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RESEARCH ARTICLE

A Review on Immersion System to increase the efficiency of Solar Panels.

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Abstract

A solar cell converts solar optical energy directly in to electrical energy. The major problem related to the solar cell is their lower efficiency. Typically when the surface of the solar panel increases, the efficiency of the solar panel decreases. Generally, a PV module has ideal conversion efficiency in the range of 15%. The remaining energy is converted into heat and this heat increases operating temperature of PV system which affects the electrical power production of PV modules and this can also cause the structural damage of PV modules, which leads to shorting its life span and lowering conversion efficiency. The cell efficiency can be increased by lowering the solar panel into liquid material, so that the temperature can reduce and the efficiency of the solar panel will increase. Another method of lowering the temperature of the panel can be achieved by passing the air continuously with the help of a blower on the rear side of the panel. So the temperature can be lowered and the air can be heated also, so that we can use it as solar air heater. Cooling is the transfer of energy from a space or from a air to space in order to achieve a lower temperature than that of natural surroundings. Temperature control of solar cells at high concentrations is a key issue. Short-term efficiency drop and long-term degradation should be avoided by effective cooling methods. In this communication, we will review to increase the efficiency of the solar panel with immersion system.

Introduction:-

A solar cell is a device that directly converts the energy from sunlight in to electrical energy through the process of photovoltaic. The first solar cell was built around 1883 by Charles Fritts, who used junctions formed by coating selenium with an extremely thin layer of gold. but cell efficiencies remained around 1%until the 1950s when U. S. researchers were essentially given a blank check to develop a means of generating electricity onboard space vehicles. Bell Laboratories quickly achieved 11% efficiency, and in 1958, the Vanguard satellite employed the first practical photovoltaic generator producing a modest one watt. As the world is facing the problem of energy deficit, global warming and detoriation of environment and energy sources, there is need for an alternative energy resource for power generation other than use of fossil fuels, water and wind. Solar energy is one of the comparable candidates for alternate energy source. Solar energy is a very inexhaustible source of energy. The power from the sun intercepted by the earth is approximately 1.8×1011MW which is larger than the present consumption rate on the earth of all commercial energy sources.

M Mohamed Musthafa et al discuss about the cooling of solar panel back side using water as the coolant. The results indicated that under cooling condition, the temperature can be reduced to effectively increase the photoelectric conversion efficiency of solar panel. Naresh Kumar Malik et al suggested about an Effective implementation of photovoltaics, focusing on semiconductor properties and overall photovoltaic system configuration. Photovoltaic advancements in the fields of thin film and nano crystalline materials continue to flourish and soon increase PV

efficiency to over 50%.As efficiency increases, PV technology attracts a greater number of people, resulting in reduced cost. The basic working principle of the solar panel is shown in the figure1.

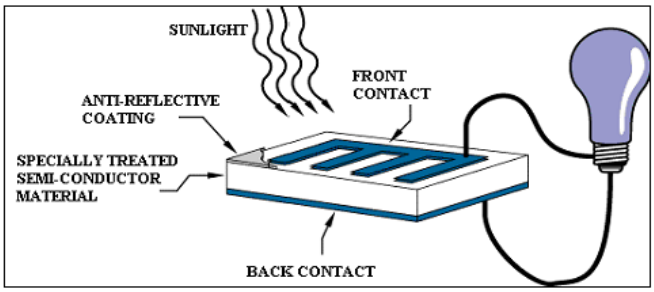

Figure: 1 Basic component that make-up a PV cell [2].

P G Nikhil et al analyzed the performance of a 7W amorphous silicon photovoltaic module, with a quantity of silicone oil spread over its surface. The experimental results suggested a way to improve the performance of the module by cooling of the solar modules by silicone oil. Li Zhu et all studied about a DI water immersion cooling method which was applied to a dish high concentration PV system to keep a submerged cell module at a low working temperature. The pump for circulating the DI water is the model TE-4-MD-HC 582604 and is a totally enclosed and thermally protected type. Mahesh Khatiwada et al found that the Photovoltaic cell converts only about 15% of the solar energy falling into the useful electricity, rest is wasted as heat. The solar panel is cooled by passing air with the help of blower. He concluded that the power output and the electrical efficiency of the panel increase on cooling the panel. Sayran A. Abdulgafar et all discus to optimize the efficiency of a solar panel by submerged it in distillated water at different depths. The repeal of thermal drift increases the solar panel efficiency by about 11% at water depth 6 cm. Yipping wang et al carried out the experiment with three different dielectric liquid, silicon oil[1] glycerol[2] ethanol[3] and found that the solar panel immersed in dielectric liquid had an increased operating efficiency. It was also observed that the absorption band almost the same but the silicon oil was turned yellow due to it's impurity after UV exposure while it remain colorless after the heat test. Jacob Buehn et al discuss to solve the problem of SAAR student design team which was in the process of developing an affordable refrigerator that is capable of operating on solar energy and alternative fuels such as small camp fires. The SAAR primarily charged utilizing the sun or other low-grade heat sources to drive the Ammonia Absorption Refrigeration Cycle.

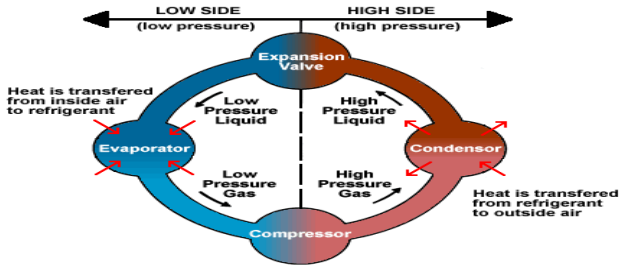

Figure: 2 Four State Cycle

Nasruddin et all discuss the simulation of a two-bed silica gel-water adsorption chiller, utilizing solar energy based on climate of Indonesia. The adsorption chiller is being calculated numerically using MATLAB. the simulation results showed that during the maximum value of irradiation, the average value of COP could reach 0.26, while during the minimum value of irradiation the COP was found to be 0.15. At the same time, the cooling capacity is also varied which can reach up to the maximum value of 37.8 kW, whereas the minimum range of irradiation values was 5.3 kW. Y Dutil et al reviewed on the state-of-the-art and potential of solar-assisted cooling and air conditioning technologies. They concluded that This technology needed moderate driving temperature (55-90^{0}C), which can be achieved by flat plate collector. Shuang-Ying Wu et al worked in order to solve the non-uniform cooling of solar PV cells and control the operating temperature of solar PV cells. Results showed that the overall thermal, electrical and energy efficiencies of the heat pipe PV/T hybrid system corresponding to 63.65%, 8.45% and 10.26%, respectively can be achieved. Thomas E et al found that The solar array string simulator design is comprised of ninety strings of power MOSFETs driven by an external power supply. The anomaly appeared during testing within the simulator operating range of 120 to 100 volts on the I-V curve. Igor Balen et al recommended to develop and design the sustainable energy system that is using solar panel for the supply air-conditioning during the whole year for maritime climate. Solar panels are used for heating of water during daytime and also for cooling of water by means.

The results were obtained for the small cooling/heating system with a total aperture area of 6 m^2 and volume of tanks of 300 l, for both circulation loops. Brian P. Dougherty et all discuss about an overview of the technology, describes the installation, and summarizes the performance of the system. he found that the photovoltaic system eliminates the durability and reliability issues associated with solar thermal hot water systems without requiring an inverter or battery storage system. This final change not only saved water and associated sewage disposal costs, but also resulted in the solar system providing 60% of the energy consumed for water heating. M. Ozgoren et al tested with two different solar panel , he found that without active water cooling, the temperature of the PV module was higher during day time and solar cells could only achieve around 8% conversion efficiency. On the other hand, when the PV module was operated with active water cooling condition, the temperature dropped significantly, leading to an increase in the efficiency of solar cells as much as 13.6%. A. Benuel Sathish Raj et al discuss about the concentrated photovoltaic system that helps in focusing the direct solar radiation on the photovoltaic module. It has been found that the electrical output of the water cooled CPV was 4.7 to 5.2 times more than the PV module. The cooling system had an heat pipe filled with Acetone. It had been observed that the output from the CPV with cooling system was much more than that from the fixed PV module.

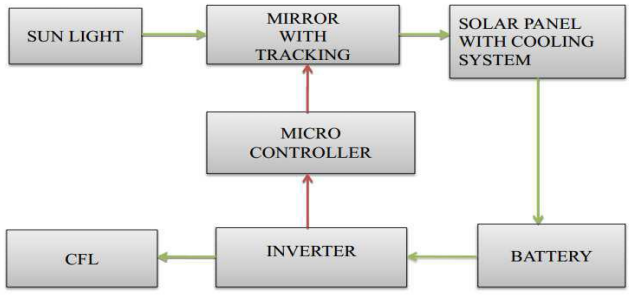

Fig-3-Basic representation of solar panel

S.Kanimozhi at al emphasised the characterization of solar cell into high intense solar light without using another cooling system than simple classical remove of heat from the back of the cell. The remote controlled robot was able to complete its mission in protecting the solar cells and in raising the I-V characteristics of 4 different solar cells and in more than 400 different experiments. Sakhare A.R. et al revealed the responses of the heated water in solar collector. He found that heated water goes to heat exchanger where refrigerant is present. In Heat exchanger refrigerant vaporizes by absorbing heat from water, then vapor refrigerant goes to condenser where it is cooled and gets converted to liquid referent which is at high pressure, this liquid referent goes to evaporator passing through expansion valve where pressure is reduced and in evaporator we get refrigeration effect.

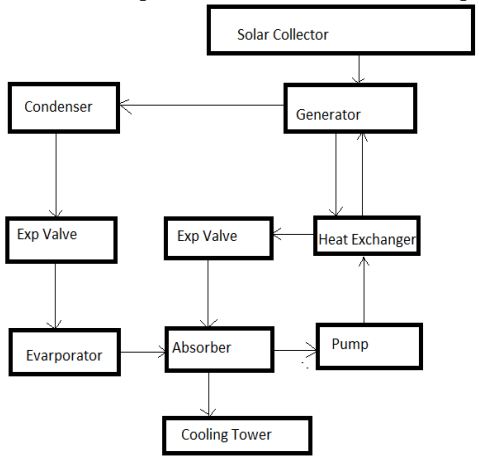

Fig-4- Schematic diagram of the absorption Cycle

Thomas Penick et al made a report on photovoltaic power generation. The report covers concentrating collectors, flat-plate collectors, thin-film technology, and building-integrated systems. they found that the Photovoltaic efficiency and manufacturing costs have not reached the point that photovoltaic power generation can replace conventional coal-, gas-, and nuclear-powered generating facility. Michel Y. Haller et al derived the general mathematical relationship for determining whether using heat from solar collectors for the evaporator of the heat

pump instead of using it directly is beneficial for the energetic performance of these systems. He concluded that this option has a higher potential for improving the overall system's energetic performance for systems with high temperatures on the demand side and low temperatures on the side of the heat source and the ambient air. Ankit S. Gujrathi et al investigated the potential of convex lens, to be used for water heating application. They emphasized the role of convex lens CSP prototype in design and manufactured using six convex lenses of dia. 10 cms each. They concluded that the low boiling fluids have good thermal properties and can be used with these types of panels as they can have good heat transfer properties and can increase the heating effect.

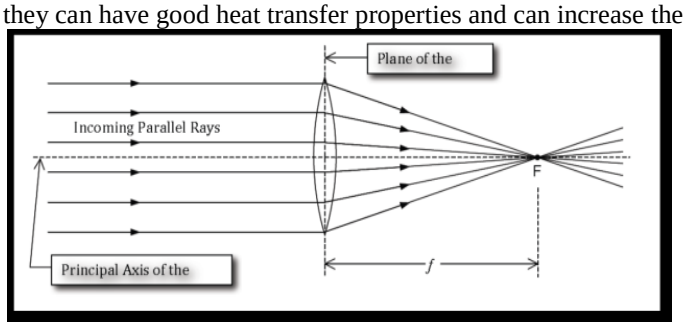

Figure-5-Concentration of incident rays by convex lens

V. Vakiloroaya et all discuss about The developing a hybrid solar-assisted air conditioner system for performance enhancement and energy efficiency improvement. They have investigated the performance of a fully-developed, solar-assisted, split system air-conditioner of 6 kW cooling capacity. Thus, the new design is promising for improving the system performance while fulfilling the cooling demands as well as achieving high energy efficiency. G. Lychnos et al investigated the feasibility of a MgCl2 liquid desiccant system for greenhouse cooling, They have tested two components of the system in the laboratory using MgCl2 desiccant. They observed good agreement between the experimental and predicted values of the mass flow rate of water evaporation/absorption, with errors of less than 7% and 13% for the regenerator and desiccators respectively. Kibong Han et al they recommended a simple method to resolve the mismatch of the external load resistance to the internal resistance which is mainly caused by fluctuations of the internal resistance of the solar cell by temperature changes. In this study they showed the difference of resistance between the external load resistance and internal resistance of the solar cell. ch srısaılam et al worked on improving the solar energy by using mirror reflection. They found that by using solar tracking the generation of solar energy is less as compared to the mirror reflection. The optical analysis and experimental current and voltage data both showed that the mirror system has higher power output as compared to without mirror system. S. C. Kaushik et al discuss the state of art of adsorbent materials, solar collection aspects of technically and economically viable solar adsorption cooling systems for Indian conditions. He concluded that carbon-methanol is suitable working pair of solar energy because of its high COP and low freezing point & no corrosion problem. N. B. Geetha et al they reviewed various possible methods of passive cooling for buildings and discuss the representative applications of each method. Passive cooling techniques are closely linked to the thermal comfort of the occupants, and it is possible to achieve this comfort by using the heat gains, thermal moderation and removing the internal heat. R.Z wang et al studied about the solid sorption refrigeration prototypes and the prototype presented was designed to use waste heat or solar energy as the main heat sources. They showed that solar ice makers prototypes have a daily ice production between 4 to 7 kg per m^2 of solar collector, with a solar cop between 0.10 and 0.15. K.A. Moharram et al the objective of this research was to minimize the amount of water and electrical energy needed for cooling of the solar panels, especially in hot arid regions. It was concluded that, it is possible to cool and clean the PV panels using the proposed cooling system in hot and dusty regions. L. Dorobanţu et al discuss the electrical performance and reliability of flat type photovoltaic modules that is severely affected by elevated cell operating temperature due to elevated ambient temperatures. They concluded that free flow front water cooling of PV panels improves the efficiency and reliability of photovoltaic energy conversion. D. Zhou et all discuss that the works done on latent thermal energy storage in building applications, covering PCMs, the impregnation methods, current building applications and their thermal performance analyses. They concluded that the PCMs to be used in buildings need to meet thermal comfort criteria, meaning the phase change temperature of PCMs should be between 18℃ to 30 It is also useful for off-peak thermal storage, ventilation and cooling. R. Hussein et al observed that the Reflection of the sun's irradiance from the panel typically reduces the electrical yield of PV modules by 8-15%. In the combined system tested in this work, applying a film of water for cooling photovoltaic panel resulted in decreasing the temperature and reflection loss of the PV panel which increased electrical efficiency of the combined system. Bhaskar B Gardas et al designed a system for cooling the solar cell in order to increase its electrical efficiency and

also to extract the heat energy. Simulation model for single pass, single duct solar collector with fins was prepared and performance curves were obtained. Performance with seven different gases analyzed. Hydrogen was found to be the most suitable option. J.Pacio et al did comparison between two candidate liquid metals namely sodium and lead-bismuth eutectic are proposed as efficient HTFs. State-of-the-art central-receiver plants use molten nitrate salts as both heat transfer fluid and storage medium. It was proved that liquid metals are much more suitable for the cooling of surfaces with high thermal loads. Xiao Tang et al discuss about the novel micro heat pipe array was used in solar panel cooling. The maximum difference of the photoelectric conversion efficiency is 3%, the temperature reduces maximally by 8℃, the output power increases maximally by 13.9% for the solar panel with heat pipe using water-cooling when the daily radiation value is 21.9 MJ. Prof. Vivek R. Gandhewar et all discuss about the discovery of semiconductors the co-efficient of performance of the TEC that was drastically improved, since materials could be used with low temperature conduction co-efficient but by doping it, the semiconductor could be made to conduct, exert electrical conduction properties in metal. Furthermore, the solar thermoelectric cooling and heating system avoids any unnecessary electrical hazards and proves to be environment friendly. Ashwin Date et all suggested that the efficiency of the solar panels can be improved by maintaining their operating temperatures as low as possible. Because of the inherent low efficiency of the panels, use of an active cooling system such as forced air and water-cooling is not a sustainable option. Rmıt. Matthıeu Maerten et al studied to investigate how much electricity can be spared for a family house cooling system with such a design. Simulations are made using a modelling tool to determine the cooling loads and the cooling system behaviour for solar panels. Musa, Mu'azu et al experimentally investigated the evaporative cooling using porous ceramic evaporators. He encouraged the results in terms of temperature reduction and cooling effectiveness. The warm inlet air cooled in the porous ceramics evaporative cooling chamber which was passed over hot films of the thermo electric cooling device to act as a better heat sink. Rupali Nazar-et all discuss about various methods for efficiency improvement of solar panel. Anti-reflecting coating for solar panels other method solar cooling techniques, which could improve efficiency of panel. they aimed to increase the efficiency and power output of the solar panel. H. Cotal et all discuss the heat transfer model from finite difference techniques to predict the temperature from various parts of a concentrator cell assembly. They found that the solar cell temperature in the CCA without conformal coating is 32^0c when illuminated at 50 W/cm^2 with the CCA back surface temperature at 25 ^{0}C. When the CCA is bonded to a surface with thin bond line of a silicone-based thermal adhesive of 2 W/m K under the same intensity and back surface temperature, the cell rises to 37.3^{0C}. Ndinechi M. C et al laid emphasis on the energy problem of Nigeria. In this they explored the introduction of passive solar cooling, photovoltaic lighting and energy saving lighting bulbs in houses costing over twenty million naira as a national housing policy. They concluded that the use of energy saving devices, other than for lighting alone will positively enhance our projection of sufficient, affordable and reliable energy in the nearest future. Amr Sayed Hassan Abdallah et all discuss about an integration of direct evaporative cooling tower with a solar chimney multi-zone thermal ventilation model. The results show that the system generates 130.5 m3/h under the effect of solar radiation only and minimum 2 ACH without pressure coefficient which is considered the minimum requirement of ACH this helps to achieve comfort during the hottest days of the summer season. Leah C. Kelley et all discus about thermal management system to improve the performance of a small-scale PVRO. This thesis presents a method of increasing the total water production of a photovoltaic powered reverse osmosis desalination unit by exploiting the complementary thermal characteristics of the solar panel and reverse osmosis unit. Paul BYRNE et all reviewed the latest research works on systems able to carry out cooling and/or desalination using solar energy. Finally they devised Two techniques that were identified as the simplest to be implemented. a membrane distillation unit coupled to the condenser of a heat pump and an ice slurry process. Pauline Gravoille et all addresses thermal comfort applications with use of active free cooling through implementation of latent heat based TES. they shows that the choice of the phase change temperature results from a trade-off between the cooling needs that can be covered during the discharging cold periods, and the need for the PCM to be charged in cold. Neelesh Dutt Pandey et all discuss about Solar air conditioning that plays an increasing role in zero-energy and energy-plus buildings design. Photovoltaic's can provide the power for any type of electrically powered cooling which can be either conventional compressor-based or absorption-based, though the most common implementation is with compressors. V.Jose Ananth Vino et all discuss about the solar panel is put in air cooling in a position of one upon the other with a surface gap for heat holding for winter for cutting the pre heating. Tests on module degradation are performed using real-time and accelerated exposures. Saurav Dubey et al presented the recent Scenario of Solar Energy and its Application in Cooling System. Solar Refrigeration Technology in which solar collector based thermally driven cycles and photovoltaic based electrical cooling systems used, were found to be an effective way of leveling the growing demand. Manish Garg et all discussed about solar heating and cooling system. This technology aimed to receive the thermal energy from sun and utilize this energy to provide hot water, space heating and pool heating for residential, commercial and industrial applications. They discussed the methods and

components of active solar heating and passive solar heating system. N. Beithou et al discuss about the heating and cooling related problems of high power consumed buildings in Jordan. Various readings are got at various interval of time. These buildings consume an estimated 30% of the country's total energy they found that the 95% of the heating required for the living room in winter can be recovered from the sun directly by using the proposed techniques. J.K. Tonui et al observed that the photovoltaic cells suffer from efficiency drop due to unbalanced moisture and temperature fluctuation for long interval of time. Therefore suspended thin flat metallic sheet at the middle or fins at the back wall of an air duct as heat transfer augmentations in an air-cooled photovoltaic/thermal solar collector was implemented to improve its overall performance. Jeffrey R. S. Brownson et al delivered wide description about the energy balance model of a Green Roof Integrated Photovoltaic system created and analyzed these in a transient system simulation, using a FORTRAN code base in the TRNSYS energy system simulation tool. Geographic regions defined by NOAA resulted in a small efficiency gain (0.08-0.55%) in terms of power output. K. Sumathy et al discuss about a new concept of efficient ice maker powered by solar energy. They found that by introducing such method using the newly developed ACF, the total efficiency of the system can be increased by about 30 %. Christopher W. Sinton et al discuss about the synthesis of solar photovoltaic power and solar water pump. They compared it to other watering system. Total dynamic head pump size and PV array passive trackers and charged controllers were measured. Numerious water pipe size chart and graphical comparison were made out. Ms. Anchali Patankar et al suggested about the efficiency improvement of photovoltaic panel using thermoelectric cooling system. It improves the power capacity of the photovoltaic by 2% - 20% and enhances the power generation efficiency of photovoltaic by 2.29% -3.37% through the combined application of photovoltaic and thermal technologies. Phil Gauthier et al laid emphasis on designing solar panel to increase its reliability. The first design was shape manipulation, in which a normal photovoltaic array would be changed from a flat panel to either a cylindrical, parabolic, or spherical light-capture device. Secondly, use a home water heating system in conjunction with the solar cells in order to control temperature fluctuation within the solar array, thus optimizing efficiency. R. Rajaram et al used the phase change material to maintain the temperature of panel close to the ambient temperature. The results indicated that, there were increase of production of power by 7.92%, Increase in performance of the solar panel by 5.02% and reduction in temperature during continuous operation of the solar panel by 4°C.A. Ababneh et al made an assessment to evaluate the effectiveness of the cooling that result from a double-effect reversed-flow lithium bromide absorption cycle driven by a combination of solar energy and a fuel-fired boiler. The results have indicated good potential of energy saving at least 45% when only 15% of the roof area is allocated to solar panels. Soteris A. Kalogirou et al made a survey on various types of solar thermal collector such as flat-plate, compound parabolic, evacuated tube, parabolic trough, Fresnel lens, parabolic dish and heliostat field collectors, optical, thermal and thermodynamic analysis and description of the methods used to evaluate their performance. Leonardo Micheli et al used micro and nano technologies which are applicable to passive CPV cooling and associated manufacturing technologies .Carbon nano-tubes and high-conductive coating showed best cooling performance. Diamond layer fabrication has been discussed, Micro-heat pipes and micro-fins can also be considered as proper solutions for passive CPV cooling. Hall James and Hall Jeffrey et all analyzed that the thin film modules embedded in solar panel perform better than the crystalline modules in high temperature zones. The estimated capacity factor that varies from 16 to 20% in various parts of the country. It was observed that quality modules are very important in determining the extent of degradation. Lip Pong TAN et all discuss that Currently, active cooling methods such as using water circulating devices are applied to control the elevated cell temperature. However power parasite and risks of mechanical failure are always associated with these cooling devices. It was observed that the finless slab had the highest base temperature compared with the other PCM slab configurations. M.M. Morad et all discuss about the thermal analysis for double slope solar still, that was carried out based on internal and external heat transfer and energy balance equations to predict its performance passive and active solar stills were installed to use solar desalination technology for producing freshwater. The experimental results revealed that active solar still maximizes both fresh water productivity as well as internal thermal efficiency compared with passive solar still under conditions of 1 cm basin brine depth and 3 mm glass cover thickness and by applying flash tactic cover cooling with 5 min on and 5 min off. K.Srithar et al discuss about a stand-alone triple basin solar desalination system that was experimentally tested. The results of the test reveal that, TBSS with charcoal and TBSS with river sand enhance the distillate by 34.2 and 25.6% higher than conventional TBSS distillates. TBSS with cover cooling reduces the glass temperature to about 8^0C compared to the conventional TBSS. Fabio Armanasco et al described that summer air conditioning represents a growing market in buildings worldwide with a significant growth rate observed in European commercial and residential buildings. Experimental tests run during summer showed average primary energy ratio and primary energy saving index of about 1.6 and 30%, respectively. Therefore optimization of the solar system design could lead to higher performance. Carolina Mira-Hernández et al discuss about a cycle-integrated energy storage strategy for vapor-compression refrigeration which is proposed wherein thermo-

mechanical energy is stored as compressed liquid. Energy is retrieved through expansion of the compressed liquid, which allows for a tunable evaporator temperature. Practical feasibility of the proposed storage strategy calls for the development of nontoxic refrigerant–adsorbent pairs with more favorable adsorption behavior. Bourhan Tashtoushe et al discuss on the simulation program which is developed on the TRNSYS-EES software. This was used to design the solar collector subsystem components and to evaluate the performance of the solar ejector cooling system with R134a as a refrigerant. The system performance was computed in the form of desired outlet temperature to run 7 kW cooling cycle. Mehdi Zeyghami et al investigated the utilization of daytime radiative cooling to enhance the performance of air-cooled concentrating solar thermal power plants. The efficiency improvement of the air-cooled advanced supercritical carbon dioxide power cycles coupled with a radiative cooler at hot source temperature equal to 800^{o}C, the required radiative cooler area was found to be 10.46 m^2/k and respective performance improvement was observed equal to 4.9%. Qi Ronghui et al discuss about the system control parameters for buildings in different climates with a multi parameter optimization based on the Multi-Population Genetic Algorithm to obtain optimal system performance in terms of relatively maximum electricity saving rate with a minimum cost payback period. Applying the optimization, humid cities could achieve an electricity saving of more than 40% with a six-year payback period. Annamaria Buonomano et al discuss about an experimental and numerical analyses of a novel high-temperature solar cooling system based on innovative flat-plate evacuated solar thermal collectors. it aimed to prove the technical and economic feasibility of the system also presenting a comparison with a conventional technology based on concentrating solar thermal collectors. Experimental results showed that collector peak efficiency was higher than 60%, whereas daily average efficiency was around 40%. G. Evola et al studied about the cooling load due to the solar radiation incident on the glazed surface of a building. In this they have discussed how the Solar Response Factor depends on the optical properties of the envelope, on the size of the windows and on the type of walls delimiting the enclosed space. Mahmut Sami Buker et al discuss the Solar liquid desiccant based on evaporative cooling is proposed as an eco-friendly alternative to the conventional vapour compression systems due to its huge untapped energy savings potential. the recent works on solar assisted, liquid desiccant cooling and its various applications combined with evaporative air-conditioning under different climates were reviewed and advantages the system in terms of energy savings was underscored. ZhongBing Liu et al discuss about the solar thermoelectric cooling technologies and proposed a technical route of solar thermoelectric cooling technologies for use in zero energy buildings. It was seen that solar thermoelectric cooling systems can minimize the energy demands, increase energy effectiveness and reduce fossil energy consumption in buildings. Lijun Yuan et al discuss about the Solar Enhancement by Natural Draft Dry Cooling Tower to enhance the cooling performance. The numerical simulation results revealed that the heat transfer rate is proportional to collector diameter, but is inversely proportional to the ambient temperature. James Muye et al proposed that the cooling cycle can be driven by low grade solar heat to service power and cooling demands in buildings. The yearly efficiency of the scroll expander founded out between 59% and 63%, whereas the annual system efficiency varied in the range of 6–8%, while the annual solar contribution changed between 23% and 30% depending on the location of the system and evaporator temperature. D. Karamanis et al analysed the low-cost sepiolite, fibrous and white phyllosilicate clay of high moisture sorption ability was studied for the evaporative cooling of its surface in comparison to concrete. it was experimentally proved that TiO_2 nanoparticles can be incorporated in the sepiolite structure without losing its water vapour sorption and photo catalytic properties. M. A. Farahat et al investigated the effect of the actual cell temperature on the performance of a photovoltaic cell . It was found that terminal voltage of the photovoltaic decreases as the temperature of the cells increases. They concluded that Combination between the solar photovoltaic and thermal collector by cooling in pipe under the cells is very efficient because of the increase of electrical power due to cooling and also the fraction of heated water. Pei Song et al investigated the cooperative quantum cutting mechanism in a spectral converter of Tm3þ=Yb3þco doped tellurite glass by setting up and solving the theoretical model of rate equations and power propagation equations. These results showed that the use of a spectral converter yields better single-crystalline silicon solar-cell performance compared with the normalized solar irradiation. S. C. Gau et al discuss about the various testing and analysis on Light induced degradation, quantum efficiencies, thickness uniformity. The results of the characterization and analyses are used to optimize parameters of the process and improve efficiencies of the devices. Pei Song et al discuss about the frame work for investigating and optimizing Ce3þ-Tb3þ=Yb3þ tripled doped solar spectral down and converting layer was provided. For the optimized Ce3þ, Tb 3þ, and Yb3þ concentrations and the thickness of doping layer, the total power conversion efficiency of 17.6% and quantum conversion efficiency of 18.7% have been theoretically obtained. Urmita Sikder et al discuss about the influences of the intermediate band fling the absorption coefficient constants, and the IB position on the efficiency of a quantum dot intermediate band solar cell was investigated considering the spatial variation of sub band gap generation rates. When the condition of φL = φH was achieved, through selection of the optimal value of ECI, a structure with ideal values off =0.5 and r=1 found to yield the maximum efficiency. Vidya Ganapati et al discuss

about the geometrical optics which achieved a maximum $4n^2$ absorption enhancement factor by randomly texturing the surface of the solar cell, where n is the material refractive index. For high-index thin films in the weakly absorbing limit our optimized surface textures yield an angle- and frequency-averaged enhancement factor of 39. They perform roughly 30% better than randomly textured structures. Yosuke Kawamoto et al discuss about the structural design of photonic crystals which helps to enhance the optical absorption of thin-film microcrystalline silicon solar cells using two methods. First, by exhaustive search, they choose a structure with the largest absorption within the investigated patterns. Then they employ a sensitivity analysis to finely modulate the structure for further increase of the optical absorption. Jonathan D. Major et al suggested that the $CdCl_2$ treatment is a key step in CdTe solar cell fabrication. In this paper they reported on the development of a NH_4Cl replacement to the $CdCl_2$ process which is a low-cost non carcinogenic alternative. Further process optimization led to device efficiencies of up to 11.5%, achieved using this new process, with VOC values of up to 832 mV, which is relatively high. Mohammad mehdi Seyed mahmoudian et al analysed about the photovoltaic power generation and found that partial shading is an unavoidable complication that significantly reduces the efficiency of the overall system. It aimed to employ a hybrid evolutionary algorithm called the DEPSO technique, a combination of the differential evolutionary algorithm and particle swarm optimization to detect the maximum power point under partial shading conditions. Stanko Tomi´c et al discuss about the Semiconductor quantum dots that is the subject of intensive research worldwide due to a number of novel properties, which make them of interest for both fundamental science and technological applications. The efficiency of multi exciton generation in colloidal QDs is determined by the competition between MEG and other hot electron-cooling processes. D. Karamanis et al discuss about The water vapor adsorption properties of raw and hydrothermally treated fly ashes with NAOH. The results indicate that the zeolitic materials prepared from the fly ash samples have a significant potential for solar cooling applications. B. Zamora et al discuss about the one cost effective method to regulate the temperature of rooftop integrated photovoltaic panels to provide an open air channel beneath the panel. This paper describes an experimental setup to study the influence of the air gap size and the forced ventilation on the cell temperature of BIPV configuration, for different values of the incident solar radiation, ambient temperatures, and aspect ratios, as well as for several forced ventilation conditions. Dilip Jain et al presented the Thermal models for the typical methods of passive cooling of roof in the arid region of Rajasthan. The periodic analysis was done for hourly variation in bare metallic roof, insulation beneath the roof, wetted roof and roof pond with movable insulation for the typical day of summer. They found that coefficient of correlation between predicted and experimental data ranged from 0.94 to 0.98 and standard error 1.76 to 2.80. They concluded that water depth of roof pond with movable insulation is appropriate for less requirement of water and for better comfort condition in arid region. N. Ben Ezzine et al discuss about the investigation of an air-cooled diffusion absorption machine operating with a binary light hydrocarbon mixture as working fluids and helium as pressure equalizing inert gas. The experimental results showed that the absorber is very sensitive to the heat power inputs to the bubble pump. Harish Deshmukh et al proposed the design of a new solar operated adsorption cooling system with two identical small and one large absorber beds, which is capable of producing cold continuously. They concluded that by using Bed-1 (173 kg), continuous cooling of about 0.82 kW can be obtained during night time and by using Bed2/3 (15 kg) for one hour adsorption/desorption period continuous cooling of same capacity can be obtained during day time. Gang Tan et all discuss about the non-vapour compression PCM integrated thermoelectric cooling system proposed for buildings. The experimental tests have demonstrated that the average COP increased by 56% (from 0.5 to 0.78) for the lab-scale thermoelectric cooling system due to integration with PCM. Sendhil Kumar Natarajan et all did the numerical study of solar cell temperature for concentrating PV with concentration ratio of 10X. The result showed that maximum of four numbers of uniform fins of 5 mm height and 1 mm thickness can be effectively used to reduce the solar cell temperature. Xiao Xue et al discuss about the composition and the preparation process of a bi-functional cool white roof coating based on styrene acrylate copolymer and cement that integrates both a good cooling effect and good mechanical properties and water impermeability. It was found that the addition of Altiris 800 greatly increases the NIR reflectance of the coating. Kibong Han et al they recommended a simple method to resolve the mismatch of the external load resistance to the internal resistance which is mainly caused by fluctuations of the internal resistance of the solar cell by temperature changes. Ahmed Elnozahy et al investigated experimentally the performance due to automatic cooling and surface cleaning of Photovoltaic module using thin film of water installed on the roof of a building in hot arid area as compared with that of a module without cooling and cleaning. They found that, the cooled and surface cleaned module has an efficiency of 11.7% against 9% for the module without cooling and cleaning.

Conclusion:-

The temperature of the solar cell has a huge impact on the efficiency of photovoltaic system. With the increase in surface temperature of solar cells or panels their efficiency decreases quite dramatically. The solar system is one of

the most important alternative sources of energy. But the problem is that the PV cell is not 100% consumable. To increase the efficiency of the PV cell we need to find the alternative which will boost the efficiency of the solar panel. Immersion system is one of the best way to increase the efficiency of the pv cell, with this there is a chance of increasing the efficiency up to 20-25%. Cooling of solar cells depends upon five major considerations that are cell temperature, uniformity of temperature, reliability, simplicity and usability of thermal energy. For immersion process there are various alternative source that we have discussed above, Water is one of the best resource and also easily available.

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