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Study of Different Types of Solar Technologies in India

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***Abstract*—The world have to think about the alternative resource of energy apart from conventional energy resources. The best non-conventional source of energy is solar energy and has a great potential of green energy. To promote the green energy, ministry of government of India launched many schemes and providing subsidies for the renewable energy resources. Solar power in India is a fast developing industry.**

***Index Terms*—Photovoltaic cells, concentrating technologies, Solar energy, Solar technologies.**

I. Introduction

With the increasing demand of energy and the gradual depletion of fossil fuels, solar energy conversion has regained the spotlight of the global energy activities. Our planet receives 160,000TW solar energy, while the present global energy demand is about 16TW. While the solar resource is virtually unlimited. Conversion of solar energy to readily usable form is too expensive to be commercially successful at present. Furthermore, reliable solar technology has to be complemented by energy storage system to accommodate the daily and seasonal variations in the solar radiation. From this perspective, India has formulated their long term solar energy utilization roadmap.

II. Related Work

A. Literature Review

Concentrating Solar Thermal Technologies (M. I. Roldan Serrano); 2017.

CST technologies can produce electricity on demand when deployed with thermal energy storage providing a source of renewable energy. There are 4 different types of CST technologies, which are; parabolic trough collector, central receiver, parabolic dish & solar furnace. PT collector have a parabolic mirror made of reflective material which absorb the sun rays & send it to the tube filled with a specific heat transfer fluid in which the thermal energy is removed & transfers to steam generator which produce super-heated steam that drive turbine & electric current is produce. Linear Fresnel is similar to PT collector. It uses series based flat or slightly curved mirror placed at different angle. Water is used as heat transfer fluid. Linear Fresnel is cheaper than PT technologies. Parabolic dish consist of concave dish shaped reflectors. This system has highest efficiency in conversion from heat to electricity than any other solar energy system.

Scheffler Dish and its Application (Somesh Santosh Junare, Shubham Vilas Zamre, Monika Madhukar Aware); 2017.

The Scheffler reflector is a new solar concentrator design which maintains a fixed focus while only having a single axis tracking mechanism. A parabolic (or paraboloid or paraboloid) reflector (or dish or mirror) is a reflective surface used to collect or project energy such as light waves. The special feature of the reflector is that concentration point of the sunshine is at the same place throughout the day even though reflector dish is moving along with the sun from morning to evening. Scheffler is an alternative for high cost or unavailability of commercial fuels – Kerosene, Coal, Gas, and Electricity. Many industrial process like drying, heating, process heat, etc. can also done with Scheffler.

B. Case Study

A Case Study of Solar Steam Cooking System at Shri Saibaba Sansthan Trust, Shirdi

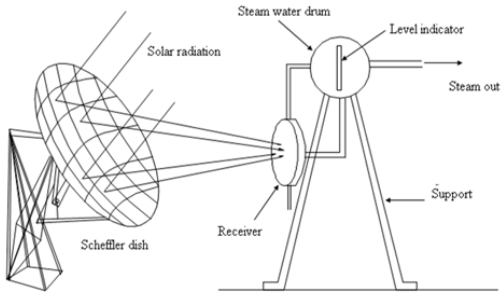

Fig. 1. Solar steam cooking system

The solar steam cooking system installed has 73 parabolic dish (Scheffler dishes) placed on the terrace of Sai Prasad building no. 2. The system follows the thermosyphon principle and thus water in the receiver comes to boiling and becomes steam .The schefflers reflector used here has an area of 16 sq.m and the total area on which dishes are installed is 1168 sq.m. The main goal of the system is to reduce LPG gas consumption by 50%.The Sansthan has a Prasadalaya where it offers food

(prasad) to the devotees at subsidized rates. Thousands of devotees partake food at a nominal rate of Rs.4/- per meal for grownups and Rs.2/- per meal for children. The Sansthan is always on the lookout for innovative ways to reduce its overhead costs. They have installed hot- water- systems at its dharmashalas / dormitories, providing staying facilities for devotees. The Sansthan have also installed solar streetlights in its pumping complex.

III. Scope of Study

The main objective of the study is to take a step towards the sustainability. The study will help in learning the best solar technology with higher efficiency.

TABLE I
Energy Scenario

S. No.	State	Photovoltaic Capacity (MW)	Solar Thermal Capacity (MW)
1	Rajasthan	43	400
2	Gujarat	722	45
3	Maharashtra	133	-
4	Karnataka	10	-
5	Andhra Pradesh	20.5	-
6	Uttarakhand	4	-
7	Punjab	5	-
8	Haryana	7.8	-
9	Uttar Pradesh	11	-
10	Jharkhand	16	-
11	Chhattisgarh	4	-
12	Madhya Pradesh	7.25	-
13	Odisha	11	-
14	Tamil Nadu	12	-
	TOTAL	**1006.55**	**445**

IV. Fundamentals and Basic Concept of Solar Energy

Solar energy can be produced by two methods. One is Solar PV i.e. through photovoltaic cells and other is Solar Thermal i.e. through concentrated solar power.

1.1 Solar Photovoltaic (PV):

The photovoltaic effect (or photoelectric effect) converts light into electricity. It was discovered by French physicist Edmond Becquerel in 1839 and was first used in industrial applications in 1954. The principle: an electric current occurs when electrons are displaced. For this to happen, photons (light particles) excite the outermost electrons of the atoms of certain semiconductor elements. In practice, light hitting a photovoltaic cell is converted into electricity by a semiconductor, generally silicon. A photovoltaic panel is made up of several cells producing direct current, which is then converted into alternating current by an inverter.

Panels can be used in small systems or large plants.

A. Solar Thermal

Concentrated solar power: This systems use mirrors or lenses to concentrate a large area of sunlight, or solar thermal energy, onto a small area. 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 or powers a thermo chemical reaction. Solar thermal power technologies are of three type's namely parabolic trough, Dish engine and Power tower.

Parabolic trough technology is the Most proven and mature technology. It consists of a field of single axis tracking parabolic trough solar collectors. Linear receiver located at the focus of parabola. The Heat transfer fluid (HTF) circulates through the receiver and returns to a series of heat exchangers. High-pressure superheated steam generated is fed to turbine.

Power tower designs: Power towers (also known as 'central tower' power plants or 'heliostat' power plants) capture and focus the sun's thermal energy with thousands of tracking mirrors (called heliostats) in roughly a two square mile field. A tower resides in the center of the heliostat field. The heliostats focus concentrated sunlight on a receiver which sits on top of the tower. Within the receiver the concentrated sunlight heats molten salt to over 1,000 °F (538 °C). The heated molten salt then flows into a thermal storage tank where it is stored, maintaining 98% thermal efficiency, and eventually pumped to a steam generator. The steam drives a standard turbine to generate electricity.

Dish designs: A parabolic solar dish concentrates the sun's rays on the heating element of a Stirling engine. The entire unit acts as a solar tracker. This CSP-Stirling is known to have the highest efficiency of all solar technologies around 30% compared to solar PV approximately 15%, and is predicted to be able to produce the cheapest energy among all renewable energy sources in high scale production and hot areas, semi deserts etc. A dish Stirling system uses a large, reflective, parabolic dish (similar in shape to satellite television dish). It focuses all the sunlight that strikes the dish onto a single point above the dish, where a receiver captures the heat and transforms it into a useful form.

Fresnel reflector: A linear Fresnel reflector power plant uses a series of long, narrow, shallow-curvature (or even flat) mirrors to focus light onto one or more linear receivers positioned above the mirrors. On top of the receiver a small parabolic mirror can be attached for further focusing the light. These systems aim to offer lower overall costs by sharing a receiver between several mirrors (as compared with trough and dish concepts), while still using the simple line-focus geometry with one axis for tracking. This is similar to the trough design (and different from central towers and dishes with dual-axis). The receiver is stationary and so fluid couplings are not required (as in troughs and dishes).

V. Benefits of Solar Power

1. Solar resources are available everywhere in the world. It gives out no emissions i.e. environmentally safe.
2. Solar energy is a clean, renewable resource that is continuously supplied to the earth by the sun.
3. Clean, quiet and visually unobtrusive in nature. Solar energy plants do not have any polluting emissions, do not make any sound, and are not considered to be an "eyesore."

4. Creates good, local jobs for the new energy economy. In fact, solar energy creates more jobs per megawatt hour than any other energy type.
5. Reliable over the long term. With no moving parts, fixed photovoltaic systems last longer than other energy sources.
6. Supports national energy independence because solar electricity is used where it is generated.

VI. Promotional Policies From Government

Jawaharlal Nehru National Solar Mission (JNNSM): The National Solar Mission was framed to promote the use of solar energy for power generation and other application; also promoting the integration of other renewable energy technologies like biomass and wind with solar energy options. The Solar Energy can be tapped via two routes solar thermal and solar photovoltaic.

Tax Incentives, Subsidies and Incentives under JNNSM: Various tax exemptions, capital subsidies and incentives are available for several components and sub-components of solar energy value chain. JNNSM promotes the assembly of solar modules after import of cells which is free from import taxes.

Feed-in tariffs: Feed in tariffs are designated prices which must be paid by utility companies for each kilowatt hour of renewable electricity produced by qualifying generators and fed into the grid. These tariffs normally represent a premium on wholesale electricity prices and offer a guaranteed revenue stream to help the power producer finance the project.

Renewable portfolio standards and supplier obligations: These standards are obligations on utility companies to source a proportion of their electricity from renewable generators. In most cases, they do not prescribe which technology should be used and the utility is free to select the most appropriate renewable sources.

Renewable Energy Certificate Mechanism: The concept of Renewable Energy Certificate (REC) concept seeks to address the mismatch between availability of RE sources and the requirement of the obligated entities to meet their renewable purchase obligation. Renewable Energy Certificate (REC) mechanism is a market based instrument to promote renewable energy and facilitate renewable purchase obligations (RPO). Cost of electricity generation from renewable energy sources is classified as cost of electricity generation equivalent to conventional energy sources and the cost for environmental attributes.

Loan guarantees and other capital incentives: Some government financial institutions offered less targeted financial incentives, available for a wide range of infrastructure investment, such as loan guarantee scheme, which stimulated a number of investments in the solar power plant.

VII. Conclusion

As we study above data, it is conclude that solar energy is efficient than any other traditional energy and it is easily available everywhere also dependency of various sector on solar energy increasing and we want to save environment then we must use Solar Panel. The most efficient commercially available solar panels is photovoltaic panel having efficiency ratings as high as 22.5%.

References

[1] Kapoor K, Pandey KK, Jain AK and Nandan A, "Evolution of solar energy in India: A review" Renewable and Sustainable Energy Reviews, 40(2014)475–487.
[2] Veeraboina P and Ratnam GY, "Analysis of the opportunities and challenges of solar water heating system (SWHS) in India: Estimates from the energy audit surveys & review" Renewable and Sustainable Energy Reviews, 16 (2012) 668– 676.
[3] Pandey S, Singh VS, Gnagwar NP and Vijayvergia MM, "Determinants of success for promoting solar energy in Rajasthan, India" Renewable and Sustainable Energy Reviews 16 (2012) 3593– 3598.
[4] Sharma NK, Tiwari PK and Sood YR, "Solar energy in India: Strategies, policies, perspectives and future potential" Renewable and Sustainable Energy Reviews 16 (2012) 933– 941.
[5] Singh A. Power sector reform in India: current issues and prospectus. Energy Policy 2006; 34: 2480–90.
[6] Ministry of Power. Available: http://www.powermin.nic.in [online].
[7] Ministry of New and Renewable Energy source (MNRE), http://www.mnre.gov.in/achievements.htm; 2015.
[8] http://www.solarindiaonline.com/solar-india.html#present.
[9] Akshay Urja. Newsletter of the Ministry of New and Renewable Energy, Government of India 2010; 4 (November– December (2–3)).
[10] Jawaharlal Nehru National Solar Mission (MNRE) Website of Ministry of New & Renewable Energy, Government of India, http://mnre.gov.in/; 2015.
[11] http://www.eai.in/ref/ae/sol/sol.html
[12] http://en.wikipedia.org/wiki/Solar_power_in_India