J Ther Eng, Vol. 11, No. 4, pp. 1231−1244, July, 2025

Journal of Thermal Engineering
Web page info: https://jten.yildiz.edu.tr
DOI: 10.14744/thermal.0000973

Review Article

Recent trends in the development and growth of solar technologies: a review

K. Sunil KUMAR[1,*], Raviteja SURAKASI[2], Kumar GOVINDHASAMY[3], S. SUDHA[4], Grynal D'MELLO[5], B.T. THARANISRISAKTHI[6]

[1]*Department of Marine Engineering, Faculty of Engineering, Sri Venkateswara College of Engineering, Pennalur, Sriperumbudur, 602117, India*
[2]*Department of Mechanical Engineering, Lendi Institute of Engineering and Technology Jonnada, Vizinagaram, Andhrapradesh, 535005, India*
[3]*Department of Civil Engineering, Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology, 600062, India*
[4]*Department of Mathematics, Hindustan Institute of Technology & Science, Deemed to be University, Chennai, 603103, India*
[5]*Department of Mechanical Engineering, Nitte (Deemed to be University) NMAM Institute of Technology, Nitte, 574110, India*
[6]*Department of Electrical and Electronics Engineering, Christ the King Engineering College, Karamadai, Coimbatore 641104, India*

ARTICLE INFO

Article history
Received: 10 May 2024
Accepted: 18 September 2024

Keywords:
Cleaner Technologies; Hybrid Systems; Solar Photovoltaic, Solar Thermal

ABSTRACT

The generation of power from solar-based power plants has wide issues in terms of less solar radiation throughout the year. One more issues pertaining the solar power plants is solar panel costs are very high and the power generation per unit is Rupees twenty, In this research study, methods used for the generation of solar panels and the various types of literature concerning the generation of power, maintenance of panels and solar radiation intensities parameters are deeply investigated and the minimal land requirements for installing the solar power plants has been discussed. The important findings from the various kinds of investigations that have recently been conducted on solar photovoltaic, solar thermal and solar photo voltaic thermal systems is inclination angle varying from 20 degrees results in achieving 1200 W/m^2 followed by solar Photovoltaic systems gives enormous power attainment of 10 kWh/m^2/day. But Solar Photovoltaic and solar thermal give the very least power generation than solar photovoltaic thermal systems range of 2 kWh/m^2/day to 4 kWh/m^2/ day. The novelty from various findings and literature gaps involved in a research study is design of solar photo voltaic thermal systems is very simple and requires very little space compared to solar photo voltaic and thermal systems.

Cite this article as: Kumar KS, Surakasi R, Govindhasamy K, Sudha S, D'mello G, Tharanisrisakthi BT. Recent trends in the development and growth of solar technologies: a review. J Ther Eng 2025;11(4):1231−1244.

***Corresponding author.**
*E-mail address: sunilkumarkresearcher@gmail.com

This paper was recommended for publication in revised form by Editor-in-Chief Ahmet Selim Dalkılıç

INTRODUCTION

The generation of power from conventional sources of energy has been limited to a certain extent. This is due to the depletion of fuels and the emission released from conventional energy sources has polluted the atmosphere and caused serious health effects to human beings [1]. Hence the people and the government have focused on implementing renewable energy sources of energy for achieving clean development mechanisms and polluting the atmosphere [2]. Although the installed capacity of power from non-renewable energy sources in India will be limited to 150 GW in 2022, the installed capacity of solar power has gradually increased from 25 to 50% over the past two years. This is due to the announcement of support by the Ministry of New and Renewable Energy (MNRE). The government announced a 50% subsidy on solar panels; Entrepreneurs and individuals must come forward to invest in projects based on solar energy [3]. Since the cost of power generation from solar technologies is 3% higher compared to wind-based generation per unit, the investment cost of wind power per megawatt (MW) is three times lower than that of solar power plants per megawatt (MW) [4]. Hence, the government has focused on providing subsidies for implementing a huge amount of investment by the year 2022. According to [5], preheating to aid combustion in the power plant sector can be achieved by the implementation of advanced solar technology to preheat the air and steam, thereby reducing carbon dioxide emissions. According to [6], the implementation of BEVs operated by solar-based energy will reduce NOx emissions by 5% and improve the battery life efficiency by 5% as compared to conventional-operated systems. According to [7], it is necessary to study the battery storage capacity, and also the voltage fluctuation details during the operation of the battery at peak hours, when solar power reaches its peak at noon, maximum reactive power is obtained. There is also a need to study fluctuation details when the battery is operated at nil solar radiation. According to [8], an in-depth investigation to estimate the lifetime of PV cells by solar integration method and from this analysis it was concluded that the lifetime of a solar panel made up of solar PV depends on the temperature factor (TF), corrosion factor (CF) and the reliability factor (RF). There is a possibility of 35% corrosion formation of corrosion on the surface of solar panels during the summer period. This lowers the voltage and instability of solar panels during the peak hours of energy transmission from PV to the grid. Hence the recent growth in the field of solar-based energy has focused on germanium and silicon-based materials; which restrict rust formation and prevent erosion for improving the lifetime as well as power generation proved by [9,10]. According to [11], the study of the physical behavior of the Nuclear Magnetic Resonance Factor (NMRF), improves the thermal conductance of the cells; and the chemical diffusion during the distortion from the structure of bonds shows the significance of mechanical strength as compared to other materials. The study also reveals that there is a 5% improvement in diffusion strength as compared to other materials. From [12], conducted an in-depth study on the bipolar properties of si-ge-based materials that can sustain maximum thermal stress. From his research study, it was observed that there was an increase life span of si-ge-based materials by 20% as compared to other materials due to the phenomenon of superconductive materials and their thermoionic nature. The properties of sensible heat storage and latent heat storage using solar PV for cooking applications are analyzed and from the studies., it was concluded that solar-based TES was effective in terms of latent heat storage; when the system is subjected to systematic temperatures in the range of 1200°C. From [13,14], studies have proven that Solar PV system has enormous benefits in terms of high global warming protection compared to conventional systems in the last two generations due to clean developing mechanisms offered by solar PV systems From [15], studies have proven that enormous benefits related to solar thermal systems due to the concentrating power technologies and higher the absorption of power at lower intensities offered by solar thermal systems. The generation of power through solar PVT systems gives enormous benefits compared to solar PV and solar thermal systems [16]. The advanced technologies coated with silica and other emulsified agents give enormous benefits in terms of less corrosion, lower emissions, and higher power generation compared to solar PV and thermal systems [17,18]. Few researchers conducted experimental investigation of generating the power using hybrid mode of wind turbine operated with solar photovoltaic systems and the energy is stored by the lithium-ion battery. The battery span time is also investigated, and the battery holds the power of 3 months without maintenance. This study also proved that hybrid mode solar way of generating the power has potential benefits in terms of efficiency and less maintenance than wind turbine power plants. From the investigation [21], the combined effects of solar photovoltaic and wind turbines with rated capacity of 1 MW have potential benefits in terms of higher modulation efficiency followed by lithium-ion battery storage systems. According to the research [22], the formation of dust on the surface of the photovoltaic thermal system occurs beyond the system working continuously for six months and drops in thermal efficiency is found by 62%, 51.2%, 40% and 37% within six months gap. From this analysis, it is understood regular maintenance is required with a well-equipped trainer to maintain the overall performance of the solar thermal systems. The deeper investigation is carried out for the solar photovoltaic systems operated by photovoltaic and thermal systems with mass flow rates of 0.5 kg/s, 0.6 kg/s, 0.7 kg/s and 0.8 kg/s, The simulation analysis is done with the help of computational fluid dynamics, from the results it is understood that maximum cycle efficiency is attained for the system at 0.8 kg/s with minimal thermal heat dissipation calculations [23].The methods adopted for carrying

out this research work are analyzed from various literature in terms of solar PV, Solar Thermal, and Solar PVT and its land requirements for achieving adequate power with lesser maintenance costs. From various literatures, it is understood that PVT kind of solar system has potential benefits in terms of solar radiations attained from morning 9 am to 4. pm. The inclination angle varying from 20 degrees results in achieving 1200 W/m^2 followed by solar PVT gives enormous power attainment of 10 kWh/m^2/day. Hence among these three techniques, Solar PVT systems proved good capability in terms of least maintenance and maximum power generation. The research gap in this review of literature is found that subside discussions are not found in any type of past literature works. This work has given a brief idea about the awareness of subsidies. The role of subside while installing the solar-based power plants is very crucial, 50 per cent of the amount is given by Ministry of renewable energy and 50 per cent of the amount is invested by the consumer. The payback period that is required for recovering this amount is 20 years with a low rate of interest. From the various literature studies, it is understood that solar photovoltaic systems and solar thermal systems have wider applications in terms of cleaner power generation with reduced maintenance, hence the people focusing on investing a larger amount of funds in this field rather than in other solar power plants. The merits focusing investing solar-based power plants is subside focused by the government is very high compared to other renewable energy and the rate of interest is very low for recovering the subside with a life span of twenty years.

Table 1. Land requirement for solar PV

SNO	Land in ACRES	Rated Capacity (MW)	References
1	25	5	[19]
2	50	10	[20]
3	250	50	[21]
4	300	100	[22]
5	2500	500	[23]
6	3500	1000	[24]
7	6000	1500	[25]
8	11000	2000	[26]
9	14000	2500	[27]
10	15000	3000	[28]

Land Requirements and Major Solar-Based Projects in India

Table 1 represents the major land requirements for the installation of solar-based power plants in acres. For the maximum generation capacity of 3000 MW power generation in India; it requires 15000 acres. Also, for the rated capacity of 2500 MW generation; the land requirement was about 14000 acres required. The least amount of 5 MW required only 25 acres. Various research has proved that the generation capacity of power from solar panels depends upon the land availability and the intensity of the solar radiation offered during the summer semester. Table 2 represents the major solar projects in India and the development of major solar-based projects from the year 2011 to 2022. The installed capacity of power has been gradually increased from 10 to 20% and 20 to 50 % from the year 2011 to 2015 and from the year 2016 to 2022. This is due to the greater awareness of subsidy policies and cleaner and greener mechanisms achieved through solar panels. It was also found that the maximum rated capacity of 2040 MW was achieved by the year 2021 at the solar park. This is due to the phenomenon of increasing the intensity of radiation in the regions of Rajasthan due to the increase in surface temperatures caused by the desert regions at

Table 2. Major solar projects in India

SNO	Place	Name	Commissioned Year	Rated Capacity (MW)	References
1	Rajasthan	Solar Park of Bhadla	2021	2040	[29]
2	Karnataka	Phavagada	2018	2000	[30]
3	Andhra Pradesh	Ultra Solar Park	2017	1000	[31]
4	Andhra Pradesh	NP Kunta Park	2021	980.5	[32]
5	Madhya Pradesh	Rewa Solar Park	2020	760	[33]
6	Tamil Nadu	Kamuthi Solar	2016	650	[34]
7	Gujarat	Charanka Solar	2012	600	[35].
8	Andhra Pradesh	Kadapa Solar	2019	260	[36]
9	Madhya Pradesh	Welspun solar	2014	152	[37]
10	Maharashtra	Sakri Solar	2013	130	[38]
11	Maharashtra	Maharastra plant	2017	68	[39]
12	Gujarat	Bitta Solar	2011	42	[40]

latitudes and longitudes. Next to Rajasthan, the installed capacity of power was seen in the range of 2000 MW in the year 2018 Phavagada which is located in Karnataka. Next to Phavagada Park, the installed capacity was seen in the ultra-solar power park offered by the Andhra Pradesh government, and the installed capacity was found to be 1000 MW. From the year 2011 to 2020 the power generation through solar-based power plants was found to be 40 to 1000 MW, which is not superior as compared to above top three majority of power plants.

Solar Installation in India

It was necessary to study the solar installation capacity and the gradual increment of solar-based power plants in India. It should be scientifically proven that the majority of customers have increased to install solar-based power plants due to the availability of subsidies, longer retention or payback periods, and reduced maintenance as compared to other conventional sources of energy.

Figure 1 indicates the installation capacity of solar power plants in India from the year 2010 to 2022. From the Figure 1, it was understood that the installation of solar power plants has been gradually increased due to the implementation of subsidies and awareness created by the MNRE. The installed capacity of solar power plants was found to be 0.2 MW in the year of 2010 and 0.4 MW in the year of 2011, Whereas a gradual increment happened from the year 2013 to 2018 (0.5 to 10 MW). This is due to the implementation of new schemes and new benefits offered by the MNRE, the Ministry of Renewable Energy Resources offered by the central government, It was also found out there was the toughest competition to be followed for the implementation of solar schemes during the year 2015 to 2018, due to the competitive implementation of other renewable sources of energy such as implementation in wind turbine power plants. One more benefit during the implementation of solar power plants was honorably favored to industrialists in terms of higher subsidies in the ratio of 50:50 offered by the central government. This motivational technique forces the industrialists to come to the front the invest a huge amount of money from the year 2015 to 2022. Hence the installation capacity increased 35% as compared to the last five years. The one more added advantage of implementing solar based powerplants all over India was found to be higher solar intensity all over India in the summer season and lesser payback periods required as compared to other renewable sources of energy. The maximum installation capacity of the solar power plant was found to be 60 GW in the year 2022. This is due to the phenomenon of this solar-based technology was proved by the customers and technologists for the maximum power achievements and maximum power benefits with lesser payback periods

Solar Panel Manufacturing Capacity and its Development

The requirements of solar PV-based power production have been increased day by day; since the technology has been increased due to the availability of maximum intensity of solar radiations [41]. Figure 2 represents the developments of materials from solar amorphous to crystals and crystals to germanium-based materials and recent developments of materials in the field of the solar sector. Earlier in 2010 to 2014, solar cells were made of amorphous materials. Later this material was equipped with crystalline materials to increase the material strength and the life of the

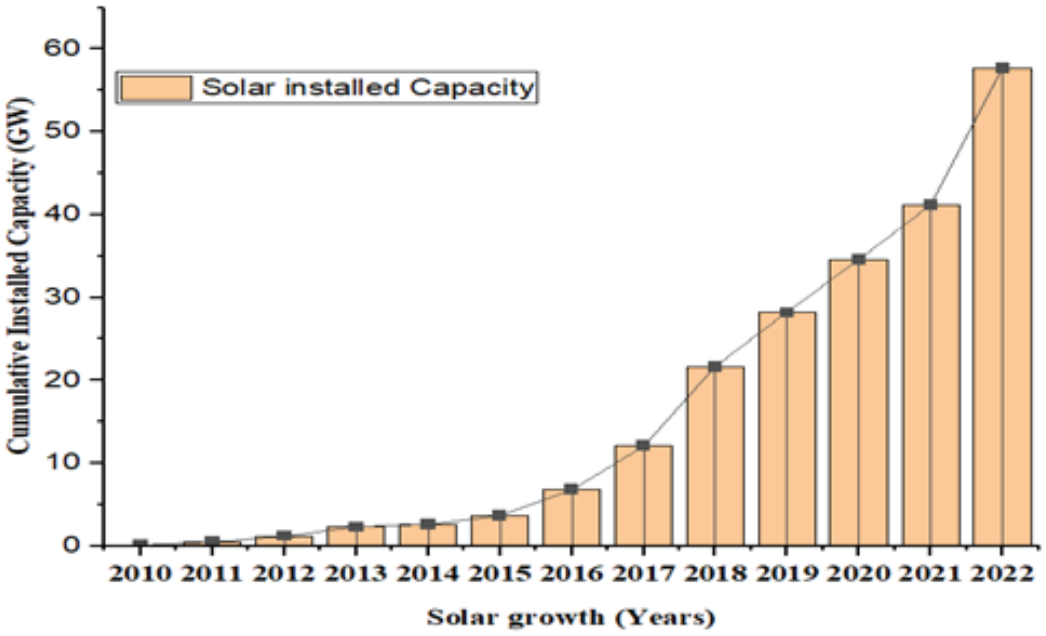

Figure 1. Solar Installation in India [41] permissions from Water and Energy International - Indian journals.com.

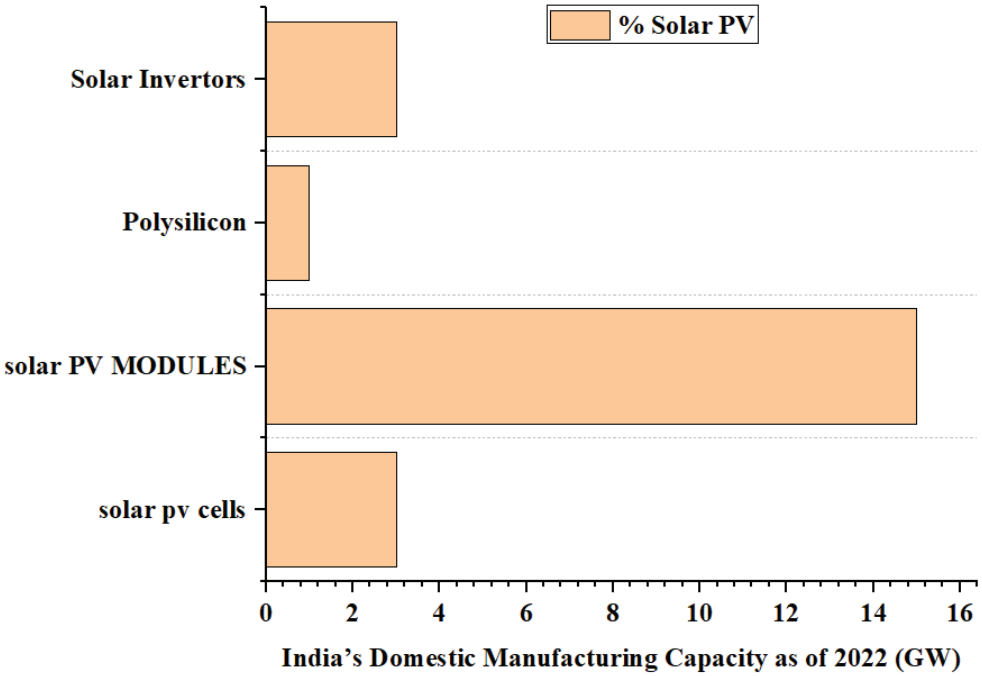

Figure 2. Solar PV domestic manufacturing in India [42] permissions from The Journal of Indian Management & Strategy.

photovoltaic cells [42]. The gradual replacement of these materials due to the short lifespan that occurs due to the rainy seasons leads to the innovation of some other materials for implementation. Later, a few researchers decided to implement materials with long lifespans and maximum capacity to produce energy based on solar radiation [43]. This allows various researchers in depth in investigate suitable materials and the implementation of integrating solar PV cells into PV modules, Polysilicon, as well as germanium-based materials, have been used for efficient energy production and longevity compared to other materials. It was found that the maximum power production, which will reach 15 gigawatts in 2022, was achieved with the help of materials based on germanium and silicon. This research provides young researchers with momentum and a wide range of stimulation, with a focus on designing more efficient materials suitable for reliability and longer life [44].

TYPES OF SOLAR SYSTEMS

Solar systems are classified into three types a) Solar PV b) Solar Thermal c) solar PVT

Solar PV

Converting solar energy in the form of high-intensity radiation into electricity in a photovoltaic system is called the solar photovoltaic method. This method requires the sun as a source that releases heat in the form of heat [44]. Figure 3 shows a typical solar PV system. The specially made up of semiconductor materials such as germanium and silica-based materials possess better mechanical properties compared to other materials [45]. It has been scientifically proven that the corrosion-resistant capacity (CRC) and the life of the PV modules made up of germanium and silica materials have increased by 25 to 35% as compared to other materials. Solar radiation at high intensity in the radiation of 5900K has a maximum capacity to generate power 10% higher than the normal intensity of radiation of 5900K has a maximum capacity to generate a power of 10% higher than the normal intensity of radiation [46]. The measured spectrum level during that maximum intensity was found to be 500 nm and it comprises higher wavelengths that emit UV rays, Infrared rays, and blue rays, which are very harmful to the environment. The solar energy that is received by the PV module will transform into an electrical form of energy through a grid connector that is directly connected to a load distribution system [47]. The energy meter is utilized to monitor the actual amount of power generated in KWH. The more amount of power in the form of KWH was produced at mid-noon, due to the availability of a higher amount of intensity of radiation at noon time ranging from 1.0 pm to 2 pm. Finally, the achieved power is stored in the form of a banking system and transmitted to grids in the form of a wheeling system [48]. The generation of power through solar PV systems in India was 39000 MW. The major installation capacity of solar PV in India was found to be "Solar Park of Bhadla "which is located in Rajasthan, an installed capacity in the range of 2500 MW. Next to the solar park of Bhadla, the second largest solar PV park was installed at the "solar park of Pavagada" where the

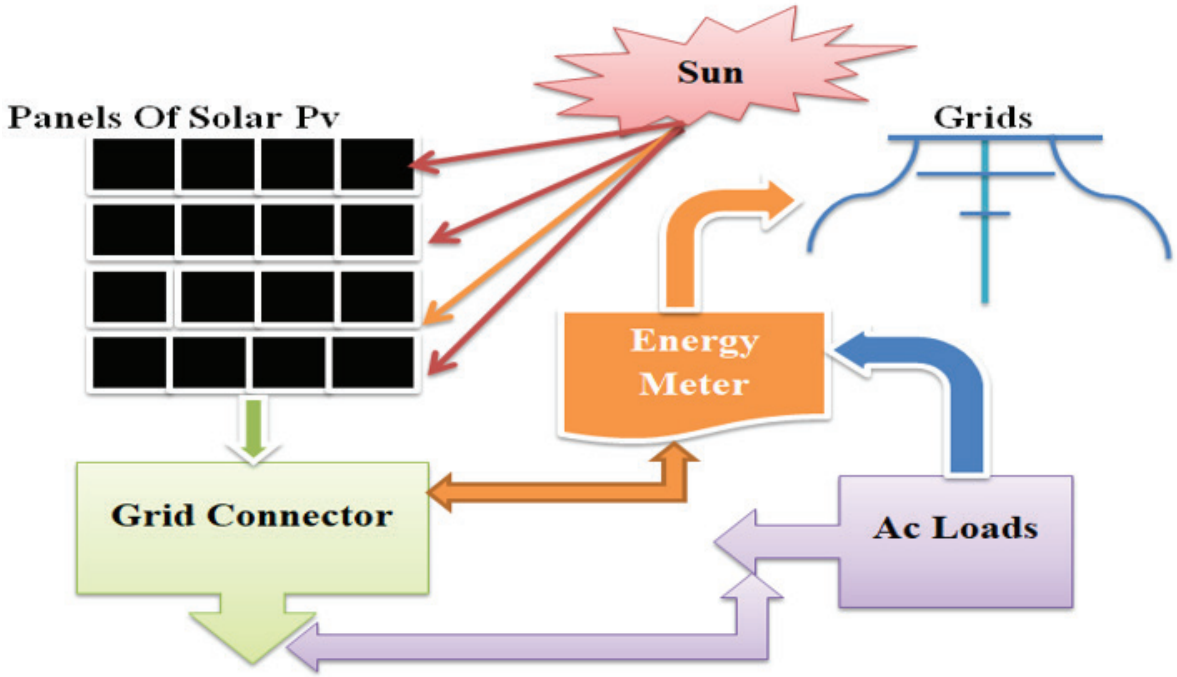

Figure 3. Solar PV [50] permissions from Renewable and Sustainable Energy Reviews - Elseiver.

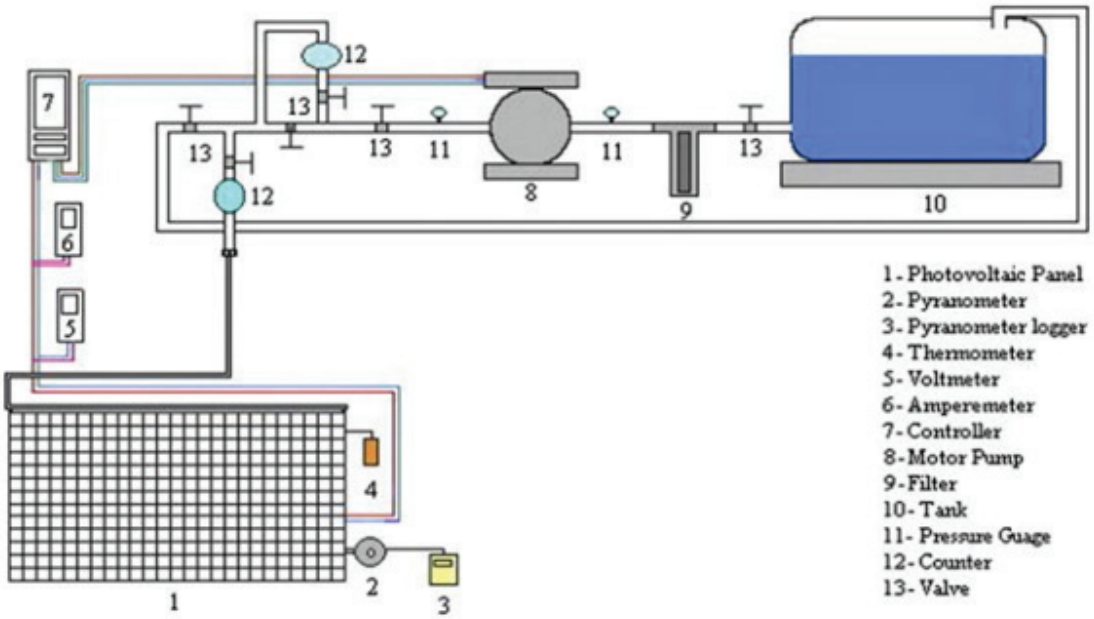

Figure 4. Schematic arrangement of Solar PV for water heating [51] permissions from the Journal Diagnostyka.

installation capacity was found to be in the range of 2100 MW located at Karnataka. The third largest installation capacity was found to be the Kurnool ultra megawatt project which is located in Andhra Pradesh and the installation capacity was found to be 1000 MW. The fourth largest installation capacity of solar PV was found to be 500 MW in the place of NP Kunta, Which is located at Anantha Puram in AP [49].

It is necessary to cool the PV cells operated at elevated temperatures. The lifetime of the cells depends upon the efficient absorbent rate and the effective cooling methods adoption [52]. Figure 4 represents the Schematic

Arrangement of Solar PV for Water Heating. Hence it is necessary to cool the modules operated at optimal temperature ranges. This demonstrated a model that was effectively utilized for the cooling of PV modules subjected to high temperatures. He also simulated those optimal temperatures concerning PV cell material characterization. From [53], the simulation study; it was understood that the maximum cooling rate was achieved in the range of 65% as compared to other conventional methods, and the maximum power was produced in the range of 82%. From the studies it is understood that there was a drastic difference in improvement as compared to other cooling mechanisms [54]. The pyrometer feature added in this research work helped find the maximum changes in temperatures in the ranges of 250 to 300°C, and sensors connected to record the absorption, reflection, and transmission of energy caused by solar panels provide significant improvement compared to other methods of cooling systems.

Solar Thermal

The thermal energy liberated from the solar modules, with the aid of temperature differences, is utilized in the form of kinetic energy, which transfers the heat from the cold body into the hot body. This process, where actual heat transfer occurs, is known as solar thermal systems, which involve changing the latent heat of evaporation [56]. The solar thermal systems allow heat transfer from cold medium to hot medium with the aid of thermal temperature difference. Figure 5. represents the actual process of solar thermal systems that works scientific manner. This system allows the phase change from the cold state into the hot state by the thermal temperature difference and the storage tank utilizes the heat the actual transfer takes place. The latent heat of evaporation occurs when the temperature difference is reached above 100°C. The flow of water due to the lesser density difference will affect the performance of the cooling for photovoltaic modules. Hence it was necessary to use a forced convection type of pump [57]. This pump allows for cooling of the modules where the flow rate was increased by 50% higher than natural convection of cooling.

Solar PVT System

The combination of solar PV and solar thermal allows partially generate the heat in the form of solar radiation and this liberated heat is stored in the form of thermal energy; this is called solar thermal systems [60]. Figure 6 represents the basic concepts of solar PVT systems. The current scenario focusing on the storage of latent heat, the charging and discharging phenomenon with the application of phase materials increased rapidly by 26% compared to the last two years, 2020 and 2021. This is due to the higher requirement of latent heat storage for different application mediums in the form of cooking utensils, space heating units, and desalination units. These systems allow a gradual increase in heating with minimal pressure and temperature ranging from 20 bar to 300°C for the generation of power in the case of concentrated solar thermal systems (CSTS) which are widely used in industrial sectors [61]. The systems are generally categorized as low, medium, and high concentrated

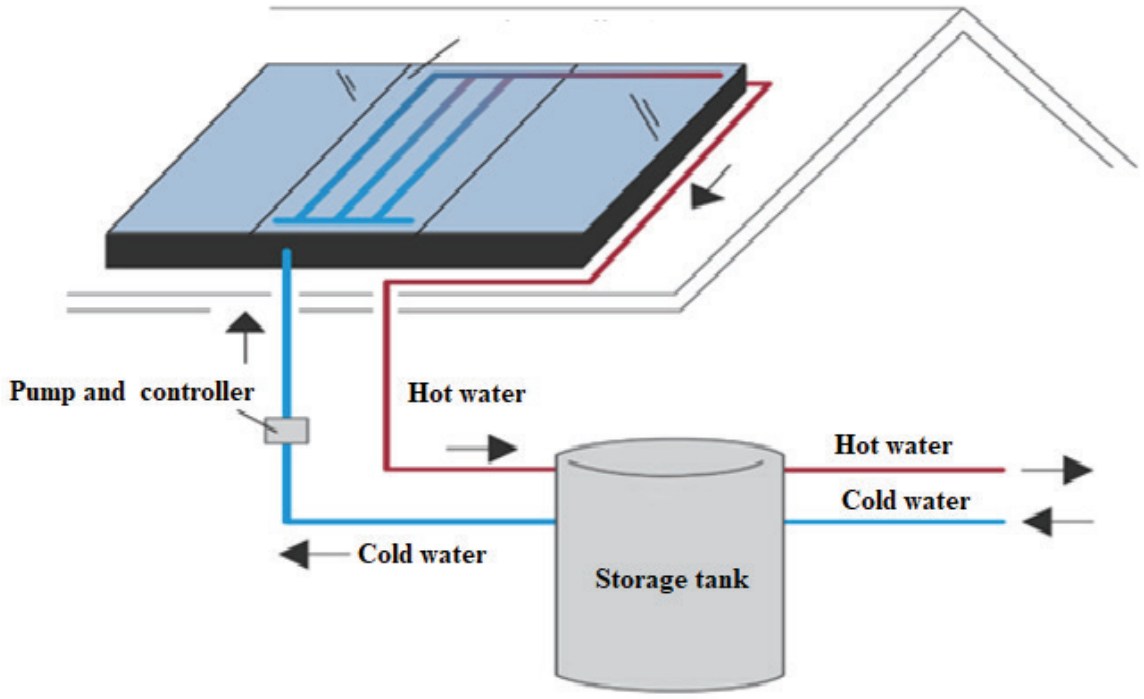

Figure 5. Solar thermal [55] permissions from Elsevier.

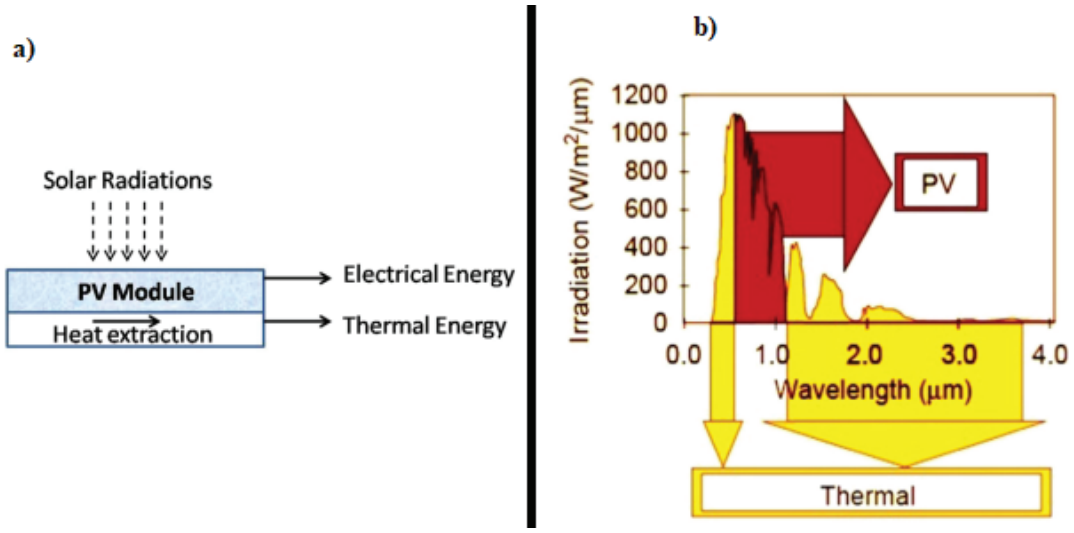

Figure 6. a) Basic concept of solar PVT b) intensity and its spectrum [58] permissions from The Black Sea Journal of Sciences.

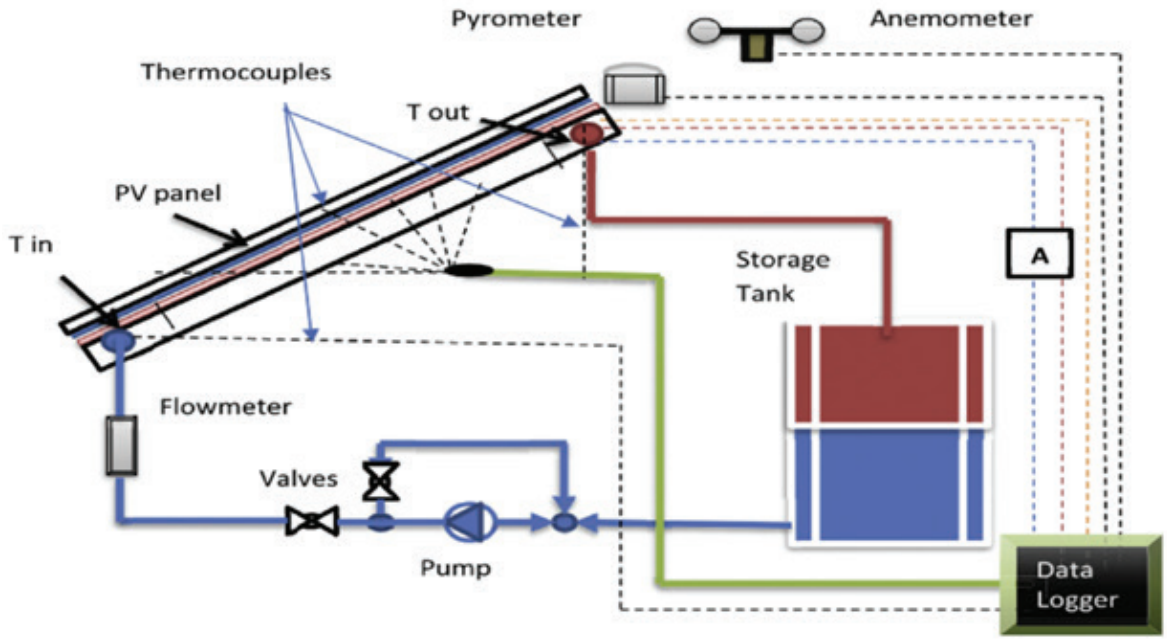

Figure 7. Schematic Arrangement of PVT Based [59].

systems; depending upon the surface temperature and operating pressures required for industrial and domestic sectors [62]. The largest thermal-based solar power plant has the highest installed capacity of 2.5 MW, was located in the district of Bikaner. In India, the installation capacity of thermal-based solar power plants was limited to 40 major projects, and the installation capacity of solar thermal-based projects achieved up to 20 MW of power. This is due to a lack of technologies to store the latent heat during the transformation of phase change at elevated temperatures. Hence India is focusing the research by investing 10 crore rupees in phase change materials and different types of thermal energy storage systems to withstand the heat and transfer the heat in different mediums [63]. Figure 7. depicts the combination of solar PV, where the solar panels are made of different high-concentration materials that allow, where the medium to be stored carefully to transfer the heat. The pumps are utilized for convection medium purposes where up to 50% of evaporative cooling is used for PV modules through forced cooling methods.

Factors Affecting Performance

The following factors as the intensity of solar radiation, environmental climatic situations such as seasonal radiation change and density of the soils, temperatures of the modules, net accumulation of dust over the solar panels during non-operating periods, structural changes during storage and non-storage atmospheric climatic conditions will affect the performance of the system. According to [64], the maximum percentage attained by the solar panels during the intensity of the radiation was 87% and there is a significant drop in thermal performance by 60%, 50%, and 30% over a certain period due to the improper maintenance at summer seasons; at most in a year three months there was a drastic change in atmospheric climatic conditions such as dust collection over the surface of the solar panels; improper cooling effects operated by solar modules at elevated temperatures and porosity formation at higher temperatures causes deviation in performance Hence, it is required to maintain proper maintenance during the operation of the solar panels and maintain the angle of inclination to achieve the maximal efficiency of the system [65]. The possibility of losses can be avoided by maintaining proper maintenance of panels. In addition to that the following characteristics affect the performance of the solar during installation [66].

1. Solar cable improper installation
2. Improper angle of inclination

Solar cable improper installation

The improper installation of solar cables reduces the transmission efficiency of the system. Figure 8 depicts the significant representation of solar cable improper installation [67]. This causes the system high transmission loss due to low impedance transmission; losses caused due to the severe failures of switches; and the impacts caused due to the resistance or corrosion caused by the cables, the failures involved in the relay, and frequent replacements of the connector and associated parts. From this literature study [68], it is understood that the failures of solar power transmission depend upon the relay circuits that transmit the power at peak intensity of power generation. Hence it is required to study the relays and the electrical circuits present in the solar system power transmission and the serious defects associated with the latest switches and gearing systems.

Improper angle of inclination

The maximum power of the solar power plant depends upon the inclination angle and the factors associated with it [70]. Figure 9 depicts the losses that occurred due to the improper inclination of the angle towards the rotation of the tilt angles. From Figure 9 it is understood that the maximum capability of the angle for tilting the entire solar system is limited to 20 degrees. If the limit exceeds 20 degrees causes major losses of the system and permanent failure of the solar tracking system.

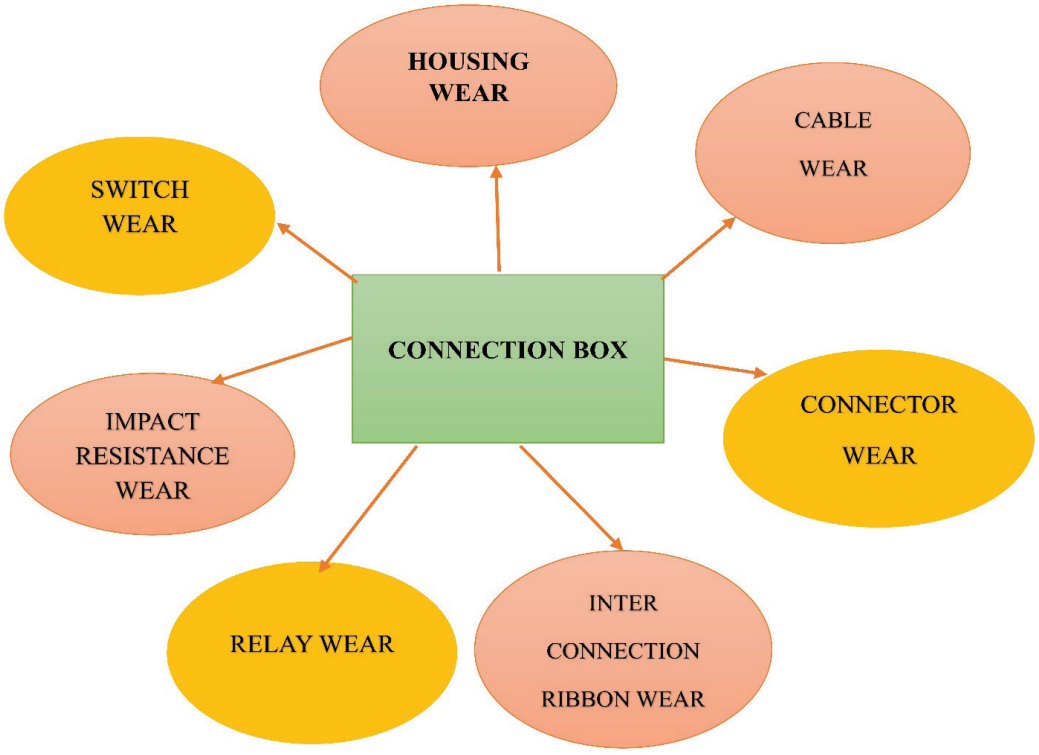

Figure 8. Typical failures caused by solar cable transmission [69] permissions from International Journal of Green Energy.

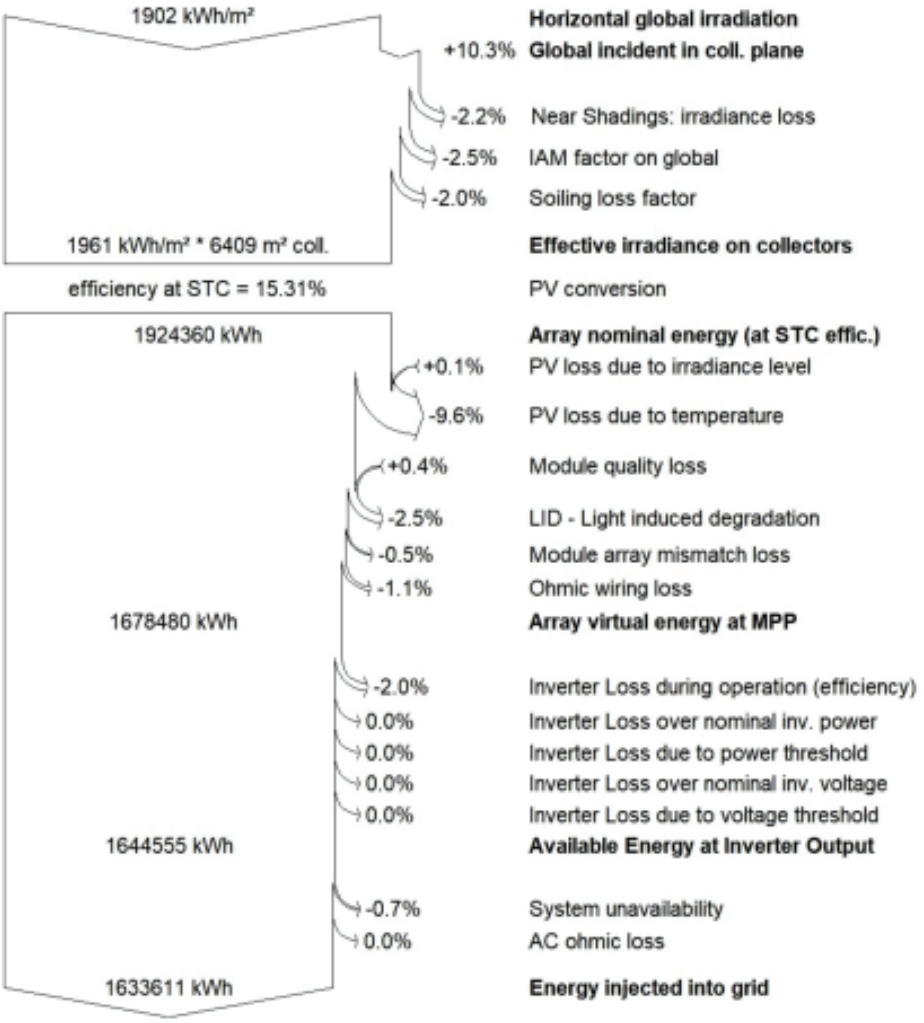

Figure 9. Losses due to improper inclination [71] permissions from International Sustainable Energy Conference.

The maximum loss of energy that is generated and distributed through the solar system is due to fluctuations caused by the system [72,73]. From Figure 9, it is understood that the generation and transmission of power depend upon the inverter associated with solar panels. The disturbance in the modules, voltage fluctuations, interrupted temperature causes, and the inadequate quality of the modules cause the heavy interrupting of the solar plant causing permanent failures of the system [74,75]. The inappropriate titling exceeding the angle of 35 to 50 degrees causes 25% losses to the system and causes a 30% drop in the efficiency of the solar power plants [76,77]. Hence it is required to maintain the correct inclination for achieving the best efficiency of solar power plants [78,79].

CONCLUSION

The study of various types of power generation through the different types of solar-based power plants has been completely investigated. Among this study the recent developments have been identified that; the majority of the consumers or customers are coming front to invest the solar powerplants; because of higher subsidies offered by the government. The maximum subsidy offered by the government is (50%) for the new customers who are very interested in investing the amount with the least payback periods. The least payback period offered by the Ministry 20 years. The following observations have been made from the various solar power plants and its recent performance towards the growth of the solar sector.

- The solar cells made of amorphous materials have diminished from the year 2010 to 2014; due to high costs in investments and less capacity for power generation.
- The introduction of amorphous crystalline-based panels and silicon-based panels from the year 2016 to the year 2022 has wide benefits in terms of the high span of the panels and an increase in power generation by 20% compared to other conventional panel systems made up of different materials.

- The maximum power generation by the solar power plants in the regions of india has been found by 10000 Megawatts in the year-end 2021
- The intensity spectrums of the solar Photovoltaic and solar Photovoltaic thermal systems depend upon the materials of the modules that can absorb the heat that withstand temperatures from 200°C to 1000°C; the corresponding intensity of the radiations is 1200 w/$m^{2.}$
- The life span of solar Photovoltaic and solar thermal depends upon the temperature dissipations of the modules and corresponding climatic conditions subjected to periodical maintenance.
- While designing the solar system, the latest technology sensors must be equipped to dissipate the heat that is released from the panels; which improves the life span of the entire Photovoltaic system.
- This Photovoltaic system allows a gradual increase in heating with minimal pressure and temperature range from 20 bar to 100 bar (Pressure in rise) and 300°C to 500 °C (Temperature in rise) for generation of power in case of concentrated solar thermal systems which is widely used in industrial sectors.
- The generation of power from the various power solar-based power plants depends upon the inclination angles of the mounting systems, the inclination angle is limited to 35 degrees, increase in the inclination angle leads to a decrease in generation of power.
- The inappropriate titling exceeding the angle of 35 to 50 degrees causes 25% losses to the system and causes a 30% drop in the efficiency of the solar power plants.
- Hence it is required to maintain the correct inclination for achieving the best efficiency of the solar power plants.
- The maximum percentage attained by the solar panels during the intensity of the radiation was 87% and there was a significant drop in thermal performance by 60%, 50%, and 30% over a certain period due to improper maintenance during the summer seasons.
- During the idle time or idle period, the proper maintenance with highly skilled and trained persons must incorporated by the solar investors; a special scheme is to be identified by the Ministry of Non renewable energy for achieving this approach.
- Hence India is focusing the research by investing 10 crores in phase change materials and different types of thermal energy storage systems to withstand the heat and transfer the heat in different mediums.
- The implementation of subside-based projects from the central government to Ministry of non renewable energy based projects has a wide range of benefits to the customers; who is willing to invest the money in solar power plants.
- This implementation gives enormous benefits in terms of non-polluted environment and healthy power generation compared to other conventional power generation systems.

ABBREVIATIONS

PV	Photovoltaic cells
PVT	Photovoltaic Thermal
PT	Photothermal cells
TF	Temperature factor
CF	Corrosion factor
C	Celcius
RF	Reliability factor
GW	Gigawatts
MW	Megawatts
MNRE	Ministry of Non Renewable Energy
KW	Kilowatts
K	Kelvin
KWH	Kilowatt Hour
CDM	Clean Developing Mechanisms.
CSTS	Concentrated Solar Thermal Systems

AUTHORSHIP CONTRIBUTIONS

Authors equally contributed to this work.

DATA AVAILABILITY STATEMENT

The authors confirm that the data that supports the findings of this study are available within the article. Raw data that support the finding of this study are available from the corresponding author, upon reasonable request.

CONFLICT OF INTEREST

The author declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

ETHICS

There are no ethical issues with the publication of this manuscript.

STATEMENT ON THE USE OF ARTIFICIAL INTELLIGENCE

Artificial intelligence was not used in the preparation of the article.

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