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SOLAR CONCENTRATING POWER SYSTEM FOR GREEN ENERGY

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Abstract

Power is the most important thing for the world. In todays world power is the most important factor. We have the dream to produce clean power, which does not cost a lot. In this paper, we present the sun as a useful source to produce clean power(green power). By comparing with the all we will find that CSP is the way that produces power in a reasonable cost. .In INDIA every year rate of electricity generated by CSP is increases day by day. INDIA has solar radiation of 1700 – 1900 kWh per kilowatt peak with more than 300 clear sky days therefore INDIA has higher potential for solar electricity generation per watt setup. CSP is a setup of mirrors which focuses sunlight on to receiver that captures the sun's energy and converts it into heat that can run a turbine or engine. Current energy production from coal and oil is damaging the environment and nonsustainable. Many developing countries cannot afford these energy sources, and nuclear power stations are an unacceptable risk in most locations. Inadequate energy supplies can lead to high energy costs as well as to poverty, which commonly results in population explosion. Thus, renewable energy is the essential development for the secure future.

Key word: Mirror setup, Renewable energy, heliostate, reflector, solar heating, molten salt, batteries, heat exachanger

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1. INTRODUCTION

In Concentrating solar strength (CSP) plant mirror setup is used to mirror and listen daylight on to receivers that collect photo voltaic electricity and convert it to heat. In CSP there are various methods to generate the power. This thermal strength is transmitted thorough by steam turbine or warmness engine that drives the generator and as a end result electricity is produced. The radiations of daylight come to the earth's surface both directly and indirectly, via quantity of reflections and deviations in the atmosphere. On ordinary days, 80 to 90% amount of solar radiations attaining the earth's surface. The direct thing is really zero in a cloudy or foggy day. Unlike , solar collectors or flat plate photovoltaic cells CSP energy plant can't use diffuse section of photo voltaic irradiation which end result from scattering of direct sun light via clouds, molecules and dust particles in the air, due to the fact it can't be concentrated. However, one of the key benefits of selecting CSP over PV is be that CSP vegetation can more without difficulty supply ancillary services and grant dispatch in a position electricity on-demand the usage of long-term.

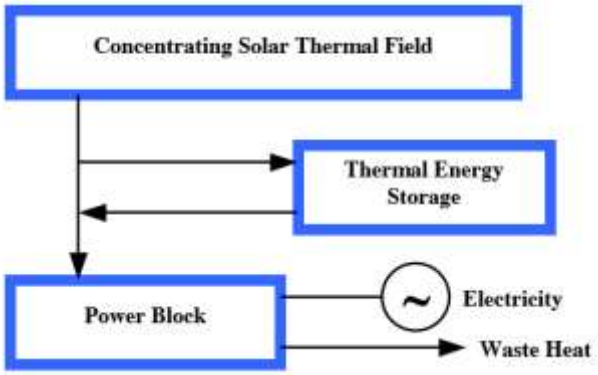

Fig.1 Main components of a Concentrating Solar Power (CSP) system

1.1 WHAT IS CONCENTRATED SOLAR POWER?

Concentrated solar strength appears like this. From the light falling on the mirrors, it is both centered onto a central tower, or from a parabolic reflect onto a central tube which incorporates heating oil or salts. CSP system is a mixture of specific collectors, power cycles and thermal storage technologies. Then this heat energy can be used in industries or for electricity generation. Most of the times, it is used for

electrical energy generation. One positive thing about this shape of photo voltaic panel is, if you use a sufficiently massive area, and keep your heating component heated in 2x amounts, you can use the heat power to produce electricity at some point of the night time too, when solar pv is deadbeat. (Generally some kind of molten salt or high temperature bearable oil is used to keep the heat energy, in large insulated tanks.).

2.SOLAR RADIATION REQUIRED FOR SETTING UP A CSP?

According to solar radiation traits the doable for CSP implementation in any given geographic location is largely decided [3]. In the shape of electromagnetic radiations the whole radiant strength per unit place acquired from the solar is referred to as irradiance. When integrating the irradiance over a certain time period, it becomes photo voltaic irradiation and is measured in Wh/m2[2]. The Solar radiation consists specifically of direct beam and diffuse, or scattered, components. The time period "global" solar radiation is definitely refers to the sum of two aspects & the day by day version of these aspects i.e. they are depends upon meteorological and environmental elements (e.g. cloud cover, air air pollution & amp; humidity) and the relative earth-sun geometry. The direct beam radiation is synonymous with direct normal irradiance (DNI) and it is measured by using monitoring the sun at some point of the sky. In CSP applications, the DNI is important in deciding the reachable photo voltaic electricity that's why the collectors are track the sun in the course of the day. fig. 2 indicates the areas which is represented by mild & dark red colours are most appropriate for implementation. For the implementation of CSP energy plant, wasteland and equatorial regions grant the best resources.

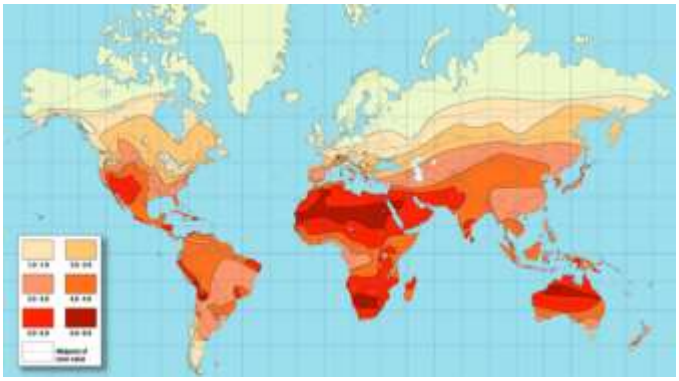

Fig.2:The solar insolation (kWh/m2/day) on an optimally tilted surface during the worst month of the year

3. CSP v/s P.V.

They're both photovolataics, they just have unique blessings and disadvantages. But when discussing CSP one consider extra than simply the power towers, as there are solely a few that are in operation. The method of CSP, parabolic trough solar thermal power plants, are much less harmful to birds. Parabolic trough structures are also utilized in hybrid structures paired with traditional strength plants. The traditional part of the plant which presents power at some stage in the night, and the solar strength is introduced to the total ability in the course of the day.

The semiconductor materials used in standard photovoltaic that convert sure wavelengths of light without delay into electrical current, normally at around 15–22% efficiency, however every so often in rare and highly-priced usages, triple-junction (3 layer) chips can convert more of the mild spectrum which get ~40% effectivity (e.g., on satellites).

Concentrating photo voltaic strength uses mirrors or lenses to focal point ambient light at 10–400x intensity on to these very luxurious ~40% environment friendly photovoltaic chips to try to get most energy from a given quantity of daylight at a lower cost. Because lenses are less expensive than semiconductors.

2. CSP TECHNOLOGIES

Now a days different CSP technologies that will be explored in the following sections i.e. they are Parabolic trough collector, Solar Power Tower technology, Dish-Stirling, Linear Fresnel collector technologies and Solar chimney.

2.1 PARABOLIC TROUGH COLLECTOR:

Explanatory trough framework or solar oriented homestead, comprises of long, parallel strains of indistinguishable concentrators modules and it utilizes the mirrored floor of a straight allegorical concentrator to listen direct daylight primarily based radiation to a protect pipe jogging along the central line of the parabola. The collector is a cylinder situated particularly over the core of the allegorical replicate and is loaded up with a working liquid. The reflector pursues the Sun amid the mild hours by using following alongside a solitary hub.

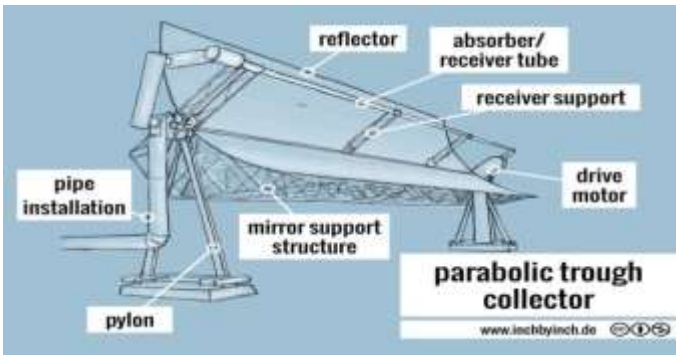

Fig.3:Parabolic Trough system

2.2 LINEAR FRESNEL REFLECTORS:

Utilize many meager replicate strips as a substitute than illustrative mirrors to suppose sunlight hours onto two cylinders with working liquid. This has the preferred standpoint that stage mirrors can be utilized which is a lot less costly than explanatory mirrors, and that extra reflectors can be put in a comparable measure of room, enabling a greater quantity of the handy daylight to be utilized.

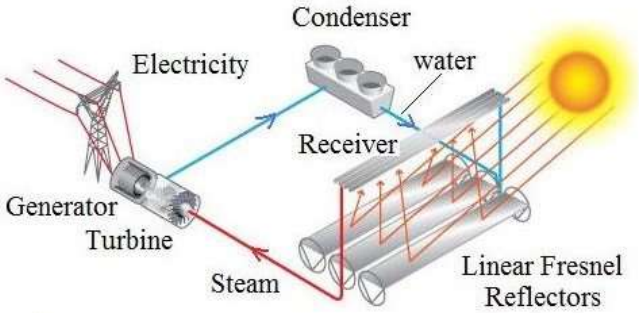

Fig.4: Concentrating Linear Fresnel Reflectors system

2.3 DISH STIRLING:

Consists of a stand-alone parabolic reflector that concentrates mild onto a receiver located at the reflector's focal point. The reflector tracks the Sun along two axes. The working fluid in the receiver is heated and then used by means of a Stirling engine to generate power. Typically, a sterling engine is used; different designs use gas (Brayton) turbines. A hybrid operation the usage of herbal fuel is additionally possible. It affords the best possible solar-to-electric effectivity among CSP technologies, and their modular nature affords scalability. The benefits of Stirling photo voltaic over photovoltaic cells are greater effectivity of converting daylight into electrical energy and longer lifetime.

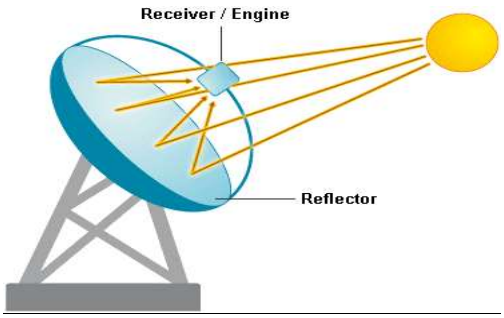

Fig-4: Dish Stirling system

2.4 SOLAR CHIMNEY:

Consists of a transparent massive room (usually completely in glass) which is sloped gently up to a central hollow tower or chimney. The solar heats the air in this greenhouse-type structure which then rises up the chimney, hereby using an air turbine as it rises. This air turbine hereby creates electricity.

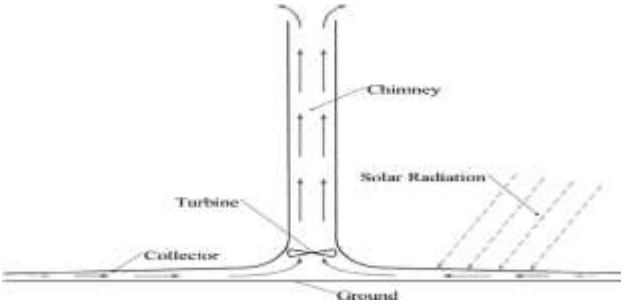

Fig.5: Solar Chimney system

2.5 SOLAR POWER TOWER:

Power tower systems also known as central receivers, use many large, flat heliostats (mirrors) to track the sun and focus its rays onto a receiver. As shown in Figure 3, the receiver sits on top of a tall tower on which concentrated sunlight heats a fluid, such as molten salt, as hot as 1,050°F. The warm fluid can be used immediately to make steam for electrical energy generation or stored for later use. Molten salt retains warmness efficiently, so it can be stored for days before being converted into electricity. That means electrical energy can be produced. During intervals of top want on cloudy days or even numerous hours after sundown.

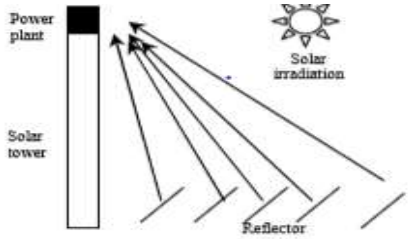

Fig- 6: SOLAR POWER TOWER SYSTEM

CSP systems	Parabolic Trough	Central Receiver	Parabolic Dish
Application	• Grid-connected plants, mid to high process heat • (Highest single unit solar capacity to date 80MW) Total capacity built : 354 MW	• Grid-connected, high temperature process heat (Highest single unit solar capacity to date : 10MW)	• Stand-alone, small off-grid power or clustered to larger grid connected dish parks (Highest single unit solar capacity to date : 25kW)
Capacity range (MW)	10-200	10-150	0.01-0.4
Concentration	70-80	30-1000	1000-3000
Demonstrated annual solar efficiency (%)	10-15	8-10	16-18
Thermal cycle efficiency (%)	30-40	30-40	30-40
Land use m^2/(MW ha)	6-8	8-12	8-12

Fig-1: Performance data for various CSP technologies

3. WORKING :

The gadget makes use of proprietary software to manage thousands of monitoring mirrors, recognised as heliostats, to at once listen daylight onto a boiler filled with water that sits atop a tower. When the sunlight hits the boiler, the water internal is heated and creates excessive temperature steam. Once produced, the steam is used either in a traditional turbine

to produce electricity or in industrial system applications, such as thermal more suitable oil restoration (EOR).By integrating traditional electricity block components, such as turbines, with our proprietary technology and next-generation solar discipline design, tasks the use of our systems are capable to supply cost-competitive, reliable and clean energy when wanted most. In addition, with the aid of integrating our technology with herbal fuel or different fossil fuels thru a procedure referred to as hybridization, projects the use of our systems are capable to in addition make bigger output and reliability.

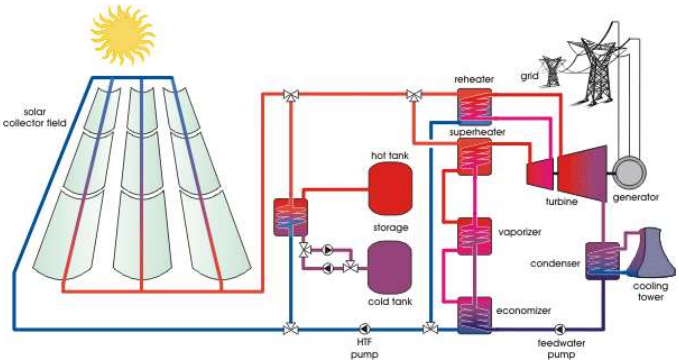

Fig- 6: Schematic diagram of solar thermal power plant

4. TECHNOLOGIES IN CSP

4.1 ABSORBER

Each kind of CSP technological know-how has its own absorber design. Parabolic troughs and Fresnel systems use linear receiver tubes composed of an external glass tube (coated to make positive excessive picture voltaic transmittance) and an inner metallic pipe (coated to make certain immoderate photo voltaic absorption). Towers use central receivers. The towers currently in operation in Spain (PS10 and PS20) have a cavity receiver, fashioned of 4 vertical metal panes in which saturated steam circulates. The panes are lined to lengthen photograph voltaic absorption and equipped in a semi-cylindrical shape to restrict radiation and convection losses.

4.2 HEAT TRANSFER

All CSP technologies use warmness transfer fluids (HTFs) to transfer the heat generated in the receivers to the strength conversion unit(s). two Parabolic troughs use artificial oil with a most operating temperature of about 400°C.Future trends are round accelerated artificial oil, molten salts or steam which allow higher temperatures. Fresnel structures also use artificial oils or water/steam. Tower systems use superheated steam or molten salt. Future tendencies are round gases (air, hydrogen, helium and carbon dioxide) and liquid metals. two Dish systems can also reach excessive temperature s, and use Stirling engines with fuel(hydrogen or helium) as the working fluid.

4.3 THERMAL STORAGE

An important attribute of CSP is the capacity to integrate thermal storage. two To date, this has more often than not been for operational purposes, offering 3060 minutes of full-load storage. Plants are now being designed for 67.5 hours of full-load storage, which is adequate to permit operation well into the evening. The solar area wants to be oversized so that warmth furnished can operate the turbine throughout the day while charging the thermal storage.

4.4 REFLECTORS

All CSP technologies (dish, tower, trough and Fresnel systems) use reflectors. The most usually used reflectors (thick glass mirrors) are made of silver-coated glass or tempered go with the flow glass with a glass thickness of 3-6 mm. Corrosion of the silver is prevented by using use of copper and of distinct coatings (lacquers). Cerium is regularly used for polishing.

5. WHY MOLTEN SALT IS USED?

With photovoltaic strength costs losing and targeted solar power (CSP) towers working at higher temperatures, the use of salts in CSP trough vegetation is being investigated to lower working costs, enhance plant efficiencies, and enable operation at greater temperatures. Most trough plants with artificial or organic oil warmness change fluids (HTFs) are constrained to less than four hundred °C. Using salts can expand that temperature up to 550 °C, permitting steam millsto characteristic at increased efficiency, amongst distinct advantages. Even although there are no business through CSP plant existence the use of salt yet, new industrial-sized plant existence designed to include their many advantages are in modern times getting into the demonstration phase.

The molten salt combination is each non-toxic and inert. Together with the Solar Reserve science design, the use of molten salt represents the most flexible, environment friendly and reasonably-priced shape of big scale electrical energy storage machine deployed today. This storage feature permits secure and dispatch in a position electricity transport besides the want for any backup fossil fuel such as the herbal fuel wished for many unique CSP technologies. Solar Reserve's day trip with molten salt consists of salt specifications, tools metallurgy, tank foundation sketch and engineering, as well as preliminary salt melting and commissioning processes.

5.1 FEATURES

Molten salt is circulated thru rather specialised piping in the receiver (heat exchanger) all via the day, and held in storage tanks at night time – requiring no fossil fuels The tanks keep the salt at atmospheric strain Use of molten salt for each heat transfer and thermal strength storage minimizes wide variety of storage tanks and salt volumes wished Molten salt is stored at 1050° F (566° C) till electricity is wished – day or night, whether or now not or no longer the sun is shining As electrical energy is needed, molten salt is dispatched from the warm tank through a heat exchanger to create superheated

steam which then powers a normal steam turbine The molten salt with the aid of no capacity wishes replacing or topping up for the whole 30+ yrs. lifestyles of the plant Heat loss is fully 1° F per day The salt, an environmentally pleasant combination of sodium nitrate and potassium nitrate, is capable to be utilized as immoderate grade fertilizer when the plant is sooner or later decommissioned. In addition to providing favourable storage conditions, as an HTF, molten salts also:

1] Pollute less
2] Non flammable
3] More abundant
4] Lower vapour pressures
5] Offer cost savings due to smaller thermal tanks and pipin

5.2 BENEFITS

Storage enables solar thermal power plant existence to function really like a traditional fossil fuel or nuclear energy plant, reliably producing electrical electricity when it's wished most but besides the related destructive emission and barring any fuel costs Solar thermal power vegetation with integrated molten salt electricity storage can function 24/7, proving base load electricity for every on-grid and off-grid features Integrated energy storage offers the potential to shift electrical energy technology to meet different profile wishes and deliver firm, reliable electricity at excessive capacity charge Molten salt thermal energy storage is the lowest capital price energy storage machine Solar thermal electricity vegetation with built-in power storage are cost-competitive with any new construct coal, herbal gas, or nuclear science Storage lets in the facility to produce greater than twice as lots net annual output (megawatt hours) than any one-of-a-kind photo voltaic technological know-how Firm output ensures a higher steady and invulnerable transmission system.

5.3FUTURE SCOPE:

Its a difficult time for CSP currently. two PV charges have plummeted, with some of the state-of-the-art initiatives imparting much less than 6 USD cents/kWh. In the shut to future it is tightly closed to depend on that PV ability will extend drastically, with CSP taking part in a meage role .The key to CSP is although the alternative of having thermal power storage, which approves for dispatchability, that capacity your can release the electrical energy to the grid when you choose to. two PV at present does not have this performance in the same fee range and reliability as CSP. Batteries, flywheels, compressed air, and others can additionally be storage options for PV if they can limit value and amplify reliability. Until that happens, CSP will continue to be a frontrunner of the dispatchable renewable strength sources. Nobody without a doubt knows how the future will unfold, however it is blanketed to anticipate that PV will amplify as expenditures continue to be low. CSP may additionally additionally commence to enhance if utilities start stressful low-carbon strength sources that can sincerely grant stability to the grid (in the form of dispatchability). two Until this demand comes to the market, it ought to be a rocky ride for the CSP industry.

5.4. ADVANTAGES OF CSP:

1. Uncomplicated Implementations and Operations
2. Supplements Other Sources of Energy
3. Relatively Uninterrupted Source of Electricity
4. Converts Solar Energy into a Transportable Form Energy

5.5 LIMITATIONS AND DISADVANTAGES OF CONCENTRATED SOLAR POWER:

1. Dependent on Locations and Large Tracks of Lands
2. Notable and Possible Negative Ecological Impacts
3. Costs Implications of Thermal Storage Materials
4. Possible Lack of Attention from Researchers and Investors

6. CONCLUSION

A huge environmental benefit that should not be overlooked is that simple and non-polluting concentrated solar power technology can be deployed relatively quickly and can contribute substantially to reducing carbon dioxide emissions. However, the **fee** of these technologie**s** is nonetheless high to enter the **world** market on a **larger** scale, and desires to minimize before such an entry can be **viable**. Today, concentrated solar power technology has a cost somewhere between those of Photovoltaics and wind (1W=4EUR). In summary, CSP is poised to become a significant player in the renewable electricity generation in countries where a significant solar energy resource is available, such as those near desert and equatorial regions.

REFERENCES

[1] Decher, R., Energy Conversion – Systems, Flow Physics and Engineering", Oxford University Press, 1994
[2]Pilkington Solar International GmbH, "Survey of Thermal Storage for Parabolic Trough Power Plants", NREL/SR-550-27925, NREL, Golden, Co, USA, 2000.
[3] Duffie, J.A. and Beckman, W.A., "Solar Engineering of Thermal Processes", Third Edition, John Wiley & Sons, 2006
[1] Hans Müller-steinhagen freng and franz trieb (2004), concentrating solar power, institute of technical thermodynamics, german aerospace centre (dlr), stuttgart, germany
[2] Lovegrove, K.; Pye, J. Fundamental principles of concentrating solar power {(CSP)} systems. In Concentrating Solar Power Technology: Principles, Developments and Applications; Lovegrove, K., Stein, W., Eds.; Woodhead Publishing: Philadelphia, PA, USA, 2012; Chapter 2,pp. 16–67.
[3] Morin, G. Optimisation of concentrating solar power (CSP) plant designs through integrated techno-economic modelling. In Concentrating Solar Power Technology: Principles, Developments and Applications; Lovegrove, K., Stein, W., Eds.; Woodhead Publishing: Philadelphia, PA, USA, 2012; Chapter 16, pp. 495– 535.

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3. CONCLUSION

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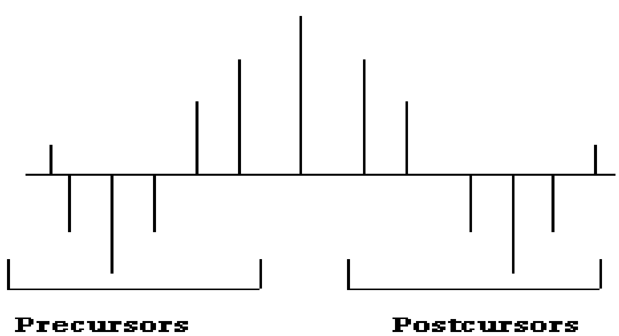

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