SOLAR PV/T HYBRID SYSTEMAND ITS TECHNIQUES: A REVIEW

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Abstract: ***By looking today's energy scenario we need for clean and renewable energy sources. Around 81% of the world's energy is provided by the coal, fossil fuels, oil, gas and remaining energy is from the renewable and nuclear energy. We know Fossil fuels are non-renewable and finite resource, which is diminishing day by day because of high cost and environmentally damaging retrieval technique, so everywhere there is a need for cheap and renewable resource. A feasible and an efficient alternative of above problem is the solar energy, in this paper, review present on Photovoltaic & Thermal (PV/T) Hybrid system, also explain various technics were discussed related to solar PV/T. The concept & theory behind the PV/T and the operation of the system were briefly introduced, and standards for evaluating technical, economical performance of the PV/T systems were addressed. From the Literature survey it can be concluded that PV/T are very capable devices and there is an extensive scope to improve their performance on the basis of cost and efficiency, making them more competitive in the market.***

Keywords: Solar energy, Photovoltaic/Thermal PVT, Efficiency, Hybrid system.

1. INTRODUCTION

Burning of fossil fuels by humans for various activities is the largest source of emissions of carbon dioxide, which is one of the greenhouse gases that allows disturbance in ecological cycle, increasing percentage of carbon in atmospheric gases, increasing pollution and contributes to global warming, also we facing many problems associated with fossil fuel. Recent years there are many negative impacts on the environment. Hence by looking negative impact of these, people are more focusing on renewable energy resources. Renewable Energy is having least negative impacts on the environment and do not add to the global warming. Among all renewable energy sources, solar energy is abundant one and cleanest energy resources in nature, and when we talk about solar energy then concept of Solar Photovoltaic (PV) cell comes in to picture. Photovoltaic cell receives solar radiation and produces the electricity. But by seeing low efficiency of the PV cell, there is lots of scope for research. Solar thermal is another application of solar energy. Solar thermal gives better efficiency than PV. Solar thermal energy is available in both direct as well as indirect forms. Also we have seen many application of solar thermal in life. Generally solar thermal utilized in low temperature as well as high temperature.

In the recent years the commercial market of solar thermal and photovoltaic electricity generation is growing promptly. Among the entire incident solar energy on PV module only 10-15% of is transformed to electricity. The rest of 85 to 90% becomes heat so in the same surface, this is the status of commercial Photovoltaic (PV) panel. So one can harness both electricity and thermal energy of the panel. PV modules show temperature increase during their operation due to the immersion of solar radiation, as most of radiation is converted into heat and not into electricity. The potential of heat (Thermal) production from a given surface is thus much higher than the electrical performance.

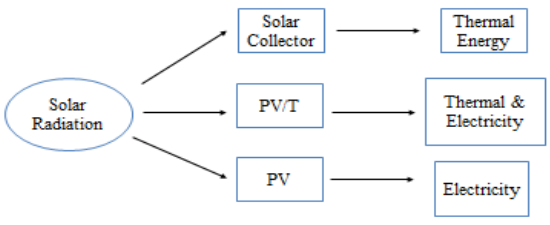

Fig. Power Generation from solar energy.

As discussed earlier 85 to 90 % of incident solar energy is converted in heat, which will not useful, this heat is called as waste heat. That heat remains in the panel and start heating the solar cells which effects on efficiency of the panel. This Waste heat could still be reused for some useful applications as well as economic purpose. The strategy of how to recover this heat depends on the method used for it. Heat generated at the panel and quality of waste heat is not same throughout the year, it depends upon season and atmospheric condition of that location. Since the solar energy during day time is flexible and night it is Zero, in summer season maximum waste heat recovery possible than that of winter.

Photovoltaic model is made up from small size of solar cell. Solar cell receives heat from sun rays and gets heated this will reduced the solar cell efficiency. So to obtain maximum efficiency, solar cell should keep as cool as possible. Thus solution for this problem is to remove heat which generate at the solar cell. This can be done by circulating water or air through photovoltaic panel. This combination is Photovoltaic/Thermal PVT technology has been done. [1] In PVT, the solar thermal system is used to reduce the temperature of the PV-cells and helps to improve their efficiency. By combining two separate applications in to one system called as hybrid Photovoltaic/Thermal (PV/T) system, which produces both electricity and heat. In Other words, PV is used as (part of) the thermal absorber. Those Solar PV and solar thermal panels operating side by side in a system are therefore not exactly within this terminology called as ‘‘combi-panel”. [2]

Hybrid solar PVT Set up consist of PV modules and heat extraction units which is mounted together, by which a circulating fluid of lower temperature is circulating through the heat extraction unit to absorb the heat, as a result temperature of PV module decreases which helps to improve efficiency and circulating fluid get heated (Thermal output).

2. LITERATURE SURVEY

A complete Literature review into R&D works and practical application of the PV/T technology was illustrated and the review results were critically analyzed in terms of PV/T type and research methodology used. The major features, current status, existing difficulties and barriers related to the various types of PV/T were identified. According to Xing Xing Zhang et al. removing the barriers in PV/T practical application, establishing the standards/regulations related to PV/T design and installation are the few questions still remaining in the world. To solve these barriers one should continuously update in this field.[3]

Due to rapidly growing market demand for solar Thermal and photovoltaic Electricity generation, there are lot of ideas coming up with various application such as agriculture, processing plant and buildings. In the building sector space is limited for the accommodation of solar PV device but cooling of solar device is also necessary otherwise it will burn out due to excessive increase in temperature. Thus in order to overcome above disadvantages, use of hybrid solar technology for multigenerational of active power or passive devices has been implemented. Passive device is cost effective hence generally preferred. [4]

K. Jaiganesh et al. studied on PV Module design. He designed Glass to Glass Photovoltaic Thermal System (G2G-PVTS) is a combined Photovoltaic (PV) and Flat Plate Solar Water Heating System (FPSWHS).In FPSWHS technology, the water act as a coolant inside the copper fins and water absorb the heat of the PV panel and stored in the insulated storage tank by way of natural flow of water through the system. The test result shows that the G2G-PVT electrical efficiency was 0.7% higher than conventional G2T-PV panel, and in addition that 44.37% of thermal efficiency was also stored. [5]

Zondag analyzed the four different PV models; one 3Dimentional dynamic model and three steady state model of 3D, 2D and 1D, the simulation of the thermal yield were calculated. They conclude that the time dependent model is required for accurate prediction.[6] Y. Tripanagnostopouls carried out his study with the experimental set up. He said that, an extensive study on water and air cooled PV/T a solar system has been conducted at the University of Patras. Where hybrid prototypes have been experimentally studied and concluded that PV modules show temperature increase during their operation due to the immersion of solar radiation, as most of it is converted into heat and not into electricity. According to R. Santbergen, [8] solar thermal and PV model having lots possibilities to improve the annual electrical and thermal yield of systems with PVT collectors by the application of anti-reflective (AR) coatings and low-emissivity (low-e) coating.[7]

María Herrando, studied on models & The model allows various design parameters of the PV/T unit to be varied, so that their impact in the overall system performance can be studied. There are two key parameters, specifically the covering issue of the solar collector with PV and the collector flow-rate, are to be considered while studying model.[9] The trend with photovoltaic (PV) installations is towards building integrated systems, and while this is advantageous in many respects, there are problems associated with conventional methods of integrating PV directly into a building.[10]

The feasibility study showed that absorption coefficients of standard PV modules should be higher than 80% to make the hybrid PV/T collector financially competitive.[11]After studying up above literature review one can understand various techniques for solar hybrid PV/T system.

3. NEED OF REVIEW

By looking the effort of various researchers in solar hybrid technologist is conclude that, PV/T has the potential to experience a growth and in future, the market share might be even larger than that for solar thermal collectors. AS a matter of facts, those having duel demand energy, (Electricity & Thermal) Solar PV/Hybrid systemize best choice for them. PV/T products suit a wide range of applications and market sectors. It can be attractive to those who are fond of advanced technology.

After the literature survey i understand various technique of solar PV/T system. The application of solar hybrid system may include not only homeowners (for small-scale family applications), but also for larger scale applications, the property developers, housing authorities, energy companies, sports centers, public swimming pools, camping sites, hospitals and hotels etc. also PV/T air system also use in solar roof top for wall heating techniques available to extract heat from the photovoltaic panel to get increasing the electrical as well as thermal output in coldest area. By the literature review it can be said that, This Solar PV/T system will plays important role in the field of Renewable Energy. The goal of present this review paper is to understand the various methods to recover waste heat from the panel and the various application of hybrid system.

4. RELEVANCE OF REVIEW FOR PRESENT RESEARCH.

In above literature survey one can understand the various techniques of solar hybrid system. In After all summarized, there existed no perfect rules in the use of PV/System; correctly. All depends on geographical location and actual application case by case. So far the solar hybrid background is concern; solar PV/T has lots of scope in future. All Reviewers in this field is focused on co-generation i.e. generation of electricity and thermal applications.

Analysis of Waste heat recovery from the solar panel is remaining for the research. This would be done by following arrangement; conductive metal or tube or plates are attached to back of a PV module copper tube is preferred as thermal conductivity is good. Working fluid (mineral oil, Glycol, water, air) is then piped through pipes. The heat is conducted through the metal or tube and is absorbed by the working fluid, and then this heat can be either exhausted or transferred at a heat exchanger which is called as closed loop system. Or this heat is used or exhausted before the fluid returns to PV cell called as open loop system. Close loop system is more effective than open loop.

5. CONCLUSION AND DISCUSSION

PV/T is a technology combining Photovoltaic and solar thermal components into a single module to enhance the solar conversion efficiency of the system and make economic use of the space. By combining two separate applications in a single module (PV/T), this will result in a higher overall solar conversion rate than that of sole PV and solar thermal collector. There are various review of the available literature on PV over the last decade was presented. Many researchers study on experimental set up & cost effective method of PV/T system, and we understand various method of removing heat from the PV panel which result improvement in efficiency, and the following conclusion have been reached- on the possibility of generating Electricity as well as heat Energy from PV/T with either water or air flow but Air PV/T collectors are less efficient than water. Air PV/T can be used at location where level of radiation and

Ambient temperature is low; space heating is required throughout the years so Air flow PV/T can be useful and cost effective rather than Water flow. However, based on the complete view of the research done till date, it is concluded that there are still a lot of work to be done in design aspect before PV/T system can be successfully implemented and integrated into domestic and commercial application.

At location where level of radiation and low ambient temperature, space heating is required throughout the years so PV/T can be better option and also cost effective. However, based on the overall view of the research done till date, it is concluded that there are still a lot of work to be done in design aspect before PV/T system can be successfully implemented

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