Fossil fuel has been the main source construction essay

Nano-FluidsMechanical Engineering Department[Type the abstract of the document here. The abstract is typically a short summary of the contents of the document. Type the abstract of the document here. The abstract is typically a short summary of the contents of the document.]Mostafa AboulgoukhThe British University in Egypt

Introduction:

Fossil fuel has been the main source of energy for a long time now. It has advantages and disadvantages but the main problem with fossil fuel other than pollution of course is the fact that it is on the verge of ending. Since energy demand has been growing day by day with the development of technology; fossil fuel stock has been decreasing all over the world making it possible that we will see a day were fossil fuel no longer exist. Therefore it has been a main concern lately for scientists everywhere to find and develop a reliable source of energy which will be able to satisfy demands and future energy consumption. This explains the big development in renewable energy that have been seen lately. Sun is the main source of renewable energy it has more advantages, applications and reliability compared to fossil fuel while it's only drawbacks are costs and having lower efficiency than fossil fuel. Renewable energy has many forms such as Photovoltaic, Solar Thermal and much more, depending on the application and the type of energy required the way of generating is identified. Solar thermal is the most common way of generating energy nowadays, the reason behind that is due to cost justification and higher efficiency than what comes second in line which is Photovoltaic. The theory behind solar thermal is the conversion of radiation coming from the sun into heat then using this heat in many forms

of applications where it can be used for heating water for residential buildings , heating swimming pools and it can be also used for generating electricity. System components that are almost common in all applications are the following:-CollectorHeat transfer fluidHeat exchangerDepending on the application a lot more components are added like for home heating swimming pool system a pump is needed to move the fluid. Each application for solar thermal collectors has it's unique way of operating but the main concept behind heat generation is almost the same for all, therefore an example about heat swimming pool will be discussed to explain how the system work from the first step which is receiving solar radiation till the last step where the output is given in the form of heat energy; this application was chosen due to it's simplicity and again it does not represent all solar thermal applications it's only an example on how the system works. One of the ways such system can be applied is by placing the collectors /or absorbers on the roof of the house run a pipe from the pool to the absorbers and from the absorbers back to the pool again and put a pump on the beginning of the pipe from the pool side to push the water up to the absorber, Basically what happens is the cold water from the pool runs up the pips to the absorber which have higher temperature due absorbing sun radiation therefore the cold water is heated and goes back due to gravity effect to the pool as hot water. As an improvement to the system a photovoltaic could be mounted on the roof to supply electricity to the pump to work and also this assures that the pump will only work when there is sun which an important aspect to save electricity. This is only one type of how solar thermal system works, On the other hand when there is a need of generating electricity the concept is the same, but only different on the final

steps where the heat transfer liquid is heated in an outer tank transformed into steam then the steam is used to turn a turbine which generates electricity and then completes the cycle by going back to the liquid state and repeating the process. The working temperature is the main factor affecting the extracted energy during the thermal process; to be able to calculate the maximum efficiency that can be achieved carnot cycle efficiency is used which isFrom this equation what can be concluded is that the higher the hot temperature is and/or the lower the cold exhaust temperature the better the efficiency. Also the type of the solar collector used is a main aspect affecting the temperature of the system; there are three main types that are usually used depending on the application and the output required. The three types are as follows:-a)Flat plate collectors: Flat plate collectors(Fig. 1) is the basic type of solar cells where the collector is composed of a module of cells where sun radiation is collected and transformed into heat energy.

b)Parabolic Dish:

The parabolic dish(Fig. 2) is one of the famous sun tracking cells where it tracks the sun and focus it's energy into one point , which then drives a sterling engine generator.

c)Central Receiver:

Central Receiver operates in a similar way as parabolic dish were the sun energy is focused onto a tower that is placed on a calculated distance from the cells where the heat exchange fluid is located in that tower to be heated and then turned into steam and used to generate electricity. Table 1 illustrates the main differences between the three types. C:

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de/wp-content/uploads/2012/03/Central-receiver. jpghttp://teeic. anl.

gov/images/photos/illust_parabolic_trough. gif

Literature Review:

Solar Thermal Systems are not very different than any other solar system when it comes to the designing process, where solar system all share the same objective as well as the same input source which is the sun. The first step that is common between all solar systems is the load profile before the designer starts designing the system first calculations must be made to determine the required output from the system which of course is different between each application and another; in solar thermal the calculated output will be in terms of heat how much heat is required to be generated and from there the designer is able to know the number of panels/collectors needed to generate that output. The second step is calculating sun angles and searching for the optimum position to direct the cells to in order to be able to achieve maximum efficiency since efficiency is the ratio between the output and input of the system and the lesser the losses the higher the efficiency. These are the steps common in any solar system going further into design energy generating processes are different from each other where every solar system is unique with a generating process. After designing and finishing the solar system the designer starts looking for ways to improve the system and each solar system can be improved in numerous ways, for solar thermal systems which is the main topic of the research and while using flat plate collectors which is the type of collector also used for the research the improvement maybe for example in improving conductivity through coating the absorber with a material with high absorbing properties. Generally

improvements are made to increase either the absorption of the collector or increasing the conductivity of the fluid to increase the heat generation. Under these two categories lies numerous way of improvements. The main topic discussed as mentioned before will be the increasing of conductivity of the fluid which is water by nano-technology which in other words means adding specific type of nano particles to increase the conductivity of the fluid used. Since nano technology may be considered as a new field a research will be conducted to test whether or not nano technology truly increase the conductivity of the fluid which in this case is water and if yes it does will the change be cost justified or is it just an insignificant change that costs a lot of money, but before going further into details and calculations a review must be made to understand how earlier scientist and engineers were able to improve their solar thermal system with first improving their design and enhancing their collectors and on the other hand through improving the conductivity of the fluid using nano technology and learn what are the important factors they discovered that should be taken into consideration when trying to improve a solar thermal system using nano technology or in other words Nano fluids which is the known term for this type of application. The first factor that affects the performance of a solar flat plate collector is the glazing medium; glazing is the ability of the material of transmitting solar energy the glazing property depends on three factors reflection, transmission and absorption the first and third factor should be as low as possible while the third should be the as high as it can get. Glazing medium is more like the cover of the flat plate collector and therefore it should neither reflect nor absorb any of the solar radiation and allow it to pass or in other words be transmitted to the absorber and the better the glazing

medium the higher the efficiency since it lowers the losses caused by reflection and absorption. The most common glazing medium used is glass. According to Rhushi Prasad (2010) plastic short films may be considered a good transmitting medium since they poses long wave transmittance, but still they are not considered as a reliable medium since it lacks sustaining high temperatures without having dimensional changes. Also Lansing(2000) claims that sometimes double glazing is used to improve the transmitting process where in this case two materials are put on top if each with other with a calculated space between them where this space should be vacuumed to minimize the losses from conduction and thermal convection. Another way to improve performance is by coating of the absorber material as mentioned before; the main function of the absorber material is to absorb as much as it can from the solar radiation coming through the glazing material. Since the most important factor that affects absorbing factor is the color of the material therefore black is usually the color used on the absorber to ensure as high absorption as it gets since black has the highest absorption rate of all colors. The best way to improve absorbers is through surface coating, Rhushi Prasad (2010) claims that not only color and coating affects the material absorption but also the material roughness where he said the emittance of a surface highly depends on it's temperature and roughness. Also Brunold(2010) agrees that temperature is an important factors when calculating material absorption since the heat loss coefficient is a function of the temperature of the absorber plate. Last but not least another way of improving flat plate collectors is by tracking the sun, the absorbed radiation by the solar collectors is divided into types direct and reflected, sun position changes every 1 solar hour which means that in order to get more direct

radiation the cells has to change it's position to be normal with the sun again this is achieved using multi axis tracking system which means building a frame that has the capability of moving and using a simple motor to move it. The hardest part is controlling the motor to move every hour with a specific degree and at the end of the day going back to it's original position; this maybe achieved by many ways one of them is GPS where it self calculates the position of the sun and then readjusts the cells to be normal with it or also another way is by using timers to control the motor movements. The second way for enhancing solar thermal system efficiency is through nano fluids, when nano particles are injected into the temperature median or in this case water; the thermal conductivity is improved or in other words the heat transfer through conduction is improved noticeably. Before going further into details an important theory should be explained first, this is the effective medium theory. The effective medium theory was first discovered by Maxwell and Lorenz at the end of the 19th century. The theory is very important since it emphasis the properties of a medium based on the properties and fractions of it's components. In the case we are discussing which is the nano fluids the theory states that keblinski(2005) " Since an aggregate of nanoparticles occupies more space than the individual nanoparticles that make up the aggregate, the volume fraction of the aggregates is larger than the volume fraction of nanoparticles. A random close packing of spherical nanoparticles will have a relative density of approximately 60%. So, if the nanoparticles have aggregated, we can expect an enhancement in the thermal conductivity of approximately 3f/0. 6, or 5f". Therefore and according to this theory it is expected of the fluid to conduct more heat after injecting it with the Nano fluids. So far carbon nanotubes

and copper nanoparticles are considered the best options for enhancing thermal conductivity since they showed noticeable enhancements with comparison to the original fluid conductivity. Since both of these elements scored the best results therefore the research will concentrate on them trying to emphasize a fair comparison between both to be able to fully understand both materials. Carbon nanotube is a material that has a shape of a tube and exhibits a few properties that gives it advantages on any other material such as high thermal conductivity, low density and a unique of strength and stiffness in comparison with other fibers. Also according to Kakosimos(2005) carbon nanotube were found to be not miscible with water which means they lack the capability of forming a homogenous mixture when added together and it was also noted that it is more difficult to be dispersed in ethylene glycol and therefore it is advisable to add a disperse to enhance the suspension of the nanotubes in the heat transfer fluid . Carbon nanotubes maybe categorized into three different types according to their structure which are Single wall nanotube, Multi wall nanotubes and Double wall nanotubes where each of them acquire unique properties and different applications. There are several ways for producing carbon nanotubes (CNTs) such as Arc method were this method was originally used for the production of C60 fullerenes and maybe considered the most popular and easiest way for carbon nanotubes production, this method includes creating carbon nanotubes through arc-vaporization of 2 carbon rods that are distanced by 1mm in between and positioned end to end, in an enclosed area containing low pressure inert gas. Another method is Ball Milling which may be considered a particularly new method that came into usage on a few years ago were carbon nanotubes started being produced from carbon and boron

powders using thermal annealing. The material second in line after carbon nanotubes is the copper nanoparticles, not only they have good thermal conductivity but they are also known for their good chemical and physical properties as well as their low preparation costs. Copper nanoparticle is also famous for having a numerous number of ways for preparations such as micro emulsion, reverse micelles, gamma irradiation and much more ways which makes it a wanted material from designers and developers when considering adding nanoparticles to enhance the thermal conductivity of solar thermal systems. On the other hand according to Dewan (2012) copper nanoparticles also exhibit a few disadvantages such as size limitation and susceptibly to oxidation. Also Dewan(2012) claims that the stabilization of copper nanoparticles may be affected significantly by the liquid in conjunction with ethylene glycol. In addition according to Wei Yu(2011) it is of believe that there is an existence of a linear relationship between thermal conductivity and copper nanotubes where the relationship indicates an improve in the ratio of thermal conductivity with 5. 0% volume are 36% this also proves the strong dependence of Nano fluids thermal conductivity on particle concentration. Last but not least and based on a study made by Sinha(2009) a relationship was found between the increase in viscosity and thermal conductivity with volume fractions in range of 0. 4-2 % volume and 200 nm CP in ethylene glycol where the increase in viscosity was more than double the Einstein law of viscosity and as for thermal conductivity the result was double the value forecasted by the Maxwell effective theory. Now and after the brief review on the properties and effect of both copper nanoparticles and carbon nanotubes on thermal conductivity a comparison based on previous research and experiments shall be established to help

clarify the difference between carbon nanotubes and copper nanoparticles when compared together in practical work. First of all and as a first point of debate according to Karlsson(2008) copper oxides maybe considered highly toxic when compared with carbon nanotubes which may be considered a problem when used in solar thermal system since the Nano fluid is injected into water to improve it's heat conductivity and after the water is heated it may be used in houses maybe for drinking and therefore if copper oxides are considered toxic they will cause a challenging problem for designers. On the other hand copper nanoparticles maybe considered more available and simpler to obtain than carbon nanotubes since there is a lot of ways to prepare it with low preparations costs, while carbon nanotubes require more complex operations to be produces with more production costs. In addition to comparison points their reaction with water should be taken into consideration since water is the fluid to be used in testing there for it is important to know how using CNT's and CU particles improve thermal conductivity when used with water. According to Lee et al. (1999) an improvement of 12% for copper oxide when injected into water while on the other hand according to J. Glory(2008) an enhancement of 64% in thermal conductivity where CNTs had an average length of 1. 7μm and diameter of 40nm.