National Institute of Technology, Hamirpur (H.P.)
Innovative Research Incubation Club

Project Proposal

Research Project Title

Design, Development and Testing of a novel Multistage Parabolic Solar Collector

Project Description

Solar parabolic dish collector is generally used to concentrate the incident solar radiation at one location (called as Focus in mathematical terms). The concentration achieved varies from 100 times to 1000 times. The normal highest solar radiation intensity at Hamirpur is around 1000W/m^2. Focusing this energy at one point can increase the temperature of a receiver surface upto 1000°C. The circulating fluid (water or air) can attain a temperature maximum upto 800°C. This is the range of pressurized and high temperature working fluid (steam or hot gases) which can drive heat engines or gas turbines as prime movers for generating electricity. The receiver is a component situated at focus point of a parabolic collector. Using the proposed design of multistage concentrating collector around 2 kW-5 kW electrical power can be produced.

A high-temperature solar thermal receiver is subject to temperature-dependent emission and convection losses. Minimizing these losses is essential to realization of high temperature, high efficiency systems. Dividing the aperture into separate stages according to the irradiance distribution has been shown theoretically (in the literature) to significantly reduce these losses. In such a partitioned system, the working fluid is gradually heated as it passes through a sequence of receiver elements with increasing irradiance levels. An experiment to demonstrate this principle using two heating stages has been constructed at the Weizmann Institute's Solar Tower (Israel).

A high temperature absorber of a solar-thermal receiver results into larger radiative as well as convective energy losses. Dividing a single large size high temperature receiver into low, medium and high temperature cavities and by heating a working fluid gradually may assist in reducing the energy losses that will improve the collection efficiency of the overall system.

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The present project proposal aims at design, development and testing of multistage receiver type concentrating collector system in order to attain the following objectives.

1) Fabrication of the test facility
2) To compare the performances of conventional single stage parabolic collector and proposed multistage collector system.

The novel thing of this proposal is multi-staging of both the collector as well as receiver.

Future aspects: The complete tested design can be proposed further for patent registration. The tested design can be proposed further for funding from Renewable energy organizations like MNRE, DST etc. for large scale electric power production.

Project Completion time: Short Term (One Semester)

✓ **Mid Term (Up to one Year)**

Long Term (More Than One Year)

Student Skills Required, Pre Requisite (if any):

M. Tech. and B. Tech. students with design, fabrication and experimental testing capabilities

Number of Students Required (UG/PG) for the Project:

One PG student: (Mr. Shobhit Kumar, Roll No.16M311) Shobhit Kumar

Two UG students: (Mr. Chennoju Bhuvan Kumar Roll No. 14377) Ch. Bhuvan Kumar

(Mr. Divyanshu Gupta, Roll No. 14357) Divyanshu Gupta

22/03/17

Name of Faculty Members: Dr. Santosh B. Bopche & Dr. Varun

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Any Other Details: The list of equipments and the estimate of the proposed project proposal is provided as follows;

Sr. No.	Name of Equipments	Approximate cost in Rupees
1.	Parabolic Collector (Aluminium)	15,000
2.	Receiver Casting and supporting structure	20,000
3.	Thermocouple, Temperature Indicator, Thermometers	20,000
4.	Venturimeter, Pump, Piping, Manometer, Manometric fluids	20,000
5.	Radiation simulator (Halogen lamps)	10,000
5.	Miscellaneous Expenses	10,000
	Total estimate, Rs.	**95,000/-**

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