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Power Generation by Insolation on Mirrors

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ABSTRACT:
Now a days all are using only conventional energy sources. By using the conventional energy source continously after few years all conventional energy sources are exhausted on the earth.So,we develop the non-conventional energy sources inadvance to avoid the energy crisis on the earth. So, we consider this factor and develop the project on solar energy converts into the electricity instead conventional energy sources. In this project, we using heliostat mirrors to focus on the water tower.Water vapour is generated after the process in the water tower and it helps to run the turbine and finally,generated electricity at the output . So,this way generates the non-conventional energy. By this energy source, wegenerate the electricity more efficiently than compare with conventional energy sources.

I. INTRODUCTION

The energy demand is growing rapidly. To provide humanity with its increased need for energy, energy technology efficiency must be improved; furthermore, renewable resources must be explored and must be aggressively studied. One of the most promising resource is the solar energy.[2] Our sun produces a huge amount of energy, it is about 4x10(26) watts of energy every second and it will continue emitting energy for a very long while; which makes it the most reliable and abundant source of energy that available at earth [3]. One hour of sun power emitted to earth provides the energy needed for everyone in our planet for an whole year.[4]. There are many technologies developed to collect energy from sun to provide energy for different applications like residence water heating, process heat, water treatment, solar power plants, etc. The main technologies used in solar power plants could be classified [3]. Among them Concentrated Solar Power systems recently has additional focus of researchers.

Thermal power technologies

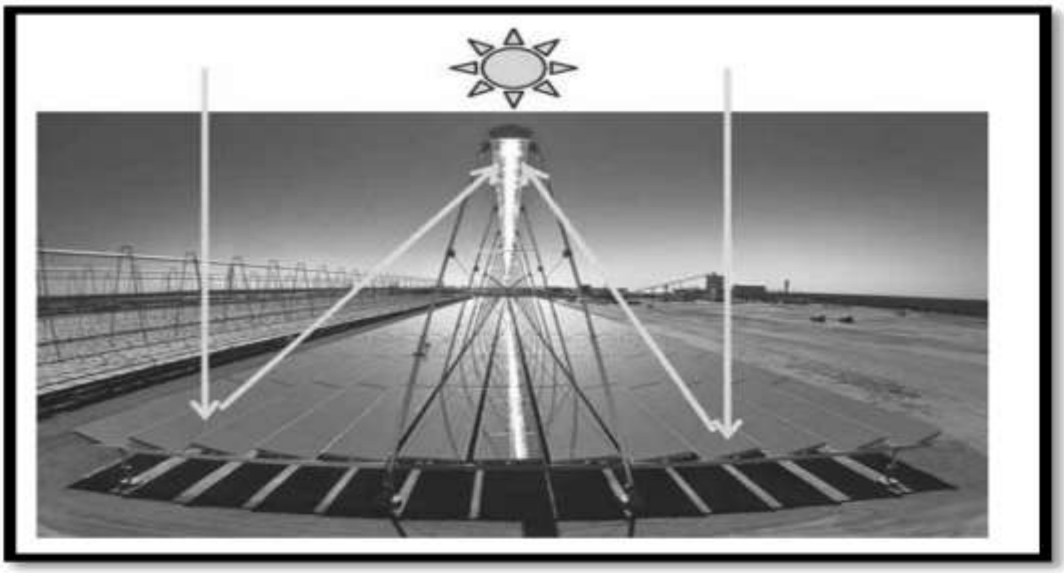
Parabolic trough

Parabolic trough reflectors,concentrate sunlight onto receiver tubes in which a transferfluid is circulated. The fluid flows in the tubes, usually aspecial oil, is then pumped through heat exchangers toproduce superheated steam. The steam is converted toelectrical energy in steam turbine generator, the latter can beintegrated into a combined steam and gas turbine cycle.

The use of oil-based working fluid limits this system to onlyaround 400 ºC.

Fresnel Mirror System

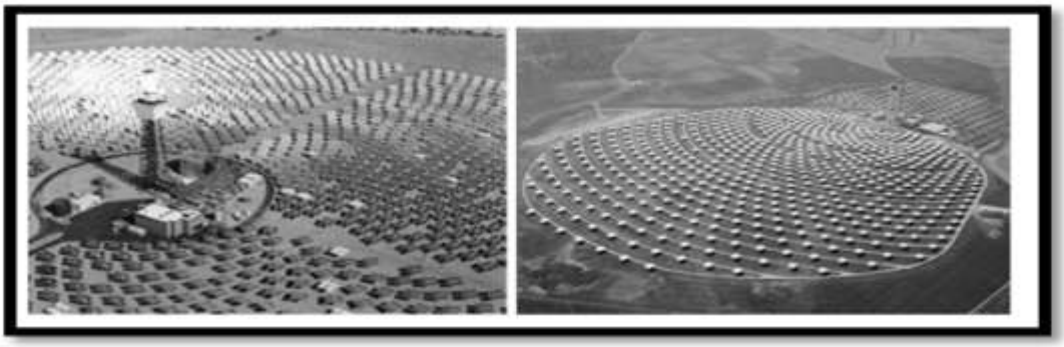
A linear concentrating Fresnel solar concentrator, is a planar array of linear mirror strips that reflect sunlight onto a stationary thermal receiver. The operationtemperature range is 100–400 ºC. Fresnel solar system isthe most land-efficient solar system; it produces 1.5-3.0times more power than other solar technology. It is seen asa potential low-cost alternative to the parabolic troughsystems.



Parabolic dishes

Dish systems, like troughs, gets benefits from the geometricproperties of a parabola, but as a three-dimensionalparaboloid. The reflected direct lightis concentrated to a point focus receiver and heat the fluidinside this point to an operating temperature of over1,000ºC, similar to tower systems. Dish systems offer thehighest potential solar conversion efficiencies of all the CSPtechnologies, because they always present their full aperturedirectly towards the sun and avoid the 'cosine loss effectthat the other approaches experience. They are, however, theleast commercially mature. Dishes up to 24 m diameter havebeen demonstrated. It is also applied with micro dishes with diameters of just several centimetres.

Central Receiver Tower



A central receiver tower system involves an array ofheliostats (large mirrors with two axis tracking) thatconcentrate the sunlight onto a fixed receiver mounted at thetop of a tower. Higherconcentration ratios are achieved compared to linearfocusing systems (Fresnel and Parabolic troughconcentrating solar systems) and this allows thermalreceivers to operate at higher temperatures about 1,000 ºCwith reduced losses. A range of system and heliostat sizes have been demonstrating.

Solar Thermal Tower Power Plants

In solar thermal tower power plants, hundreds or eventhousands of large two-axes tracked mirrors are installedaround a tower. These slightly curved mirrors are also calledheliostats; a computer calculates the ideal position for eachof these, and a motor drive moves them into the sun. Thesystem must be very precise in order to ensure that sunlightis really focused on the top of the tower. It is there that theabsorber is located, and this is heated up to temperatures of1000°C or more. Hot air or molten salt then transports the heat from the absorber to a gas turbine or to steam

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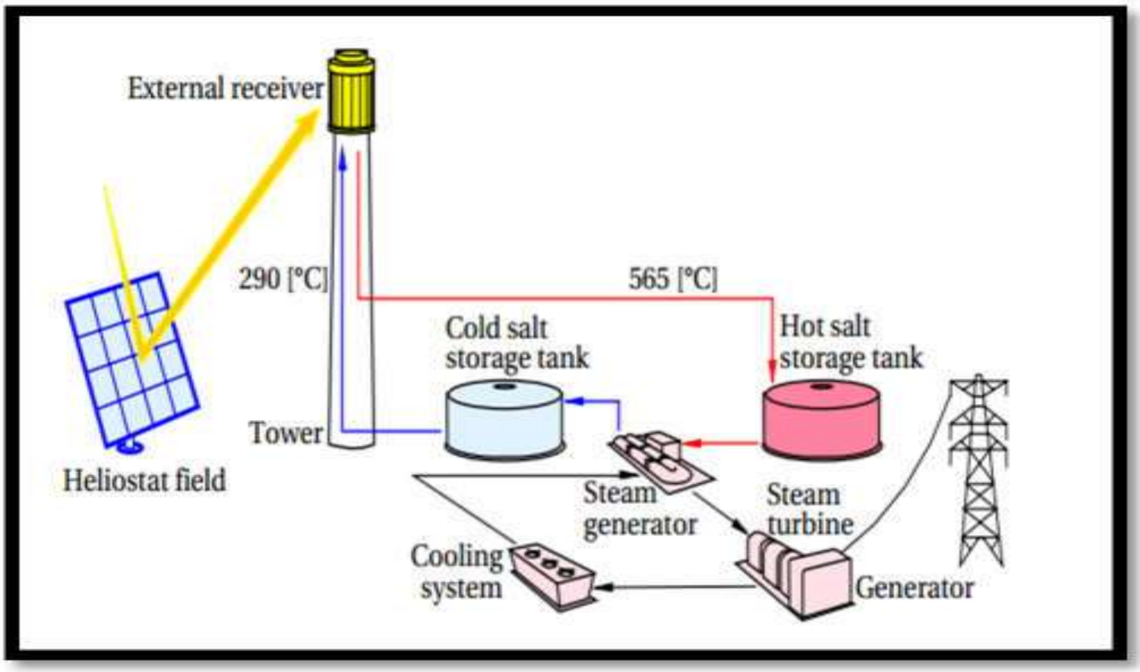
generatorproduces superheated water steam which drives a turbineand electrical generator.



Heliostats

A heliostat is a mirror that tracks the sun in order toconstantly reflect the rays of sunlight onto a fixed target. They are a main element in the solar tower system; theypresent the sun reflecting and thus concentrating parts of thesystem. A field of heliostats concentrates the sunlight ontoa central receiver at the top of the tower. The tower is fixedand the sun moves, so the heliostats have to track the sun inorder to reflect the rays on the receiver. These mirrors haveto have good reflectivity, accuracy of the tracking system, resistance to wind, and low specific costs. They are mountedon a frame, which has horizontal and vertical axes, which

provide the ability of tracking the sun. The mirror facets areplane rectangular mirror with a slight convex curvature.

Tower

The role of the tower is mainly to keep the receiver on itstop. It has to provide a space for the storage tank of thereceiver. The main design parameter of the tower is itsheight.

Receiver

Receivers are the most important elements in concentratedsolar power systems, because they are the translator of theconcentrated radiation to heat. Their performance directlyaffects the plant's output power [16]. Receivers might beassembled from various materials; those materialsdetermine their heat properties. They receiver designs can be grouped in two main groups: external and cavityreceivers. See Figure 14. Cavity receivers have an additionalwindow around them to prevent heat loss to the air. Generally, they are used with the North-South heliostatfields. The external receivers do not have this covering box, so they have a larger heat loss due the winds, but they havethe advantage having a full acceptance angle, which means

more energy input. External receivers usually used with thesurrounding heliostat fields.

The position of each heliostat in the heliostats field followsthe general pattern of the field. The basic patterns are thegrid and the circular patterns. The performance of the heliostats field is affected by manyfactors; shading, cosine, reflectivity, cleanliness, blocking, atmospheric and spillage losses. To simulate these losses, two methods are used:

1. Convolution-based algorithms and
2. Ray-tracing algorithms.

- Shading losses: occur at the start and end of the day as thesun is low at the sky; some heliostat's shadow will lay onother heliostat preventing the full surface reflecting the sun

rays, it is expressed for each heliostat as a ratio of coveredarea by others' shadow to the total mirror's reflective area.

- The cosine losses: happen when the heliostat plane is notperpendicular to the sun vector and this way reflects lessthan its own area towards the

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receiver. The cosine lossescannot be avoided. The cosine efficiency is given by theheliostat projection area along the sun vector divided by theheliostat total area, easily expressed by the cosine of theincidence angle.

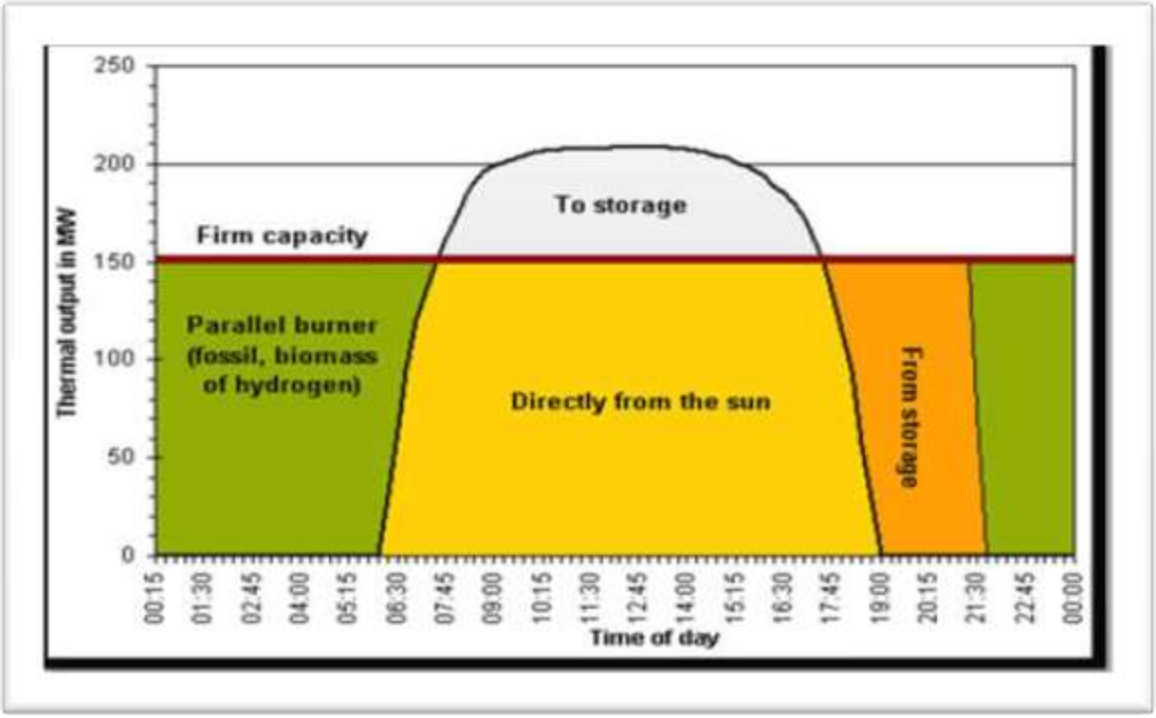
- The reflectivity losses: are determined by the amount oflight that is not reflected by the clean mirror, depends on themanufacturing quality of the mirror and on its resistance tocorrosion.

diffusion by dirt on the mirror. It depends on dust depositand the frequency of cleaning or raining. These last twolosses are described by a loss coefficient, which is equal for each heliostat and assumed constant over time at a givenannual mean value.

-The blocking losses: occur when solar radiation reflectedby a given heliostat is interrupted by another heliostat,partially or fully. It is calculated as the ratio of blockedreflected radiation for each heliostat. Unlike the shadowlosses, blocking losses are fixed during the day and can be
avoided totally by better design of the heliostat field.

- The atmospheric attenuation: affects the reflected solarradiation by absorption and diffusion through the airbetween the heliostat and the receiver. This effect is only roughly assumed because no such data for the air quality through the day.

- The spillage losses: occur from the fact that some reflectedsolar radiation misses the receiver.



PT plant is needed to produce an amount of energy EPB_nom during the nominal day. The nominal day is the day that includes the design point. The design point is commonly selected during the summer solstice to minimize energy losses (energy losses bydevocalizing a part of the solar field when DNI is high or when the storage is full). One of the key designparameters is the nominal direct normal irradiance (DNInom). During the nominal day, the equivalenthours with DNI equal to DNInom can be expressed as follows:

N(hours-eq) =D(daily-nom)/DNI (nom)

Where D(daily-nom) is the nominal daily direct insolation.

We define the ratio (Rh) as follows:

Rh=N(hours_TES) +N(hiurs_eq)/N(hours_eq)

The nominal thermal power of the PB is a function of its efficiency.

QPB_nom =PPB_nomηPB_nom

The incident thermal power on the SR is calculated as a function of its nominal efficiency:

PSR_incident_nom =PSR_nomηSR_nom

WherePSR_incident_nom and ηSR_nomis the nominal incident thermal power and the nominal efficiency of the receiver, respectively.The nominal thermal power of the PB is a function of its efficiency. _=_ _ (5) The incident thermal power

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on the SR is calculated as a function of its nominal efficiency:
A typicalconfigurationof solarpowertower plants.
In this case, it is assumed that a PT plant is needed to produce an amount of energy EPB_nom during the nominal day. The nominal day is the day that includes the design point. The design point is commonly selected during the summer solstice to minimize energy losses (energy losses by devocalizingapartofthesolarfieldwhenDNIishighor whenthestorageisfull). Oneofthekeydesign parameters is the nominal direct normal irradiance (DNInom). During the nominal day, the equivalent hours with DNI equal to DNInom can be expressed as follows:
Nhours_eq =Ddaily_nomDNInom

WhereDdaily_nom is the nominal daily direct insolation. We define the ratio (Rh) as follows:
Rh =Nhours_TES +Nhours_eqNhours_eq

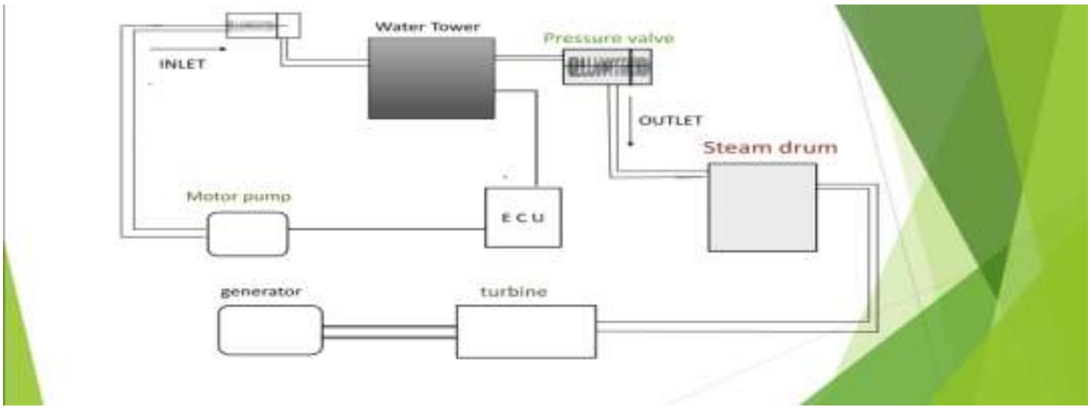
WhereNhours_TES is the number of hours of storage. A typical value of Nhours_TES is the difference between the number of hours of the day and the number of equivalent hours. It can also be given input data to meet specific objectives. The size of the TES that meets the nominal daily demand can be calculated as:
ETES_nom
=Nhours_TESNhours_eq+Nhours_TES.Enom_PB
ηTES_nom.ηPB_nom

WhereETES_nom is the capacity of the TES. ηTES_nom and ηPB_nom are the nominal efficiencies of the TES and the PB, respectively. Thenominalpowerofthereceiverisafunctionofthesola rmultiple (SM)andthenominalthermal power of the PB.
PSR_nom = SM.QPB_nom

EVOLUATION:

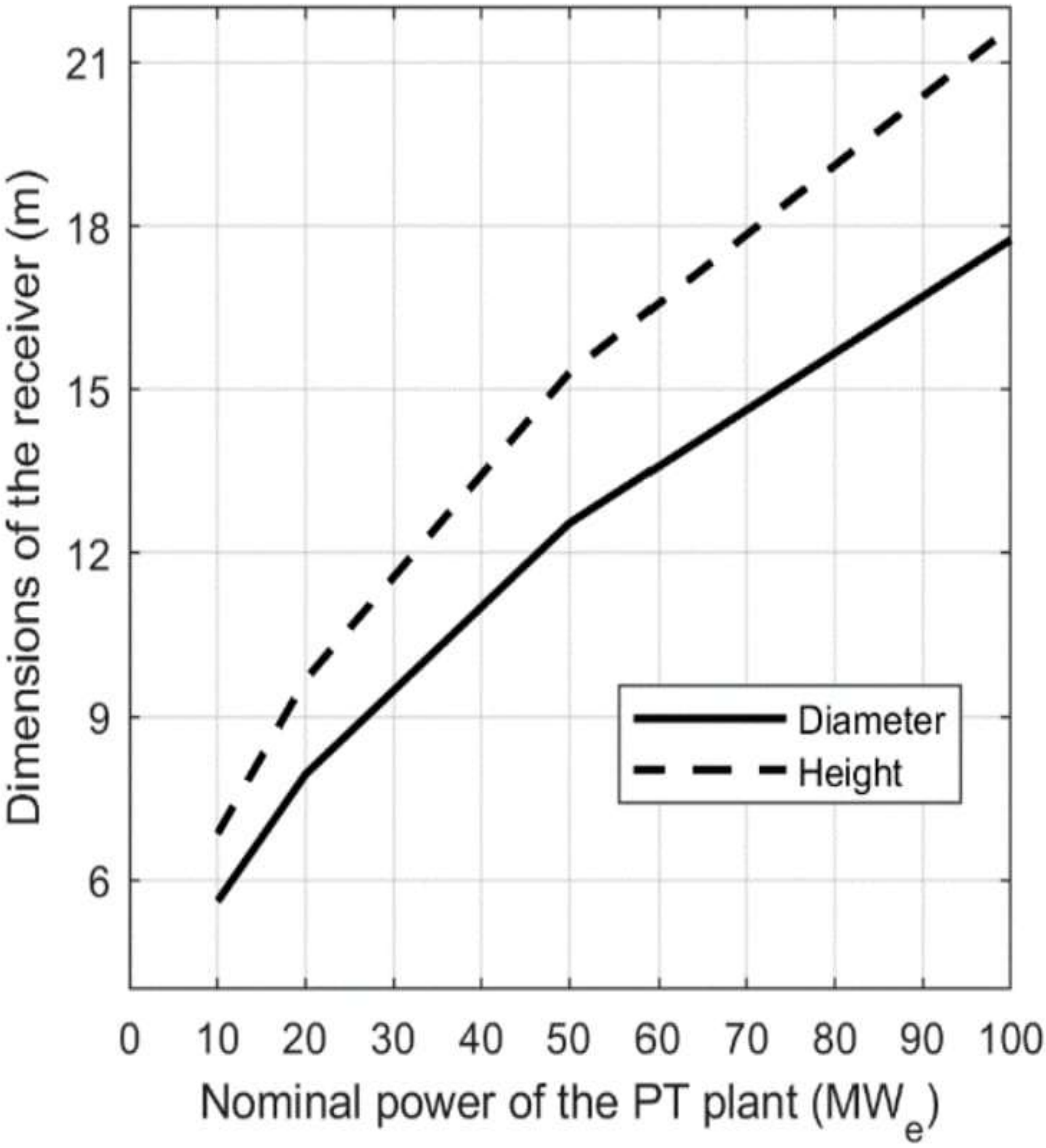
In This Project we have changed the working fluid as water by the replacement of molten salt solution. Because of contaminants stick on the inner surface of the pipes while cooling at after the day time heat absorption . To avoid the problems on the projects we improve by decrease the disadvantage.

We change working medium and also install water sensor at the receiver. To sense the level of water and also refill the water automatically by using the electronic control unit (E C U). And shown in below figure



II. RESULT:

By install the various components increase efficiency in the solar towerplant .



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