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# Advancements in Renewable Energies and Technologies

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**ABSTRACT: This paper contain the recent advancements in the Renewable energy production, modelling and optimization of the renewable energy system. A classification of energy sources is presented in terms of their sustainability and ease of integration to a energy system. Current modelling methods are further compared with respect to computational limitations, level of precision as well as the degree of certainty in the output level. Moreover, the recent studies of Renewable energy systems are classified in accordance with the optimization objectives, including energy efficiency, cost, exergo-economic/thermo-economic and green-house gas (GHG) and pollutant production.**

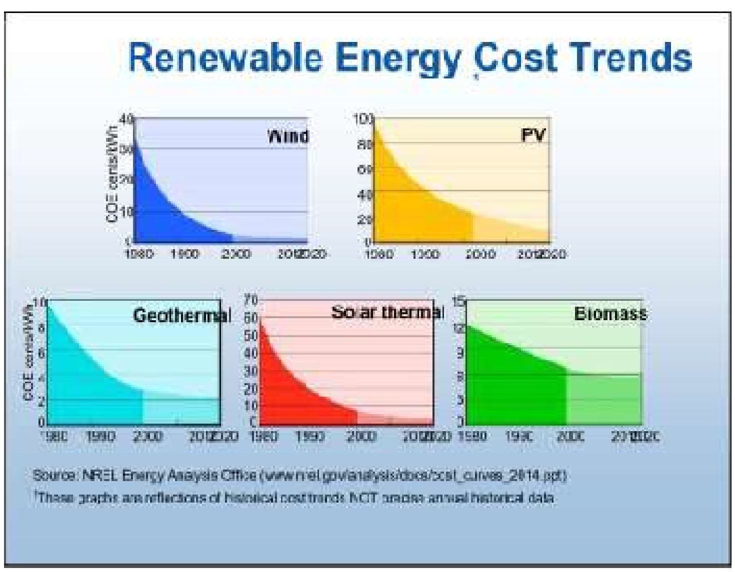
**Key words:** Renewable energy, Greenhouse gases, Energy efficiency, Sustainability, modeling.

## I. INTRODUCTION

Presently, the world energy consumption is 10 terawatts (TW) per year, and by 2050, it is projected to be about 30 TW. The world will need about 20 TW of non-$CO_2$ energy to stabilize $CO_2$ in the considered as the "tipping point" for solar energy system (Kazmerski, 2006). In this scenario of renewable energy advancements government of India has provided a lot of concentration towards this existing field and allotted the budget to the ministry of new and renewable energy resources.

## II. SOLAR ENERGY SYSTEM

Solar cells based on compound Semiconductors [1] (III–V and II–VI) were first investigated in the 1960s. At the same time, polycrystalline Si (pc-Si) and thin-film solar cell technologies were developed to provide high production capacity at reduced material consumption and energy input in the fabrication process, and integration in the structure of modules by the deposition process and consequently cost reduction for large-scale terrestrial applications.



**Methods of producing Electricity**

As the resultants Cochin International airport, the country's first airport built under PPP model has scripted another chapter in aviation history by becoming the first airport in the world that completely operates on solar power. The International Energy Agency[2] projected in 2014 that under its "high renewables" scenario, by 2050, solar photovoltaics and concentrated solar power would contribute about 16 and 11 percent, respectively, of the worldwide electricity consumption, and solar would be the world's largest source of electricity. Most solar installations would be in China and India [2].

**Photovoltaic cell**: Renewable energy systems in the form of photovoltaic solar panels have been integrated in a solar cell, or photovoltaic cell (PV), is a device that converts light into electric current using the photovoltaic effect. The first solar cell was constructed by Charles Fritts in the 1880s. The German industrialist Ernst Werner von Siemens was among those who recognized the importance of this discovery In 1931, the German engineer Bruno Lange developed a photo cell using silver selenide in place of copper oxide [3].

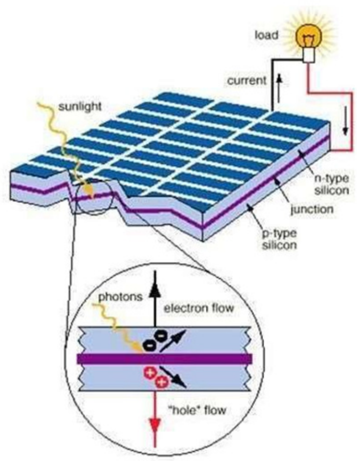
•A solar cell is a small semiconductor device which has a light sensitive *N-P* junction. When solar light rays strike the *N-P* junction, DC e.m.f. is generated with P terminal as positive and N-terminal as negative. Nominal ratings of a typical single PV-cell when exposed to full sun light are:

-Voltage 0.45 V, DC -Current 0.75 A,
DC -Power 0.33 W.

When exposed to sun light, the solar cell acts like tiny DC cell. Several Solar cells are connected in series, parallel to get desired voltage, current and power.

There are existing different types of Photovoltaic solar panel technologies.

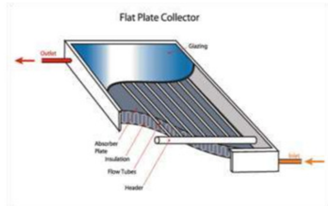
1. Flate Solar Panel
2. Concentrated Solar panel.




**Flat-plate collector** is a metal box with a glass or plastic cover (called glazing) on top and a dark-colored absorber plate on the bottom. The sides and bottom of the collector are usually insulated to minimize heat loss. Sunlight passes through the glazing and strikes the absorber plate, which heats up, changing solar energy into heat energy. The heat is transferred to liquid passing through pipes attached to the absorber plate. Absorber plates production for the generation of electricity and thermal detoxification. Concentrating collectors are best suited to climates that have a high percentage of clear sky days. The principal types of concentrating collectors include: compound parabolic, fixed reflectors, Fresnel lens, and central receiver. The main types of concentrating collectors are:

Parabolic dish collectors
Parabolic trough collectors
Power tower
Stationary concentrating collector

A PV concentrating modules uses optical elements (Fresnel lens) to increase the amount of sunlight incident onto a PV cell. Concentrating PV modules/arrays track the sun and use are commonly painted with "selective coatings," which absorb and retain heat better than ordinary black paint. Absorber plates are usually made of metal typically copper or aluminum because the metal is a good heat conductor. Copper is more expensive, but is a better conductor and less prone to corrosion than aluminum. In locations with average available solar energy, flat plate collectors are sized approximately one-half- to one-square foot per gallon of one-day's hot water use. There are several types of flat-plate collectors available.





**Concentrating solar collector** is a solar collector that uses reflective surfaces to concentrate sunlight onto a small area, where it is absorbed and converted to heat or, in the case of solar photovoltaic (PV) devices, into electricity. Concentrators can increase the power flux of sunlight hundreds of times. This class of collector is used for high temperature applications such as steam concentrating devices to reflect direct sunlight onto the solar cell to produce the electricity directly. Concentrating solar collectors in concentrated Solar Power (CSP) facilities concentrate sunlight onto a receiver where it heats a heat transfer fluid that subsequently exchanges its.

**Solar Thermal Electricity-**Absorbed heat to produce steam to power a steam turbine-generator (STG) to produce electricity It is important to understand that solar thermal technology is not the same as solar panel, or photovoltaic, technology. Solar thermal electric energy generation concentrates[4] the light from the sun to create heat, and that heat is used to run a heat engine, which turns a generator to make electricity. The working fluid that is heated by the concentrated sunlight can be a liquid or a gas. Different working fluids include water, oil, salts, air, nitrogen, helium, etc. Different engine types include steam engines, gas turbines, Stirling engines, etc. All of these engines can be quite efficient, often between 30% and 40%, and are capable of producing 10's to 100's of megawatts of power. Photovoltaic, or PV energy conversion, on the other hand, directly converts the sun's light into electricity. This means that solar panels are only effective during daylight hours because storing electricity is not a particularly efficient process. Heat storage is a far easier and efficient method, which is what makes solar thermal so attractive for large-scale energy production. Heat can be stored during the day and then converted into electricity at night. Solar thermal plants that have storage capacities can drastically improve both the economics and the dispatchability of solar electricity.

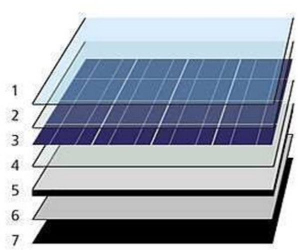
**Hybrid Photovoltaic/Thermal Electricity (PV-T)**

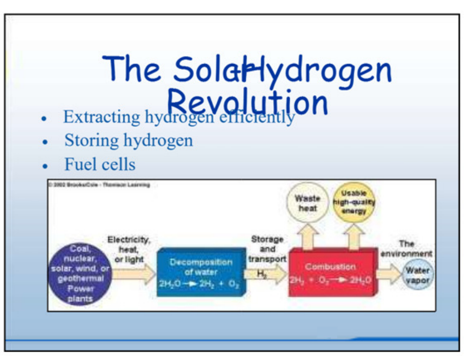
The solar radiation increases the temperature of PV modules, resulting in a drop of their electrical efficiency. By proper circulation of a fluid with low inlet temperature, heat is extracted from the PV modules keeping the electrical efficiency at satisfactory values. The extracted thermal energy can be used in several ways, increasing the total energy output of the system. Hybrid PV/T[5] systems can be applied mainly in buildings for the production of electricity and heat and are suitable for PV applications under high values of solar radiation and ambient temperature. Hybrid PV/T experimental models based on commercial PV modules of typical size are described and outdoor test results of the systems are presented and discussed. The results showed that PV cooling can increase the electrical efficiency of PV modules, increasing the total efficiency of the systems. Improvement of the system performance can be achieved by the use of an additional glazing to increase thermal output, a booster diffuse reflector to increase electrical and thermal output, or both, giving flexibility in system design.

## The Solar Hydrogen

Solar energy is abundantly available globally, but unfortunately not constantly and not everywhere. One especially interesting solution for storing this energy is artificial photosynthesis. This is what every leaf can do, namely converting sunlight to chemical energy. That can take place with artificial systems based on semiconductors as well. These use the electrical power that sunlight creates in individual semiconductor components to split water into oxygen and hydrogen. Hydrogen possesses very high energy density, can be employed in many ways and could replace fossil fuels. In addition, no carbon dioxide harmful to the climate is released from hydrogen during combustion, instead only water. Until now, manufacturing of solar hydrogen at the industrial level has failed due to the costs, however. This is because the efficiency of artificial photosynthesis, i.e. the energy content of the hydrogen compared to that of sunlight, has simply been too low to produce hydrogen from the sun economically.

An international team has succeeded in considerably increasing the efficiency for direct solar water splitting with a tandem solar cell whose surfaces have been selectively modified. The new record value is 14 percent and thus tops the previous record of 12.4 percent, broken now for the first time in 17 years.




## CONCLUSION

In this paper I have discussed about current and futuristic source of renewable energy technologies**.** It has become imperative for the power and energy engineers to look out for the renewable energy sources such as sun, wind, geothermal, ocean and biomass as sustainable, cost effective and environment friendly alternatives for conventional energy sources. However, the non-availability of these renewable energy resources all the time throughout the year has led to research in the area of hybrid renewable and solar energy systems. In the past few years, a lot of research has taken place in the design, optimization, operation and control of the renewable energy systems. One of the most important future based coming source of energy is Solar Hydrogen energysystem The results of the analyses showed that the replacement of fossil fuel based genets with hydrogen technologies is technically feasible, but still not economically viable, unless significant reductions in the cost of hydrogen technologies are made in the future.

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