Concentrated Solar Thermal Power Plant

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Abstract— Concentrated solar power plants (CSP) are gaining increasing interest solar tower collectors (STC). There is an opportunity to add a concentrated solar power (CSP) system to an existing another power plant. The addition of the CSP system would create a hybrid project that maintains or improves the power output of another power plant facility. CSP systems use mirrors or lenses to concentrate a large area of sunlight onto a small area. In CSP stand alone projects, electrical power is produced when the concentrated light is converted to heat, which drives a heat engine (usually a steam turbine) connected to an electrical power generator.

Key words: Mirrors, Boiler, Turbine, Generator

I. INTRODUCTION

More energy from the sunlight strikes on earth Our sun produces 400,000,000,000,000,000,000,000,000 watts of energy every second and the belief is that it will last for another 5 billion years. In fact, solar energy dwarfs all other renewable and fossil-based energy resources combined. We need energy – electrical or thermal – but in most cases where and when it is not available. Low cost, fossil-based electricity has always served as a significant cost competitor for electrical power generation. To provide a durable and widespread primary energy source, solar energy must be captured, stored and used in a cost-effective fashion. Solar energy is of unsteady nature, both within the day (day–night, clouds) and within the year (winter–summer). The capture and storage of solar energy is critical if a significant portion of the total energy demand needs to be provided by solar energy.

Concentrating solar power systems use mirrors to concentrate sunlight from a large area to a small area where it is absorbed and converted to heat at high temperatures. The high temperature heat is then used to drive a power block (usually a steam turbine connected to an electrical power generator) similar to the power block of a conventional thermal power plant

II. BLOCK DIAGRAM

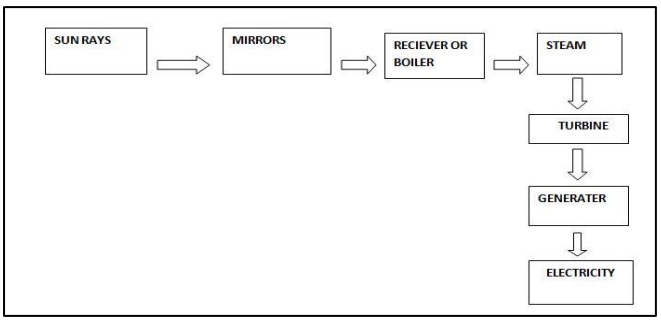

Fig. 1:

Fig. 2:

III. WORKING

These large installations use large, flat mirrors to reflect sunlight at a collector located at the top of a tower. Numerous mirrors encircle the tower and each is constantly adjusted to focus the sunlight towards the central receiver. The large amount of solar energy is captured by a heat-carrying fluid which is then used to produce high-pressure steam to turn a turbine and generator. In the first systems, water and steam were used to convert the solar energy into electricity. It was successful but electricity production would stop when clouds obscured the sun or after the sun set. Advanced designs use molten nitrate salt which can hold more heat than water & steam. The substance is continuously cycled through the solar beam to collect more and more heat and then stored for later use or passed through in a heat exchanger to create steam that drives the turbine. This method allows for continuous electricity generation during cloudy periods and into the evening. Power towers use large, flat mirrors called heliostats to reflect sunlight onto a solar receiver at the top of a central tower. In a direct steam power tower, water is pumped up the tower to the receiver, where concentrated thermal energy heats it to around 1,000 degrees Fahrenheit. The hot steam then powers a conventional steam turbine. In this case, the medium that transfers heat from the receiver to the power block is steam. Some power towers use molten salt in place of the water and steam. That hot molten salt can be used immediately to generate steam and electricity, or it can be stored and used at a later time.

A large power tower plant can require thousands of computer-controlled heliostats that move to maintain point focus with the central tower from dawn to dusk. Because they typically constitute about 50% of the plant's cost, it is important to optimize heliostat design; size, weight, manufacturing volume, and performance are important

design variables approached differently by developers to minimize cost.

IV. ADVANTAGES

1) Solar farms can be placed in hot, dry locations
2) The entire system uses established technology that is readily available (mirrors, tubes and electrical generators).
3) These units produce electricity during the day when air-condition loading is high.
4) These clean-running, daytime power plants help supplement other primary electrical generation sources.
5) These are utility-scale, renewable-energy power plants located in arid desserts regions that can produce hundreds of megawatts of electricity.
6) Clean energy
7) Pollution free as CO_2 emissions is not present
8) Concentrating solar power (CSP) plants are capital intensive, but have virtually zero fuel costs

V. DISADVANTAGES

1) Cloudy weather effects the efficiency.
2) Construction/installation costs are high.
3) They require a considerable amount of space.
4) Water Issue – Solar Thermal Plants use lots of Water which is Major Problem in Desert Areas.
5) Ecological and Cultural Issues – The Usage of Massive Arrays of Mirrors is noted to heavily impact the Desert Wildlife endangering the endangered species.

VI. APPLICATIONS

1) Elecricity generation
2) Used for grid and hybrid projects
3) Generated energy can be supplied to industries and commercial use.

VII. CONCLUSION

As per the geographical location of the country, India stands to its benefit and has tremendous scope of generating solar energy. Solar Power Generation alone can cater more than 60-65% of our entire need of power. Thus, we have to focus on following future plans of installing large projects.

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