watering capability of 1145 litres per hour and a cooling capacity of 62.45 tonnes per hour. We find that the optimal efficiency indices for gor, cop, and overall energetic intensities are 4.54, 1.29, as well as 5.83, respectfully. Additionally, excluding the The cost of the cooling effect of underground water is predicted to be 2.89 \$/m3. Apart from air conditioning capabilities, the integration efficiency beats the typical hdh system by 2.20 times in terms of total gor, 2.21 continuous days with freshwater output, with efficiency gains of 8.24 times.

“**vapor absorption refrigeration system for rural cold storage: a comparative study”** Divyaarputham selvaraj1 and kirubakaran victor et al. (2020) [05]

The purpose of this research is to investigate the power quality issues in traditional vapor compression systems. A comparison of vapor absorption refrigerant (vars) and vapor absorption refrigeration refrigeration (var), as well as power multivariate statistical and thermometer on both systems, has been performed and presented. The value addition of agricultural goods enhances rural farmers’ livelihood chances. Chiller is one method for shelf life extension of agricultural products. Global warming and ozone depletion caused by coolants have grown as the use of air conditioning utilizing vapor compression refrigeration technologies has expanded. To address this issue, the United Action Plan on Climate Change imposed many limits on the refrigerant (unfccc). Because there is currently way to halt the development, your focus must be on developing alternative. Numerous research towards a refrigeration substitute have previously been undertaken.

Literature Gap

In this chapter we have studied previous work for Vapor Absorption System and its working and simulation. However, the effect of condenser on VAR system with solar panel is not studied yet. In this project we propose the same using CFD software ANSYS fluent in which we can compare for Energy analysis, static temperature, wall temperature, Enthalpy, Total Enthalpy, and Entropy

3.1 Problem Formulation

we have studied previous work for Vapor Absorption System and its working and simulation. However the effect of condenser on VAR system with solar panel is not studied yet.In this project we propose the same using CFD software ANSYS fluent in which we can compare for Energy analysis, static temperature, wall temperature, Enthalpy, Total Enthalpy, and Entropy.

3.2 Objective

1. To perform comparative analysis of a solar-powered vapor absorption refrigeration cooling system energy for different condenser
2. To design Tapered helix condenser, helical condenser and Planar condenser model.
3. To Calculate and compare the results of three condenser types: helical coil, tapered helix, and planar type condenser, including Energy analysis,

static temperature, wall temperature, Enthalpy, Total Enthalpy, and Entropy.

III. **METHODOLOGY APPROACH**

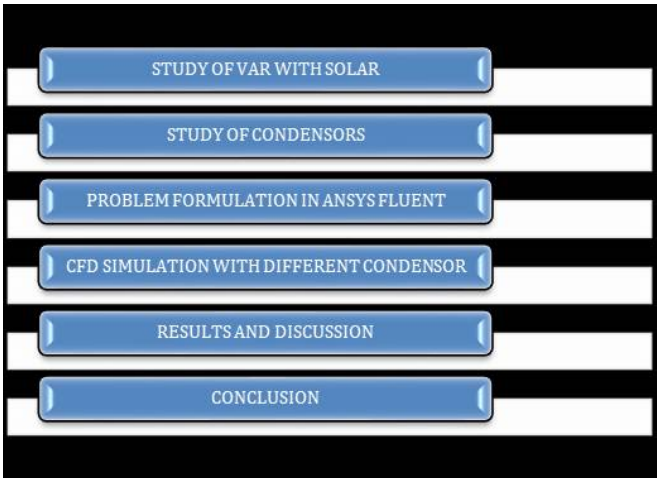


Fig1.3 Methodology Process

3.3 Computational fluid dynamics (CFD)

CFD is a discipline of mechanical that resolves problems through use of numeric analyses of information structure. and analyze issues involving fluid flows. With high-speed computing systems, the computations necessary to model the interactions of liquids or gases with surface specified by initial conditions may be performed. Ongoing research results in software that enhances the efficiency and accuracy of complicated simulation situations such as hypersonic or turbulence simulations.

3.4 Ansys Fluent

ANSYS Fluent is a cutting-edge computer tool that allows for the simulation of fluid flow, heat transport, and reactions in complicated geometries.

3.5 Entropy

Entropy is the amounts of thermal energy per unit temperatures in a system that cannot be used for meaningful work Entropy is a measure of a system's molecular disorder since work is formed from structured molecular motion., or unpredictability. Entropy gives clear insights through into path of spontaneously changes for several daily events.

T1 is greater than T2.

$$\Delta S = Q\left(\frac{1}{T_2} - \frac{1}{T_1}\right),$$

If T1 = T2, the reservoirs are in equilibrium, no heat fluxes occur, and S = 0.

$$\Delta S = \frac{Q_2}{T_2} - \frac{Q_1}{T_1}.$$

A cycle for which S = 0 is reversible since an infinitesimal modification is enough to allow the heat engine to operate backwards as a refrigerator.

$$\left(\frac{Q_2}{Q_1}\right)_{\min} = \frac{T_2}{T_1}$$

3.6 Enthalpy

Enthalpy is defined as the total of a thermodynamics system's functional energy or the products of its total pressure. Enthalpy is an energy-like attribute or state function with energy dimensions (measured in joules or ergs), Its value is determined completely by the temperatures, pressure, and composition of the system, rather than its history. H is equivalent to the enthalpy. product of the pressure and the system's internal energy, E., P, and volume, V:

$H = E + PV$.

The change in internal energy is directly proportional to the temperature transmitted to the system less the work done by it, according to the rule of energy conservation.

3.7 Total Energy

Overall Energy denotes the total final energy consumption at a certain branch/variable. Total energy differs with Final Energy Intensity in that energy data is recorded directly, rather than as the result of a level of activity as well as an energy intensity.

A body's or object's total energy is the sum of its Kinetic Energy and Potential Energy.

Total Energy = Kinetic Energy + Potential Energy

According to the definition. Let “m” be the mass of the body, v be its velocity, and h be its height above the earth.

3.8. Design of condensers

The dimensions mentioned below are approximate: Height is 40 mm, pitch is 8 mm, 100 mm coil diameter, and 3.176 mm tube diameter

3.9. Different condenser geometry inputs

Table.1.2 coil parameters

	Helical coil	Tapered-Helix	Planar Tube
Temperature at the Inlet	313 K	313 K	313 K
Temperature at the Outlet	305 K	305 K	305 K

Table.4.3 coil parameters

	INLET	OUTLET
Persuasion (kPa)	88	3.45
The temperature was (K)	313	305
Rate of Total Heat Transfer (kW)	20	
(kg/s) Mass Flow Rate	0.0132	

IV. RESULT AND DISCUSSION

Results comparison between Tapered helix condenser and Planar condenser model by using temperature.

Geometric Modeling of condensers

According the literature, each constituent of this working example may be constructed in the most efficient manner possible using a certain set of commercially available materials. The condenser may be configured in a variety of ways, and the expansions coil can be configured with the best number of pitched the coil diameter for a specific length of copper pipe.

As a consequence, this article describes a CFD investigation of the condensation coil and expansion coil. CATIA V5 is used to generate the expanding coil and condenser models, which are then put into the ANSYS 15 workstation. Following that, the model is processed in the ANSYS workstations module to yield a structured mesh.

4.1. Results comparison between Tapered helix condenser and Planar condenser model by using temperature.

1. **Tapered Helix Condenser**

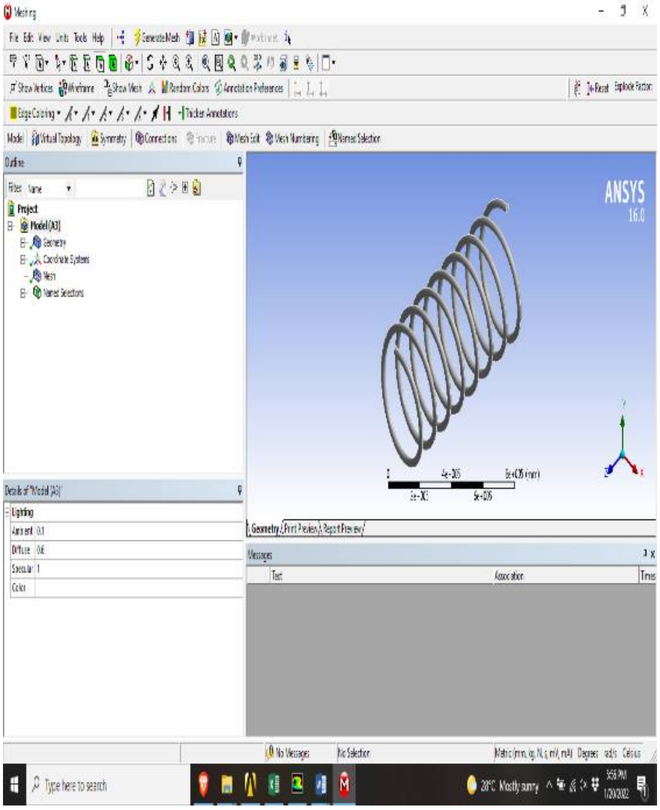


fig1.9: Tapered Helix Condenser

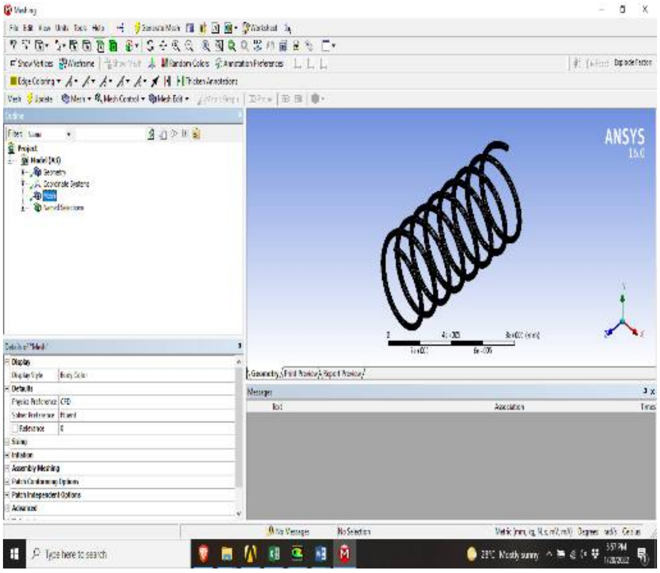
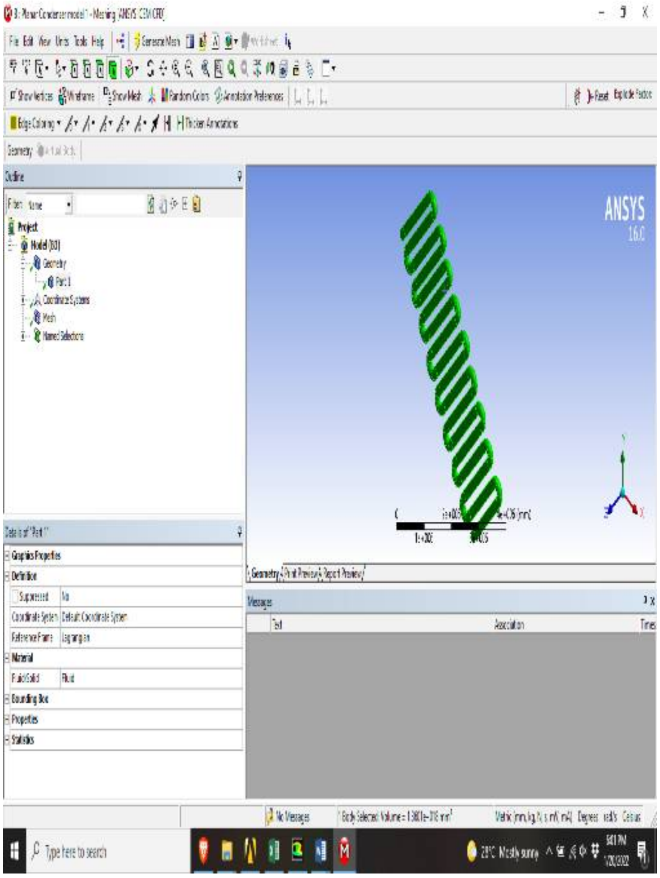


Fig1.10: Meshing of Tapered Helix Condenser

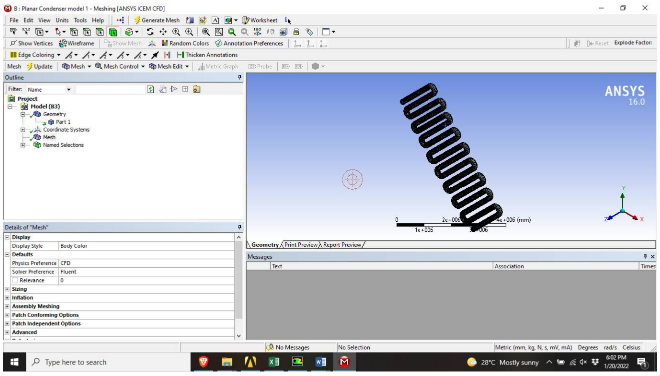
Meshing: From basic, automatic meshing to a precisely tailored mesh, Ansys provides the whole solution. By keying away physics decisions and implementing smart default, strong automated systems make it simpler to mesh an new shape on a first attempt. Additionally, users may reply quickly to parameters variations, which simplifies the transfer from CAD to CAE and aids in up-front designing.
Meshing details: Nodes: 1419100 and Elements: 1900000

2. Planar Condenser model



Details of "Part1"	
Graphics Properties	
Definition	
Suppressed	No
Coordinate System	Default Coordinate System
Reference Frame	Lagrangian
Material	
Fluid/Solid	Fluid
Bounding Box	
Properties	
Statistics	

Fig1.11: Planar Condenser model

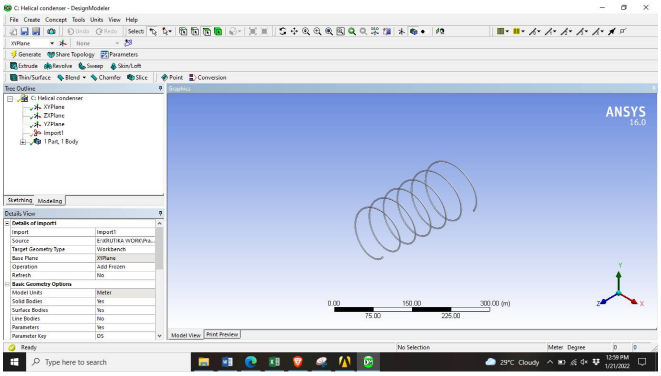


Details of "Mesh"	
Display	
Display Style	Body Color
Defaults	
Physics Preference	CFD
Solver Preference	Fluent
Relevance	0
Sizing	
Inflation	
Assembly Meshing	
Patch Conforming Options	
Patch Independent Options	
Advanced	

Fig1.12: Meshing of Planar Condenser model

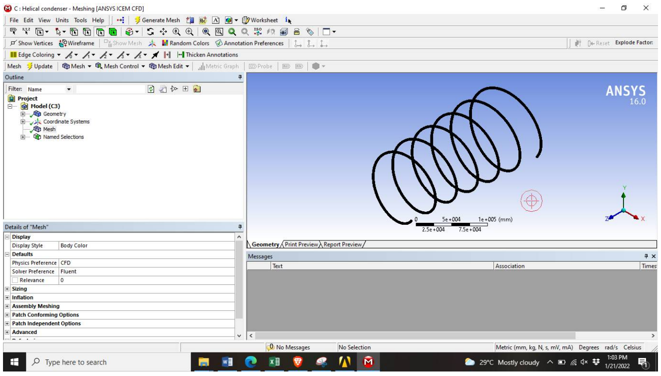
Meshing: From basic, automatic mesh generation to a precisely tailored mesh, Ansys provides the whole solution. By keying away physics decisions and applying smart assumptions, powerful automated systems make it simpler to construct a new shape on the first effort. Additionally, users may reply quickly to parameters changes, which simplifies the transfer from CAD to CAE and aids in up-front designing.
Meshing details: Nodes: 1419100 and Elements: 1900000

3. Helical Condenser



Details of Import1	
Import	Import1
Source	E:\KRUTIKA WORK\Pra...
Target Geometry Type	Workbench
Base Plane	XYPlane
Operation	Add Frozen
Refresh	No
Basic Geometry Options	
Model Units	Meter
Solid Bodies	Yes
Surface Bodies	Yes
Line Bodies	No
Parameters	Yes
Parameter Key	DS

Fig1.13: Helical Condenser model



Details of "Mesh"	
Display	
Display Style	Body Color
Defaults	
Physics Preference	CFD
Solver Preference	Fluent
Relevance	0
Sizing	
Inflation	
Assembly Meshing	
Patch Conforming Options	
Patch Independent Options	
Advanced	

Fig1.14: Meshing of Helical Condenser model

Meshing: From basic, automatic meshing to a precisely tailored mesh, Ansys provides the whole solution. By inputting off physical decisions and implementing intelligent defaults, strong automated systems make it simpler to mesh a new shape on the first attempt.

Additionally, users may reply quickly to parameters, which simplifies the transfer form CAD to CAE and aids in up-front designing.

Meshing details: Nodes: 1419100 and Elements: 1900000

4.2. Results of condensers

Tapered helix condenser

1. **Static temperature**

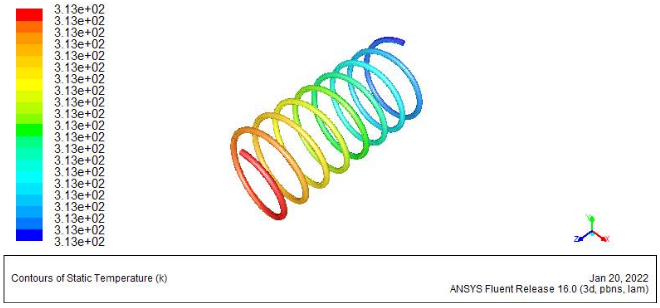


Fig1.15: Static temperature

Graph: Static Temperature

The graph depicts the findings of static temperature, in which static temperature is constant towards the conclusion.

2. Wall temperature

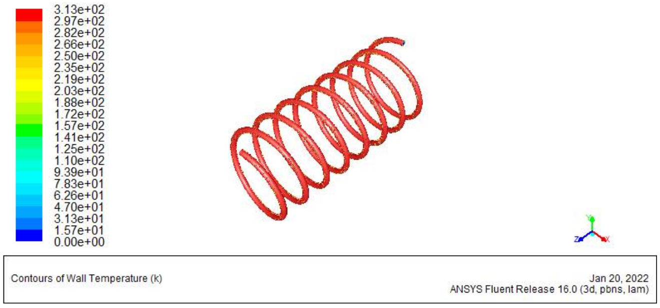


Fig1.16: Wall temperature

Graph: Wall temperature

The graph depicts the findings of wall temperature, in which wall temperature is greatest at the beginning and diminishes towards the conclusion

3. Enthalpy

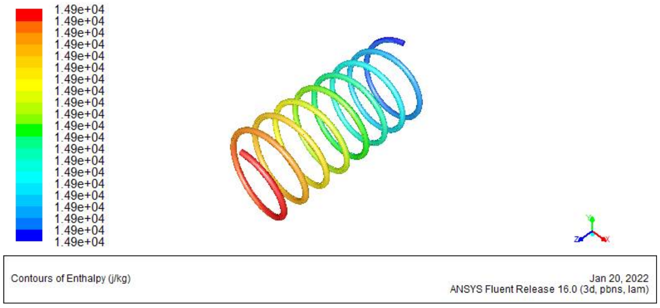


Fig1.17: Enthalpy

Graph: Enthalpy

The graph depicts the findings of enthalpy, in which enthalpy is greatest at the beginning constant towards the conclusion.

4.Total enthalpy

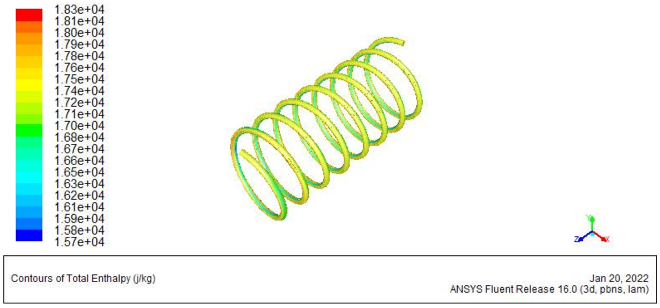


Fig1.18: Total enthalpy

Graph: Total enthalpy

The graph depicts the findings of total enthalpy, in which enthalpy is greatest at the beginning and diminishes towards the conclusion

5.Entropy

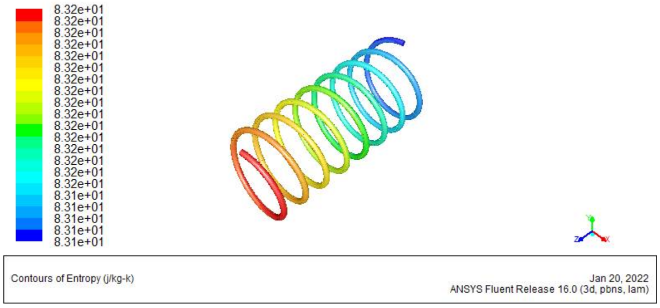


Fig1.19: Entropy

Graph: Entropy

The graph depicts the findings of entropy, in which entropy is greatest at the beginning and diminishes towards the conclusion.

Planar condenser model

1.Static temperature

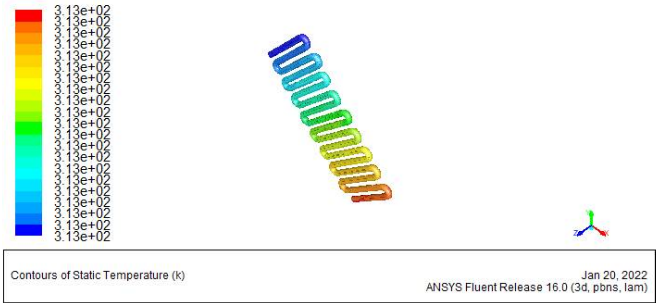


Fig1.20: Static temperature

Graph: Static temperature

The graph depicts the findings of static temperature, in which static temperature is constant towards the conclusion.

2. Wall temperature

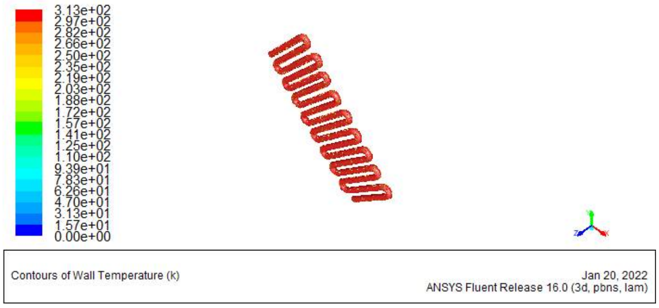


Fig1.21: Wall temperature

Graph: Wall temperature

The graph depicts the findings of wall temperature, in which wall temperature is greatest at the beginning and diminishes towards the conclusion.

2. Enthalpy

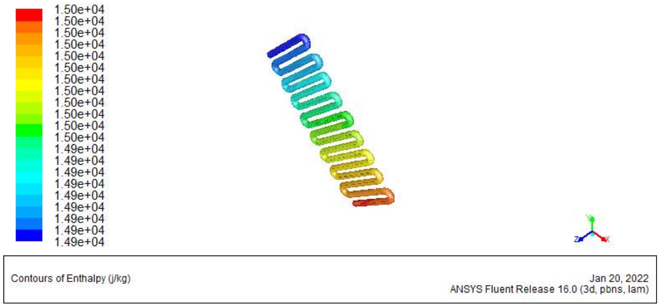


Fig1.22: Enthalpy

Graph: Enthalpy

The graph depicts the findings of enthalpy, in which enthalpy is greatest at the beginning up to the middle stage and diminishes towards the conclusion.

3. Total enthalpy

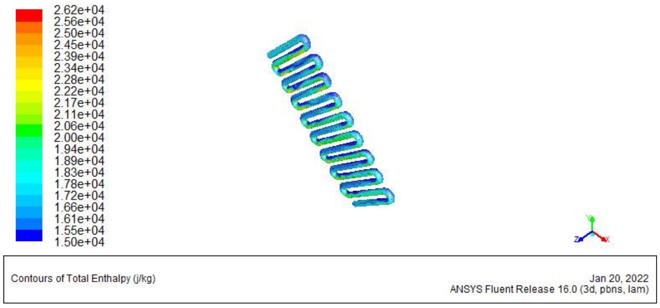


Fig1.23: Total enthalpy

Graph: Total enthalpy

The graph depicts the findings of total enthalpy, in which enthalpy is greatest at the beginning and diminishes towards the conclusion.

4. Entropy

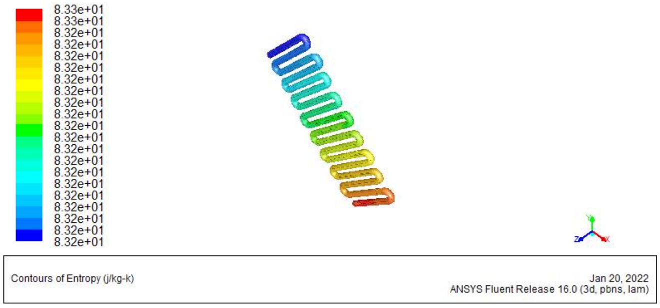


Fig1.24: Entropy

Graph: Entropy

The graph depicts the findings of entropy, in which entropy is greatest at the beginning and diminishes towards the conclusion.

Helical condenser model

Static temperature

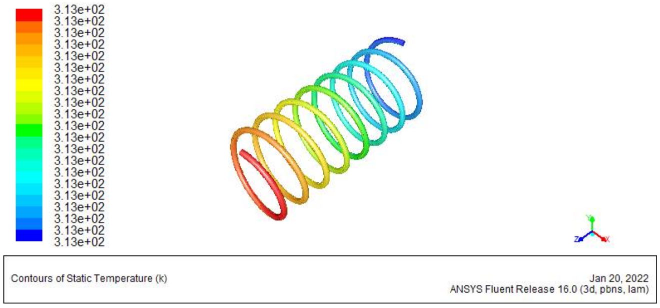


Fig1.25: Static temperature

Graph: Static temperature

The graph depicts the findings of static temperature, in which static temperature is constant towards the conclusion.

2. Wall temperature

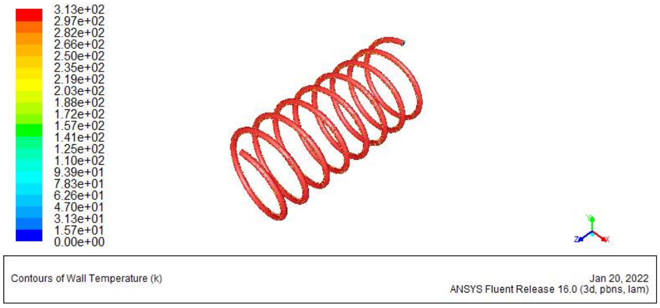


Fig1.26: Wall temperature

Graph: Wall temperature

The graph depicts the findings of wall temperature, in which wall temperature is greatest at the beginning and diminishes towards the conclusion.

3. Enthalpy

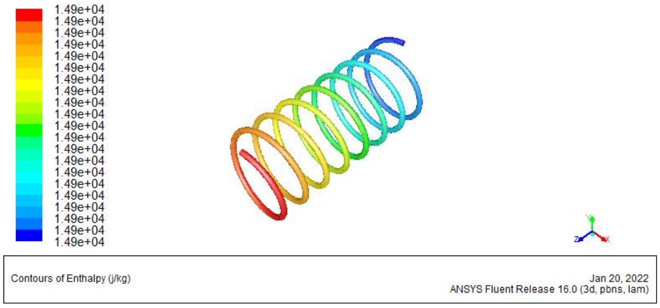


Fig1.27: Enthalpy

Graph: Enthalpy

The graph depicts the findings of enthalpy, in which enthalpy is greatest at the beginning constant towards the conclusion.

6.Total enthalpy

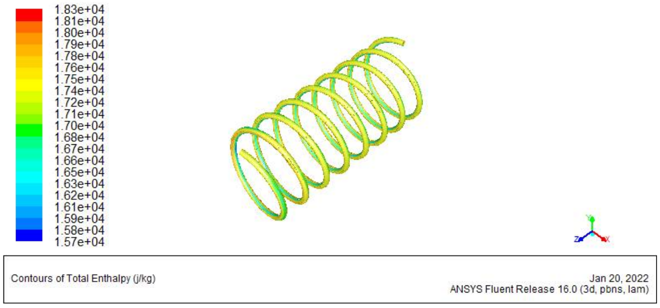


Fig1.28: Total enthalpy

Graph: Total enthalpy

The graph depicts the findings of total enthalpy, in which enthalpy is greatest at the beginning and diminishes towards the conclusion.

7.Entropy

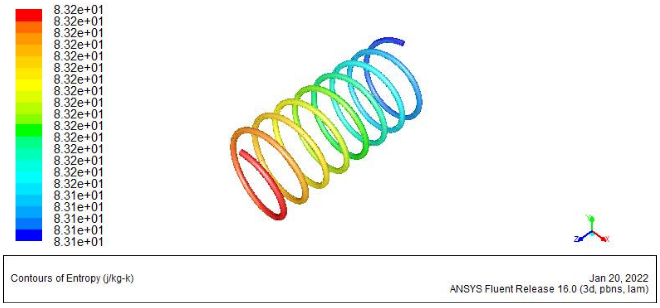
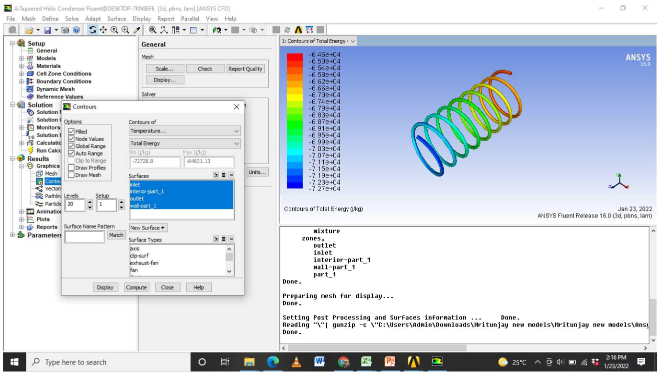


Fig1.29: Entropy

Graph: Entropy

The graph depicts the findings of entropy, in which entropy is greatest at the beginning and diminishes towards the conclusion.

4.3. Comparative Analysis of All Condenser



```
      mixture
    zones,
      outlet
      inlet
      interior-part_1
      wall-part_1
      part_1
Done.

Preparing mesh for display...
Done.

Setting Post Processing and Surfaces information ...     Done.
Reading "\"| gunzip -c \"C:\Users\Admin\Downloads\Mritunjay new models\Mritunjay new models\Ansy
Done.
```

Fig1.30: Total Energy J/KG

Graph: Total Energy J/KG

The above graph is total energy of tapered helix condenser is 67500 J/Kg which is 20 % lesser than Planar condenser model. The planar condenser model total energy 108151 is and helical condenser value is 7.56E+04

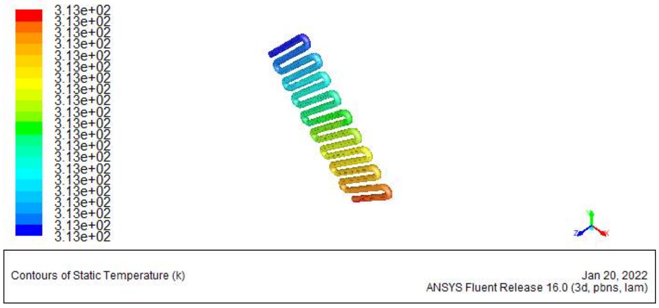


Fig1.31: Static Temperature

Graph: Static Temperature

The above graph is 5.17 Static Temperature of Tapered helix condenser is 31300 which is the almost same Planar condenser model. The planar condenser static temperature3.13E+02 is and helical condenser value is 3.51E+02

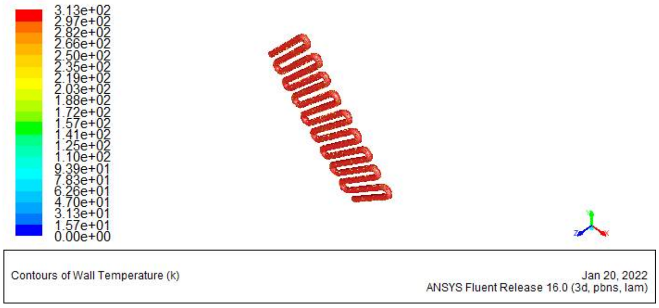


Figure 1.32: Wall Temperature

Graph: Wall Temperature

The above graph 5.18 Static Temperature of Tapered helix condenser is 31300 which is the almost same Planar condenser model.

The planar condenser model wall temperature 3.13E+02 is and helical condenser value is 3.51E+02

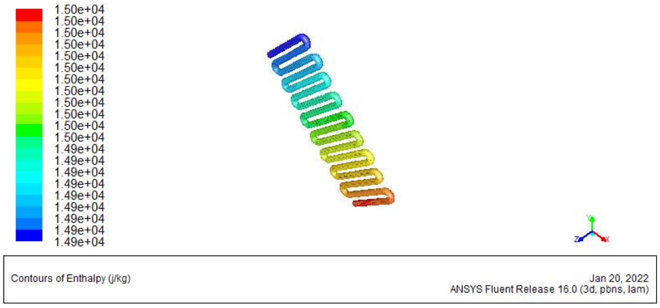


Fig 1.33: Enthalpy

Graph: Enthalpy

The above graph 5.19 Enthalpy of Tapered helix condenser is14900 which is is the almost same Planar condenser model .The planar condenser model enthalpy 1.50E+0.4 is and helical condenser value is 1.67E+04

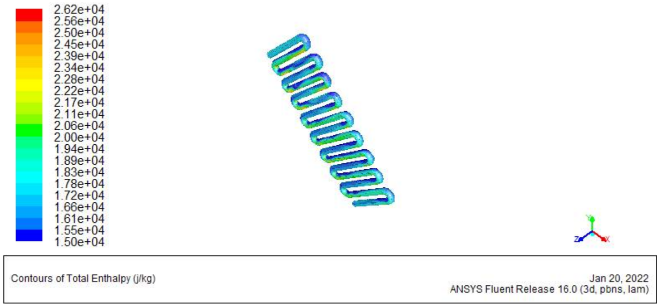
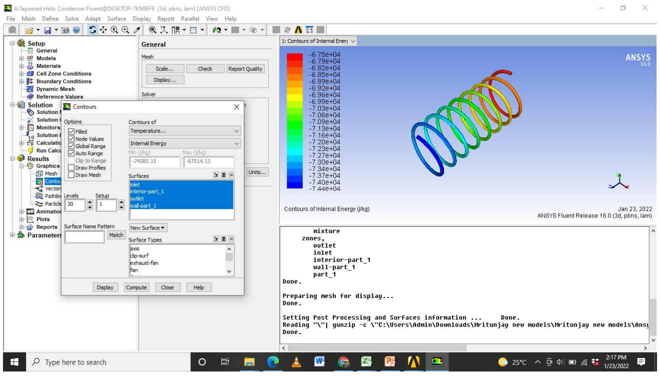


Figure 1.35: Total Enthalpy

Graph: Total Enthalpy

The above graph is total Enthalpy of Tapered helix condenser is 26200 which is the almost same Planar condenser model .The planar condenser model total enthalpy 2.62E+0.4 is and helical condenser value is 2.93E+04



Options: ☑ Filled ☑ Node Values ☑ Global Range ☑ Auto Range ☐ Clip to Range ☐ Draw Profiles ☐ Draw Mesh

Contours of: Temperature... / Internal Energy

Min (j/kg): -74385.15 Max (j/kg): -67514.13

Surfaces: inlet, interior-part_1, outlet, wall-part_1

Levels: 20 Setup: 1

Surface Types: axis, clip-surf, exhaust-fan, fan

```
        mixture
     zones,
        outlet
        inlet
        interior-part_1
        wall-part_1
        part_1
Done.

Preparing mesh for display...
Done.

Setting Post Processing and Surfaces information ...     Done.
Reading "\"| gunzip -c \"C:\Users\Admin\Downloads\Mritunjay new models\Mritunjay new models\Ansy
Done.
```

Fig1.36 Internal Energy J/Kg

Graph: Internal Energy J/Kg

The above graph Internal energy of tapered helix internal energy J/kg energy 8.33E+04 is and helical condenser value is 2.05E+04.

V. CONCLUSION & FUTURE SCOPE

5.1. Conclusion

We're working on a project called perform energy analysis in ANSYS fluent for Experimental set up referred from literature review. Here firstly whole set up is modeled in ANSYS FLUENT and after that 3 types of condensers are compared for total temperature, entropy, enthalpy, total energy and internal energy of condenser. Following results are obtained from ANSYS fluent set up:

- The above graph 5.16 is total energy of Tapered helix condenser is 67500 J/Kg which is 20 % lesser than Planar condenser model. The planar condenser model total energy 108151 is and helical condenser value is 7.56E+04
- The above graph is 5.17 Static Temperature of Tapered helix condenser is 31300 which is the almost same Planar condenser model. The planar condenser static temperature3.13E+02 is and helical condenser value is 3.51E+02.
- The above graph 5.18 Static Temperature of Tapered helix condenser is 31300 which is the almost same Planar condenser model. The planar condenser model wall temperature 3.13E+02 is and helical condenser value is 3.51E+02.
- The above graph 5.19 Enthalpy of Tapered helix condenser is14900 which is the almost same Planar condenser model. The planar condenser model enthalpy 1.50E+0.4 is and helical condenser value is 1.67E+04.
- The above graph 5.20 is total Enthalpy of Tapered helix condenser is 26200 which is the almost same Planar condenser model. The planar condenser model total enthalpy 2.62E+0.4 is and helical condenser value is 2.93E+04.
- The above graph 5.21 Internal energy of tapered helix condenser is 18300 J/Kg which is 20 % lesser than planar condenser model. The planar condenser internal energy J/kg energy 8.33E+04 is and helical condenser value is 2.05E+04.

5.2. Future Scope

Several characteristics explored in this thesis suggest potential future study topics:

The future of the project lies in increasing the condensers efficiency. Thermodynamics properties of the system can all be determined by measuring these quantities in a lab or on a computer.

REFERENCES

[1] Wang, X., Yan, Y., Wright, E., Hao, X., &Gao, N. (2021). Prospect Evaluation of Low-GWP Refrigerants R1233zd(E) and R1336mzz(Z) Used in Solar-Driven Ejector-Vapor Compression Hybrid Refrigeration System. Journal of Thermal Science, 30(5), 1572–1580. https://doi.org/10.1007/s11630-020-1297-z

[2] Selvaraj, D. A., & Victor, K. (2021). Vapor absorption refrigeration system for rural cold storage: a comparative study. Environmental Science and Pollution Research, 28(26), 34248–34258. https://doi.org/10.1007/s11356-020-11214-z

[3] Aramesh, M., Pourfayaz, F., Haghir, M., Kasaeian, A., & Ahmadi, M. H. (2020). Investigating the effect of using Nano fluids on the performance of a double-effect absorption refrigeration cycle combined with a solar collector. Proceedings of the Institution of Mechanical Engineers, Part A: Journal of Power and Energy, 234(7), 981–993. https://doi.org/10.1177/0957650919889811

[4] Panchal, H., Patel, R., &Parmar, K. D. (2020). Application of solar energy for milk pasteurisation: a comprehensive review for sustainable development. International Journal of Ambient Energy, 41(1), 117–120. https://doi.org/10.1080/01430750.2018.1432503

[5] Ghorbani, B., &Mehrpooya, M. (2020). Concentrated solar energy system and cold thermal energy storage (process development and energy analysis). Sustainable Energy Technologies and Assessments, 37(July 2019), 100607. https://doi.org/10.1016/j.seta.2019.100607

[6] Wu, H., Liu, Q., Bai, Z., Xie, G., Zheng, J., & Su, B. (2020). Thermodynamics analysis of a novel steam/air biomass gasification combined cooling, heating and power system with solar energy. Applied Thermal Engineering, 164, 114494. https://doi.org/10.1016/j.applthermaleng.2019.114494

[7] J. Souza, R., Dos Santos, C. A. C., Ochoa, A. A. V., Marques, A. S., L. M. Neto, J., &Michima, P. S. A. (2020). Proposal and 3E (energy, exergy, and exergoeconomic) evaluation of a cogeneration system utilising an organic Rankine cycle and an Absorption Refrigeration System in the Northeast Brazil: Thermodynamic investigation of a facility case study.Energy Conversion and Management, 217(April), 113002. https://doi.org/10.1016/j.enconman.2020.113002

[8] Wang, Y., Chen, T., Liang, Y., Sun, H., & Zhu, Y. (2020). A novel cooling and power cycle based on the absorption power cycle and cycle of booster-assisted ejector refrigeration driven by a low-grade heat source: Energy, exergy and exergoeconomic analysis. Energy Conversion and Management, 204(July), 112321. https://doi.org/10.1016/j.enconman.2019.112321

[9] Nikbakhti, R., Wang, X., Hussein, A. K., &Iranmanesh, A. (2020). Absorption cooling systems – Review of various techniques for energy performance enhancement. Alexandria Engineering Journal, 59(2), 707–738. https://doi.org/10.1016/j.aej.2020.01.036

[10] Qasem, N. A. A., Zubair, S. M., Abdallah, A. M., Elbassoussi, M. H., & Ahmed, M. A. (2020). Novel and efficient integration of a humidification-dehumidification desalination system with an absorption refrigeration system. Applied Energy, 263(November 2019). https://doi.org/10.1016/j.apenergy.2020.114659

[11] Owebor, K., Oko, C. O. C., Diemuodeke, E. O., &Ogorure, O. J. (2019). Thermo-environmental and economic analysis of an integrated municipal waste-to-energy solid oxide fuel cell, gas-, steam-, organic fluid- and absorption refrigeration cycle thermal power plants. Applied Energy, 239(April 2018), 1385–1401. https://doi.org/10.1016/j.apenergy.2019.02.032

[12] Alrwashdeh, S. S., &Ammari, H. (2019). Life cycle cost analysis of two different refrigeration systems powered by solar energy. Case Studies in Thermal Engineering, 16(November), 100559. https://doi.org/10.1016/j.csite.2019.100559

[13] Kutlu, C., Erdinc, M. T., Li, J., Wang, Y., & Su, Y. (2019). A study on heat storage sizing and flow control for a domestic scale solar-powered organic Rankine cycle-vapor compression refrigeration system. Renewable Energy, 143, 301–312. https://doi.org/10.1016/j.renene.2019.05.017

[14] Kizilkan, O., Khanmohammadi, S., &Saadat-Targhi, M. (2019). Solar based CO2 power cycle employing thermoelectric generator and absorption refrigeration: Thermodynamic assessment and multi-objective optimization. Energy Conversion and Management, 200(June), 112072. https://doi.org/10.1016/j.enconman.2019.112072

[15] Ustaoglu, A., Okajima, J., Zhang, X. R., & Maruyama, S. (2019). Assessment of a solar energy powered regenerative organic Rankine cycle using compound parabolic involute concentrator. Energy Conversion and Management, 184(January), 661–670. https://doi.org/10.1016/j.enconman.2019.01.079