STUDY OF SOLAR ENERGY & IT'S APPLICATION IN DAILY LIFE

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ABSTRACT

This paper builds upon past analyses of solar energy deployment contained in the Word Energy Outlook, Energy Technology Perspectives and several IEA Technology Roadmaps. It aims at offering an updated picture of current technology trends and markets, as well as new analyses on how solar energy technologies for electricity, heat and fuels can be used in the various energy consuming sectors, now and in the future.

Keyword: ***Fusion, Radiation***

I. INTRODUCTION

The sun constitutes of hot plasma interwoven with magnetic fields. The energy is generated by nuclear fusion of hydrogen nuclei into helium. The surface temperature attained by sun is 5762 K (Kreith F, Kreider JF, 1978). The sun's total energy output is 3.8 x 10^{2o} MW, a small quantum of which, 1.7 X 1014 kW of the total emitted radiation is intercepted by earth. Nevertheless, world energy demand for one year is only 30 min of solar radiation falling on earth. Entire solar radiation emitted by sun is not reached on earth due to atmospheric absorption, diffraction and scattering. Thus, a solar constant is defined by the solar irradiance that the sun deposits per unit area, that is directlySolar energy technologies transform the energy in sunlight into electrical and thermal (heat) energy. The earth's surface receives approximately 1000 watts of power from the sun for every square metre facing the sun.Solar energy is a rapidly growing way to generate electricity, and it is estimated by the International Energy Agency that solar energy power, and some experts think it will contributeto 50% of the total world's energy exposed to sunlight and perpendicular to it is 1.368 kW/m² (Kalogirou S.A, 2004). Solar energy harnessing system is broadly classified into two categories viz. Solarthermal and Solar Photo Voltaic (PV). Thermal system captures the solar energy and utilizes it for thermal applications like space heating and cooling, water heating, desalination etc., whereas PV system converts the sunlight directly into electricity without intervening engine. Ghaffour Noreddine et al., (2014) presented a Renewable energy-driven integrated desalination system. Since Solar PV generates high grade energy, it is not recommended to degrade it into low grade energy utility such as heating of water, desalination, distillation etc.

Tech-Socio-Commercial suitability of Oceans environment for solar energy harnessing includes

1. Cooling by air and seawater promotes higher PV conversion efficiency (Skoplaki E and Palyvos JA., 2009).
2. Abundant water for cleaning of the panel.
3. The modular and scalable system from microwatt to megawatt.
4. Reduces water evaporation and growth of algae by shading the water.
5. Buoyancy may be utilized in best way with a supporting a simple structure design.

6. Environment friendly.
7. Availability of abundant space close to energy demand.

1.1 Limitations

1. Salty water corrosion and scaling.
2. A strong design of floating platforms required to ensure durability against typhoons.
3. Diversion of marine ecosystem and livelihood of creatures.
4. At present no policy is available worldwide to encourage the deployment.[1]

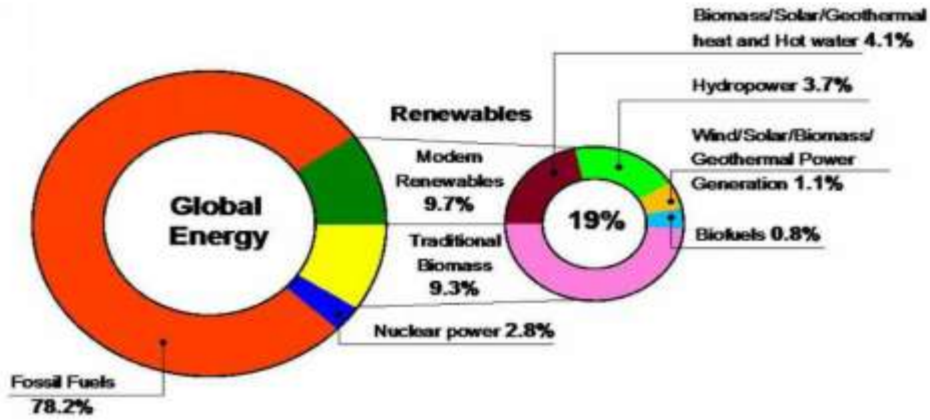

Figure – 1 Estimated Renewable Energy Share of Global Final Energy Consumption, 2011 (Ren21 GSR, 2013)

II. SOLAR ENERGY - BASIC PRINCIPLES

Solar energy is created by light and heat which is emitted by the sun, in the form of electromagnetic radiation. With today's technology, we are able to capture this radiation and turn it into usable forms of solar energy - such as heating or electricity. http://www.articlesbase.com/technology-articles/solar-energy-basic-principles-649460.html) Solar energy is the sun's nuclear fusion reactions within the continuous energy generated. Earth's orbit, the average solar radiation intensity is 1367kw/m2. Circumference of the Earth's equator is 40000km, thus we can calculate the energy the earth gets is up to 173,000 TW. At sea level on the standard peak intensity is 1kw/m2, a point on the earth's surface 24h of the annual average radiation intensity is 0.20kw/m2, or roughly 102,000 TW of energy. Humans rely on solar energy to survive, including all other forms of renewable energy (except for geothermal resources) Although the total amount of solar energy resources is ten thousand times of the energy used by humans, but the solar energy density is low, and it is influenced by location, season, which is a major problem of development and utilization of solar energy.

III. SOLAR THERMAL COLLECTORS

Solar thermal collector is the heart of the system, which captures the solar heat and transfers it to circulatingmedia. Commercially available solar collectors are shown in Figure–2 to 4 Ayden Hakan*et al.*, (2014)envisaged the solar preheating and superheating added OTEC system. Yamada Noboru et al., (2009) simulated thesolar boosted OTEC system using 5000 m² flat plate collector and efficiency increased by 1.5 times. Most of theonboard thermal energy demands consists water heating for bathing and cleaning, space heating & cooling, cooking,preservation of foods and commodities, fisheries etc. State of the art solar collectors are capable enough to meet therequirement efficiently.

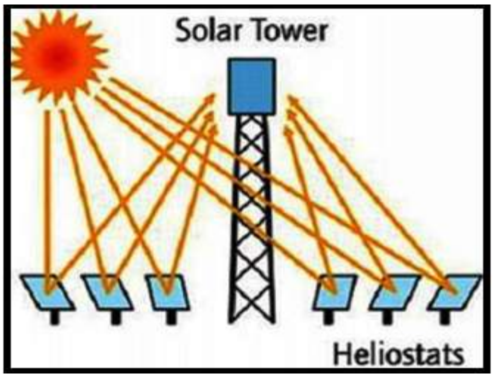

Fig.-2 Central Receiver: plurality of heliostats placed on ground concentrate the solar radiation on a central receiver placed atop a fixed tower

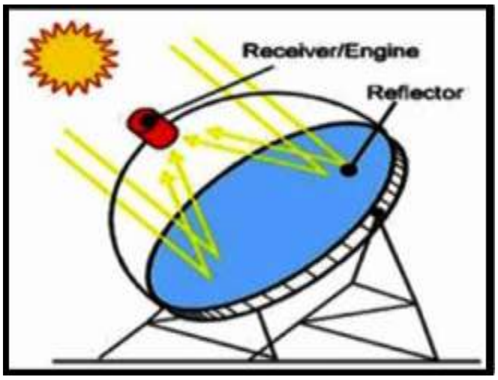

Fig-3 Parabolic Dish: point focusing solar concentrator equipped with full point dual axis solar tracker

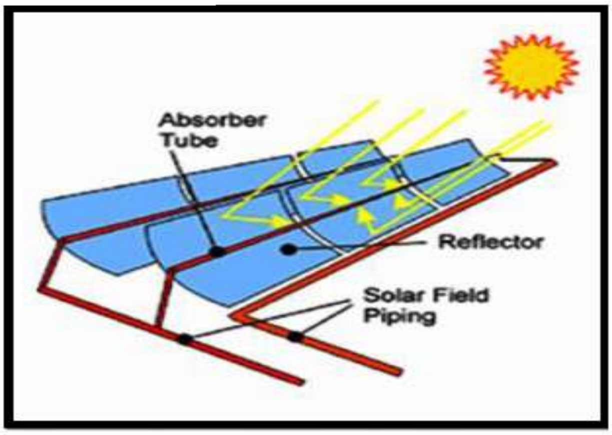

Fig-4 Paraboli Trough: Inside Curved Reflectors in Parabolic Trough Shape Equipped with Single Axis Tracking

IV. APPLICATION OF SOLAR ENERGY

4.1 Solar Water Heating

Solar energy can be used to heat water. Heating water for bathing,dishwashing, and clothes washing is the second largest homeenergy cost. Installing a solar water heater can reduce your water heating bill by as much as 50 percent.A solar water heater works a lot like solar space heating. In ourhemisphere, a solar collector is mounted on the south side of a roofwhere it can capture sunlight. The sunlight heats water in a tank.The hot water is piped to faucets throughout a house, just as itwould be with an ordinary water heater.[3]

Fig-5 Solar Water Heater

4.2 Solar Electricity

Solar energy can also be used to produce electricity. Two ways to make electricity from solar energy are photo voltaics and solar thermal systems.

4.3 Photovoltaic Electricity

Photovoltaic comes from the words *photo*, meaning light, and *volt*, a measurement of electricity. Sometimes photovoltaic cells are called PV cells or solar cells for short. You are probably familiar with photovoltaic cells. Solar-powered toys, calculators, and roadside telephone call boxes all use solar cells to convert sunlight into electricity. Solar cells are made up of silicon, the same substance that makes up sand. Silicon is the second most common substance on Earth. Solar cells can supply energy to anything that is powered by batteries orelectrical power. Electricity is produced when radiant energy from the sun strikes the solar cell, causing the electrons to move around. The action of the electrons starts an electric current. The conversion of sunlight into electricity takes place silently and instantly. There are no mechanical parts to wear out Compared to other ways of making electricity, photovoltaic systems are expensive and many panels are needed to equal the electricity generated at other types of plants. It can cost 10 to 30 cents per kilowatt-hour to produce electricity from solar cells. Most people pay their electric companies about 12 cents per kilowatt-hour for the electricity they use, and large industrial consumers pay less. Solar systems are often used to generate electricity in remote areas that are a long way from electric power lines. In 2009, the DeSoto Next Generation Solar Energy Center inFlorida opened. It is the largest photovoltaic plant in the country, generating 25 megawatts of electricity—enough to power 3,000 homes.[4]

Fig-6 Thermal Electricity

4.4 Solar Thermal Electricity

Like solar cells, solar thermal systems, also called **concentrated solar power (CSP)**, use solar energy to produce electricity, but in a different way. Most solar thermal systems use a solar collector with a mirrored surface to focus sunlight onto a receiver that heats a liquid. The super heated liquid is used to make steam to produce electricity in the same way that coal plants do. There are CSP plants in California, Arizona, Nevada, Florida, Colorado, and Hawaii. Solar energy has great potential for the future. Solar energy is free, and its supplies are unlimited. It does not pollute or otherwise damage the environment. It cannot be controlled by any one nation or industry. If we can improve the technology to harness the sun's enormous power, we may never face energy shortages again.[5]

Fig-7 Solar Panels (Photovoltaic)

4.5 Solar Space Heating

Space heating means heating the space inside a building. Today, many homes use solar energy for space heating. A passive solar home is designed to let in as much sunlight as possible. It is like a big solar collector. Sunlight passes through the windows and heats the walls and floor inside the house. The light can get in, but the heat is trapped inside. passive solar home does not depend on mechanical equipment, such as pumps and blowers, to heat the house, whereas active solar homes do.[5]

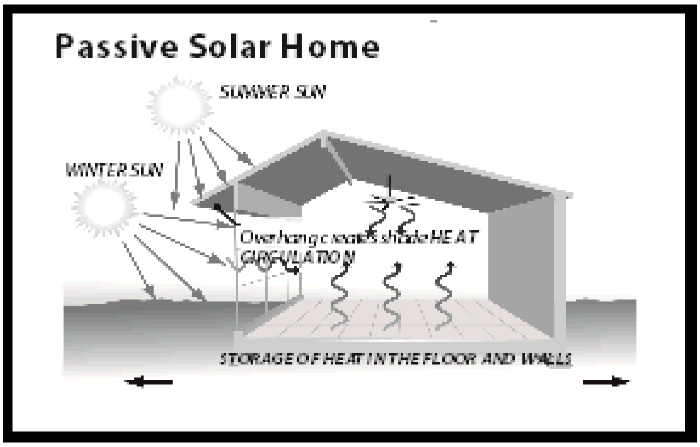

Fig-8 Solar Space Heating

4.6 Solar Distillation

Before beginning a discussion on water treatment systems that utilize solar power, it is worth mentioning the sun and how much power is actually available. As the Earth is an imperceptible cosmic dot from the sun's perspective, very little of the total energy emitted from the sun ever reaches the Earth. In fact, at the outmost reaches of our atmosphere we receive only one-billionth of the energy that the sun produces. The sun's energy per unit area is called solar flux, and is generally measured in W/m2. While the extraterrestrial solar flux (flux at the outer edge of our atmosphere) is 1,353 W/m2, this can never be reached on the Earth's surface. If the solar flux were that high on the Earth's surface we would be in much greater danger from the sun, so we are quite thankful that the atmosphere absorbs much of the solar flux. However, the interference from the atmosphere complicates solar technologies. Due to atmospheric diffusion, solar flux is reduced by at least 15–30%, even on the sunniest day of summer on the equator. Typically, solar flux from 300 to 1,000 W/m2 is referenced as being used for solar technologies. Often times, references to higher solar flux values include the magnifying characteristics of compounding reflectors.

Solar technology is surprisingly fickle as it is heavily dependent on sufficient solar flux. Attributes that affect solar flux are absorption and scattering by the atmosphere, the time (day, month, or year), latitude, altitude, and meteorological effects. Additionally, technology used to capture the sun's energy is expensive to manufacture and produce, though often not as expensive as other water treatment technology costs. Under current systems and operations, desalination costs are substantial for developing communities—particularly those with comparatively small populations. The infrastructure required to produce and support continuous desalination and purification—including power supply, pre-treatment, brine management, janitorial maintainability, repairs and modifications maintainability, and inventory—is a daunting task when the protective hedge of other city-sized systems are far removed. However, while cities may have the cash flow to employ full-scale operations to alleviate water needs, those left beyond the reach of urbanization have hand-collected water from unsanitized sources as their only recourse. Yet despite developing countries with 50–70% of their population living in the few urban centers (UN DESA 2007), there still remains hundreds of millions of people qualified by the UN as being "water-stressed" who need access to cheaper and more reliable technology to bring them clean water.[4]

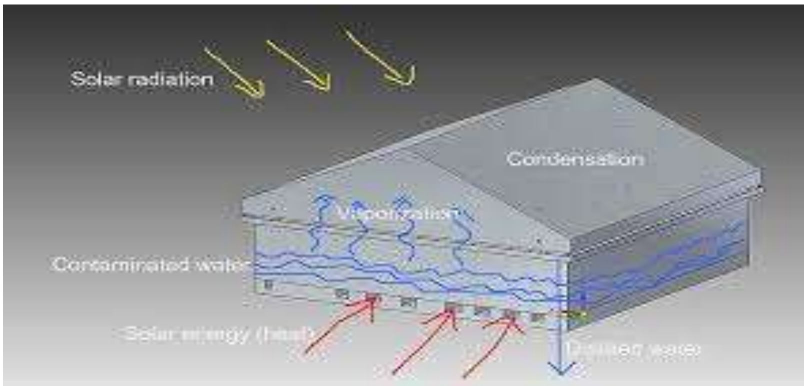

Fig-9 Solar Distillation

4.7 Energy Requirements for Water Distillation

The energy required to evaporate water, called the latent heat of vaporisation of water, is 2260 kilojoules per kilogram (kJ/kg). This means that to produce 1 litre (i.e. 1kg as the density of water is 1kg/litre) of pure water by distilling brackish water requires a heat input of 2260kJ. This does not allow for the efficiency of the system sued which will be less than 100%, or for any recovery of latent heat that is rejected when the water vapour is condensed.

It should be noted that, although 2260kJ/kg is required to evaporate water, to pump a kg of water through 20m head requires only 0.2kJ/kg. Distillation is therefore normally considered only where there is no local source of fresh water that can be easily pumped or lifted.[3]

V. CONCLUSION

Conclusion of this paper is achieving the SAI goals for PV installation will result in a significant amount of electricity generation resources that will displace generation from more traditional sources. The first step in estimating the benefits of the SAI is to determine the amount of electricity generation that will result in both the high and low scenarios. The PV energy estimates are then used to determine the economic and environmental benefits in subsequent sections of this report.

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