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CONCENTRATED SOLAR POWER

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Abstract: Currently we are facing big energy crisis, thus in accordance with producing high amount of electrical energy, we are also increasing pollution along with it. The sources of energy especially conventional sources are limited in nature which includes coal, crude oils, natural gases etc. due to its limited availability in nature. But we cannot stop production of electricity, as it has become our prime need. So as we know energies are a great need of every human beings but as these conventional sources are vanishing day by day, so today's need is to look forward for non-conventional and renewable energy resources. Thus it is our whole and sole responsibility to think over it. So use of non-conventional energy sources is a best solution. Thus we have taken a minute step to study the modern methods of producing electricity. Our presentation which is based on "CONCENTRATED SOLAR POWER", gives a perfect view of concentrating scattered solar energy at a particular small area so that it can be effectively used for producing electricity.

Keywords: Solar Power, Concentrated.

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INTRODUCTION

As we all know the rate of consumption of energy is increasing day-by-day as the population is increasing, but the convenventional energy sources are limited in nature. So we have to look forward for non-conventional energy sources and the solar energy is the best available option due to its many advantages and quite of few are, it is non-polluting, unlimited source & freely available.

The basic idolum is that whenever we think about solar energy few things come in our mind such as typical solar cooker, typical solar water heater and the most important is the solar panels for generating electric power.

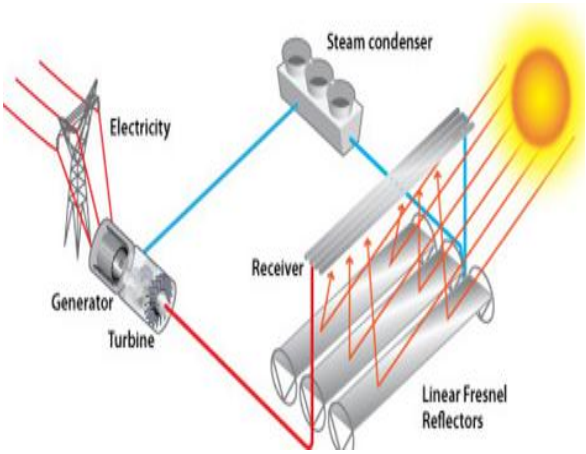
As solar is the huge source of energy which is about $1*10^{11}$ MW intercepted by the earth, but the main problem is that it is scattered and hence we need to concentrate it if we want to utilize it at its maximum strength. Thus the concept of concentrated solar power has been developed.

Concentrated solar power (also called concentrating solar power, concentrated solar thermal, and CSP) systems generate solar power by using mirrors or lenses to concentrate a large area of sunlight, or solar thermal energy, onto a small area. Electricity is generated when the concentrated light is converted to heat, which drives a heat engine (usually a steam turbine) connected to an electrical power generator or powers a thermo chemical reaction. Mainly four elements are required in this plant concentrator, receiver, storage medium and power conversion device. Of all components thermal storage is key component, however it is one of the list developed. Only a few plants in the world have tested high temperature thermal energy storage systems. There are three basic concepts of concentrated solar power namely through type system, dish type system and power tower. The dish type is also known as engine type system, the through type system is also called as linear concentrator whereas the power tower is most developed.

Parabolic trough

A parabolic trough consists of a linear parabolic reflector that concentrates light onto a receiver positioned along the reflector's focal line. The receiver is a tube positioned directly above the middle of the parabolic mirror and filled with a working fluid. The reflector follows the sun during the daylight hours by tracking along a single axis. A working fluid (e.g. molten salt[is heated to 150–350 °C (423–623 K (302–662 °F)) as it flows through the receiver and is then used as a heat source for a power generation system. Trough systems are the most developed CSP technology. The Solar Energy Generating Systems (SEGS) plants in California, the world's first commercial parabolic trough plants.

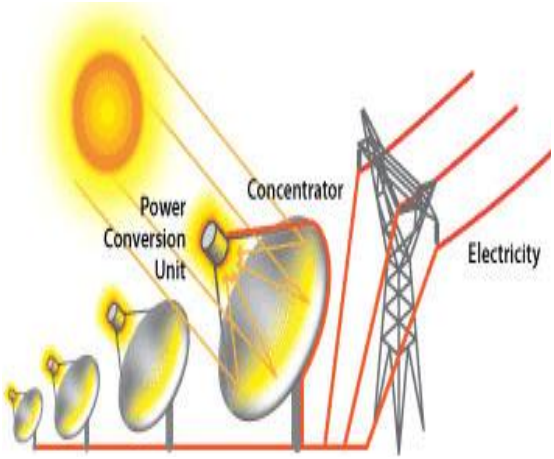
Also trough systems use large, U-shaped (parabolic) reflectors (focusing mirrors) that have oil-filled pipes running along their center, or focal point, as shown in Figure. The mirrored reflectors are tilted toward the sun, and focus sunlight on the pipes to heat the oil inside to as much as 750°F. The hot oil is then used to boil water, which makes steam to run conventional steam turbines and generators.



Dish Engine Systems

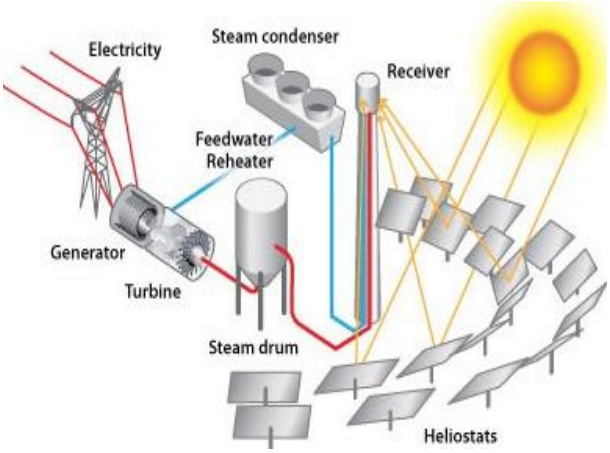
Dish/engine systems use mirrored dishes (about 10 times larger than a backyard satellite dish) to focus and concentrate sunlight onto a receiver. As shown in Figure, the receiver is mounted at the focal point of the dish. To capture the maximum amount of solar energy, the dish assembly tracks the sun across the sky. The receiver is integrated into a high-efficiency "external" combustion engine. The engine has thin tubes containing hydrogen or helium gas that run along the outside of the engine's four piston cylinders and open into the cylinders. As concentrated sunlight falls on the receiver, it heats the gas in the tubes to very high temperatures, which causes hot gas to expand inside the cylinders. The expanding gas drives

the pistons. The pistons turn a crankshaft, which drives an electric generator. The receiver, engine, and generator comprise a single, integrated assembly mounted at the focus of the mirrored dish.



Power Tower Systems

Power tower systems also called central receivers, use many large, flat heliostats (mirrors) to track the sun and focus its rays onto a receiver. The amount of solar energy collected is a function of the number of heliostats installed. However, as the number of installed mirrors increases, the height of the tower must also increase. Tower heights range from approximately 300 to 650 feet. As shown in Figure, the receiver sits on top of a tall tower in which concentrated sunlight heats a fluid, such as molten salt, as hot as 1,050°F. The hot fluid can be used immediately to make steam for electricity generation or stored for later use. Molten salt composed of either water or molten nitrate salt, moves through the receiver and is heated to temperatures over 500 °C. retains heat efficiently, so it can be stored for days before being converted into electricity. That means electricity can be produced during periods of peak need on cloudy days or even several hours after sunset.Additionally, power tower systems typically employ dry cooling as opposed to wet cooling technology, requiring less water to operate the system.



- **Key points of power tower:-**

There are some key-points of this tower type system….

1. It can operate at both day and night, as molten salt shows very less drop about 40 to 50 degree in its temperature even if it is stored for 12 to 15 hours without heating.
2. This system only uses flat mirrors to concentrate sun light so it is very cheaper in cost.
3. There is no problem of blocking in this system because all the operations are carried out at very high temperature.
4. The molten salt used is a inorganic salt so there is no problem of corrosion and also some modern ceramic material is used in storage system to resist corrosion.
5. Here energy is stored in the form of heat not in terms of charges, and so
6. its benefit is that storage of heat is quite cheaper than storing charge in batteries.

CSP PLANTS IN INDIA

Table 1-TROUGH SYSTEM IN INDIA

PROJECT NAME	LOCATI-ON	CAPA-CITY	STATUS	START YEAR
Dhursar	Dhursar Rajasthan	125.0 MW	Operational	2014
Godawari Solar Project	Nokh, Rajhastan	50.0 MW	Operational	2013
Gujarat Solar One	Kutch Gujarat	25.0 MW	Under Construction	2014
Megha Solar Plant	Anantapur Andhra Pradesh	50.0 MW	Operational	2014

In India, through type concentrated solar plant are developed and many are under construction. In Spain, the power tower type system is quite developed and those are working and also producing about 20 MW each. But India has only two power tower types one at Bikaner (Rajasthan) producing 2.5MW of power is in operation sice 2011 and other one is at IIT Bombay, Gurgaon having capacity of 1MW (2012) and generally used for study purpose. So India need to developed more power towers to generate more electricity from solar energy.

BENEFITS

Concentrated solar power has many benefits over conventional methods of producing electric power, like it is chemically safe and stable ,there is no danger of any chemical explosion like that in nuclear or thermal power plant., it has negligible maintenance, the only maintenance is required for tracking and driving system, cost also constructing a concentrated solar power plant is easier than that of a nuclear or thermal power plant, it does not require any heavy and continuous source of raw material and the most important is that it is highly ecofriendly system.

OBTACLES

Concentrated solar power has high initial cost than conventional power plants. This plant requires large storage system like tanks as a result large areas is requires to carry out its function. And the basic difficult is to find side with adequate amount of water and high exposure to sun light at the same time.

CONCLUSION

It is best example of use of non-conventional energy source .More use of solar energy can lead us to more brighter future .Here the tower type more developed and reliable technique as compare to dish and through type that is , so in INDIA more provision should be provided to establish the power towers to reduce the energy crises, CSP is a more viable source of available energy. The further development and research can lead this concentrated solar power technique to develop cheap and clean power.

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