

# ***Floating Solar Chimney Technology***

## **1. Introduction**

*Solar Chimney Technology* is a solar thermal electricity generating technology. See for example [http://peswiki.com/index.php/Floating\\_Solar\\_Chimney\\_Technology](http://peswiki.com/index.php/Floating_Solar_Chimney_Technology) or [www.floatingsolarchimney.gr](http://www.floatingsolarchimney.gr) or [www.matineeenergy.com](http://www.matineeenergy.com)

Shortly, the warm air produced in a large transparent roof solar collector is up drafting through a tall chimney, and leaving part of its thermodynamic energy to a set of air turbines geared to appropriate electric generators.

[http://en.wikipedia.org/wiki/Solar\\_updraft\\_tower](http://en.wikipedia.org/wiki/Solar_updraft_tower)

These Solar Chimney power plants were named *Solar Aero-Electric Power Plants* (*SAEPPs*) due to their similarity to Hydro-Electric Power plants.

Thus a Solar Aero-Electric Power Plant is a set of three major components:

- **The Greenhouse.** A large solar collector open around its periphery with a transparent roof supported a few meters above the ground.
- **The Solar Chimney.** The warm air inside the greenhouse, due to its relative buoyancy to the ambient air, is up drafting through a tall cylinder in the center of the solar collector.
- **The Turbo-Generators.** A set of air turbines geared to appropriate electric generators in the path of air flow are forced to rotate generating electricity ( the air turbines can be with horizontal axis around the Solar Chimney or with vertical axis inside the Solar Chimney).

The energy source, for the electricity generation, is the horizontal solar irradiation passing through the transparent roof of the greenhouse and partly trapped by the greenhouse effect of the transparent roof. Thus the ground below the greenhouse is heated and consequently its thermal energy is transferred to the moving air entering the greenhouse and moving towards the FSC bottom entrance.

In all continents there are plenty of sunny places, with annual horizontal solar irradiation in the range of 1650- 2400 KWh per m<sup>2</sup>.

## **2. History**

- The Solar Chimney technology for electricity generation was inspired by several engineers in the first decades of 20<sup>th</sup> century. In 1926 Prof Engineer Bernard Dubos proposed to the French Academy of Sciences the construction of a Solar Aero-Electric Power Plant in North Africa with its solar chimney on the slope of the high height mountain.

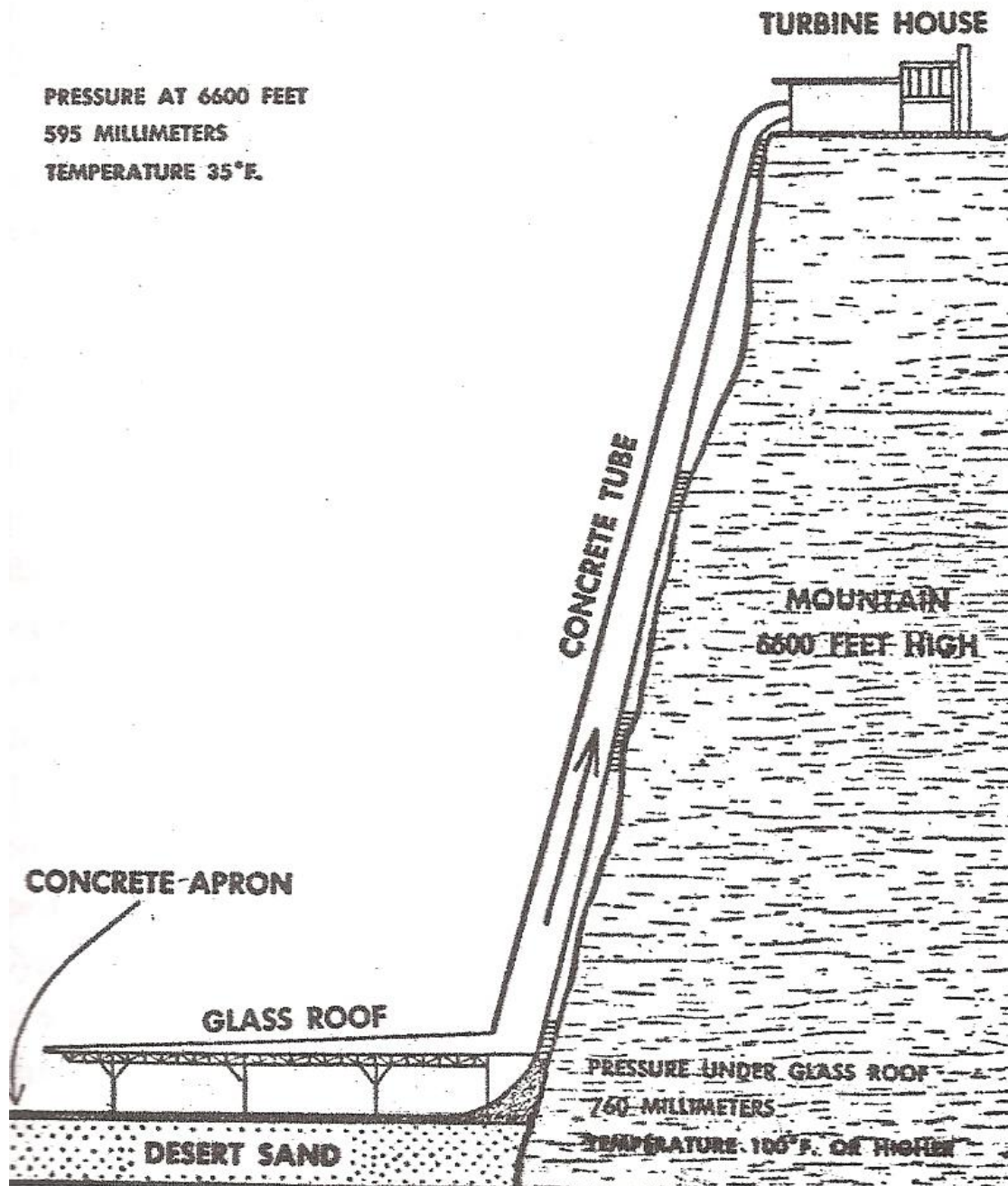


Figure and data from the book: "Engineer's Dream"  
By: Willy Ley, Viking Press 1954

- More recently Schaich, Bergerman and Partners, under the direction of Prof. Dr. Ing. Jorg Schlaigh, built an operating model of a SAEPP in 1982 in Manzaranes (Spain), which was funded by the German Government. This solar chimney power plant, of rating power 50 KW, was operated successfully for approximately 8 years.
- Its solar chimney was made by steel tubes of 10 m diameter and had a height of 195 m. [http://www.math.purdue.edu/~lucier/The\\_Solar\\_Chimney.pdf](http://www.math.purdue.edu/~lucier/The_Solar_Chimney.pdf)

During its operation optimization data was collected. Prof. Jorg Schlaigh in 1996 published a book (titled “The Solar Chimney”) presenting the solar chimney technology.



**A view of the Manzanares Solar Chimney Power Plant**

- The collected operational data were in accordance with the theoretical results
- Prof. Jorg Schlaigh proposed in his book huge reinforced concrete solar chimneys of heights 500m-1000m. These solar chimneys are very expensive constructions. Therefore the investment cost per produced KWh on the solar chimney technology with concrete chimneys is higher than the competitive solar thermal technologies (SCP for example).
- However the solar chimney technology has an important benefit in comparison to the other renewable technologies (Wind, SCP, PV). This is the ability of its Power Plants, equipped with thermal storage facilities of negligible cost, to produce electricity for 24h/day, 365days/year.

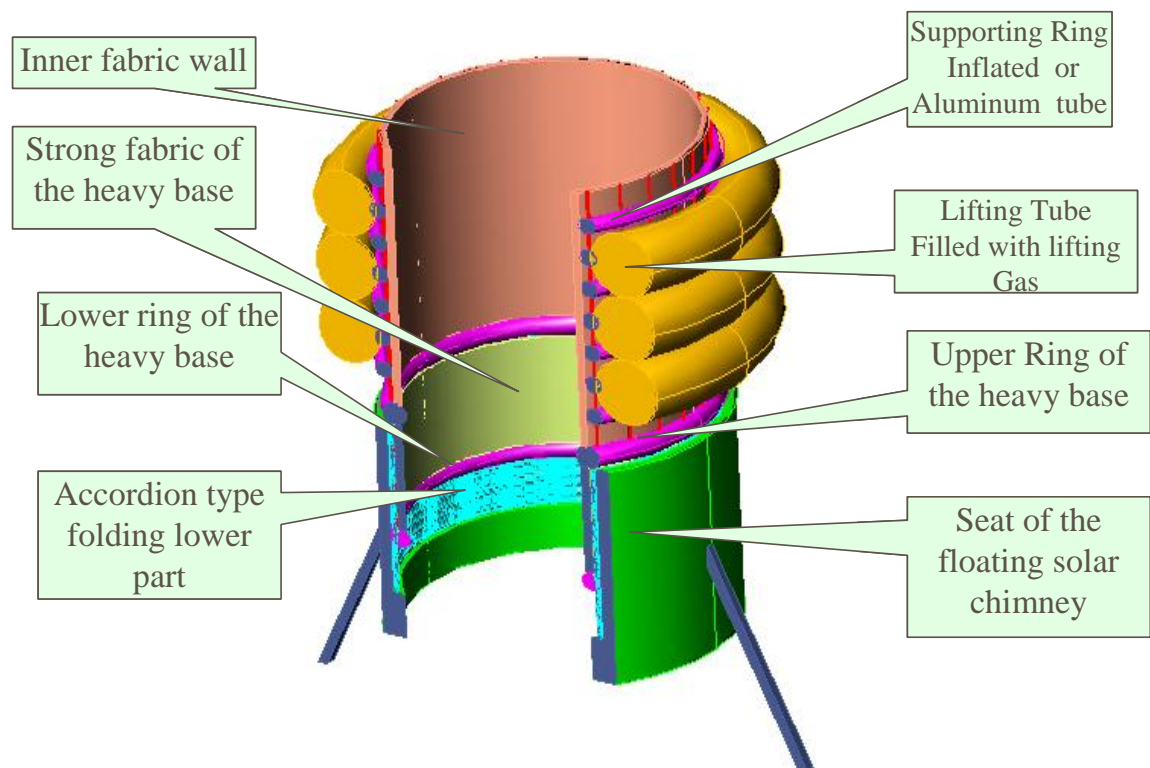
### 3. The innovation.

In order to decrease the construction cost of the *Solar Aero-Electric Power Plants (SAEPPs)* the inventor proposed to replace the concrete solar chimneys with lighter than air inflated fabric structures named *Floating Solar Chimneys (FSCs)*. In a series of papers the inventor gave the main characteristics of the SAEPPs with *Floating Solar Chimneys*.

Low cost *Floating Solar Chimneys* up to 1000 m with internal diameters 25 m ÷ 40 m, can be constructed with existing polyester fabric, giving to their respective *Solar Aero-Electric Power Plants*, low investment costs.

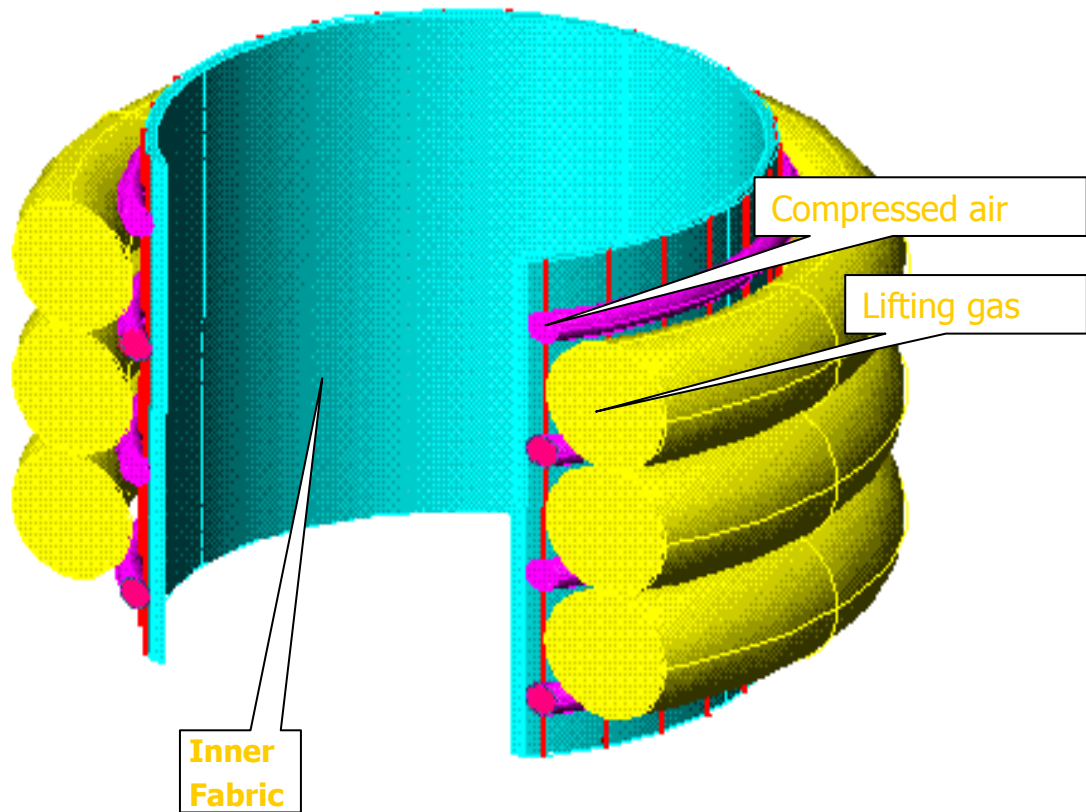
By this innovating *Floating Solar Chimney Technology* for FSC heights of maximum 1000m, up to 1.2 % of the arriving horizontal solar radiation on the solar collector surface, can be converted to electricity.

An indicative representation of the lower part of a *Floating Solar Chimney* is shown in the following figure.



An indicative figure of the lower part of a Floating Solar Chimney

An indicative representation of the small part of a *Floating Solar Chimney* main cylindrical air up-drafting body is shown in the lower figure.



An indicative figure of a small part of the fabric structure