Design and installation of (flower sun) a concentration dish and study its parameters

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Abstract
Design and installation of (3m) aperture concentration, by using Six curved pieces in the form of parabola Was covered by Aluminum golden mirror, the (focus) at (1.52 m) from the center of parabolic dish, a receiver (boiler) fixed at focus, the concentration ratio (37), we find the heat loss (29.780 W), and the useful energy (1376.93W) and the efficiency of the concentration 60 % at (500-750W/m^2) the solar dish suitable for solar application.

Keywords: solar energy, solar power, solar thermal, solar concentration, parabolic dish, solar receiver.

Introduction
Solar energy is the main energy within the renewable energies and has increased attention to reduce environmental pollutants and help in providing additional sources of fuel for this many researchers worked to design and develop systems and components to benefit from, in 2009 Joshua " designs, builds and tests the class center and uses it to generate steam. By focusing solar radiation on a future in which water passes, the water is heated to the highest temperature to form the steam. Also use manual tracking to capture solar energy. So that the collector is always directed at a different time of day towards the sun. Has obtained high temperature test results above 200° C " [1]. Habra 2009 "investigated the solar tracking system of the solar dish based on image processing of the computer. This is done by using the camera to get the optimal picture from the shadow bar on the screen "[2]. Ouederni 2009, "design and study of a class center of 2.2 m was designed and the surface was covered with a reflective layer and a metal disk was placed in the focus of the parabola the "[3], Mo Wang, Kamran "2010 "designed a three-dimensional model of a parabolic dish system with argon gas as working fluids to simulate the thermal performance of a class-focused solar system" [4]. Liang Lie, [2011] "designed mirrors for a large equivalent capacitor plate, an important component of many solar systems, which need to be relatively accurate and expensive to manufacture and transport" [5] .

Theoretical part :
Concentration one of most important in solar thermal component there are three type of concentration solar dish, solar trough, solar power tower the idea of all type capture the solar radiation and reflection to one point (focus), her we use solar dish concentration, the parallel beam came from sun in to parabola concentration and reflection to the receiver(boiler) Figure (1). the area of concentration to the area of the boiler defined the concentration ratio C_r .

"$C_r = \frac{A_a}{Ar}$" -------(1)[6]

WhereA_a area of concentration, Ar area of boiler,

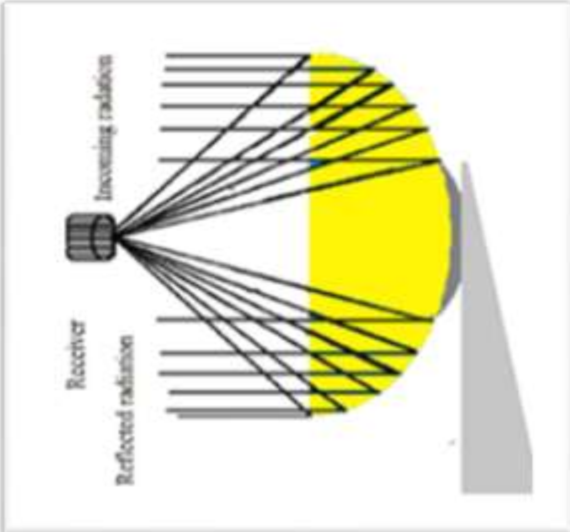

Figure (1) The parallel beam of radiation incident on the dish reflection on focus

We can find the, geometrical parameters by using equation (2,3,4) show figure (2)[7]:

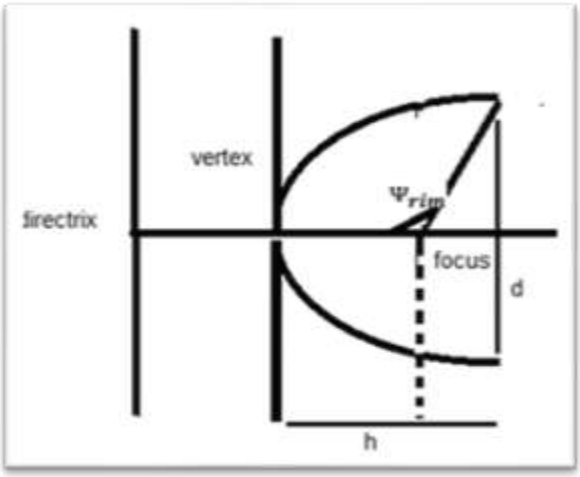

Figure (2) parabola

"$f = \frac{d^2}{16\,h}$"-----------------(2)

F = focus, d= aperture diameter of concentration, h= the distance from vertices of parabola to aperture.

As well as the rim angle can be found from the following relationship (3),and ($\frac{f}{d}$),

"$\tan_{\Psi_{rim}} = \frac{1}{(\frac{d}{8h})-(\frac{2h}{d})}$"------- **(3)**

"$\frac{f}{d} = \frac{1}{4\tan(\frac{\Psi_{rim}}{2})}$ " − − − − −**(4)**

The "useful" energy of the solar thermal complex, Is the rate of thermal energy that leaves the collector, usually describes in terms of the rate of energy that is added to the liquid heat transfer passes through the receiver or absorption [6,8]:-

"$Q_{useful} = Q_{optical} - Q_{loss}$ "---------(5)

Q _useful - Rate of useful energy going to the receiver.

Q _ (optical) - Optical power rate (short wavelength)

Q _loss - The rate of thermal energy loss from the receiver

" $Q_{useful} = m\ C_{p}(T_{out}-T_{in})$" ----------(6)

Where

(m) the mass of the fluid flowing during the heat transfer (kg / s) (Tout) the temperature of the fluid out of the receiver K

(T_{in}) The temperature of the liquid entering into the receiver K

To find the characteristics of the system and heat transfer processes, water is used for its good properties in heat transfer

The optical energy we can find from optical characterization see in equation [8]:-

"$Q_{opt} =$ A a · ρ_s_m·τ_g·α_r· R· S· I_a " ------------(7)

(ρ s _ m) - Reflective for Concentrated τ_g - transmittance of any glass covering the receiver A_a - The area of concentration S - Receiving shadow factor- I_a - Solar radiation incident on the concentration

α_r - Receiver Absorption.

We can find the efficiency by equation [7]:-

"$\eta_{col} = \frac{Q_{useful}}{A_a I_a}$ " ----------(8)

Experimental work:

The solar concentration is the main part of thermal solar energy in Salah al-Din/Tikrit College of Science, we design and installation of the solar dish and its examination.

Components of the solar system:

A. Reflection surface and frame:

The aluminum flat plates were made of, 80% reflective, the panels were cut to Six pieces a (conical shape) with dimensions of length (1.25m), width (1.20 m) Figure (3), each reflectance installation by iron frame with same dimension, but Each piece is set on a curved iron base and after all the pieces are installed we get the shape of the parabola A space is left between each piece and another to reduce the air resistance of the reflective surface, Figure (4) show (flower sun) concentration, The base of the reflectors was set on a base 1.5 meters high.

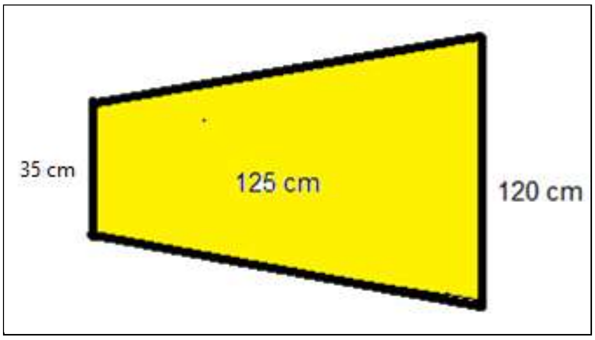

Figure (3) One piece of reflection

Figure (4) the system of concentration.

B receiver (boiler):

The receiver, make from a steel cylindrical (150 mm), A copper tube with a length of (5m) was rolled into the cylinder and pulled out from behind the cylinder Figure (5), to connected with rubber tube and connected with storage tank.

Figure (5) the cylindrical receiver

C. Storage tank

The Freon gas bottle was used as a storage water tank in the system after some modifications were made by making an entry hole and another to exit the liquid

Result and discussion

Solar radiation in Iraq Tikit, Altitude (34.59) and longitude (43.68), because "IRAQ at the second for NASA classification, otherwise tikrit in the middle of Iraq", show the solar radiation increasing from sun rise to the mid noon safter that decreasing at the sun set Figure (6). is the same of [9]:

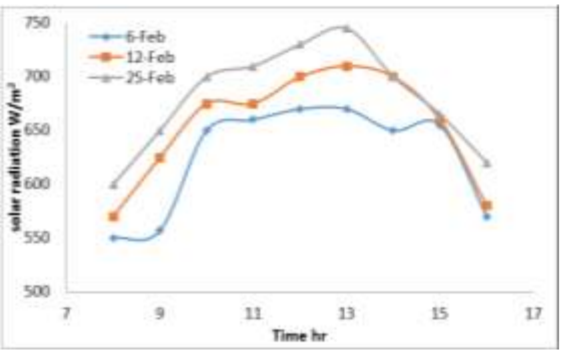

Figure (6) Show relation between solar radiations with time

As well as we can find the Geometric concentration by using equation (1,2,3,4) table 1 , show the value of design.

Geometric concentration for parabola dish table (1)

Aperture diameter (d)	3 m
Depth of parabola (h)	0.4 m
Focal distance (f)	1.5
Rim angle	50^{0}
Area of concentration	5m
concentration ratio C_r	37

In Figure (7) over all system testing we see increasing solar radiation in clear day Corresponding 15/4/2017 from 8-12 o'clock at this time the, water temperature increasing because the receiver temperature is too high as well as the output water is heated, and become steam goes to the tank and thus enter the new cold water so the cycle continues to warm water and reach the high degree Figure (7),is the same of [7].

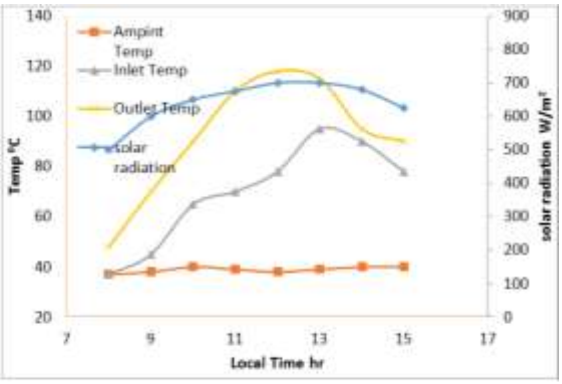

Figure (7) Show the solar radiation and temperature with time

From the testing in Figure (7) and when used heat transfer equation (5,6,7,8)

As well as when wind speed increasing the heat loss increasing Figure (8) because the boiler will be cold and decreasing temperature of water, is the same of [7]:

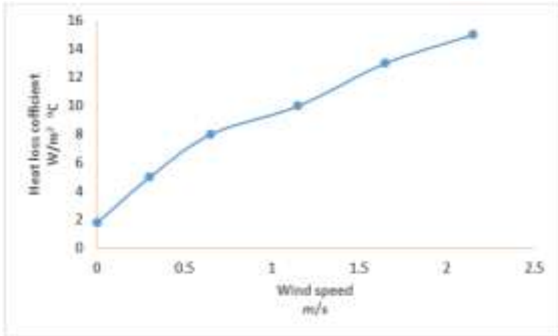

Figure (8) Show heat loss coefficient with variation wind speed

We can find the efficiency of system with work temperature divided to solar radiation Figure (9) the system is perfect with these parameters.

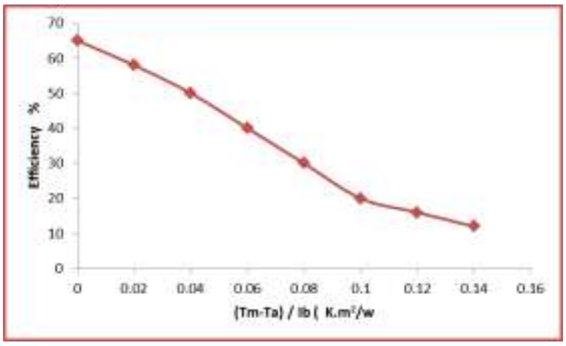

Figure (9) Show variation of efficiency with work temperature

Conclusion

Solar dish concentration is relatively perfect for solar thermal application, many applications in the word. in my work study solar radiation in Salah – Alden - Tikrit we find that the solar radiation is suitable for all application, so as .study all parameter,we find, the concentration is a good with wind affected otherwise, because high income temperature, and when increasing the area for solar dish the temperature increasing faster to super-heated .

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تصميم وتركيب المركز الشمسي الطبقي (زهرة الشمس) ودراسة خصائصه

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الملخص

تصميم وتثبيت مركز بعرض وجه (3m) ,باستخدام ست قطع منحنية على شكل قطع مكافىء وتم تغطيته بعاكس الومنيوم ذهبي, البؤرة على بعد (1.52m) من مركز القطع المكافىء، حيث تم تثبيت المستقبل وكان عامل التركيز (37) والحرارة المفقودة (29.780), والطاقة المفيدة (1376.93 W)، وكذلك الكفاءة للمركز (60%), عند ($500\text{-}750W/m^2$)، واثبت المركز انه مناسب للتطبيقات الشمسية.