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THE SOLAR CHIMNEY

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Introduction

Nowadays there is a growing awareness that some alternative energy sources could have an important role to play in the electricity generation. However, only the solar energy represents totally nonpolluting inexhaustible energy resource that can be widely used in the future. There are lots of methods of applying the solar energy and the Solar Chimney is one of them [5].

Parts of the Solar Chimney

The Collector

Collector is a part of the solar chimney that is used to produce hot air via greenhouse effect. It is usually 5-6 meters high and covers a very large area about thousands of m². Since glazing increases the mass of the roof, the glazed collectors must have powerful frame [1].

- There is no limitation for the surface area. The larger the area, the more energy is generated by the chimney.
- There should be slightly increasing height towards the chimney in order to obtain minimum friction loss.
- Covering materials may be different, such as; glass or plastic film. The most efficient one is a glazed collector. It can convert up to 70% of irradiated solar energy into heat. Also, with proper maintenance, its life span can easily be 60 years or more.

Turbines

Turbines are used to convert the obtained current of air to the mechanical energy. Turbines are placed horizontally in chimney and vertically in the collector. In order to obtain maximum energy from the warmed air, turbine blades should cover all the cross-sectional area of the chimney. To do this, one big turbine or a few small turbines should be used in the chimney [3].

The chimney

The most important part of the plant is the chimney. It acts as a thermal engine because there is nearly no friction loss in the chimney as it's a pressurized tube.

- The longer the chimneys height is the more energy is produced from the chimney.
- The efficiency of the chimney doesn't depend on the amount of the temperature rising, but it depends on the outside temperature.

Thus, efficiency is directly proportional to the ratio between the height of the chimney and the outside temperature [3].

Although, the efficiency is proportional to the height of the chimney, there is a limitation in practice. There are two types of different chimneys applied for the plant. Free standing chimneys and cable-stayed tubes. The life span of a free standing chimney is longer than that of the guyed tubes. It lasts about a hundred years, while the guyed tubes' is much shorter [3].

Solar Chimney Working principles

Transparent roof transmits the short wave solar radiation component and retains long-wave radiation from the heated ground. Thus, when solar radiations pass through the transparent roof it is absorbed by the ground elements and it converts into heat energy.

- As the air is heated, it rises up and moves towards the chimney. Also, it gains velocity.

- Heated air enters the chimney placed at the center of the roof and creates an up draught there.

- Inside the chimney, the turbines with electric generator produce electricity [2].

Comparing with the collector and turbine, the chimney efficiency is relatively low. For example, at a height of 1000 meters, chimney efficiency is somewhat greater than 3%.

Technology

- Solar chimneys are large-scale power plants with the 5 to 200 MW output each.

- A 100 MW plant will produce about 750 GWh/year at 2.300 kWh/m² global horizontal radiation.

- The glass roof has to be several kilometers in diameter and the tube has to be as high as possible to achieve a large annual output.

- The turbine's life span is based on its resistance to rapid pressure and speed changes of the air [3].

The Energy Storage

Since collectors produce hot air via the greenhouse effect, to produce electricity during the night, there must be placed tight water-filled tubes under the roof [4].

- The water heats up during the daytime and emits its heat at night.

- These tubes are filled only once, no further water is needed, because the tubes remain closed after filling process.

- The volume of water in the tubes is selected to correspond to a water layer with a depth of 5 to 20 cm depending on the desired power output [3].

The Mildura Solar Chimney

The 1000m Solar Chimney in Mildura, Australia, will be the highest man-made structure on Earth, and can produce 200MW, providing power to 200,000 homes.

- The construction cost is estimated at \$395 million. (About 14 percent more than an equivalent coal-fired power station).

- The aim of the Australia's Government is to produce 10% of energy from renewable sources by 2020 [1].

Advantages

- Solar chimney power stations are particularly suitable for generating electricity in deserts and sun-rich wasteland.
- It provides electricity 24 hour per day.
- No any fuel is needed. It needs no cooling water and is suitable in extremely dry regions.
- It is particularly reliable and a little trouble-prone compared with other power plants.
- The solar chimney materials are: concrete, glass and steel. They can be easily found anywhere in sufficient quantities.
- No ecological harm and no resources consumption.

Disadvantages

- Some estimates say that the cost of generating electricity from a solar chimney is 5 times more than from eg. a gas turbine.
- Solar chimneys have a very high capital cost.
- The structure itself is massive and requires a lot of engineering expertise and materials to construct [1].

Conclusion

Solar chimney power stations could make important contributions to the energy supplies in Africa, Asia and Australia, because there is plenty of space and sunlight available there. It is very important for the future, because our resources are limited, except our sun.

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STUDY OF PROBLEMS OF FOREST FIRE DANGER

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Introduction

Any natural phenomenon consists of a set of idealized processes. The study of such processes is the responsibility of various disciplines. Therefore, for a thorough in-depth study of natural phenomena the certain disciplines must have an extensive knowledge base. When considering the phenomenon from the perspective of each