Solar Power Generation by PV Technology

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Abstract -- Solar vitality is the most bounteous stream of vitality. It is accessible specifically as sun based disengagement and in a roundabout way as wind vitality. Sunlight based vitality has the wellsprings of sustainable power source. Its potential is 178 Billion MW, which is around 20,000 times the world's request. Sun conveys vitality as electromagnetic radiation. The change of solar radiation to the electrical power depends on the photovoltaic standards. A sun powered cell is an electronic gadget which specifically changes over daylight into power. The yield proficiency and execution of PV framework are impacted by numerous components, for example, sun powered following framework, sun powered point, shading or incomplete shading, clean and cell working temperature. This paper audit the photovoltaic generation, producing capacity natural angles and its productivity combined with assortment of its application.

Index Terms—Solar vitality, electromagnetic radiation, photovoltaic, proficiency, temperature.

I. INTRODUCTION

Sun oriented vitality is spotless and is inexhaustibly accessible. Sunlight based advancements utilize the sun to give warm, light, power, and so forth for residential and mechanical applications. With the disturbing rate of consumption of the major traditional vitality assets, for example, Coal, Petroleum and Natural gas, combined with the ecological corruption caused by the way toward tackling these vitality sources, it has turned into an earnest need to put resources into sustainable power source assets that would control the future adequately without debasing the earth through greenhouse gas outflow. The vitality capability of the sun is enormous, however in spite of this boundless sun oriented vitality asset, collecting it is a test mostly in light of the constrained effectiveness of the exhibit cells. The best change proficiency of most industrially accessible sun powered cells is in the range 10-20s%.

Today solar energy is used in a couple different manners. First is the photovoltaic conversion format, which most people know as solar panels. These panels are used to create electricity directly from the sun. These boards can be utilized alone or can be utilized as a part of conjunction with other power assets. The second sort of sun powered power that is utilized today is warm sun based power, which is the place the sun is utilized to warm liquids, which at that point Powers turbines or other kind of apparatus.

The efficiency of solar energy exists primarily because it takes advantage of renewable energy – the sun – unlike typical energy solutions which use fossil fuels. The efficiency of solar energy harnesses the energy received from the sun and channels it into existing electrical grids.

Sun powered innovations are extensively portrayed as either inactive or dynamic relying upon the way they catch, change over and disperse daylight. Dynamic sun oriented procedures utilize photovoltaic boards, pumps, and fans to change over daylight into helpful yields. Inactive sun powered procedures incorporate choosing materials with good warm properties, planning spaces that normally flow air, and referencing the situation of a working to the Sun.

II. PHTOVOLTAIC POWER GENERATION

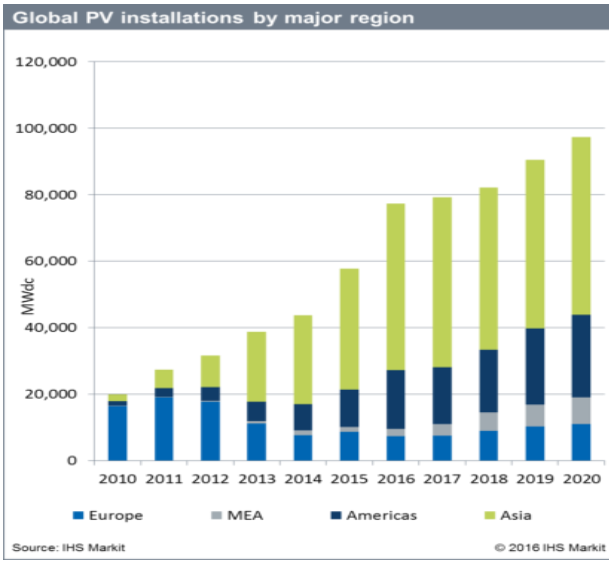
PV is developing as a noteworthy power asset, relentlessly ending up more reasonable and ended up being more dependable than utilities. The photovoltaic impact is the essential chief process by which a PV cell changes over daylight into power. At the point when

light sparkles on a PV cell, it might be reflected, retained, or go directly through. The assimilated light produces power. A sun oriented PV module is regularly arrangement associated adequate number of sunlight based cells to give required standard yield voltage and power.

A photovoltaic sunlight based module is an arrangement of electrically associated sun powered cells. Its motivation is the age of electric current. Sun powered cells can be made from various materials. Generally mono-crystalline or polycrystalline silicon is utilized.

Overall development of photovoltaic has been fitting an exponential bend for over two decades. Amid this timeframe, photovoltaic (PV), otherwise called sun oriented PV, has developed from an unadulterated specialty market of little scale applications towards turning into a standard power source. For 2015, overall arrangement of around 55 GW is being guage, and introduced limit is anticipated to dramatically increase or even triple past 500 GW amongst now and 2020.

India lies in a radiant tropical belt (High segregation). Its aggregate hypothetical accessible potential is every year more than 5000 trillion kWh. Abused potential (creation/introduced limit) is almost no including complete introduced limit (framework and off matrix) of surmised 110MW and that exclusive around 17.82MW (as of Dec 2010) is network associated (as of Jan 2011)



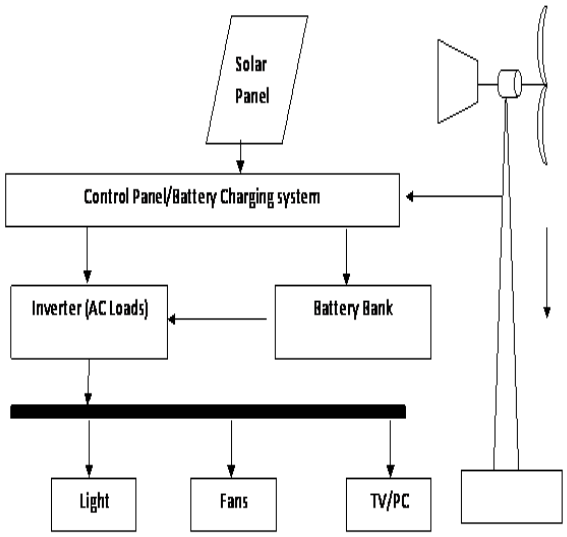
III. HYBRID PHOTOVOLTAIC POWER GENERATION

Hybrid power generation system is a combination of two renewable energy source. The PV sources consolidates with another wellspring of sustainable power source like breeze or some other regular sources turn into a mixture framework. Katti and Khedkar explored the choice help procedure and impacting factors in the plan of an incorporated sun oriented breeze control framework for remain solitary applications for the coordinated PV-hvybrid system in remote site at Suktawa in Hoshangabad region of Madhya Pradesh in India

The mixture sun oriented breeze turbine generator utilize sunlight based boards that gather light and change over it to vitality alongside wind turbines that gather vitality from the breeze. Sun powered breeze composite power inverter contains the expected AC to DC transformer to supply charge to batteries from AC generators. Consequently the power from the sun oriented boards and wind turbine is sifted and put away in the battery bank.

The PV-wind hybrid system returns the lowest unit cost values to maintain the same level of DPSP as compared to standalone solar and wind systems. For all load demands the levelised energy cost for PV-wind hybrid system is always lower than that of standalone solar PV or wind system, while this system has still not achieved market maturity, in future the PV-wind hybrid option is expected to be techno-economically viable for rural electrification.

Hybrid solution are not feasible in non-windy location. Besides, hybrid solar-wind solutions are mainly applied to electricity production.



IV. TYPES OF SOLAR PHTOVOLTAIC CELL

Power is delivered in sunlight based cells which comprise of more layers of semiconductive material. At the point when the sun's beams sparkle downward on the sun based cells, the electromotive power between these layers is being made, which causes the stream of power. The higher the sun oriented radiation force, the more noteworthy the stream of power.

The most widely recognized material for the creation of sun oriented cells is silicon. Silicon is acquired from sand and is a standout amongst the most well-known components in the world's outside layer, so there is no restriction to the accessibility of crude materials. Solar cell manufacturing technologies are:

- Monocrystalline Si cells:
  Change effectiveness for this sort of cells run from 13% to 17%, and can for the most part be said to be in wide business utilize. In great light conditions it is the most effective PV cell. This sort of cell can change over sun powered radiation of 1.000 W/m2 to 140 W of power with the cell surface of 1m2. The generation of mono crystalline Si cell requires a totally unadulterated semiconducting material.

- Multicrystalline Si cells:
  This sort of cell can change over sun based radiation of 1.000 W/m2 to 130 W of power with the cell surface of 1 m2. The creation of these cell is monetarily more effective contrasted with monocrystalline.

- Ribbon silicon:
  It has the advantage in its production process in not needing a wafer cutting (which results in loss of up to 50% of the material in the process of cutting). However, the quality and the possibility of production of this technology will not make it a leader in th e near future. The efficiency of these cells is around 11%.

- Thin-film technology:
  In In this the modules are fabricate by heaping to a great degree thin layers of photosensitive materials on a shoddy substrate, for example, glass, stainless steel or plastic. The way toward creating modules in thin- film innovation has brought about diminished generation costs contrasted with crystalline silicon innovation, which is to some degree more serious. The present value advantage in the generation of thin-film is adjusted with the crystalline silicon because of lower proficiency of the thin-film, which ranges from 5% to 13%. There are four sorts of thin-film modules (contingent upon the dynamic material) that are currently in business utilize:

1. Amorphous silicon (a-Si) :-

Shapeless Si Cells: Cell productivity is around 6%, a cell surface of 1 m2 can change over 1.000 W/m2 of sun oriented radiation to around 50 watts of electric vitality. On the off chance that a thin film of silicon is put on a glass or another substrate it is called shapeless or thin layer cell. The layer thickness is under 1 microns, in this manner the lower creation costs are in accordance with the ease of materials. Be that as it may, the proficiency of shapeless cells is much lower contrasted with other cell composes

2. Cadmium Tellurium (CdTe)

Cadmium tellurium (CdTe) cells: Cell effici ency is around 18%, a cell surface of 1 m2 can convert solar radiation of 1.000 W/ m2 to 160 W of electricity in laboratory cond itions. Cadmium teleurid is a fusion of metal cadmium and tellurium semimetal. It is suitable for use in thin photovoltaic modules due to the phys ical properties and low technology manufacturing. Despite these advantages it is not widely used due tdi) cadmium toxicity and suspected carcinogenicity.

3. Copper indium gallium selenide (CIS, CIG S)

CIS cells have the highest efficiency among the t hin- film cells, which is about 20 %. This cell type can convert solar radiation of 1.000 W/m2 to 160 W of electricity with the cell surface of 1 m2 in laboratory conditions.

4. Thermo sensitive solar cells and other organ cells (DSC)

The development of these organic cells is yet to come, since it is still testing and it is not increasingly comm ercialized. Cell efficiency is around 10%. The te sts are going in the direction of using the fac ade integrated systems, which has proven to be high quality solutions in all light radiation an d all temperature conditions. Also, a great potential this technology is in low cost compared to silicon c ells.

V. IMPROVING THE EFFICIENCY OF SOLAR PHOTOVOLTAIC POWER SYSTEM

i) Improving The Conversion Efficiency Of Solar Cell

This section identifies the major sources of loss in the solar cell conversion efficiency process and the corresponding approaches to mitigating the losses thereby improving to efficiency. Solar panel is the core components to convert solar energy into electricity. But the conversion efficiency of solar panel is very low at present. The world's solar cell efficiency level of laboratory is: silicon cell panel up to 23.7%, poly cell panel up to 18.6%, and amorphous silicon cell panel up to 12.8%. In recent years, scientists continue to invent new solar panel. This makes the efficiency of solar panel continue to increase. As the latest achievements of solar panel in recent years, the Nano solar panel shows a new development direction.

Solar Array Mounting And Tracking

The transformation effectiveness of a sun based board Is specifically corresponding to the measure of direct sun powered irradiance that is assimilated. Irradiance is the measure of sunlight based radiation that strikes the surface of a sun oriented cell or board and it is communicated in kW/m2. The irradiance increase by time is a measure of sun powered insolation. The pinnacle sun hours is the number of hours every day when the sun oriented insolation =1kw/m2.Apart from the impact of climatic weakening, sun powered vitality retention is additionally influenced by the world's separation from the sun and the earth tilt point regarding the sun. The edge between the genuine south and the point coming soon straight forwardly underneath the sun is the Azimuth edge, estimated in degrees east or west of genuine south. For south facing locations in the northern side of the equator, the default esteem is an azimuth point of 180°. Increasing the azimuth edge amplifies evening vitality creation. For a settled PV array, the azimuth point is the edge clockwise from genuine north that the PV exhibit faces and for a single pivot following framework, the azimuth edge is the edge clockwise from genuine north of the hub of turn. The azimuth edge isn't material for double axis solar following PV clusters.

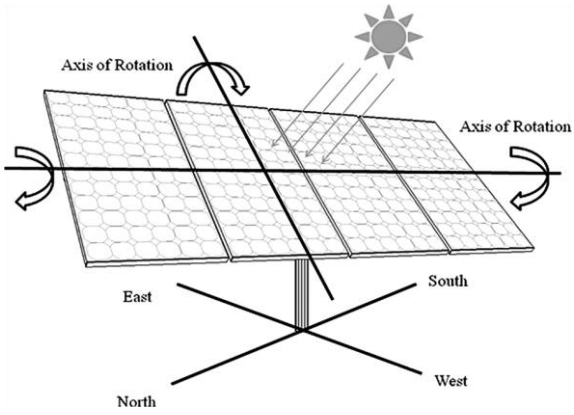
Heading	Azimuth Angle
N	0 or 360
NE	45
E	90
SE	135
S	180

SW	225
W	270
NW	315

Azimuth Angle by Heading

iii) Solar Tracking

A sun powered tracker is a gadget that move or modify the positional point of sun based photovoltaic board towards the sun. The sun's position changes both with season and time of day as the sun moves over the sky. Sunlight based boards assimilate vitality better when orientated opposite tithe sun, in this manner the sun based tracker instrument will basically build the viability of sun based boards over a settled sun powered cluster or board.



Types of Tracker

Trackers can be arranged by the unpredictability of activity and complexity. There are two noteworthy gatherings; Active and passive Trackers. Uninvolved trackers are without engine. Dynamic trackers are mechanized and can be sub-sorted into single axis and double axis trackers:

1. Single Axis

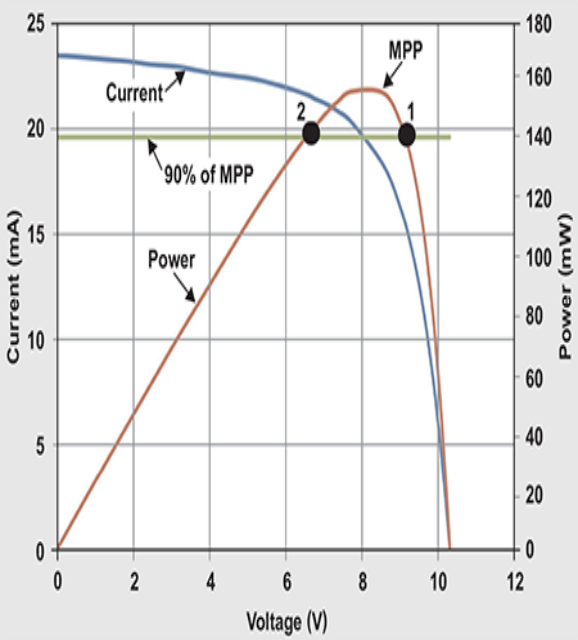
Solar trackers can either have a horizontal or a vertical axis. The even sort is utilized as a part of tropical locales where the sun gets high at twelve, yet the days are short. The vertical kind is utilized as a part of high scopes where the sun does not get high, but rather summer days can be long. In concentrated sun oriented power applications, single hub trackers are utilized with illustrative and straight Fresnel reflect outlines.

2. Dual Axis

The Dual axis solar trackers have both a horizontal and a vertical axis and thus they can track the sun's apparent motion virtually at any angle. A dual axis tracker maximizes the total power output of solar array by keeping the panels in direct sunlight for the maximum number of hours per day.

iii) The Maximum Power Point Tracking (MPPT)

The element that enables an inverter to stay on the regularly moving most extreme power point (MPP) of a PV cluster is called greatest power point following (MPPT). As talked about in the area of the sunlight based cell gadget material science, the IV trademark bend of PV modules incorporates the short out current esteem (Sic) at 0 DC, the open-circuit voltage (Vic) esteem at 0 and a ―knee‖, the point where greatest power point (MPP) is found on the bend, this is the area on the IV bend where the voltage duplicated by the present yields the most elevated estimation of energy. The MPP for a module at full sun at different temperature conditions. As cell temperature expands, voltage reductions and module change effectiveness endures. Other than temperature, module execution is likewise influenced by sun irradiance. At the point when sun is full i.e., at Irradiance of 1000 W/m2, module current is most noteworthy and when there is less daylight, module current abatements as is change productivity. Since daylight force and module or cell temperature shift substantially throughout the day and the year, exhibit MPP (current and voltage) likewise changes as needs be. The capacity of an inverter to oblige these ecological varieties and streamline its execution to meet matrix criteria and different regulatory standards (NEC, IEEE and UL and so forth) at all the season of task is accomplished to a great extent because of successful most extreme power point following element.



V. FUTURE SCOPE

Due to the reduction of fossil fuel, the renewable sources could be the potential sources of energy. Generation of power from photovoltaic is one of the fastest growing industry worldwide and in order to maintain this growth rate needs for new development with respect to material use and consumption of energy, reliability and production technology as well as to increase the new concept to increase the efficiency of the system. A number of major government and industry R&D efforts aim to make solar thermal power plant (STP) and concentrating photovoltaic (CPV) a mainstream power source within the next decade. India is each seeking after a forceful sunlight based vitality development system, making a vital industry and setting up goal-oriented mid-term focuses for the household showcase in the multi-GW scale.

VI. CONCLUSION

A presented review consists on the photovoltaic technology. The review carried out on the hybrid photovoltaic generation and types of PV cells. The presented review included the improvement of efficiency of photovoltaic technology for developing the pollution free environment

REFERENCES

[1] Rehman S, Bader Maher A, Al-Moallem Said A. Cost of solar energy generated using PV panels. Renewable and Sustainable Energy Reviews 2007; 11:1843–57.

[2] Guha S. Amorphous silicon based photovoltaics— from earthto the "final frontier". Solar Energy Materials & Solar Cells 2003;78:597–612.

[3] Shaahid SM, Elhadidy MA. Economic analysis of hybrid photovoltaic– diesel–battery power systems for residential loads in hot regions—A step to clean future. Renewable and Sustainable Energy Reviews 2008;12:488–503

[4] A report by International Energy Agency(IEA)2011.

[5] Seng, A.K., Handbook for Solar Photovoltaic(PV) Systems, 2010, EMA and BCA, Singapore.