

CONCENTRATED PHOTOVOLTAIC CELL AND HYBRID TECHNOLOGY

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Abstract - *Everything is energy. Without this nothing is to be! A major play in the world in day to day life. As the future needs have been increased, the demands also increased. Currently, the intake of electricity has been raised to a steep inside the past few years. Because of this increase in usage we have been undergo with power shutdowns every month and power cuts every day during unique timings. In order to meet the raising demand, and to reduce the impact of conventional sources in the environment, the world now turns its view in the field of renewable sources. With the ecological aspects and the rising demand in the industry as well as the domestic hybrid technology approach is made with a combined mode power with featured efficient. This paper demonstrates a combined mode power with ecological aspects and featured parameters. Evolves with a focus into the solar efficiency with total internal reflection and focus by a specific spot with a fresnel layer. As it is a featured work the complete efficient cooling and storage is made so as the power produced is high and save it almost. Hybrid approach has been made with a cell and combines more sources mode power from a single option. Thus, it dominates the power production and to satisfy the future needs and demands of the power industry.*

1. INTRODUCTION

The survival of the today's world without power is like searching water in the desert. Power industry plays a vital role in day to day life of everything we use. The gradually development in the power industry as now turned into a boom of evolution turning everything as a part of electrical. More and more have enhanced now days in the field and revolution has been done. In the past days, conventional sources of energy played a vital in energy production. Fossil fuels are meant to non-ecological and a harm to environment. At present we are in the end of the conventional era. Due to the rising demand in the current world of the domestic and industrial of the upgraded field the energy consumption is more than the rate required. As the usage increases the demand gradually develops and now short coming and power shut downs and power failure occurs. Due to this short coming the world next turn it view

in the field of non-conventional resources (renewable resources). The vast and ecological mode of power, non-scalable, and widely available resources around us. The most forms of renewable energies are under categorized as

- Solar energy
- Wind energy
- Tidal energy
- Geothermal energy
- Hydro energy

These renewable resources play a vital role in energy production. Renewable resources make a contribution of 28 percentage of the world electric power.

Our project work demonstrates with a solar energy system with featured application parameters. The solar power contributes a large among renewable sources. Due to the overheating of the photovoltaic panels the efficiency of the panel cells gets reduced. And this leads to the less power as an output. We are making a overview with focusing into the efficiency of the panels using solar concentrators (fresnel lenses) to focus in specific spot and panel frame is being developed so that TIR [14](total internal reflection) phenomenon take place. The deviated rays get focused into a single beam of ray such the specific spot being active more so that the cells converts the light energy into electrical energy effectively. Such the heat is focused and panel tracking is designed such that the power output remains same throughout the day. The tracking system is made into bi-directional mode so the efficient capturing the rays throughout the day is done. As the concentration increases the efficiency of the panel evolves, the power output will be rated high power output. Indicator meters have been connected to make sure the voltage and current produced from the system. To maintain the efficiency from decreasing among the thermal losses an efficient cooling system is developed such that the photovoltaic power panel remains efficient. An efficient cooling method is carried out so that the process also meets the demand of the fresh water management meetings water crisis. Completely the cell is being automated using sensors and faults indicators and

have been designed to indicate the faulted part. Hybrid concept is approached within the cell on application of the cooling process of the photovoltaic power panel cells. Thus it evolves as a multi-level combined featured mode power cell with featured application parameter.

2. LITERATURE WORK

Patil Diyvesshakaram [1] et.al describes the most abundant, constant means of ecological source, solar power. The proceedings with a solar power gradually increase at present with a developed application such as natural water heating system with lenses. The lenses (frenzel lens) projected with a definite ray of sunlight concentrated into a copper sheet with a natural heating system. Tracking has been designed in order to increase the efficient heating through the day. Thus, it enhances an efficient and ecological way of heating system application.

Katie shanks [2] et.al envelopes a conjugate homogenizer with refractive, reflective properties. The process evolves under total internal reflection which is purely (refractive in inside and reflective at the outside). It captures the light that have been scattered and tested with a withstandng temperature of 60 degree celsius and greater than 100 degree celsius continues to the deforming state. A maximum reach of 223.6 degree celsius have been reached and finally evolves into the properties of total internal refelction(TIR), a simple and a effective method of concentration to power panel in order to increase the efficiency and to increase the power generation of the panel.

Y. Suresh [3] et.al proposes with an inverter on account with multi-level cascaded property. The power cells are brought in contact of serious mode of connection which takes low voltage configuration on the account of cascaded property the output dominates with high rated output voltage and high rated output current waveforms. As the level of the cascaded application mode increases the direct current (DC) [15]source also gradually increases and carried out with a better performance of the storage system property with a mode of cascaded application. This contributes a better method storage with high rated output.

Zeyad A. Haidar [4] et.al describes the domination of efficiency of the photovoltaic power panel cells. A simple method is carried out and cooling of the system power panel cells is done within it. Evaporation has been carried out as the cooling process to maintain the efficiency of the panel cells. The panels are constructed above storage water tanks and evaporation process takes here to maintain the

temperature of the panel cells. Under this cooling method the temperature of the panel cell has been reduced up to 20-degree celsius and dominates with a evolution efficiency of 14 percentage. a mode with a simple and effective means of maintaining the efficiency if the photovoltaic power panel cells.

Jeng-nangJaung and R. Radharamanan [5] proposes a tracking system of photovoltaic power panel cell with a conversion of converting the direct sources of current to the alternating sources of current. The tracking system have been designed to the photovoltaic power panels in account of concentration to the sunlight all over the day. Safety, reliability and stability are the real time responses of the designed featured photovoltaic panel cells. An additional feature of climate, temperature resistant and fault indicators have been constructed in order to show an indicated signal with light emitting diode (LED). A photovoltaic panel cell with featured application for the future modes.

Lei Jing [6] et.al envelopes the optimization of photovoltaic power cell system with frenzel lenses concentration. A multi-junctional cell response and the direct sunlight are in consideration with the lenses concept aspect. The system gradually joins the enhancement of the energy efficiency of the photovoltaic power panels. The novel type lenses are compared with the conventional lenses. Th evolved efficiency is about 10 percent increased on the noval lenses than the conventional lenses. A simple and a compactness mode of concentration with the evolved efficiency in the power panel cells.

This paper (November 2015) [7] proposes the efficient cooler system under the photovoltaic power panel cells with the account of air-cooled heat sinks. Under operating conditions, the efficiency of the photovoltaic power panel cells is meant to be decreased by thermal losses. This system evolves a air cooled heat sink heat cooled designed under the power cells as it the maintainer and cooler using ANSYS (fluent software for turbent flow). This maintains the temperature of the power panel cells and the gradually develops the efficiency of the panel. Under the cooling system the system is maintained with a minimum thermal loss and developed with better efficiency.

Adeel Saleem [8] et.al describes the most reliable sources, renewable sources with a efficiency concentrator. The efficiency of the photovoltaic power panel cells taking in account the factors shade, irradiances, temperature with a smart storage health monitoring system. This system is developed and mainly focuses into the affecting factors and

designed with a smart storage system built with embedded system and the efficiency to be meant improved. Featured with complete accessible power panel cell and concentrates in the efficiency and the storage capacity.

Firtrahidayanti [9] et.al envelopes the potential of the photovoltaic power cells is not fully utilized. This study improves the efficiency of the system with a fresnel lens concentrator and designed with tracking system. The intensity is been gradually increased and focused into the photovoltaic panel cells and made to concentrated and the efficiency is being increased as side. This lens concentration is widely designed for the intensity focusment into the panel cell for the increment in power production. These two parameters are been designed and enhances with a better efficiency model.

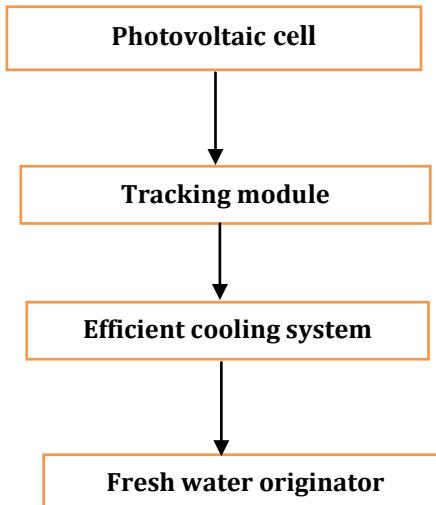
Meheren Gul [10] et.al proposes one of the ecological technologies that has vital enhancement role in the renewable field. Solar system is being vast and scalable, clean and a reliable from of electricity in the future. This paper demonstrates that the R&D (Research and Development) activities in the panel section, funding in the panel research, diving policies, cost analysis, balancing the budget and constructed a modeled panel etc. these analyses will made and listed with the globally installed power panels and the analysis are surveyed.

Shaik mohammedsaiedrubab [11] et.al envelopes temperature is the foremost factor that has been governing the parameter of the photovoltaic panel power cells. As the temperature increments the efficiency of the power panel cell gradually decreases and hence the power production is losses in the form of thermal losses. Here it demonstrates with Various cooling methods have been designed to maintain the efficiency of the power panel cells. Different methods of cooling's have been demonstrated with the photovoltaic power panel cells in order to achieve the efficiency of the power cells

SeyadaliFerhatia [12] et.al presents a Dc microgrid within aameliorated power management system. Here the dc over the ac and a dc microgrid have been demonstrated and combines the two sources with the hybrid management. under different loading conditions the main aim is to provide high quality solar energy with solar irradiance. voltage ripple has been reduced, provides a permanent supplying to the load. This hybrid module composes fuel cell ad solar panels and focuses into the parameters affecting and designed module is developed.

This paper (July 29,2019) [13] proposes a battery composes of a durable and affordable materials. this concept undergoes with power generation were the feeshater and alt water meets. These two sources combine and enhances a wide mode of renewable power termed blue energy.it is known as the 97 percent efficiency form of power generation from salinity gradient.

PROPOSED WORK



Photovoltaic cell concentrator

Initially the work begins with the construction of the photovoltaic panels. Here we proposed with a initially 10 watt solar panels numbered 4 to 5 and brought and fixed with gap of 5 centimeters. All the cells are being cascaded and the output from the cell is connected to a combiner and output of the cell is reached. The photovoltaic panel power cells are cascaded in order for a better efficient combined power. After the construction of the photovoltaic power panel cells the frame work have been developed for the photovoltaic power panel fixation and the concentrator fixations. The frame type is of aluminum as it acts as a corrosion resistant and salt resistant as the entire setup is at coastline areas. Aluminum frames are developed for a specific height for the concentrators of the lenses. Fresnel lens (solar concentrators) is made to be designed at the top of the photovoltaic power panels with a specific height from the concentration. The fresnel lenses focuses the deviated rays into a single ray to spot a specific spot and the light intensity in boosted by the concentrators as it merges the deviated ray in a single ray. The ray spots and photovoltaic power panels and nextly total internal reflection (TIR)[16] process carried out inside the panel power cell as the developed aluminum frames are designed with prism or else mirrors apart. The spotted light after reflection undergoes

TIR phenomenon and hits back again and again. The process is repeated again and again and the efficient of the photovoltaic power panels is maintained. The solar power developed from the cell panels is carried with cascaded storage system is increase the much efficient storage property. As the solar concentrators are being focused on the panel the panels get damage. To prevent the damage of the panel a cooling system is developed and with automated modes maintain the panel as a temperature resistant. Normally the panels can produce a higher efficiency of 26% of its own. While we are designed it with the solar concentrators the efficiency is gradually increased with a rate more than 2 times of the normal rated output. The panel is being coated with a anti reflective agent, salt resistant coating or powdered coatings is done to photovoltaic cells for the proof resistant. Thus the solar concentrators are being a simple and a compact method of the solar efficiency increment and its has been developed and efficiency of the photovoltaic panel power cells have been achieved.

Tracking module

Tracking module the one of the most application parameter we have designed in our photovoltaic power panel cells. Under the panel construction the aluminum tube frames have been developed for the cooling system and under the tube's aluminum sheets is soldered. And below the frame the stepper motor is connected with the Arduino as means for the tracking purpose two modes of tracking have been designed into the photovoltaic panel cell. Ldr is connected and is of dependent of the light tracking of the sun direction. Bi- directional mode is being designed with the track of the path of the solar way. Secondly the tracking is also made as timer version 12 hours mode from east to west and west to east. Two modes of tracking have been developed into the photovoltaic power panels for the better tracking system for the system efficient as much more. The whole day efficient method is made in account so that the efficiency is brought throughout the day efficient. Tracking system is mainly focusing between the hours of (6 to 8 am, 4 to 6 pm) for mild rays and tracking as well as with the lenses focuses to catch the rays almost the efficient to more from normal photovoltaic power panel cells. The tracking with lens mode mainly concentrates in these hours to produce high rated power from the minimum light rays. Hence the tracking system is developed and designed for the power cell for better efficient ways of capturing.

Efficient cooling system

The main concentration of the photovoltaic power panel power cell as the concentration is higher, greater the efficiency. But due to the thermal losses the efficiency of the photovoltaic power panel cells gets decreased. As the efficiency drops the output rated power gets reduced or decreased. Concentrators[23] are much important to make the system better concentration for the power but without a cooling power produced will be losses in the form of the thermal losses. To overcome the defects and losses we can come across an efficient cooling system is designed. Two modes of cooling system are made. The min the coolant we undergo is sea water as coolant. But the coolant makes the system rust and salt blocks while cooling. But we have designed it with the aluminum frames. Aluminum does not react for the rust, salt as well as scales formation. Aluminum tubes are made as a rectangle frame for the flow of water. The aluminum tubes have been coated with a powdered coating inside and outside of the tubes. [21]Copper sheets have been taken and solder at the top of the framed tubes and as well the copper is coated with powder coating for salt resistant. Moreover, the copper is being coated with heat resistant coating for the absorption of the thermal from the panel cell. At the bottom of the tubes unit a small distill unit is designed for emergency purpose of cooling of the photovoltaic panel power cells. Salt water is slightly gets deposited in the tubes. These deposits have been clean and processed during the night time with pressurizer motor. And outlet of the cooling system with hot water and hot steam is being processed into the hybrid approach

Fresh water originator

The cooling system outlet with a hot steam and vapor is collected and compressed. The vapor gets collected and gets compressed with flat slope plate form the conversion of vapor into water. The water that we collected through a transparent tube and filtered once and stored with water collector. The collected water gets transmitted to the nearest unit for the water saving purpose. Water level indicators made been designed inside the storage tank for the transportation.

HARDWARE REQUIREMENTS

Photovoltaic panels

Photovoltaic power cells are one among the cell that converts light energy into electrical energy. A panel is a combination of the photovoltaic cells within it. The panel is a light depend

that absorbs the light from the sun and converts it into the direct current electricity. It is one of the most abundant and eco-friendly ways of producing energy from the sun. The wide range of power that contributes a world of total of 26% of power production. [17] Many modes have been there with a greater efficiency.



Stepper motor

Stepper motor, the one that converts electrical energy into mechanical energy. It is an electromechanical device. The principle phenomenon of the stepper motor is operating magnets around motor shafts turn at a precise angle with an electricity generation. [22] They are the high holding torque motors and used for the tracking purpose of the panel throughout the day.



Fresnel lenses

The solar concentrator is used for concentrating the light rays in a definite spot onto the panel. [18] The fresnel lenses are the lenses with concentric circles that hold and focus the deviated light in a specific definite direction. These concentrators are focused with the specific height from the panel to get full focus on the panel for a better efficiency.



Mirrors

The mirrors are developed around the panel for the [19] TIR (total internal reflection) phenomenon and deviated light are being focused and spotted inside and forth back again and again.

Aluminum tube and frames

The aluminum tube and frames are chosen for as it is salt and rust resistant when compared to other metals. Thus, it's been developed and designed as frame and coated with powder coatings and heat resistant coating make it much more effective.



3. CONCLUSION

Therefore, we have suggested a system to increase the production of power. In this proposed system, we have developed an idea for meeting the current as well as the future demands. In near upcoming days the power through the conventional sources will create a huge demand as the availability comes to an end [20]. The world totally turns its view towards the non-conventional resources. At that time the non-conventional power production sectors should be as much efficient to meet the demand of the world. The individual sources efficiency must be upgraded to improve more for the future view of the demand. Hence, we have proposed a system with a hybrid approach and efficient as much possible for the demand. This method involves hybrid cell technology with a multi-level application as with efficient solar cell, combined mode of power, efficient

storage system, fresh water originator. thus, This future work will improve more than the limits, an efficient method in power production sectors.

REFERENCE

- 1) Patil DivyeshSakharam, Patil Nilesh Ramesh, Patil Bhushan Tukaram, Patil Satish Ramesh "Design And Optimization Of Solar Water Heating System By Using Fresnel Lens With 2-Axis Tracking " (September 2014).
- 2) Katie Shanks, Hasan Baig, N. Premjit Singh, S. Senthilarasu , K.S. Reddy, Tapas K. Mallick "Prototype fabrication and experimental investigation of a conjugate refractive reflective homogeniser in a cassegrain concentrator" (September 2016).
- 3) Y. Suresh, J. Venkataramanaiah, Anup Kumar Panda, C. Dhanamjayulu, P. Venugopal "Investigation on cascade multilevel inverter with symmetric, asymmetric, hybrid and multi-cell configurations" (27 October 2016).
- 4) Zeyad A. Haidara, Jamel Orfib, Zakariya Kaneesamkandib "Experimental investigation of evaporative cooling for enhancing photovoltaic panels efficiency".
- 5) Jeng-Nan Juang and R. Radharamanan "Design of a Solar Tracking System for Renewable Energy" (2014).
- 6) Lei Jing, Hua Liu, Yao Wang, Wenbin Xu, Hongxin Zhang, and Zhenwu Lu "Design and Optimization of Fresnel Lens for High Concentration Photovoltaic System" (30 March 2014).
- 7) Cătălin George Popoviciu, Sebastian ValeriuHudișteanu, Theodor DorinMateescu, Nelu-Cristian Cherecheș "A Efficiency improvement of photovoltaic panels by using air cooled heat sinks" (18-20 November 2015).
- 8) Engr. Adeel Saleem, adeel.saleem, Kashif Mehmood(3) "The Efficiency of Solar PV System" (19-20 December 2016).
- 9) FitriaHidayanti, FitriRahmah, Joel Agusto "Design of Solar Tracker on Solar Panel with Fresnel Concentrator" (2020).
- 10) Mehreen Gul, Yash Kotak and Tariq Muneer "Review on recent trend of solar photovoltaic technology" (2016).
- 11) Shaikh Mohamadsaied Rubab, MulaniSaifali Abbas, Shinde Mayur Balasaheb, Chaure Balaji Mohan "A Review Paper on Improving The Efficiency Of Solar Panel" (Oct -2017).
- 12) Seydali Ferahtia, Ali Djérioui, Samir Zeghlache1, ·Azeddine Houari "A hybrid power system based on fuel cell, photovoltaic source and supercapacitor" (20 April 2020).
- 13) Stanford University "Researchers develop technology to harness energy from mixing of freshwater and seawater" (July 29, 2019).
- 14) P.S. Ramaprabha And H.Ranganathan – "Colour Histogram Based Colposcopy Cervical Image Classification" Will Be Published In Volume 4 : Issue 1 Of International Journal Of Advances In Computer Science And Its Applications – Ijcsia Issn 2250 – 3765
- 15) P.S. Ramaprabha And H.Ranganathan - "Texture Based Analysis And Contour Detection Of Cervical Smear Image"
- 16) - International Journal On Intelligent Electronic Systems, Vol. 5, No.1, January 2011 Pp50-54 Issn 0973-9238
- 17) V.Maheswari , P.Elangovan , M.Baranidharan , S.Deepa, Lavanya Dhanesh,(2019) "Theoretical And Simulation Analysis Of First Generation Dc-Dc Converters", International Journal Of Advanced Science And Technology Vol. 28, No. 19, (2019), Pp. 72-78
- 18) Dr.S.Deepa,Lavanya Dhanesh , P.Elangovan,(2019), "Optimal Fuzzy Controller For Power Quality Improvement Of Dynamic Voltage Restorer Using Bacterial Foraging Algorithm", " International Journal Of Advanced Science And Technology" Vol. 28, No. 19, (2019), Pp. 10-15
- 19) Lavanya Dhanesh, Dr.P.Murugesan (2017) "Smart Scheduling Of The Real-Time Tasks Using The Cyclic Priority Preemptive Pipeline Scheduling Algorithm" In The International Journal Named "Journal Of Computational And Theoretical Nano Science" Issn 1546-1955 Volume 14,Number 3, Pp.1-8.
- 20) Lavanya Dhanesh (2016),"Automatic And Effective Tracking Of Hit & Run Misbehavior Driver With Emergency Ambulance Support" In The International Journal Of Advanced Research In Electrical, Electronics And Instrumentation Engineering, Vol 5, Issue 3 March 2016.
- 21) Deepa S., Rajapandian.S., (2013) "Harmonic Reduction Technique Using Flying Capacitor Based Z Source Inverter For A Dvr", International Journal Of Engineering, Vol26, No.1, Pp 481-490
- 22) Dr.Lavanya Dhanesh , "Iot Based Microgrid Automation For Optimizing Energy Usage And Controllability", International Research Journal Of Engineering And Technology (Irjet), Volume: 07 Issue: 08, Aug 2020, E-Issn: 2395-0056
- 23) C.T.Manikandan,K.P.Nithya,M.Padmarasan, "Coupled Inductor Based Single Stage Boost Three-Phase Inverter",Inernational Journal Of Engineering Trends And Technology,,Vol 22 ,No 9,Pp 416-421,Issn 2231-5381,Apr 2015
- 24) C.T.Manikandan,E.Ashok Kumar, "An Integrated Dynamic Voltage Restorer-Ultra Capacitor Design For Improving Power Quality Of The Distribution Grid", International Journal Of Engineering Science And Computing,Vol 6,No 3,Pp 2639-2643,Issn 2321-3361,Mar-2016