Impact Factor (SJIF): 3.632

International Journal of Advance Research in Engineering, Science & Technology

e-ISSN: 2393-9877, p-ISSN: 2394-2444

(Special Issue for ITECE 2016)

Kalina cycle with solar concentrator

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Abstract - Renewable energy is the most popular topic of the energy field most of the research working on this field. Energy comes from the sun and other things but for the energy generation purpose the thermal power plant is work. The power plant is runs on the different thermal cycles like Carnotcycle, Rankincycle,dieselcycle, petrol cycle etc...But the efficiency is not that much sufficient so of the one ofcycle is use in thermal power plant is known as the kaliancycle. Different from others is only the working fluid here working fluidis the mixture of the two fluid (water +Ammonia). In this cycle we are including the solar concentrator in before the boiler generally, in re-generative cycle we have diverted the high temperature steam in high power turbine (HPT) and some steam is in the Low Power Turbine (LPT). By the solar concentrator we try to change the cycle. We directly supplied the high and lower power steam to the turbine and after that the temperature of the water or steam is decreasing due to the expansion process inside the turbine so for that increasing that temperature we directly supplied the solar concentrated water they have more temperature as compare to the out let of the turbine. So we mix both liquid in one sort age tank and increasing the temperature of the fluid. This fluid is supplied to the boiler. So, less power required to generate the steam. Here we use the parabolic solar concentration (Dish stilling) the temperature rang is 250C- 500C. For the increase the solar concentrator efficiency we try to put the one solar tracking mechanism so that we get constant sun rays whole day. We are working the analysis of the different part of that cycle. We are also working with control system of that cycle.

Keywords – Comparison of Kalinavs. Rankin Cycle, Parabolic Solar Concentrator, Efficiency, Load on Boiler

I. INTRODUCTION

Energy is the most popular topic of today's scenario. Human cycle and Animals are fully dependent on Energy. Human is using the energy in different form mostly the form of the Electricity. Electricity is generated by using the Different Process. Generally we are using the fossil fuels for generated the Electricity. This all are Non-Renewable source. It will be over in few years. So, For Energy generation we implement the different Energy sources. Mostly the solar Energy, the sun constitutes of the hot plasma interwoven with magnetic fields. The Energy is generated by the nuclear fusion of hydrogen nuclei into helium. The surface Temperature attained by the sun is 5762K. The sun's total energy output is 3.8×10^{20} MW, a small quantum of which, 1.7×10^{14} KW. Of the total emitted radiation is intercepted by the Earth. Nevertheless, world energy demand for one year is only 30min. of solar radiation falling on earth. … (1) That much Energy is free available on the earth so we are trying to sun the maximum solar energy in the power plant. power plant generally work on the different cycles like Rankin cycle , Carnot cycle , Diesel cycle etc. but here for the energy generation They are using the coal , fossil flues. For the convert the water in to steam. For steam generation we are trying to use the solar concentrator to increase the efficiency of the power plant. Solar based thermal power plant steam generation usage of the a thermal storage unit based only on sensible heat may be lead to large exegetic losses during the charging and discharging, due to poor matching of Temperature Profile. By the kalina cycle in which evaporation and condensation take place over a

Temperature Range. overall Efficiency of the heat exchanger processes can be improve , and the overall performance is also improve…..(2) we are trying to increase the efficiency of the Re- Generative cycle to attaching the solar concentrator Mechanism.

Renewable Energy is the over future sources of the industry. Now a days the most of the Energy system is work on the either solar base or other renewable energy based. In thermal cycles is also try to modify or converted in renewable energy side.so decreasing the air pollution as well as decreasing the uses of the fuels .thermal power plants are work on the either coal base or may be gas turbine. All the power plant work on the Rankin cycle or regenerative cycle. But in the Rankin cycle the efficiency of the power plant is less that's why the power plant working on two or more cycle and this type of cycle is known as regenerative cycles. By the using the regenerative cycle the efficiency of the power plant is up to 40%. One of the thermal power plant cycle name is kalina cycle. In this cycle the changes in the working fluid. Here the working fluid use to be mixture of Water andammonia.The initial the boiling point of this mixture is decrease and the 400C the water and ammonia mixture will be the super-heated. By using this cycle be decreasing the wastage of the coal or fossil fuels. Ammonia and water forms a zoetrope mixture.

II. KALINA CYCLE VS RANKINE CYCLE

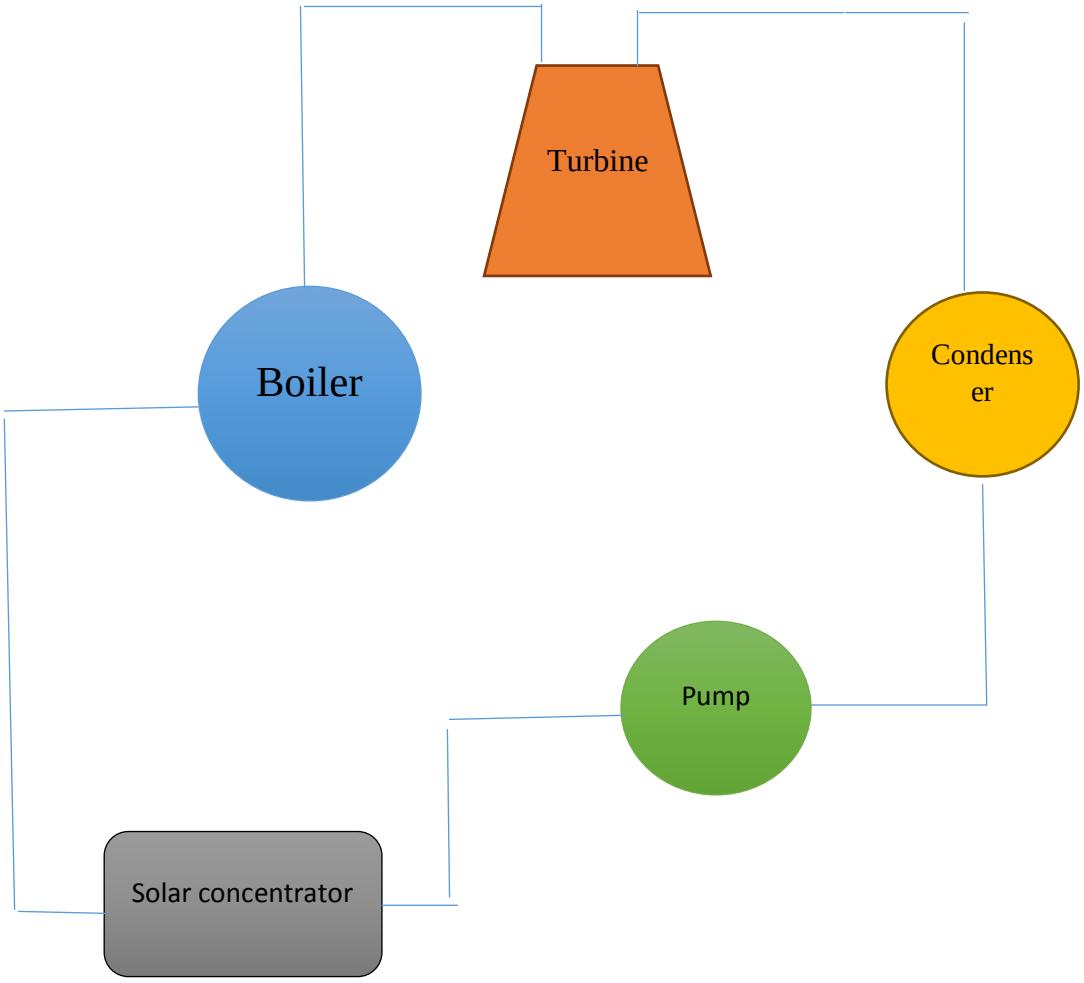
The technology is the creation of Dr. Alexander Kalina, a Russian scientist. Formed EnergyInc. to develop and commercialize an advanced Thermodynamic cycle. The kalina cycle is a new concept in heat recovery and power generation which uses a mixture of the 70% ammonia 30% water as the working fluid. This type of the concept is suitable for medium to low temperature heat recovery systems with gas of fluid inlet temperatures in the range of 400F to 1000F offering more gains (over Rankin cycle) as the gas temperature decreases. Gas turbine based combined cycle using this concept having 2-3% higher efficiency over multi pressure combined cycle plants using steam/ water as the working Fluid. The main reason for the improvement is that the boiling of ammonia- water mixture occurs a range of temperature s, unlike steam and hence the amount of the energy recovered from the gas stream is much higher…... (4)…..

III. SOLAR CONCENTRATOR IN KALINA CYCLE

Solar concentrator is widely use in renew able energy sources. Now a day number of the power plant wring on the solar base. DSG base power plant (Direct steam generation). Here we are using the parabolic solar concentrator to increase the efficiency of the kalina cycle. Here we are use the solar concentrator power (CSP). Concentrating solar power technologies use different mirror configurations to concentrated to the sun's light energy onto a receiver and convert it into heat. The heat can then be used to create steam to drive aturbine to produce electric power or used as in over power plant concept to run the turbine. CSP (concentrator solar power) here we are using before the boiler for increasing the temperate ofthe workingfluid(water +ammonia). We are increasing the temperature up to 150 C.The sun energy is concentrated by parabolic ally curved, trough-shaped reflectors onto a receiver pipe running along the inside of the curved surface. The temperature of the heat transfer fluid flowing through the pipe, usually

thermal oil but here we are using the mixture of fluid (water+ ammonia) is increasing normally 293 to 393 C but we are increasing the temperature up to 150C . This heat energy is used to great electricity in conventional steam generator. Generallycollector field comprises may trough in parallel rows aligned on a north – south axis. This configuration enables the single- axis through to track the sun from east to west during the day to ensure that the continuously focused on the receiver pipes.

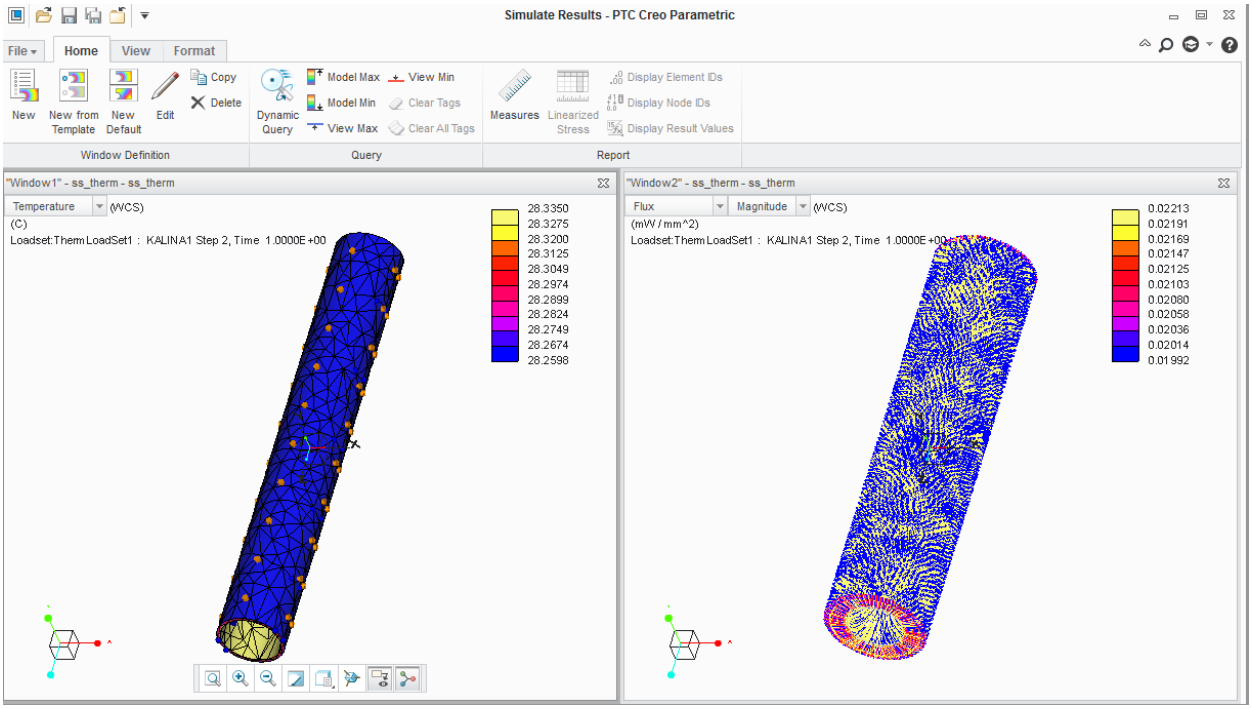
Diagram



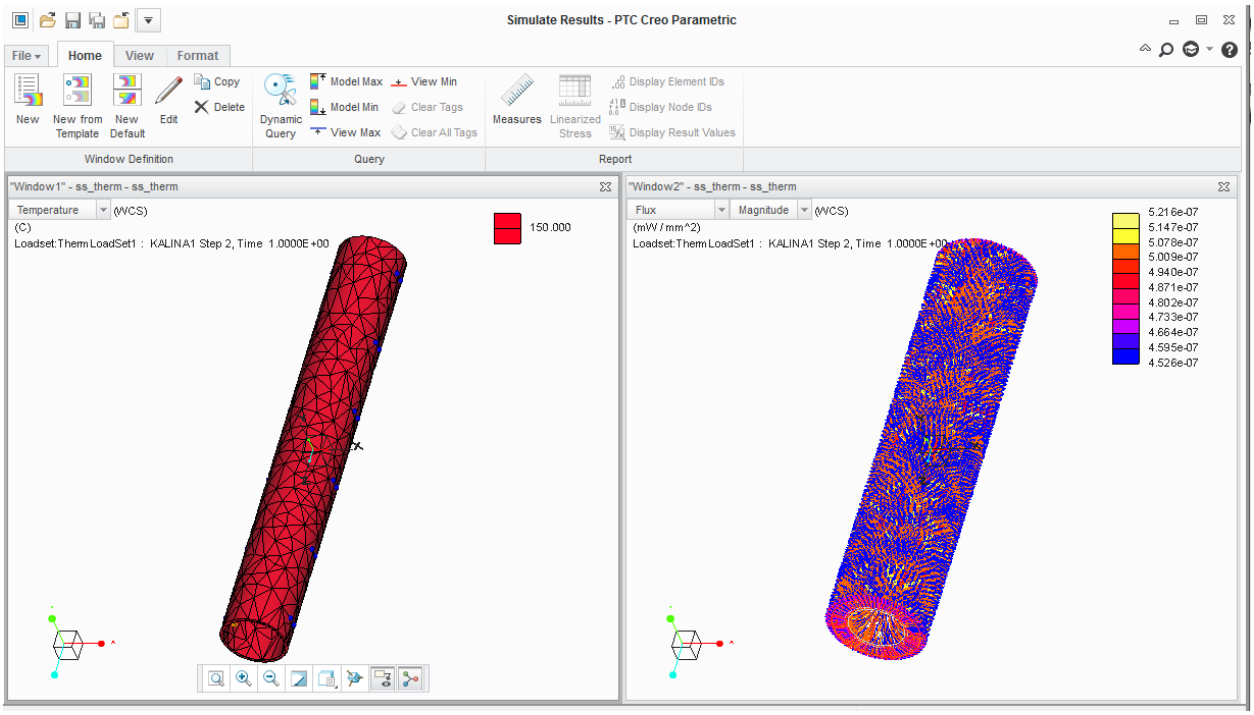
Normally power plant is working in the field where the after the condenser or alter the pump the pipes is use that temperature is increasing up to only 55 C but in over cycle we are increasing the temperature of the pipes. Pipe

temperature increasing by using solar concentrator here we show the analysis of the pipe below. The Dimension of the pipe that we consider is below: -

This are the Analysis of the particular pipe in normal as well as with solar concentrator



(Normally working pipes Analysis at55c)



…(7)…

(Pipe increasing Temperature by the parabolic solar Concentrator at150C)

Sr. No.	Specifications	Values
1	Diameter	1000mm
2	Length	7000mm
3	Material	SS
4	Thermal Conductivity (at 55C- 125C)	16 W/ mol.K

After that we get the results is nothing in change in the pipe. But we are using the solar concentrator in before the boiler so the load of the boiler is decreasing. Load to convert the steam in to supper heated is decreasing.

CALCULATION OF ENERGY CONSUMPTION

1. Initial Condition of Rankin Cycle,

$Q = m\, c_p dT$

$Q = m\, C_p\, (T_2 - T_1)$

$m = 0.83$ kJ/s

$C_p = 1.008$ kJ/kg K

$T_1 = 550\ ^oC$

$T_2 = 0\ ^0C$

So,

2.Normal Condition of Rankin Cycle,

$Q = m\, c_p dT$

$Q = m\, C_p\, (T_2 - T_1)$

$m = 0.83$ kJ/s

$C_p = 1.008$ kJ/kg K

$T_1 = 550\ ^oC$

$T_2 = 55^0C$

So,

$Q = 0.83 \times 1.008 \times (550 - 0)$

$Q = 460.152$ W

$Q = 0.83 \times 1.008 \times (550 - 55)$

$Q = 414.368$ W

3. Initial Condition of Kalina Cycle,

$Q = m\, c_p dT$

$Q = m\, C_p\, (T_2 - T_1)$

$m = 0.83$ kJ/s

$C_p = 1.008$ kJ/kg K

$T_1 = 400\ ^oC$

$T_2 = 0\ ^0C$

So,

$Q = 0.83 \times 1.008 \times (400 - 0)$

$Q = 334.656$ W

4.Normal Condition of Kalina Cycle,

$Q = m\, c_p dT$

$Q = m\, C_p\, (T_2 - T_1)$

$m = 0.83$ kJ/s

$C_p = 1.008$ kJ/kg K

$T_1 = 400^oC$

$T_2 = 150^0C$

So,

$Q = 0.83 \times 1.008 \times (400 - 150)$

$Q = 209.16$ W

…(6)…

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