PAPER ON SOLAR HYBRID CHIMNEY

AMIT SHARMA[1]
1(AMITY UNIVERSITY RAJASTHAN)

SACHIN KUMAR[2]
2(AMITY UNIVERSITY RAJASTHAN)

ABSTRACT

Hybrid chimney is a new method for producing electric power from a Solar/ wind hybrid system. Energy from sunlight is converted to heat by a large solar collector. The solar collector heats the air above it and the heated air rises. Cooler air moves in to replace the rising hot air and a cycle begins. The solar collector continually heats the air, which rises and is replaced by cooler air. The heated rising air decreases the air pressure above the collector. The rising hot air over the collector has an air pressure than the cooler air over the land away from the collector. The Chimney connects the lower air pressure, near the center of the collector, to the higher air pressure, a short distance away from the collector. Air moves from high to low air pressure through the chimney. Inside the Chimney, pressure-staged wind turbines convert the wind's energy into electricity.

Keywords:-Solar chimney; collector; turbine; power conversion unit; solar updraft tower.

INTRODUCTION

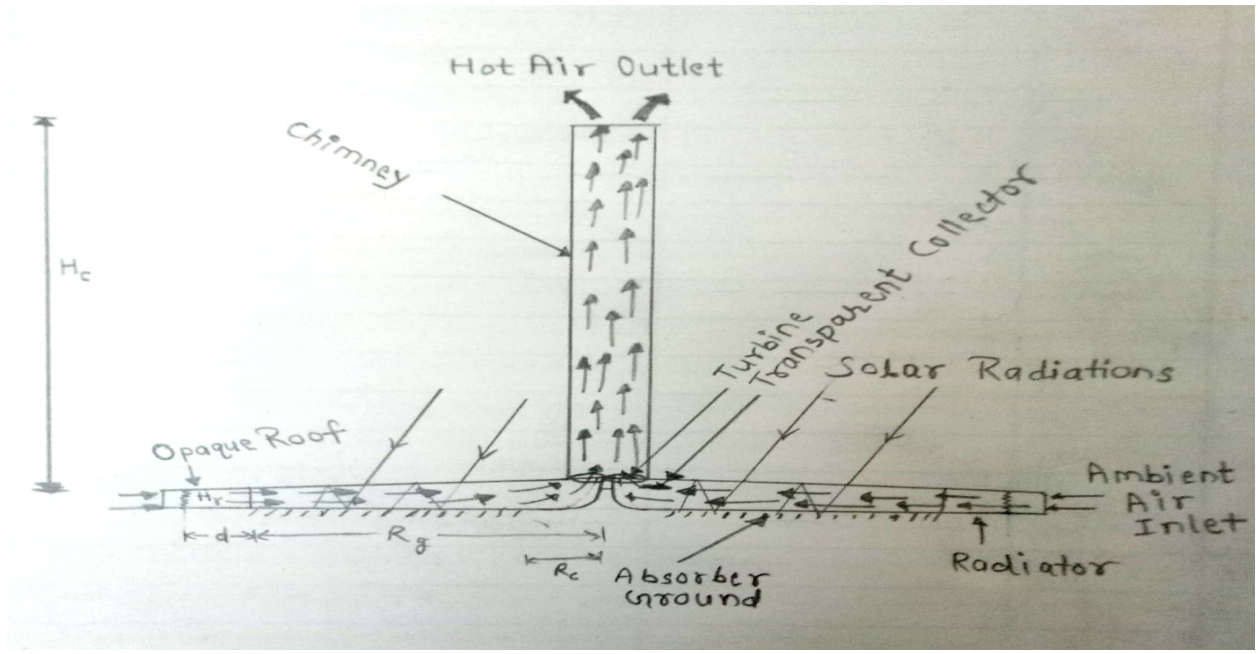
India is a developing country in which each sector such as automobile, process automation, real estate, agriculture growing with high speed. As each sector grows with very fast rate, they are facing major problem of power supply. Present power generation is less as compared to required demand. To balance the power distribution, they have to shut down their units for one or two days in a week in different region which will effect on Indian economy. Maximum power generation is based on conventional source of energy i.e. fossil fuels such as oil, coal, which will not last for long time. Excess use of these fuels / energy may cause shortage of energy in future. Nature also has some limitations to develop fossil fuel. The use of conventional energy also cause problem of air pollution which will affect the nature creating global warming. So that research scholars and scientists are planning for non conventional source of energy such as wind, tidal, biogas, geothermal and solar. The geographical location and fixed seasons in India is best suitable for solar power plant which gives idea about solar chimney power plant. Solar chimney power plant is used to generate electricity by using solar energy. Solar energy radiations are used to heat the air under roof or collector. The hot air is allowed to pass through the tall chimney and it is then utilized to drive the turbine which will generate the electricity. I am planning to vary the diameter of chimney to keep velocity and speed of turbine constant which will enhance the efficiency and

stability of power plant. This can be done by pressure sensor transducers and closed loop control system.

PRINCIPLE OF SOLAR CHIMNEY PLANT

Figure 1 shows the basic details of solar chimney power plant. It consists of solar collector, chimney and turbine. The solar radiations are used to convert into electricity with the help of solar chimney plant. Direct and diffuse radiation strikes the glass roof collector, where specific fraction of energy is reflected, absorbed and transmitted due to atmosphere, clouds and surface. The quantity of reflected, absorbed and transmitted energy depends on the solar radiation incidence angle and optical characteristics of glass such as refractive index, thickness, and height and extinction coefficient. The transmitted solar radiations through the roof strike the ground surface where part of radiated energy is absorbed by the surface and part is reflected. The reflected radiations are used to heat the air under roof .hot air under roof rises up into the chimney of the plant [19], thereby drawing in more air at the collector perimeter and thus initiating forced convection which heats the collector air more rapidly. As the air flows from the collector perimeter towards the chimney [18] its temperature increases while the velocity of the air approximately constant because of the increasing height of the collector. The heated air travels up the chimney causing to create pressure difference at the inlet and outlet of the chimney thus the air flowing through the chimney is used to drive the generator to generate the electricity.

Figures and Tables:-



The data use for the fabrication is taken considering the climate condition. In The ground region the summer period mainly April, May, June, July. The Temp is approximately varied from 30-35

degree Celsius. During the Complete day mainly from 9am to 4 pm the hot air blow .The minimum air Velocity during that period vary from 5-9 meter per second. So for designing concern we take this velocity in consideration. Acc. To formula:-

Total Pressure Difference = V^2 *D* 1.5

V= Velocity in meter per second
D= Density in Kg per $meter^3$
1.2245 Kg per $meter^3$

Also Total Pressure Difference = D*g* H

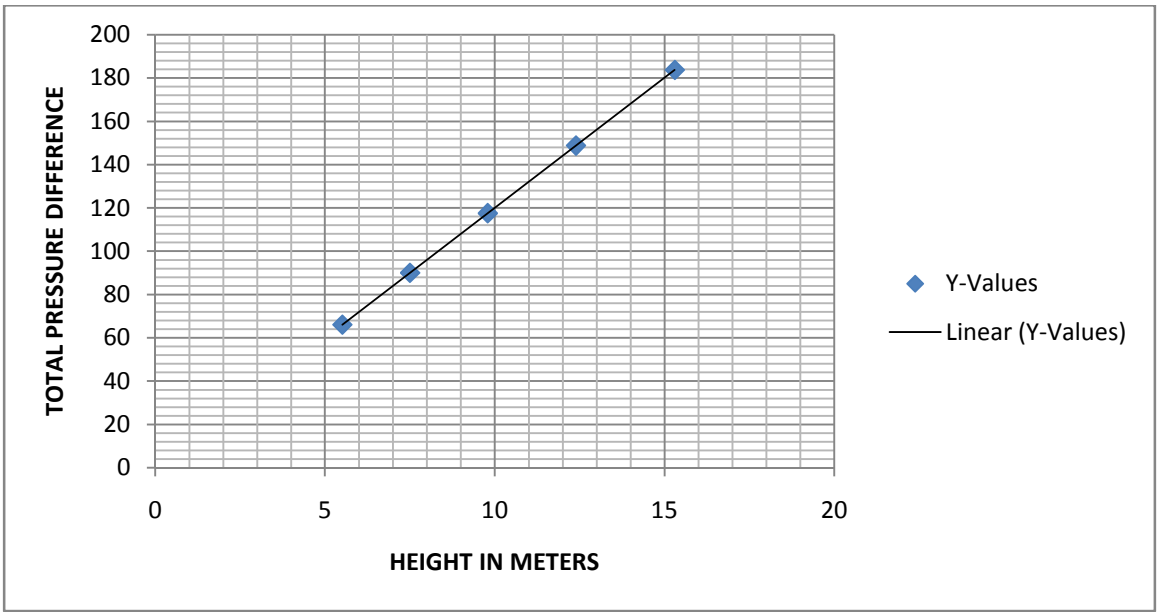
H = Height of Chimney in Meter
g = Acceleration due to gravity in Meter per $Sec.^2$

CALCULATION TABLE:-

Sr. No.	VELOCITY(m/s)	TOTAL PRESSURE DIFFERENCE	HEIGHT IN METER
1.	6 m/s	66.12 N/m^2	5.51
2.	7 m/s	90.001 N/m^2	7.5
3.	8 m/s	117.552 N/m^2	9.79
4.	9 m/s	148.776 N/m^2	12.39
5.	10 m/s	183.67 N/m^2	15.30

So the average height of Hybrid Chimney is about 7.56 *meter.*

GRAPH BETWEEN HEIGHT OF CHIMNEY AND TOTAL PRESSURE DIFFERENCE:-



BASIC COMPONENTS OF SOLAR CHIMNEY

1. THE SOLAR COLLECTOR:-

The solar collector must have low reflectivity. In other words, it must be a dark color, so that most of the sunlight that strikes it will be changed into heat, instead of being reflected. A matte (not shiny) black color will Absorb, rather than reflect, visible light. However, in order to convert as Much of the sun's energy to heat as possible, the solar collector must Also absorb light well in the ultraviolet light, 44% visible light, and 51% infrared light. A carbon-based pigment (known commercially as "carbon black") will absorb greater than 90% of the energy from light across the spectrum of ultraviolet, visible, and infrared wavelengths. Carbon black is common pigment used in industrial paints. Any one of a large number of different materials could be covered with carbon black pigment for use in the solar collector. The solar collector material does not need to have high thermal mass. Since the goal is to transfer the heat from the collector to the air, the collector does not need to retain the heat. So here we use black ceramic gravel is heavy enough not to blow away in the wind, will allow rainfall to pass through to the ground beneath, and can be spread over a large area of land by machinery, requiring much less manual labor. It is also less expensive to manufacture than many other materials. Black ceramic gravel is one of the better materials for the solar collector. The black color would have to come from carbon black pigment, either painted on the ceramic after firing, or irked into the clay itself. Hot air for the solar chimney is produced by the greenhouse effect in a simple air Collector consisting only of a glass or plastic film covering stretched horizontally two to six meters above the ground. The height of the covering increases adjacent to the chimney base, so that the air is diverted to vertical movement with minimum friction loss. This covering admits the short-wave solar radiation component and retains long-wave radiation from the heated ground. Thus the ground under the roof heats up and transfers its heat to the air flowing radically above it from the outside to the chimney.

2. CHIMNEY:-

This is the biggest part of this project having 25 feet height. The bottom diameter of chimney is 22 inch & top diameter is 8 inch. The material of this chimney is G.I. sheet of 24 gauges. The main purpose of chimney is converting the pressure energy into kinetic energy. The chimney itself is the plant's actual thermal engine. It is a pressure tube with low friction loss (like a hydroelectric pressure tube or penstock) because of its optimal surface-volume ratio. The up thrust of the air heated in the collector is approximately proportional to the air temperature rise Toll in the collector and the volume, I.e. the height He multiplied by the diameter Dc) of the chimney. In a large Hybrid chimney the collector raises the temperature of the air by about 35 K. This produces an up draught velocity in the chimney of about 15m/s. It is thus possible to enter into an operating Hybrid chimney Plant for maintenance without difficulty.

3. TURBINES:-

Turbine is an important component of solar chimney power plant. It is used to convert air flow into mechanical energy and transmit to the generator. It is similar to the wind turbine and located at the base of chimney. The speed of turbine due to air flow causes to drive the generator to generate electricity and powered it to grid.

CONCLUSION

At this point in time, two conclusions are clear. First, this type of system will produce some power. The sun will heat the collector, which will heat the air. The higher air temperature will expand the air, reducing air pressure. Air must move from high to low pressure, through the chimney and past the wind turbines, producing power. A sea breeze works much the same and produces significant wind. Some power can certainly be produced in this way will be less than is theoretically possible.

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