



PROJECT REPORT [10ME85]

ON

COMPUTATIONAL ANALYSIS OF SOLAR UPDRAFT TOWER

Submitted in partial fulfillment of the requirement for award of degree in
Bachelor of Engineering
(Mechanical Engineering)

Of

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ABSTRACT

To construct and study a scaled power generating prototype of a solar updraft tower (SUT) with the help of a Computational fluid dynamics (CFD) model. It begins with the development of a CFD model of the solar updraft tower and obtaining the experimental data, with considerable accuracy range for three different types of chimneys of the solar updraft tower. The CFD model is used to compare three types of solar chimneys for different heights and width, considering that the chimney gets high flow rates in all the three cases. The CFD model shows a uniform temperature and velocity inside the chimney that allows developing a simple physical model of the chimney, which gives a good precision of results. Finally a simplification of the solar chimney and other systems are installed in a building and are simulated and also another physical model is developed for this kind of building, giving an idea of the behaviour of this solar setup in diverse conditions.

The solar updraft tower is a renewable-energy power plant for generating electricity from solar power. Sun rays heat the air beneath a very wide greenhouse-like roofed collector structure surrounding the central base of a very tall chimney tower. The resulting convection causes a hot air updraft in the tower by the chimney effect. This airflow drives wind turbines placed in the chimney updraft or around the chimney base to produce electricity. Plans for scaled-up versions of demonstration models will allow significant power generation. The solar updraft towers use solar energy from the sun to drive turbines, which in turn generate electricity. The method that these towers use to generate the power is very different to both solar photovoltaic and concentrated solar power plants.

The solar updraft tower uses the very simple principle that hot air rises as their basis for energy production. Essentially they consist of three parts, the first is a massive solar collection area, where the sun rays are incident on a green house type structure, heating the air underneath it and trapping it in. In the centre of the collector area is a large diameter chimney structure, which vents the hot air into the atmosphere. As the hot air moves from the solar collector area to the chimney structure, it drives the third element of the solar updraft tower, the electricity producing turbine, these are either situated around the base of the chimney or actually in a horizontal plane within the chimney itself.