Open Journal of Nano
1 (2012) 4–6

Power Generation in the Laboratory Conditions by Solar Chimney

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Abstract: In the Laboratory conditions, for production of electricity by means of solar chimney method; several lamps, and heathers are used as artificial sun to kept greenhouse effects around the lower end of the chimney. Sometimes solar heated hot water is also used to keep warm under the nylon curtain. Hot ground starts heating the air under the nylon covered region. Then due to the temperature difference between to ends of the chimney, warm air runs up through the chimney. By cooling the upper end of the chimney, temperature difference between two ends of the chimney wind speed could be controllable. A small turbine placed perpendicular to the air flow at the end of the chimney for transferring mechanic energy to electricity. Some details of this study and some preliminary results will be presented.

Keywords: Solar chimney, renewable energy, electricity production

1. Introduction

Today, fosil fuels became almost to the point of exhaustion which are not sufficient anymore to meet the growing energy needs of the world. Turkey has a big potential for renewable energy sources. Considerable part of the required energy, could be met by using renewable energy sources. In many parts of Southeastern Anatolia Region and at Diyarbakir, incident solar energy per square meter is well above the Turkey's average value. In this region and at around Diyarbakır, the annual average wind speed is 5 m/sec. There is no specific and seasonal wind direction. But we can able to produce wind by using solar chimney. When we placed wind turbines in front of this wind we can able to generate electricity [1]. In the solar chimney method heat from sun rays carried to the floor by means of heated water which circulated by pumping. Also artificial sun(several lamps) are also used to kept greenhouse effects around the lower end of the chimney. Hot ground starts heating the air. Then due to the temperature difference between to ends of the chimney, warm air runs up through the chimney. By cooling the upper end of the chimney, temperature difference between two ends of the chimney wind speed could be controllable. For production of electricity, by means of this air flow several turbines could be run[1-2]. Main part of the Project can be seen in Figure.1 Some details of this study will be presented[3].

The need for cheap, clean renewable energy is inescapable as climate change is more evident now than ever. A solar chimney possesses all of these qualities, with economic appraisals based on both experience and knowledge suggesting that warm weather large scale solar towers (Chimney generates $\geq$ 100 MW) are fully able to produce energy at costs comparable with conventional power plants (Badenwerk and EVS, 1997).

2. Dicle University Solar Chimney

2.1. Properties

We began by welding the circular base that held up the tower. It stood 40cm above the ground. We then submerged 1/4th of its length it into the dirt for stability. Next we submerged several iron stakes around the circular base. We used a water leveler to ensure that each of the

stakes was of equal height above the ground and to ensure that the perimeter of the collector was completely level. We then connected each of the stakes to each other and the center base with thin ropes. We covered the area between the stakes and the center with nylon. The area covered by the nylon was 9m^2. We then cut a circular hole atop the nylon for the pipe to fit over. We then erected and firmly lodged the pipe into place by attaching ropes at the top and using friction between it and the circular base at the bottom.

Size of solar chimney prototype. Refer to Table 1 in the text.

Table 1. Physical properties

Height of Chimney	**4 m.**
Diameter of the collector	3,40m
Chimney inlet diameter	0,36m
Chimney outlet diameter	0,11m
Section area of chimney inlet	0,40699m^2
Section area of chimney outlet	0,037 994m^2
Collector entrance aperture	0,3m
The average height of the collector	0,4m
Collector surface area	9,075m^2
Inlet of environmental section area	3,2m^2

2.2. Second subsection

An experimental setup.

Figure 1. An experimental setup

Formulas;

$$n_{koll} = \frac{m\Delta T c_p}{GA_{koll}} = \frac{\Delta t c_p V_k A_k g_{koll}}{GA_{koll}} \quad (1)$$

$$n_{baca} = \frac{gH_{gp}}{t_0 c_p} \quad (2)$$

$$P_{\text{türbin}} = V_{baca} A_{baca} \Delta P_s \quad (3)$$

3. Third Section

By cold water system which is establish at the top of the chimney the temperature difference increased so that the air stream accelerated in the chimney. We can say that speed of the air increases by the rotation of the propeller integrated to the motor that is assembled to the top of the chimney. As a result, the measured values in multimeter increase as well. We were expecting a little bit more increase of the values read by multimeter. Yet, we couldn't raise the height of the chimney, that is, it came out that however high the difference of coldness and hotness the height of the chimney is important [3].

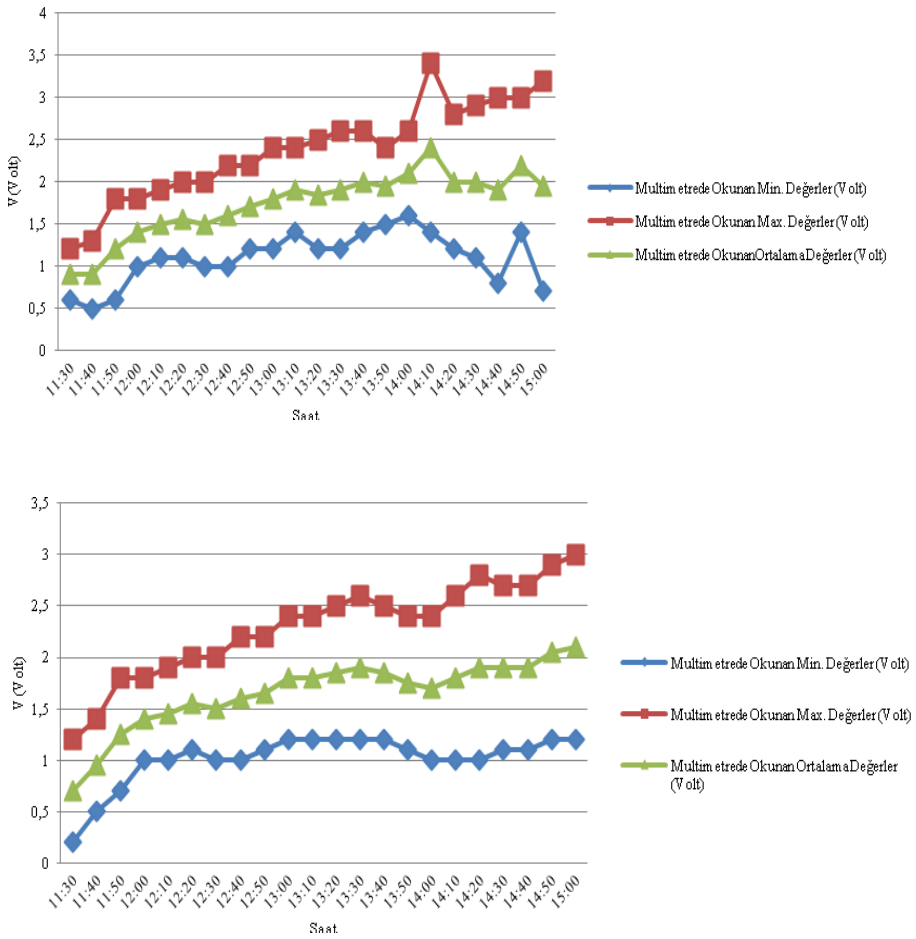

Figure 2. Some plots

4. Conclusions

As a result of the theoretical calculations and experimental studies; soil which is at the top of the collector of the greenhouse and indoor air temperatures increased while radiation intensity comes from artificial energy sources (solar) increases, in the afternoon temperatures of ground was relatively accentuated to stable structures.

And the chimneys of different sizes using the pipe in the greenhouse area of increasing air flow rate changes are examined. Engines, propellers placed in different parts of the chimney connected to a digital multimeter by the measured values of the parameters affecting the performance of the system were taken to register. In Diyarbakir, in natural conditions the solar chimney, larger systems can produce continuous electrical method is proposed to establish eligibility.

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