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Design and Modification of Organic Rankine Cycle

Gupta Deepak[1], Singh Shailesh[2], Rajput Prafulla[3], Khatik Sahil[4], Gamit Tanay[5], Prof. Narendra Dalia[6]
[6]*Guide,* [1, 2, 3, 4, 5]*Department of Mechanical Engineering*

Abstract: ***The Organic Rankine cycle is very similar to the Rankine cycle which is oftenly used when the high Temperatures are not available to produce steam. The Ordinary Rankine cycle used in thermal power plant for converting water into steam and further that steam isexpanded through a turbine for generating electricity.***
The advantage of using organic fluid over water is that it has a low boiling temperature which is a prime criterion for the use with any low- grade heat source. Due to the low liquid to vapor-volume ratios associated with organic working fluids, a single stage expansion device can be used to convert thermal energy to mechanical work. In water fed Rankine cycle, a robust turbine is used which requires the working fluid to be superheated to avoid any condensation droplets forming during expansion. Removing chances for possible damage to the blades. In an ORC, a compact low-speed expansion device may be used which does not require the mandatory superheating of the fluid.
Index Terms: Rankine cycle, evaporator, Scroll Expander, condenser, Hermetic Compressor, dynamometer etc.

I. INTRODUCTION

The Energy plays an important role in the development of anycountry. The development of a country can be quantified as a function of its energy resources and utilization. Energy is the most important element for a human for social redevelopment. People are constantly using energy from the beginning of the journey of human life on earth and within every human society, region and country.
Human beings use energy in different forms, like mechanical energy,heat, electricity, etc. and other many more it must mention that .

A. Main Component

- Evaporator
- Scroll Expander
- Dynamometer
- Condenser
- Hermetic Compressor

1) Evaporator

Evaporator is a device used to convert Refrigerant to vapour form. In our project the Refrigerant comes into evaporator. Evaporator is provided by an electric Heater which is working onbase of electricity. This heater heats the refrigerant by giving heat. After heating the refrigerant, it goes to centrifugal Compressor.

Figure 2: Evaporator

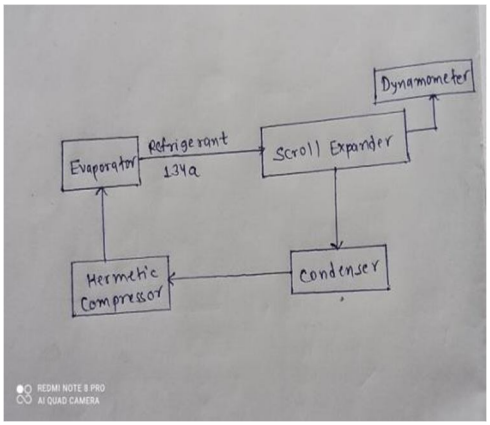

Figure 1: Drawing Of Organic Rankine Cycle

Basic principle of organic rankine cycle using organic fluid over water is that it has a low boiling temperature which is a prime criterion for the use with any low-gradeheat source. Due to the low liquid to vapor-volume ratios associated with organic working fluids, a single stage expansion device can be used to convert thermal energy to mechanical work.

Component Details

DESCRIPTION	MATERIAL
CONDENSER COIL	6 MM THICK
EVAPORATOR COIL	8 MM THICK
OMPRESSORCAPACITY	2 TONNE
MATERIAL	MILD STEEL
COIL MATERIAL	COPPER
EVAPORATOR BODY	STEEL
CONDENSER PASS	2 PASS
EVAPORATOR PASS	5 PASS

Table 2 : Components

2) Refrigerant

The Aim to use the Refrigerant at the place of water is the low boiling Temperature. Here we have use refrigerant 134a because it is an ecofriendly refrigerant. By this the pollution will be negligible during generation of electricity. It has generally 70 to 90 degree Celsius temperature of boiling.

Figure 3: REFRIGERANT

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II. WORKING PROCEDURE

In our project the Refrigerant comes into evaporator. Evaporator is provided by an electric Heater which is working on base of electricity. This heater heats the refrigerant by giving heat. After heating the refrigerant, it goes to centrifugal Compressor. Here the centrifugal compressor takes mechanical energy and convert it into electrical energy. Dynamometer is connected with centrifugal compressor which identifies the amount of electricity generated. After that the Refrigerant passes through condenser. This condenser cools the refrigerant to normal temperature. After that Pump takes it to again evaporator.

Design Parameters of Scroll Expander

DESCRIPTION	PARAMETERS
TECHNOLOGY	RECIPROCATING
FREQUENCY	50Hz
VOLTAGE	220-440 V
MATERIAL	MILD STEEL
PHASE	THREE PHASE

Table 1 : Design Parameters

Designs Of coil in Evaporator

Figure 4: TOP VIEW OF EVAPORATOR

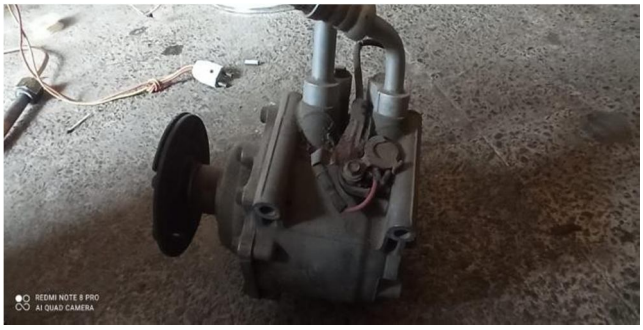

Figure 5: SCROLL EXPANDER

Figure 6: HERMETIC COMPRESSOR

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Figure 7: COPPER JOINT

III. COST ESTIMATION

SR.NO.	MATERIAL	RATE/ QUANTITY	PRICE
1	EVAPORATOR	1800	1800
2	HEATER	700	700
3	COIL	600	600
4	REFRIGERANT	3000	3000
5	SCROLL EXPANDER	2300	2300
6	DYNAMOMETER	500	500
7	CONDENSER	800	800
8	HERMETIC COMPRESSOR	4000	4000
9	COPPER JOINT	300	600
10	PIPE	900	900
	TOTAL	15200	15200

IV. CONCLUSION

Our project have used evaporator as boiler, centrifugal compressor as turbine, dynamometer, condenser and compressor as pump. Our project is kind of small power plant which can cover a small area by generating electricity by using refrigerant in the place of water in conventional power plant. Here we have used R-134a as refrigerant, this is Eco-friendly so it does not harm environment in any manner.

We can conclude that after using this mechanism not only the overall efficiency should improve. And it is convenient to use.Also low maintenance cost and easy to make in a small place.

V. ACKNOWLEDGMENT

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REFERENCES

[1] Andrea Toffolo , Andrea Lazzaretto , Giovanni Manente , Marco Paci, "A multi criteria approach for the optimal selection of working fluid and design parameters in Organic Rankine Cycle systems", Applied Energy 121 (2014) 219–232
[2] Athanasios I. ,Papadopoulos , Mirko Stijepovic , Patrick Linke "On the systematic design and selection of optimal working fluids for Organic Rankine Cycles" Applied Thermal Engineering 30 (2010) 760–769
[3] B. Twomey, P.A. Jacobs, H. Gurgenci, Dynamic performance estimation of small- scale solar cogeneration with an organic Rankine cycle using a scroll expander,Applied Thermal Engineering 51 (2013) 1307e1316.
[4] Guoquan Qiu, Hao Liu, Saffa Riffat "Expanders for micro- CHP systems with organic Rankine cycle" Applied Thermal Engineering 31 (2011) 3301-3307
[5] Isam H. Aljundi "Effect of dry hydrocarbons and critical point temperature on the efficiencies of organic Rankine cycle" in Renewable Energy 36 (2011) 1196-1202
[6] Jen-Chieh Chang, Tzu-Chen Hung, Ya-Ling He, Wenping Zhang" Experimental study on low-temperature organic Rankine cycle utilizing scroll type expander", Applied Energy 155 (2015) 150–159

BIOGRAPHIES

k persuing his Bachelor Degree in Mechanical Engineering from, Bhagwan Mahavir College of Engineering And Technology
7, Gujarat, India

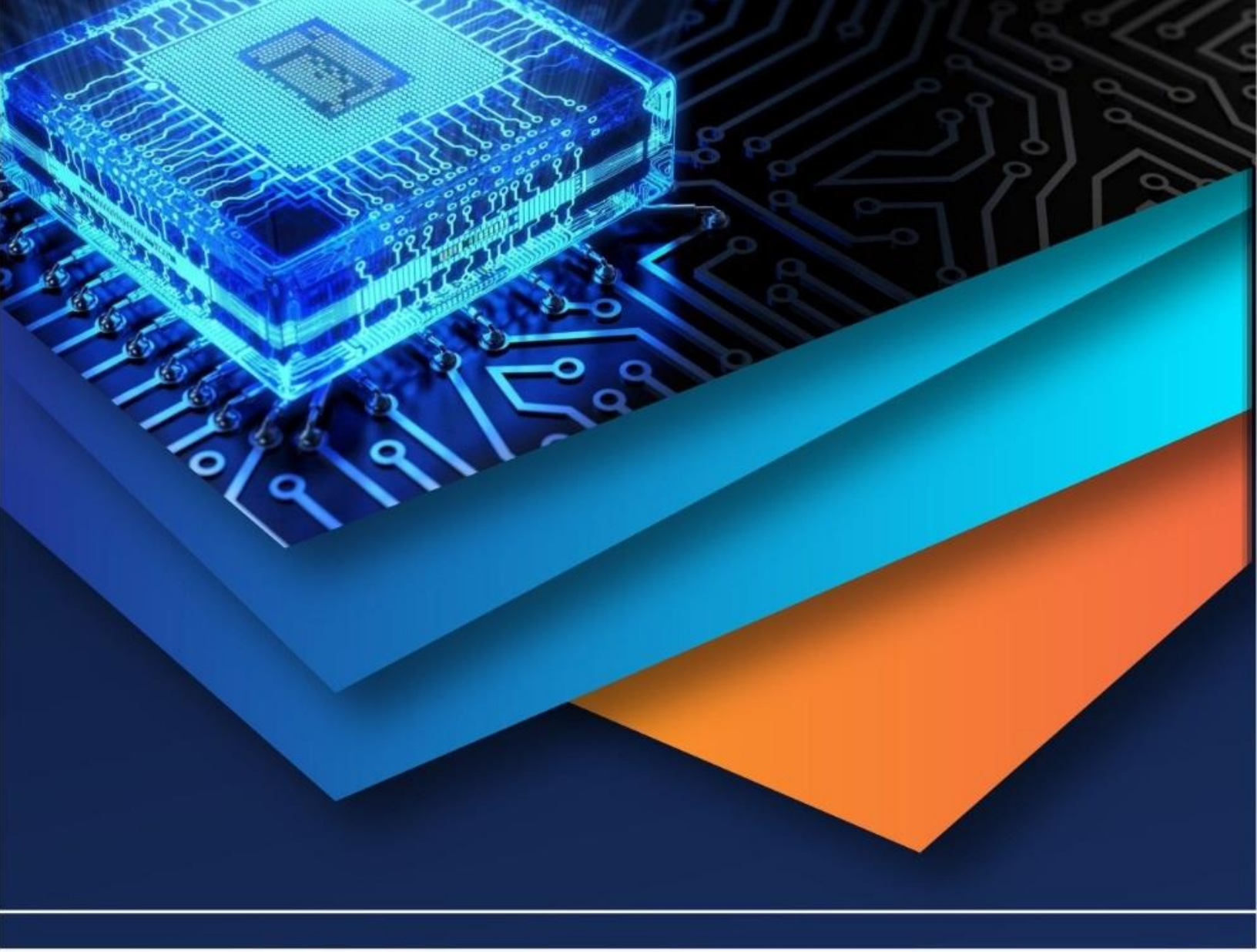
Singh, Shailesh persuing his Bachelor Degree in Mechanical Engineering from, Bhagwan Mahavir College of Engineering And
urat- 395007, Gujarat, India

lla persuing his Bachelor Degree in Mechanical Engineering from, Bhagwan Mahavir College of Engineering And
Surat- 395007, Gujarat, India

persuing his Bachelor Degree in Mechanical Engineering from, Bhagwan MahavirCollege of Engineering And Technology
7, Gujarat, India

persuing his Bachelor Degree in Mechanical Engineering from, Bhagwan Mahavir College of Engineering And Technology
, Gujarat, India

ra Dalia professor of Thermal Engineering, in Department of Mechanical Engineering, Bhagwan Mahavir College of
And Technology Surat-395007,Gujarat, India



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