A NOVEL APPROACH FOR IMPLEMENTATION OF CONCENTRATED SOLAR POWER TECHNOLOGY

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ABSTRACT

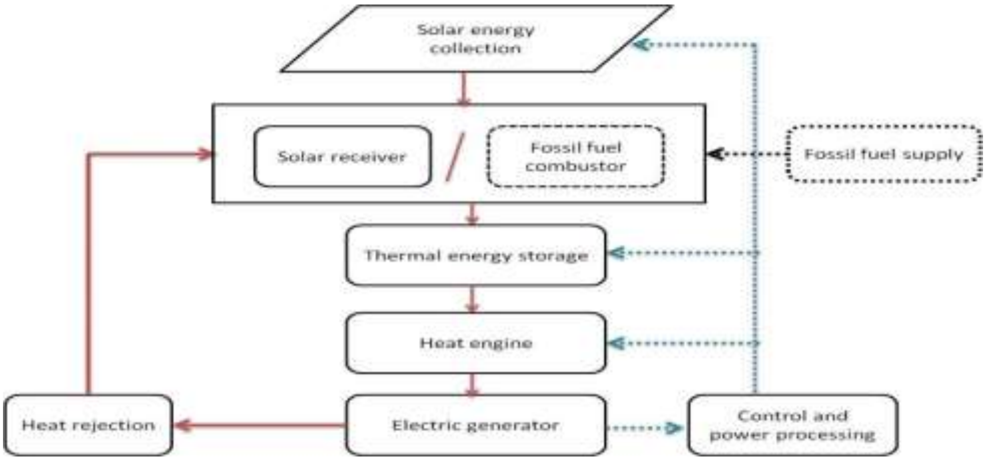
Concentrated solar power technology system uses mirrors or lenses with tracking system to focus a large area of sunlight onto a small area. The concentrated light is then used as heat or as heat source for conventional power plant (solar thermoelectricity), the conversion takes place from heat to steam to drive a turbine that generates electrical power. Between 11 to 21 GW (CSP) could be built and integrated into existing fossil fuel plants, enough to power to between 3 million to 6 million homes. A single CSP plant can generate enough power for about 70,000 homes. This hybrid system improves the efficiency and performance of both resources and help cut carbon pollution. Energy input from CSP is 100% renewable, it will not emit green house gases. CSP are capital intensive, but have zero fuel costs .There is also a significant amount of perceived knowledge about the cost and performance of renewable power generation that is not accurate; or indeed even misleading. This up-to-date analysis of the costs of generating electricity from CSP will allow a fair comparison of CSP with alternative generating technologies.

Keywords: *Concentrating Solar Power, Concentrating Solar Power Collectors, Isolation, Solar Power Concentrators.*

I. INTRODUCTION

A legend has it that Archimedes used a "burning glass" to concentrate sunlight on the invading Roman fleet .In 1866, Auguste Mouchout used a parabolic [shape of the glass is pointed here] trough to produce steam for the first solar steam engine[1]. The first patent for a solar collector was obtained by the Italian Alessandro Battaglia in Genoa, Italy, in 1886.Professor Giovanni Francia (1911–1980) designed and built the first concentrated-solar plant[2][3], which entered into operation in Sant'Ilario, near Genoa, Italy in 1968. This plant had the architecture of today's concentrated-solar plants with a solar receiver in the center of a field of solar collectors. The plant was able to produce 1 MW with superheated steam at 100 bar and 500 °C[4].The solar concentrators used in CSP systems can often also be used to provide industrial process heating or cooling, such as in solar air-conditioning[5].

II. MATHEMATICAL MODEL



III. RESULTS AND DISCUSSION

What are the different forms that exists in the concentrating technology?

There are five forms:

3.1 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. 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. The world's first commercial parabolic trough plants, Acciona's Nevada Solar One near Boulder City, Nevada, and And sol..

Fig 1 Parabolic Trough

3.2 Enclosed Trough

Enclosed trough systems are used to produce process heat. The design encapsulates the solar thermal system within a greenhouse-like glasshouse. Lightweight curved solar-reflecting mirrors are suspended from the ceiling of the glasshouse by wires. The mirrors concentrate the sunlight and focus it on a network of stationary steel pipes, also suspended from the glasshouse structure.

Water is carried throughout the length of the pipe, which is boiled to generate steam when intense solar radiation is applied Sheltering the mirrors from the wind allows them to achieve higher temperature rates and prevents dust from building up on the mirrors.

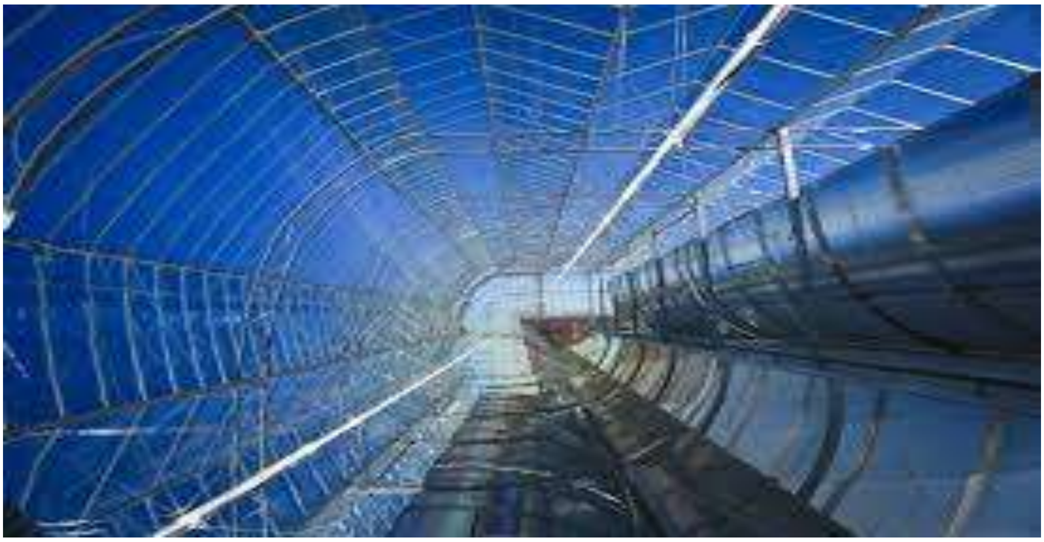


Fig 2. Enclosed Trough

3.3 Fresnel Reflectors

Fresnel reflectors are made of many thin, flat mirror strips to concentrate sunlight onto tubes through which working fluid is pumped. Flat mirrors allow more reflective surface in the same amount of space as a parabolic reflector, thus capturing more of the available sunlight, and they are much cheaper than parabolic reflectors.

Fresnel reflectors can be used in various size CSPs.

Fig 3. Fresnel Reflector

3.4 Dish Sterling

A dish Sterling or dish engine system consists of a stand-alone parabolic reflector that concentrates light onto a receiver positioned at the reflector's focal point. The reflector tracks the Sun along two axes. The working fluid in the receiver is heated to 250–700 °C (523–973 K (482–1,292 °F)) and then used by a Sterling engine to generate power. Australia are representative of this technology.

Fig 4. Dish Sterling

3.5 Solar Power Tower

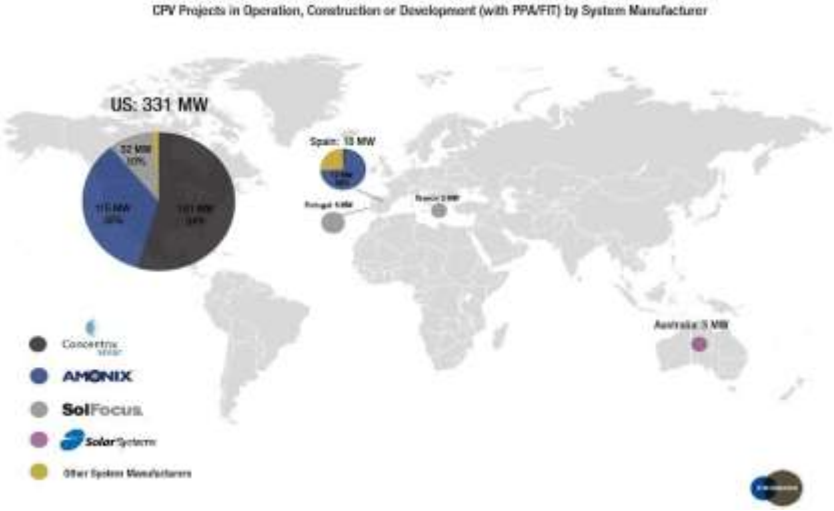
A solar power tower consists of an array of dual-axis tracking reflectors (heliostats) that concentrate sunlight on a central receiver atop a tower; the receiver contains a fluid deposit, which can consist of sea water.

The working fluid in the receiver is heated to 500–1000 °C (773–1,273 K (932–1,832 °F)) and then used as a heat source for a power generation or energy storage system..California and the CESA-1 in Platforms Solar de Almeria Almeria, Spain, are the most representative demonstration plants.

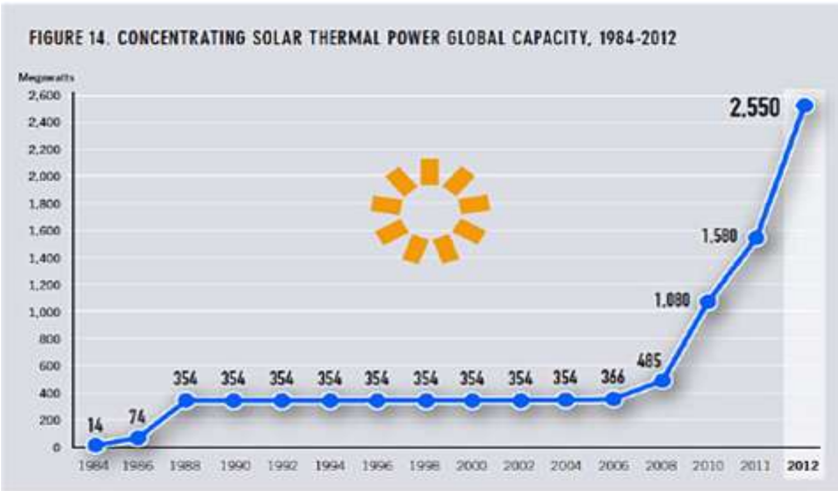
IV. INSTALLATION COSTS

The cost of building a CSP station was typically about US$2.50 to $4 per watt,[31] while the fuel (the sun's radiation) is free. Thus a 250 MW CSP station would have cost $600–1000 million to build. That works out to $0.12 to 0.18 USD/ kWh . However, in November 2011, Google announced that they would not invest further in CSP projects due to the rapid price decline of photo-voltaics . Google invested US$168 million on Bright Source. As of March 2012, there were 1.9 GW of CSP installed, with 1.8 GW of that being parabolic trough.

V. COMPARISON OF OLD AND NEW STATISTICS



USA is the leading manufacturer in production and operation of the concentrating solar technology with 331M Power .



*CSP Hockey Stick: From 2007-2012, global CSP capacity grew at a CAGR of 43%!

VI. FUTURE ESTIMATION OF CONCENTRATED SOLAR POWER IN INDIA:

India's Concentrating Solar Power (CSP) journey under the ambitious Jawaharlal Nehru National Solar Mission (JNNSM) started in 2010 with a total of seven projects being awarded, amounting to a total capacity of 470 MW. Four years have passed since Phase 1 and, to date, only one project (50 MW Godavari Green Energy) out of the seven was commissioned before the March 2014 deadline .The reasons for delays are many:

- Insufficiently accurate Direct Normal Irradiance (DNI) data
- Expensive financing leading to very difficult financial closure
- Unclear future of government subsidies
- Difficulty securing land and water
- The need for a local manufacturing
- The tight profit margins and even tighter time limitations.

6.1 Potential until 2024

Currently, the country has one 50 MW of CSP project in operation (Godawari), a 125 MW CSP project expected to come online in the coming weeks (Reliance/AREVA) and a 50 MW project (Megha) expected to begin commissioning within months. The remaining 250 MW of CSP plants awarded in the Phase 1 are still stuck development.

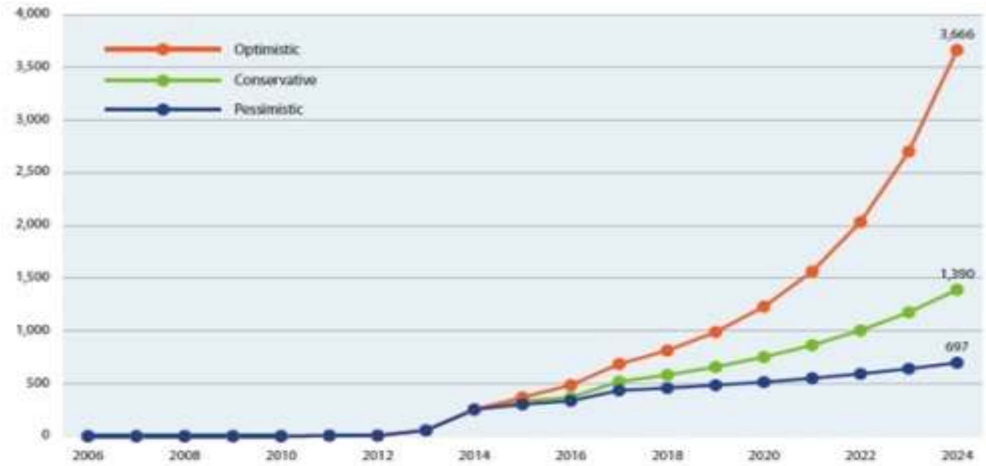
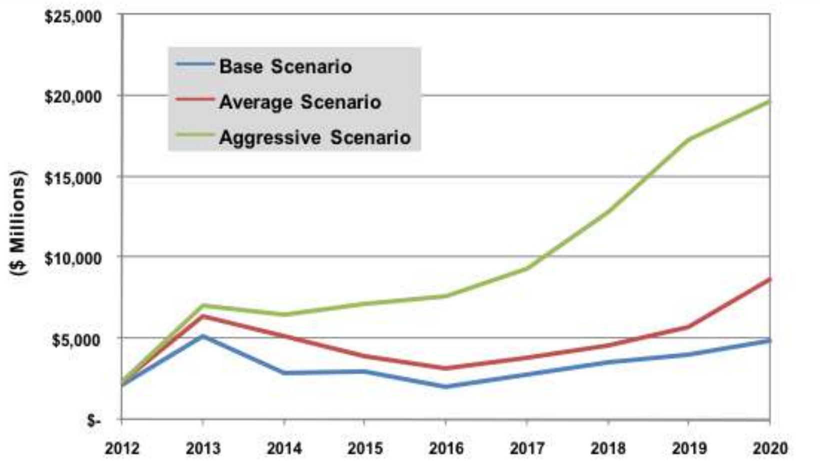


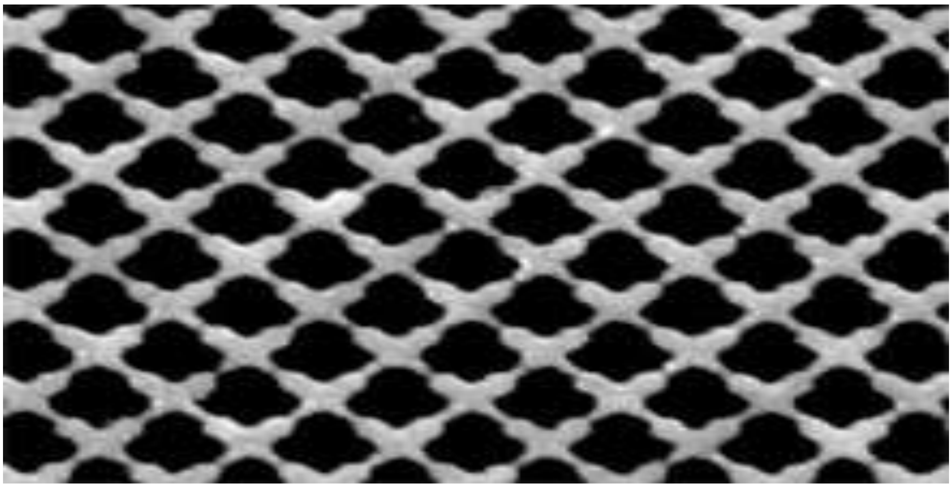
Chart 1.2 ***CSP Revenue, World Markets: 2012-2020***



(Source: Pike Research)

The change that can put forward the concentrating solar power in more effective way:

A Super-Absorbent Solar Material: A new material, patterned at the nanoscale, absorbs a broad spectrum of light and could make thin-film solar cells more efficient.



Researchers are applying the design to semiconductor materials to make solar cells that they hope will save money on materials costs while still offering high power-conversion efficiency. Initial tests with silicon suggest that this kind of patterning can lead to a fivefold enhancement in absorbance. The researchers have made a 220-nanometer-thick silicon film that absorbs the same amount of light as an unpatented film 25 times thicker.

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