LITERATURE REVIEW ON DESIGN AND DEVELOPMENT OF LOW TEMPERATURE ORGANIC RANKINE CYCLE

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Abstract - Main purpose of thesis to develop and design a low temperature organic rankine cycle and to this studied carried out on the basis of expander and refrigerant available for ORC system a develop and improve a expander using a scroll compressor in a reverse manner. And check the performance of the scroll compressor with using a dynamic test batch. And reused same expander in a ORC system. And check the performance parameter of scroll compressor. Also select proper refrigerant and heat source and pump for ORC system from available option

Key Words: Electric energy generator, Refrigerant, compressor, evaporator, condenser, Pump

1. INTRODUCTION

Energy plays an important role in the development of any country. 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. Also, it must be mentioned that demand of energy use is increasing every year. Energy is used for everything including heating, cooking, agriculture, transportation, manufacturing and even telecommunication.

According to the some truthful resources Around 1.5 billion people worldwide do not have access to electricity. Most of this electricity deprived live in sub-Saharan Africa and south Asia. Usually, this population lives in remote areas far from the centralized electricity grid with very low income and extending the electricity is not seen as economically feasible for electricity companies which prefer to concentrate their activities in urban areas.

In the analysis of energy supply and demand criteria it may be mentioned that energy demand has an inherent trend to increase due to population growth and economic development. On the other hand, energy supply has finite reserve in non-renewable sources and an infinite availability in renewable sources; though the vast majority of the world's energy consumption is still dependent on non-renewable sources, specifically oil, coal and gas.
And in today's world most of energy is produced by using a conventional power plant which uses a fossils fuel. So it can be created pollution related problem, acid rain, ozone depletion, global warming. Whereas on the hand we are also use some renewable energy like wind energy, tidal energy, solar energy biomass and geothermal energy as well as waste heat for electricity production becomes important.

2. BODY OF PAPER

Organic Rankine cycle works on the same principle as that of Rankine cycle. The working fluid in the form of liquid is pumped to a boiler where it changes its state to vapour then passes through an expansion device and finally condenses to liquid state. In the ORC however instead of using water, organic fluid is used as working substance. 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 vapour-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. This has an removing chances for possible damage to the Atmosphere. In an ORC, a compact low-speed expansion device may be used which does not require the mandatory superheating of the fluid. This has an advantage on using low grade heat sources as in some cases superheating has adverse effect on the overall cycle efficiency.

In an ORC, a large variety of working fluids may be used depending on the operating condition and the temperature difference between source and sink. However, the purpose of an ORC focuses on use of low grade heat energy.

3. WORKING

The present O.R.C. system consists of heat exchangers, a micro-turbine/expander, a condenser and a pump. The pump supplies the working fluid to the heat exchanger where it is heated and converted into a high pressure vapor and then it enters in to a micro turbine/expander. The low pressure vapor is exits at expander and is then enters into a condenser where it is condensed. The condensate is pumped back to heat exchanger.

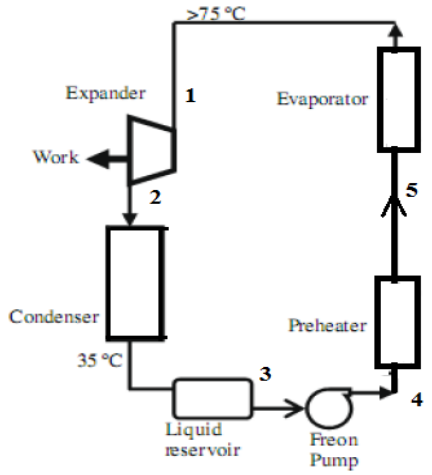

Fig: Thermodynamic analysis

In this study, we consider a subcritical cycle where the vapor at the turbine inlet is saturated. The superheat was not found of interest as the incorporation of a superheated could bring additional cost. In addition increasing the maximum temperature of the heat source increases the heat loss of it. Because of these reasons the saturated Rankine cycle has been investigated in this study instead of a superheated cycle. The said thermodynamic O.R.C. is well depicted on T-s diagram in Fig Process 1-2 is an expansion process occurs in micro turbine/expander, 2-3 is heat rejection in a condenser, 2-3 is heat rejection in a condenser, 3-4 is a pumping process, 4-5 is preheating and 5-1 is vaporization. The process of vaporization (5-1) in an O.R.C. may end in a saturated vapor state or superheated vapor state.

(a) Heat Exchanger

(b) Compressor

(c) Evaporator

4. OBSERVATION

- The GWP of refrigerant R-134a is more.
- We can generate power up to 800watt-850watt.
- We can use van-compressor in place of scroll-compressor
- We can also use refrigerant R-600a in place of R-134a

5. FUTURE WORK

- To find out best working fluids for low temperature ORC based on thermodynamic transport and environmental properties and by thermodynamic cycle analysis.
- To design a heat exchanger to collect heat from hot air (solar or other sources) to refrigerant as working fluids.
- To evaluate feasibility of scroll compressor as an expander in a reversed manner in a expander dynamometer setup on a air.
- To build a low temperature ORC test bench. To evaluate performance of ORC test bench by varying different parameters.

6. LITERATURE REVIEW

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