A Review: Analysis of Integrated Solar Heat and Wind Power Plant

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Abstract— In the recent few years there are many researcher have exposed strongest attention for exploration the performances of solar chimney wind power plant due to its economic, environmental and huge potential application. There are different geometrical parameters and operating conditions like chimney height, collector radius, throat radius, solar radiation, wind velocity, solar absorption coefficient, solar loss coefficient, chimney shapes which are play vital role for optimize the performances of solar chimney wind power plant.

Key words: Renewable Energy Sources, SCWPP, Wind Power Plant, Solar Chimney, Electrical Energy

I. INTRODUCTION

With the decrease of fossil fuel resources and increasing worldwide pollution problems, there is a growing need for an environmentally friendly renewable energy source. It is vital that the utilization of this energy source be economically viable, especially for its possible use in third world countries. Engineers and scientists are increasingly looking to solar energy as a potential answer to this problem.

Man has already tried to harness energy from the sun in various different ways. These include parabolic trough solar power plant, Central Receiver power plants, Dish-Stirling systems, solar pond power plants and Photovoltaic power plant.

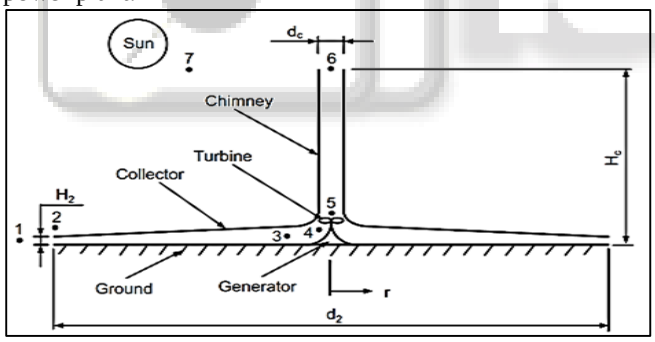

Fig. 1: Schematic illustration of a solar tower power plant

Since the 1970's, the development of solar tower power plant have been investigated and have since become a good prospect for large scale energy generation. The solar tower power plant consists of a translucent collector (located a few meters above ground level) with a central tower which houses a turbo-generator at its base, as shown schematically in fig. 1.

The operation of such a solar power plant is relatively simple. Solar radiation heats the ground beneath a clear glass collector. Underneath the collector, the heated ground heats the air, causing the air to rise. The warm air is trapped under the collector but rises through the central tower, driving the turbine and consequently generating electricity.

Solar tower power plants have some advantage over the above mentioned power generation schemes, such as the Parabolic Trough and Central Receiver solar power plants. These include the use of both beam and diffuse radiation, while energy is stored naturally in the ground during the day is released at nighttime, thus producing electricity over a twenty –four hour period. Solar tower makes use of simple technologies, are built from low cost materials and have no water requirements.

II. REVIEW OF WORK CARRIED OUT

Marco Aurelio dos Santos Bernardes et al. [1] The paper compares the procedural methods used in the Bernardes and Pretorius studies, and investigates the effect of different heat transfer models on solar chimney performance. In conclusion, higher heat transfer coefficients from the ground and from the roof to the flow results in lower air temperature in the collector, leading to lower losses through the roof and higher heat transfer to the flow with the Pretorius scheme and lower heat transfer coefficients from the roof to the ambient results also in lower losses through the roof with the Bernardes scheme. This compensatory effect leads to similar temperature profiles of the air for both schemes, minimizing the influence of the choice of heat transfer coefficients in the solar chimney performance.

As per R. Khana et al. [2] it was found that the lightness driven characteristic convection inside a sun oriented stack is examined with a joined numerical and expository strategy which is upheld by a subjective stream representation analyze.

Author of [3] present the reason for this review is to assess the execution of sunlight based smokestack control plants hypothetically and to evaluate the amount of the delivered electric vitality. A scientific model in light of the vitality adjust was produced to assess the power yield of sun oriented fireplaces and to look at the impact of different surrounding conditions and auxiliary measurements on the power yield.

In paper [4] a sun based gatherer, smokestack and turbine are displayed together hypothetically, and the cycle strategies are done to settle the subsequent numerical model. Results are approved by estimations from a real physical plant.

Author of [5] presents a numerical model and investigation of a slanted sort rooftop beat sunlight based fireplace. The model is for the most part settled to represent the impact of the smokestack tallness and the gatherer zone on the framework's execution. The expectation comes about acquired from the model have exhibited that the most impacting parameter on the rooftop best sun based smokestack execution is the solar intensity.

Richard Petela [6] a streamlined model of sunlight based stack influence plant (SCPP) comprises of a warming air gatherer, turbine and fireplace. Thermodynamic translation of procedures happening in these SCPP parts depends on the inferred vitality and exergy equalizations. The cases of the vitality and exergy stream graphs indicate how

the SCPP contribution of 36.81 MW vitality of sun powered radiation, comparing to 32.41 MW contribution of radiation exergy, is disseminated between the SCPP segments. Responsive patterns to the fluctuating info parameters are considered. Furthermore, the idea of mechanical exergy (ezergy) of air is connected and it took into consideration quantitative assurance of the impact ascribed to the earthbound gravity field on the part procedures of the SCPP.

T.P. Fluri et al.[7] Several cost models for huge scale sun powered fireplace control plants are accessible in the writing. Notwithstanding, the outcomes introduced differ fundamentally, even in situations where the info parameters and the utilized models are as far as anyone knows fundamentally the same as. The principle target of this paper is to elucidate this matter by contrasting past cost models with a recently created elective model. Promote, the effect of carbon credits on the levelised power cost is likewise explored.

A reference plant is presented, with measurements and money related parameters picked particularly with the end goal of making the aftereffects of this examination practically identical to those of past productions. Taken a toll models are introduced for the principle segments of a sunlight based stack control plant, i.e. the gatherer, the stack and the power change unit. Comes about demonstrate that past models may have belittled the underlying expense and levelised power cost of a substantial scale sun oriented stack control plant. It is additionally demonstrated that carbon credits fundamentally lessen the levelised power cost for such a plant.

As indicated by creator [8] A sun powered stack is a sun oriented power plant which produces mechanical vitality (for the most part as far as turbine shaft work) from a rising hot air that is warmed by sun based vitality. The present paper looks at the expectations of exhibitions of sun oriented fireplace plants by utilizing five straightforward hypothetical models that have been proposed in the writing. The parameters utilized as a part of the review were different plant geometrical parameters and the insolation. Computational Fluid Dynamics (CFD) recreation was additionally directed and its outcomes contrasted and the hypothetical expectations. The power yield and the proficiency of the sunlight based fireplace plants as elements of the contemplated parameters were utilized to look at relative benefits of the five hypothetical models. Models that performed superior to anything the rest are at long last prescribed.

Author of [9] the stream conduct because of common convection of air inside a sun based smokestack with a forced warmth flux on a vertical safeguard divider is examined by a scaling investigation and a comparing numerical reenactment. Three unmistakable stream administrations are recognized, one with a particular warm limit layer and the other two without an unmistakable warm limit layer, contingent upon the Rayleigh number. The two administrations without an unmistakable warm limit layer are further grouped into low and medium Rayleigh number sub-administrations separately. These sub-administrations are portrayed by conduction predominance in which the warm limit layer develops to envelop the whole width of the channel before convection winds up plainly vital. Stream improvement in each of these stream administrations and sub-administrations is portrayed through transient scaling, and scaling relationships are produced to depict the temperature, stream speed and mass stream rate, which describe the ventilation execution of the sunlight based smokestack. The scaling contentions are approved by the comparing numerical information.

In paper [10] The warm execution of a PCM based sun oriented stack is tentatively explored in this paper. The examination is done inside a research center condition with three diverse warmth fluxes of 500 W/m2, 600 W/m2 and 700 W/m2. The outcomes demonstrate that for a same charge time of 7 h 10 min however the PCM does not completely dissolves in the instances of 600 W/m2 and 500 W/m2, the safeguard surface temperature varieties for the three warmth fluxes are the same amid the stage change move period. In opposition to the sensible warmth release period, amid the stage change period, the surface temperatures slide gradually till the inactive warmth discharges totally. The stage change periods are almost 13 h 50 min for all cases examined. The wind current rates shift comparing to the safeguard surface temperature.

In paper [11] A productivity show at outline execution for counter-pivoting turbines is created and approved. In light of the proficiency conditions, an off-outline execution display for counter-turning turbines is created. Joined with a thermodynamic model for a sun powered fireplace framework and a sun oriented radiation demonstrate, yearly vitality yield of sun oriented stack frameworks is resolved. Two counter pivoting turbines, one with gulf control vanes, the other without, are contrasted with a solitary runner framework. The outline and off-outline exhibitions are weighed against in three distinctive sun powered smokestack plant sizes. It is demonstrated that the counter-pivoting turbines without guide vanes have bring down outline proficiency and a higher off-plan execution than a solitary runner turbine. In light of the yield torque versus control for different turbine formats, invaluable operational states of counter pivoting turbines are illustrated.

Author of [12] Numerical recreations have been done on the sunlight based smokestack control plant frameworks combined with turbine. The entire framework has been separated into three locales: the gatherer, the smokestack and the turbine, and the scientific models of warmth exchange and stream have been set up for these areas. Utilizing the Spanish model as a pragmatic illustration, numerical reenactment comes about for the model with a 3-edge turbine demonstrate that the most extreme power yield of the framework is somewhat higher than 50kW. Moreover, the impact of the turbine rotational speed on the stack outlet parameters has been examined which demonstrates the legitimacy of the numerical strategy progressed by the creator. From there on, outline and reproduction of a MW-reviewed sunlight based fireplace control plant framework with a 5-sharp edge turbine have been introduced, and the numerical recreation comes about demonstrate that the power yield and turbine effectiveness are 10MW and half, individually, which exhibits a reference to the plan of substantial scale sun based smokestack control plant frameworks.

Author of [13] In a sun oriented stack, the lightness instigated stream of air produces ventilation of the building where the smokestack is connected. At the point when air

twist blows over the upper piece of a sunlight based stack, a blended lightness wind driving actuated stream shows up, and after that the warm conduct of the smokestack changes definitely. Expecting that the stack is without any defensive gadget at its upper part, numerical outcomes for the weight distinction coefficients, normal Nusselt number and the incited mass stream rate are gotten for estimations of Rayleigh number changing from 107 to 1012 (symmetrically, isothermal warming condition) and 1011 to 1015 (symmetrically, uniform warmth flux warming condition), with twist speeds from 0 to 10 m/s. A connection for the non-dimensional mass stream rate is introduced, which is legitimate for the total scope of significant parameters respected, with a normal deviation around 6%.

Author of [14] Current in sun oriented smokestack control plant that drives turbine generators to produce power is driven by lightness coming about because of higher temperature than the surroundings at various statures. In this paper, the most extreme smokestack tallness for convection maintaining a strategic distance from negative lightness at the last stack and the ideal fireplace stature for greatest power yield are introduced and dissected utilizing a hypothetical model approved with the estimations of the just a single model in Manzanares. The outcomes in view of the Manzanares model demonstrate that as standard slip by rate of climatic temperature is utilized, the greatest power yield of 102.2 kW is gotten for the ideal stack tallness of 615 m, which is lower than the most extreme fireplace stature with a power yield of 92.3 kW. Affectability investigations are additionally performed to inspect the impact of different slip by rates of climatic temperatures and gatherer radii on most extreme tallness of stack. The outcomes demonstrate that most extreme tallness step by step increments with the pass rate expanding and go to interminability at an estimation of around 0.0098 K m-1, and that the greatest stature for convection and ideal stature for greatest power yield increment with bigger gatherer span.

III. Conclusion

This paper has presented a literature review of Analysis of Integrated Solar Heat and Wind Power Plant. The review shows that in future further improvement in power increase the solar absorption coefficient and reduces the solar loss coefficient in same working condition.

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