Journal of The Gujarat Research Society

ISSN: 0374-8588
Volume 21 Issue 9, September 2019

A Short Review on Solar Power Plant

Anurag Srivastava
Faculty of Engineering, Teerthanker Mahaveer University, Moradabad, Uttar Pradesh, India

ABSTRACT: India is a developing country where every industry, such as automotive, process automation, real estate, high-speed agriculture, is growing. As each industry is rising at a very fast pace, they face a big power supply problem. This paper offers a summary of the solar chimney power plant that utilizes renewable energy sources. It works on the theory that solar energy is transformed into electrical energy. The sun's heat radiation is used to heat the air under the roof and the hot air is allowed to move through a chimney that rotates the turbine. The turbine is used to drive the energy producing rotor of an AC alternator. This paper deals with basic solar plant components and earlier research information. It also provides an idea of the actual work on solar chimney power plants to be carried out.

KEYWORDS: Collector, Generator, Pressure, Radiation, Sensor, Solar energy, Solar chimney, Turbine, Velocity.

INTRODUCTION

India is a developing country where every industry, such as automotive, process automation, real estate, high-speed agriculture, is growing. As each industry is rising at a very fast pace, they face a big power supply problem. Compared to the required demand, current power output is lower. In order to balance the distribution of electricity, they have to shut down their units in different regions for one or two days per week, which will affect the Indian economy. Maximum power generation is based on traditional energy sources, i.e. fossil fuels such as oil and coal, which are not going to last long. Excess use of these fuels/energies can contribute to potential energy shortages. Nature also has several fossil fuel production restrictions, Often, the use of traditional resources.

Air pollution is a phenomenon that affects nature, causing global warming. In this way, researchers and scientists are preparing for non-conventional energy sources such as wind, tidal, biogas, geothermal and solar energy. India's geographical location and fixed seasons are ideally suited for solar power plants that provide insight into solar chimney power plants. The solar chimney power plant, using solar energy, is used to produce electricity. The air under the roof or collector is heated by solar energy radiation. The hot air is allowed to pass through the tall chimney and is then used to drive the electricity-generating turbine[1]. It is expected to vary the chimney diameter to keep the turbine velocity and speed stable, which will increase the power plant's performance and stability. The pressure sensor transducers and the closed loop control system will do this.

Working Principle of the solar plant

The basic specifications of the solar-chimney power plant are shown in Figure 1. The solar collector, chimney and turbine are included. With the help of solar chimney plants, solar radiation is used to turn it into electricity. Direct and diffuse radiation strikes the glass roof collector, where the atmosphere, clouds and surface reflect, absorb and relay precise fractions of energy. The sum of reflected, absorbed and transmitted energy is dependent on the angle of incidence of solar radiation and the optical characteristics of glass, such as refractive index,

thickness, height and coefficient of extinction. The solar radiation emitted by the roof strikes the surface of the ground where part of the radiated energy is absorbed by the surface and part is reflected. The reflected radiation is used to heat the air under the roof. Hot air under the roof rises up into the plant chimney, bringing more air into the perimeter of the collector and thereby initiating forced convection that heats the collector air faster. If the air flows from the perimeter of the collector to the chimney[2], its temperature increases, while the air velocity is roughly constant due to the collector's increasing height. The heated air flows up the chimney, allowing the chimney's inlet ant outlet to create pressure difference, so the air circulating through the chimney is used to push the generator to generate electricity.

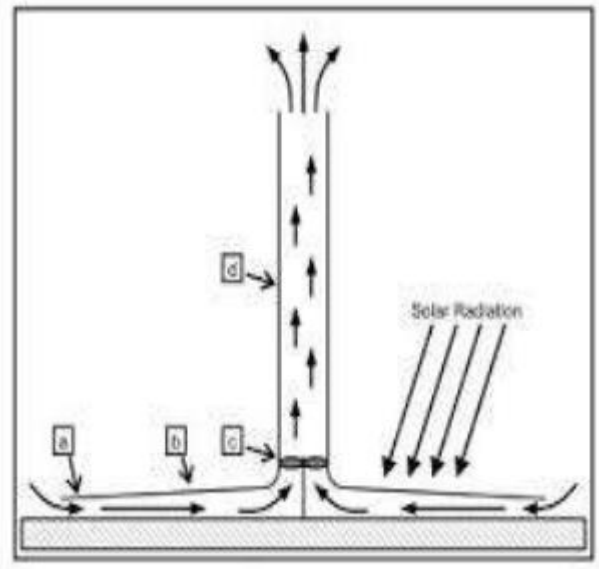

Figure 1: Shows the Chimney of Solar Plant

Basic parts of the plant

Collector

The primary component of solar chimney power plants is the collector. Solar energy collectors are special types of heat exchangers that convert solar radiation energy into the transport medium's internal energy[3]. The collector is used to generate the greenhouse effect of hot air. The radiation the collector absorbs is used to heat the air between the surface of the ground and the collector. The material used for the construction of the collector is plastic film or plastic film from glass. The collector roof is situated above the floor stage. The roof height adjacent to the chimney is more ideal for diverting the air with less pressure towards the chimney. The amount of radiation obtained would be depending on the collector's material and the solar radiation angle.

In order to increase the performance of the power plant, substantial research has been carried out on the design of the collector. Two kinds of collectors have been introduced and tested by Pasumarthi and Sherief, i.e. by expanding the base and adding the intermediate medium in it that has increased the temperature[4]. Schlaich introduced an empirical model (1995). Kroger and Buys (1999)[5] presented numerical collector models. They also presented transient collector analysis to estimate maximum power for one year of operation. Gannon and Van

Backstrom(2000), Hedderwick(2001), Beyers et al(2002) present work in their paper unique to the collector of solar chimneys[5].

M. An analytical model was proposed by O. Hamdan(2004) to predict solar chimney power plant output. In 2005[6], Canada's E. Bilgen and J. Rheault suggested building the solar collector in a messy and tapered section to increase the performance of the collector.N. Ninic (2006) studied the different types of solar chimney collectors and designs for improved solar chimney efficiency. Bonnelle (2003) proposes new collector configurations to boost the performance of the collector[7].

Chimney

Another major component of the solar chimney power plant is the chimney. Plant performance depends on the chimney's material, structure and height. It also depends on the chimney diameter. The middle of the roof collector is installed. To build the chimney tower at the base and top of the chimney, the temperature differential will suck the hot air towards the top of the chimney. To drive the turbine mounted in the chimney, the upward motion of the hot air is used. In order to reduce the mechanical mechanism[8], the turbine is usually positioned near the base of the chimney. Efforts are made to increase the performance of power plants, such as sloped solar chimney, floating solar chimney, geothermal solar chimney, hybrid cooling tower solar chimney, and various types of chimney. The reinforced concrete was proposed by Schlaich(1994) as an elevated building material framework tower. Studies have shown that this construction approach is basically the most sustainable and cost-effective alternative[9][10] .

Turbine

An significant component of the solar chimney power plant is the turbine. It is used to translate the flow of air into mechanical energy and to transfer it to the generator. The wind turbine is similar and is mounted at the base of the chimney. The speed of the turbine allows the generator to produce electricity and power it to the grid due to air flow[2].

CONCLUSION

The solar chimney power plant is an alternative technology for power generation. Implementing these plants would help to balance India's energy demand. The analysis addresses the fundamental principles, processes and components of the power plant. This article also offers descriptions of power plants for solar chimneys throughout the world.

REFERENCES

[1] A. Dhahri, “A Review of solar Chimney Power Generation Technology,” 2013.

[2] T. W. Von Backström *et al.*, “State and recent advances in research and design of solar chimney power plant technology,” *VGB PowerTech*, 2008.

[3] A. Demirbas, “Biofuels securing the planet’s future energy needs,” *Energy Convers. Manag.*, 2009, doi: 10.1016/j.enconman.2009.05.010.

[4] N. Pasumarthi and S. A. Sherif, “Experimental and theoretical performance of a demonstration solar chimney model-part I: Mathematical model development,” *Int. J. Energy Res.*, 1998, doi: 10.1002/(SICI)1099-114X(19980310)22:3<277::AID-ER380>3.0.CO;2-R.

[5] T. P. (Department of M. andMechatronic E. U. of S. Fluri, “Turbine Layout far and Optimization of Salar Chimney

Power Conversion Units," *M.SC., Dep. ofMechanical Andm. Eng. Univ. Stellenbosch Priv. Bag X1,matiel. 7602 , South Africa.*, 2008.

[6] M. O. Hamdan, "Analysis of a solar chimney power plant in the Arabian Gulf region," *Renew. Energy*, 2011, doi: 10.1016/j.renene.2010.05.002.

[7] N. Ninic, "Available energy of the air in solar chimneys and the possibility of its ground-level concentration," *Sol. Energy*, 2006, doi: 10.1016/j.solener.2005.05.010.

[8] A. J. Gannon and T. W. Von Backström, "Solar chimney turbine performance," *J. Sol. Energy Eng. Trans. ASME*, 2003, doi: 10.1115/1.1530195.

[9] J. Schlaich, "Tension structures for solar electricity generation," *Eng. Struct.*, 1999, doi: 10.1016/S0141-0296(98)00021-2.

[10] M. Kaltschmitt, W. Streicher, and A. Wiese, *Renewable energy: Technology, and environment economics*. 2007.