

A Review Paper on Solar Panel Cooling Technique

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Abstract-

The working state of Photo voltaic (PV) frameworks is foe of itself. The fundamental info daylight to creating power with PV, execution diminishes as the working temperature goes higher. This review work is investigation of the most recent writing research works setting to accomplishing improved effectiveness through proper cooling frameworks. The exploration work can be isolated two sections upgrading the productivity of the sun based PV frameworks and guaranteeing an increase throughout everyday life. It is found while perusing that with the aloof cooling frameworks temperature of PV module in the scope of 6-200 C is diminished with an improvement in electrical productivity up to 15.5% maximum & with dynamic cooling frameworks temperature decrease by 300 C also improves in electrical effectiveness up to 22% most extreme. With dynamic extra warm vitality yield with effectiveness coming to as high as 60%. In light of the this audit, it might be anticipated that with the swelling development of sun oriented PV power around the world, the perfect cooling framework is getting to be critical so as to guarantee better vitality reap and use..

Keyword: Photovoltaic, CFD, Pyranometer, Microchannel

1. INTRODUCTION

Nonconventional vitality supply is the way to maintainable monetary development by reducing the

carbon impression and satisfying developing vitality request. In the times of 2010– 2030 overall vitality utilization will be expanded by 33%. The demonstrated and anticipated vitality sources are not economical and just inexhaustible sources like sun oriented vitality can be the answer for practical power supply. The present vitality source share is as oil 32.4%, gaseous petrol 21.4%, and coal 27.3% while the offer of sustainable power source is just 13% and atomic power 5.7% [1]. Ozone harming substance outflow has developed at a rate of 2.2% per annum in the last decennia of 2000– 2010 though this rate was as low as 1.3% for the past three decades from 1970 to 2000. Therefore, the volume of CO₂ and other hurtful ozone harming substances is expanding steeply in the earth and exacerbating the atmosphere state further. Sun oriented photovoltaic (PV) power generation is a standout amongst the most potential alternatives to experience the future vitality dilemma. The PV framework has an incredible potential in the tropical region Solar PV boards are utilized because of their ability to work under diffuse radiation. PV boards react to various climatic conditions is essential for study. Just 15– 20% of the sun oriented radiation can be changed into power, the rest being squandered as warmth. PV module productivity diminishes at a rate of around 0.40– 0.65% with a one-degree augmentation of module temperature [2]. PV temperature can reach as high as 800C especially in hot dry areas. In this way, looks into concentrated improving the effectiveness of the photovoltaic cells by controlling the cell temperature. In the dry areas,

the temperature may leave the working extents, which result warm debasement and decrease in proficiency. Test examines are persistently proceeding to discover a financially savvy answer for the execution upgrades of sun powered photovoltaic modules. The paper will be useful for the specialists, producers, leaders just as customers to be familiar with current and refreshed PV innovations and show signs of improvement execution from the frameworks.

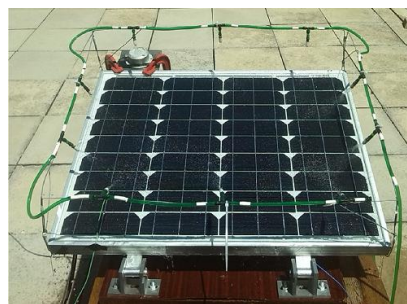
2. LITERATURE SURVEY

S. Nizetic[3] and his group utilized the water splash cooling method to cool the mono crystalline photovoltaic sun oriented board. The creator has utilized water sprayer on both side of sun based board. This demonstrates the substitute cooling method to cool the two sides of sun powered PV board at the same time. Creator examined the all out cooling impact on sun oriented PV board and its execution in position of greatest sun powered light dimensions. Creator has built up an exploratory setup

Baloch.et.al [4] plays out an Experimental and numerical examination of a meeting channel heat exchanger for PV cooling system. The expectation of this experimentation is to limit and keep up uniform temperature on the sun based PV board surface. Experimentation has done in Saudi Arabia in the for the range of 7 months for example from June to December. Creator has tested at the same time on uncooled sun based PV framework and combining channel cooled PV framework. Numerical examination is utilized to explore the impact of various joining edge on the warm qualities of sun based PV framework. By the experimentation creator has reached resolution that best execution as far as normal cell temperature and temperature dispersion by standard deviation of 0.910. Creator has built up a complete frame work model to evaluate the execution of sun based PV framework. Creator has coupled this model with optical, radiation, warm, electrical and CFD show. The outcome demonstrates that most extreme temperature of cell gets for uncooled sun oriented PV board indicated 71.20C in given time of

and elaborate sit in detail. The trial set up is created and tried in a land run of the mill Mediterranean atmosphere. The test results demonstrate greatest conceivable electric power yield is increment by 16.3%. Result additionally indicates upgrade of sunlight based PV board effectiveness by 14.1%. Because of such examination sunlight based board temperature is decreased from 540C to 240C. As in experimentation water shower is utilized on both side of sun powered board, the splash goes about as a self cleaning for sun based PV board.

Fig. 1- Diagram of two side spraying machine [1]



range. When uniting cooling framework is utilized cell temperature is decreased to 45.10C under comparable working condition. In the relative investigation between the two frame work, it has been discovered that rate improvement in power yield is 35.5% and rate improvement in the transformation proficiency is 36.1%. IT has likewise been seen that combining cooled sun powered PV framework is affordable than uncooled sun oriented PV framework by 19.5%. Fig. 2 demonstrates the outline of Converging channel cooling for sun oriented PV with pyranometer on location of Saudi Arabia. The given graph in fig. 3 demonstrates the power yield to month. The diagram demonstrates the yearly vitality acquires from uncooled sun based PV is 29.5kW and for cooling PV board is 38.34kW. Greatest vitality yield in the long stretch of May for example 4.45kWh



Fig. 2- Converging channel cooling for solar PV at site [4]

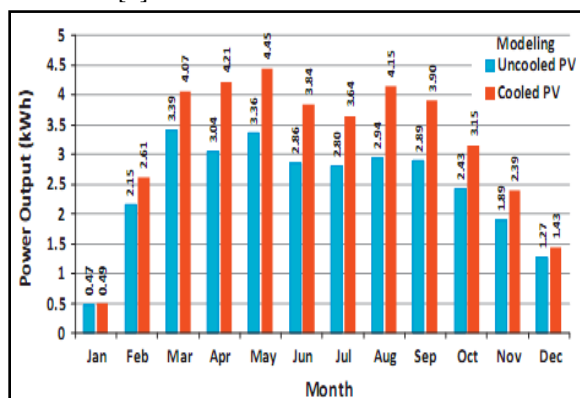


Fig. 3- Annual energy yield simulation for uncooled and cooled PV. [4]

Masoud.et.al. [5] has done the comparative study on using single and multi header micro channel in a hybrid cell cooling technique. In the experimentation author has attached the micro channel to the bottom side of solar PV panel. Author has used two types of micro channel i.e. one with single header and one with multi header. Both the microchannel have same hydraulic diameter i.e. 0.667mm. For the removal of heat from PV panel through microchannel working fluid is used. In this system, author select water as a working fluid. Author has conducted experiment at indoor condition. Experimentation is performed at various flow rates for both the system. Through the experimentation it has been observed that multi header microchannel is more effective than single header microchannel. Multi header microchannel removes 19% more heat than single header microchannel through PV panel also 28% more

electric power is generated. The main conclusion from the paper is, it is very necessary for distribution of flow of coolant over PV panel.

Mehotra.et.al. [6] played out an experimentation on a sun based board with water drenching cooling method at college working of MANIT, Bhopal. Creator has done experimentation for the 6 days. In the experimentation sun powered board is submerged in water at various profundities. The trial result demonstrates that as the profundity of board in water builds the temperature of board is diminished and the proficiency of board increments. In any case, effectiveness increments up to certain profundity just thereafter proficiency lessens ceaselessly. The greatest upgrade in productivity acquire is at the profundity of 1cm for example 17.8%. Creator proposed that, this sort of procedure is extremely valuable for Concentrated Photovoltaic framework where cell temperature is exceptionally high because of which proficiency of framework diminishes. Creator suggested that different fluids can be utilized rather than water like mineral oil, ethanol and so forth.

Rajput.et.al.[7] present an investigation of execution of novel aloof technique to cool a sunlight based PV board at most extreme temperature. Creator has utilized 20 Watt polycrystalline sunlight based cell photovoltaic board having effectiveness of 11.7%. A solitary channel PV gatherer with a round and hollow stick balance heat sink is utilized for testing. The balance thickness of warmth sink is 1.22fin/cm². Creator has utilized aluminum material for the balance material. Indoor testing has been performed under incandescent lamp. The light power for the testing is 1378.4W/m². Before the connection of warmth sink the most extreme temperature of board acquire is 81.70C. By the connection of blades its temperature diminished to 58.40C. The net warmth exchange rate from base side of board is 667.2 W/m². Because of the connection of balance, heat exchange is upgraded by 30 to 41.5%.

Acuri.et.al. [9] has contemplated distinctive PV cooling framework with water and air. Creator has arranged two unique frameworks one is for air and another is for water. It has been discovered that plan of water framework is more perplexing than air framework. As water needs sealed joints. It needs water siphon for the flow of water. While structure of air cooling framework, is very straightforward than water cooling framework. It needs basic channels and fans to blow the air over the board. Creator has considered diverse development perspectives like testing with various number of cylinders and inspect the outcomes. For the structure of channel for water cooling framework creator utilizes the plastic material due to their impressive development points of interest. In any case, the warm execution of plastic is extremely low. Creator likewise referenced that, rather than plastic in the event that sheet metal utilized, at that point number of required channel will be less. The outcome demonstrates that most extreme variety in temperature is 3K for the pitch of conduit 159mm with in general warmth misfortune coefficient 45.09 W/m²K for the water cooling framework. If there should be an occurrence of air cooling framework, creator has utilized sheet metal pipes. Separate fan is utilized for every conduit. Most extreme difference in temperature got with 4 channels is 4K with generally speaking warmth misfortune coefficient 40.60 W/m²K. Creator has reenacted the outcome utilizing TRANSYS and relative investigation happens. Yearly execution of framework is tried.

Bahaidarah.et.al. [10] has check the execution of water cooled mixture PV framework. Creator led numerical and trial investigation of framework. Through the examination electrical and warm execution is checked. The experimentation is completed at Dharhan, Saudi Arabia. Creator has utilized EES (Engineering Equation Solver) programming to build up a framework. A sun based warm authority is fitted at base side of the PV board which limits the warmth from the board coming about high temp water and improved electrical

power. The proficiency of PV board is relying upon the board temperature.



Fig. 4- Experimental Setup [9]

As temperature of board builds, its productivity diminishes. Fig. 5 demonstrates the subtleties of setup. Figure demonstrates the test setup made out of a 230 W mono-crystalline sort PV module joined with a sun oriented warm gatherer. The cooling board is joined to the back side of the module and furnished with bay/outlet association for the water stream. The cooling water is put away in a protected tank associated with the PV/T framework through PVC (Polyvinyl Chloride) channels. A water siphon of 0.5 hp is utilized to circle the water through the gatherer. The greatest passable weight limit for water stream in the cooling board is 6 psi. A detour framework which controls the weight by siphoning the water back to the capacity tank, with the assistance of weight check and valve game plan, has been added to guarantee it doesn't surpass as far as possible. To direct the water stream inside the cooling board, a stream meter with greatest stream rate of 3.6 L/min is utilized. The cooling water courses through the authority, catches the waste warmth from the PV module and produce high temp water which is gathered at the gatherer outlet. Result appears, because of cooling strategy, the temperature of the module lessens by 20% and electrical effectiveness is increment about by 9%.

Moharram.et.al.[11] performed probe photovoltaic boards, with a non-pressurized cooling framework dependent on showering of water sometimes on the PV panels. There searcher points cooling the PV boards with least measure of water and vitality. The time required to cool the PV boards by water showering to its working temperature had been determined systematically by A scientific model

of warming and cooling. Approve the consequence of impact the impact of cooling on the execution of PV boards by performing test. The cooling rate for the sun oriented cells is 20C/min dependent on the concerned working conditions, which implies that the cooling framework will be worked each time for 5 min, so as to diminish the module temperature by 100C. The aftereffect of the cooling rate are closer to the exploratory estimations The PV boards yields the most elevated yield vitality if cooling of the boards begins when the temperature of the PV boards achieves the greatest reasonable temperature 450C. The creator presumed that; it is conceivable to cool and clean the PV boards utilizing the proposed cooling framework in hot and dusty regions..Both the warming rate and the cooling rate models have been validated tentatively.

Kaiser.et.al. [12] has performed exploratory on cooling BIPV modules by constrained convection in air channel. The cell temperature influences the effectiveness of photovoltaic frameworks. An outside channel underneath the board is financially savvy strategy to manage the temperature of housetop coordinated photovoltaic boards. The ability of ventilating this channel impacts by the cell temperature of these PV modules. Creator portrays a test setup to ponder the impact of the air hole estimate and the constrained ventilation on the cell temperature of a BIPV design, for various estimations of the occurrence sunlight based radiation, surrounding temperatures, and angle proportions, just as for a few constrained ventilation conditions. Semi observational connections for the Ross coefficient, module temperature, electrical productivity, and power yield are proposed, are closer to trial estimations. A basic channel perspective proportion near 0.11 can be considered to limit overheating of PV gadgets. For a channel speed $V_v = 6$ m/s, a power yield increment of 19% is seen over the normal ventilation case ($V_v = 0.5$ m/s).

Kim.et.al. [13] has done the experimentation of a photovoltaic-warm air collector. A photovoltaic-warm (PVT) authority is a sun oriented gatherer that

mix of a photovoltaic (PV) module with a sun powered warm gatherer, creating power and warmth in the meantime. The mix of PV modules with thermals authorities could cause higher temperatures in the PV module, and this declines the effectiveness of PVT gatherers. Depending on the medium utilized for gathering warm vitality, there are two kinds of PVT authorities: air-based and water-based. So as to have better execution of air-based PVT gatherers, it is important to separate the warmth, as hot or warm air, from the PV module and in this manner decline its temperature. The warm air extricated from the PVT gatherer can be used as a warmth hotspot for the structure. In this investigation, an air-based PVT authority with a mono-crystalline PV module was planned, and its electrical and warm execution was dissected with the exploratory outcomes. The outcomes demonstrated that the warm and electrical efficiencies of the PVT authority were, by and large, 22% and about 15%, individually.

Hernández.et.al. [14] has done experimentation for cooling of photovoltaic board by methods for an incited or constrained air stream. Auther portray the electrical conduct of the sun powered boards so as to improve the plan of photovoltaic establishments put in rooftop applications guaranteeing low working temperatures which will right and turn around the impact created on productivity by high temperature. To do this, a test establishment has been built at the Universidad Politécnica de Cartagena in Spain. Auther led tests completed on two indistinguishable sunlight based boards. One of them has been adjusted and mounted on various channels through which wind streams. The directed examinations demonstrate the impacts of the air channel cross-segment, the air speed, and the board temperature on the electrical parameters of the sun based boards, for example, the voltage, flow, power, and execution. Creator reasoned that the air space between the photovoltaic boards and a steel rooftop must be sufficiently high to enable the board to be cooled to accomplish higher effectiveness.

3. CONCLUSION

The examination directed on PV cooling technology is outlined in this paper and further research way is recognized for issues and the prospects in this field. After this writing audit of research papers on cooling arrangement of Solar PV framework. It might be finished up as follows. Passivesystems are as yet practical just for little scale utilization with certain difficulties to survive. PV-PCM or PVT-PCM advances may acquire a noteworthy change passivecoolingsystems. The dynamic cooling systems very much viable in business scale PV board cooling with the inadequacy of the issue of additional power requirement. Active systems would be a moderate arrangement if the warmth vitality is adequately utilized. Further work can be reached out on suitable heat recuperation innovations.

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