International Journal of Innovative Research in Computer Science and Technology (IJIRCST)
ISSN: 2347-5552, Volume-12, Issue-6, November 2024
https://doi.org/10.55524/ijircst.2024.12.6.9
Article ID IJIRD-1360, Pages 63-68
www.ijircst.org

Free Recharging Individual Home Appliances Batteries Using Advanced Roof Top Solar Power System in India

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Received 19 October 2024; Revised 2 November 2024; Accepted 16 November 2024

ABSTRACT- India is having best weather system to apply the solar power system to individual home for people's regular day to day working devices. Sunlight The local weather has a significant impact on photovoltaic systems, with dust being the most significant factor. Dust accumulation on the surface of photovoltaic (PV) panels prevents sunlight from reaching the cells, which ultimately lowers the system's power output. Depending on the location, PV integration strategy, and size of the PV power plant, regular cleaning is necessary to prevent dust-based power losses. This publication examines the effects of dust buildup on solar systems, including radiation loss and output power operation, and establishes the ideal cleaning interval. In the current sector recharging and battery maintenance is one of the most difficult in our day to day life. This paper explains the novel technology help to analyse the battery level. The systems find the level of battery as well as automatically recharge the device using solar power system. So for this devices can recharge automatically and stop recharging after completing the battery level is full. Communication is one of the most preferable and should not avoidable. This method help to recharge the mobile devices without socketing and plugin device for our regular power supply. The proposed ARTSPS helps to easy recharging is possible while we are going to apply this novel revolution. ARTSRS Solar panels are designed to work in all weather conditions. The only factor that can affect a solar installation is snow accumulation, which can reduce production due to shading.

Keywords- Solar System, Mobile Devices, Auto Recharging System, Renewable Energy, Advanced Roof Top Solar Power System

I. INTRODUCTION

Due to its abundant supply and environmentally friendly characteristics, solar energy is a reliable renewable energy source. Due to its many uses, including photovoltaic systems, concentrated power plants, solar water heating, solar space conditioning, and solar water desalination, solar energy will emerge as one of the most viable alternatives in the next years. Performance losses must be decreased since photovoltaic sources have become a large source of energy in recent decades [1].

As a major energy resource and a particularly notable type of renewable and environmentally friendly energy, solar energy is widely acknowledged as an ecologically sustainable technology. A major factor in achieving sustainable development is energy solutions. As a result, the large amount of solar energy that can be harvested every day makes it a very attractive source for producing power [2][4]. To fulfill our energy needs, both technologies concentrated solar power and solar photovoltaics are constantly evolving. Due to its significant benefits, such as affordability, streamlined production procedures, and comparatively high photovoltaic efficiency, dye-sensitized solar cells (DSSCs) are becoming more and more recognized as a very promising photovoltaic technology [3].

Significant progress has been made in increasing the power conversion efficiency of DSSCs over the last three decades thanks to the creation of innovative photo-a node sensitizers, counter electrodes, and electrolytes. As a result, the extensive use of solar energy power systems throughout the world supports the energy sector and meets labor market demands, allowing for significant advancement. The last year has demonstrated our industry's adaptability and tenacity in the face of a constantly shifting global energy crisis [10]. Energy markets and economies throughout the world are still impacted by the ongoing geopolitical instability, especially the protracted conflict in Ukraine and tensions in the Middle East, even though some of the immediate pressures have subsided. Diu is India's first Union Territory to run entirely on solar energy. Since solar energy is naturally renewable, it can meet our electricity demands without having any negative effects on the environment, such as the release of greenhouse gases.

II. RELATED WORKS

High solar irradiance, steady sunny weather, and lower ambient temperatures are the best conditions for solar energy. Generally speaking, areas with plenty of sunshine and little cloud cover provide the most solar electricity [12]. Since solar energy depends on sunlight to produce power, the best circumstances for its utilization would be lengthy days with lots of sunshine. By 2022, India wants to have a renewable energy capacity of 175 GW, of which 100 GW would come from solar power [8]. Technology for concentrated solar power is expected to expand 87%

between 2018 and 2023, 32% faster than it did during the preceding five-year period from 2012 to 2017, and reach 4.3 GW in 2023 [9]. Researchers, legislators, and business experts wishing to understand the current state of concentrated solar power in India may find the current review article to be a useful resource in the future. It can support the creation of plans to overcome challenges and promote effective and sustainable solar energy solutions [4] [5].

III. PROPOSED WORK

To manage excess and short falls in electricity supply. There is an urgent need for more infrastructure and storage capacity to handle surplus and shortages in the electrical supply. By enacting new laws and lowering regulatory hurdles, several nations are turning to dispersed generation, stronger local networks, and smaller facilities to guarantee supply. One significant obstacle that highlights the need for more reasonably priced solutions is the high cost of storage technology. Similar worries include deployment difficulties, transportation, operations and maintenance, and investment expenses. Technological developments in fields like storage, expediting transportation and deployment, and utilizing economies of scale to lower costs will all be crucial in figuring out how to cut these costs [6].

The long-term economic benefits of renewables cannot be overlooked, despite their increasing upfront prices. Only 17.9% of solar electricity is used in India, compared to other nations worldwide. Spring is the best season to install solar panels. For professionals working on your roof, the typically moderate temperatures around that time are ideal. Furthermore, springtime often provides ample exposure to sunshine. The ideal time to install solar panels is just before the hottest part of the summer [15].

A. Schemes In India

- **Pradhan Mantri Kisan Urja Suraksha Evam Utthan Mahabhiyan (PM KUSUM):** PM-KUSUM scheme is one of the largest initiatives in the world to provide clean energy to more than 3.5 million farmers by solarising their agriculture pumps [11]. PM-KUSUM scheme aims to support installation of additional solar capacity of 30.80 GW.
- **Roof Top Solar (RTS) Program:** It is a Rooftop Phase-I of RTS program was launched on 30th December, 2015 in which incentives and subsidies were provided for residential, institutional and social sectors. Achievement linked incentives were also provided for government sector. Rooftop Phase-II was launched in February 2019 with a target of achieving cumulative capacity of 40,000 MW by the year 2022.
- **Solar Parks:** The goal capacity of the solar park development plan is 40 GW. Benefits under the program are available to all states and Union Territories. Central and state government agencies, private businesses, and joint ventures amongst these organizations are all involved in the development of solar parks [14].

B. Advanced Roof Top Solar Power System In India

An advanced rooftop solar power system, often known as a rooftop PV system, is a photovoltaic (PV) system that is installed on the roof of a building or other structure, whether it be residential or commercial [1] Photovoltaic modules, mounting systems, cables, solar inverters, battery storage systems, charge controllers, monitoring systems, racking and mounting systems, energy management systems, net metering systems, disconnect switches, grounding equipment, protective devices, combiner boxes, weather proof enclosures, and other electrical accessories are some of the different parts of such a system.

Figure 1: Home Appliances Roof Top Solar Power System

Figure 1 displays the sample Rooftop mounted systems are a type of distributed generation since they are smaller than utility-scale solar ground-mounted photovoltaic power plants with megawatt capacity. Rooftop solar is more environmentally friendly than utility-scale solar, according to a thorough life cycle analysis study. Grid-connected solar power systems make up the majority of rooftop PV installations. Whereas rooftop PV systems installed on commercial buildings frequently have capacities ranging from 100 kW to 1 megawatt (MW), those on residential buildings usually have capacities of around 5–20 kW. Industrial-scale PV systems with a capacity of 1–10 MW may be installed on very big rooftops [4] [7].

C. Algorithm Of Advanced Roof Top Solar Power System

Accurate prediction of the performance of energy systems from renewable energy sources, including systems based on grid-connected photovoltaic panel technology, is crucial to increase the overall penetration of renewable energy sources in the power grid, and at the same time optimize the efficiency of the operation of such a grid.

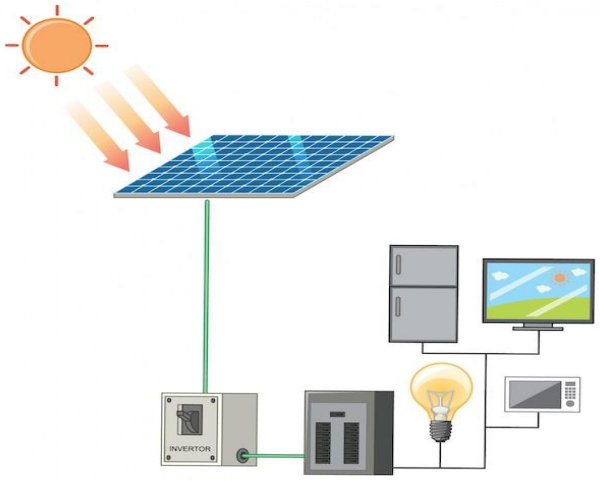

Figure 2: Home Appliances charging using Roof Top Solar Power System

Figure 2 explains the charging possibilities for home appliances in home. The ideal conditions for solar panel performance are a clear, bright day and night. Table 1 is showing the algorithm of advance roof top solar power system.

Table 1: Algorithm of Advanced Roof Top Solar Power System

Step 1:	Building location according to the southern direction
Step 2:	Roof angle of inclination
Step 3:	Shape of the roof (monopitch, pitched equal, pitched unequal, hipped)
Step 4:	Transmission losses of electricity in the installed photovoltaic system based on consumer preferences
Step 5:	Selection of optimal photovoltaic panels from the point of view of technology based on customer preference between price and quality
Step 6	Technical data of photovoltaic panels selected for analysis, made in 17 different technologies
Step 7:	Monthly and hourly insolation level, kWh/m^2 for the city of Opole Province (Poland)
Step 8:	Performance of photovoltaic panels on sunny days, on days with partial cloud cover and on days with heavy cloud cover, estimated based on the adjustment factor
Step 9:	Photovoltaic panel performance by month based on average air temperature, estimated on the basis of an adjustment factor
Step 10:	The maximum roof area remaining after subtracting the necessary technical clearances between separate rows of PV panels and the clearances from the edge of the roof at the perimeter

The panels get as much light as possible on a bright, cloudless day. It doesn't have to be a really hot day for solar panels to function well because they are powered by light rather than heat.

D. Green Energy Corridors

In March 2020, the 3200 km transmission lines and 17,000 MVA substations that make up the Inter-State Transmission System (ISTS) component were finished. Eight states that are rich in renewable energy (RE) Tamil Nadu, Rajasthan, Karnataka, Andhra Pradesh, Maharashtra, Gujarat, Himachal Pradesh [13], and Madhya Pradesh have been approved to use the Intra-State Transmission System (InSTS) component to evacuate more than 20,000 MW of renewable electricity. The recent REINVEST meeting in Gandhinagar, which attracted renewable energy investment bids of USD 386 billion and intends to build 570 GW of solar generating capacity by 2030, has elevated India's solar goals to new heights. The drive for solar domination is a global strategic play with ramifications beyond clean energy [6].

Figure 3: Home Constructed Basis on Solar Energy

Figure 3 explains the construction basis on solar energy and approved List of Models and Manufacturers (ALMM). This is the production-linked incentives for solar cells and modules are two recent legislative changes in India that are intended to strengthen domestic manufacturing and lessen reliance on Chinese imports. In India, a home is a fundamental necessity for survival, and the cost of keeping an electrical connection is significant. However, a home that uses solar energy may save power costs and generate solar energy on its own. Thus, lessen the load on the government while simultaneously boosting economic expansion.

E. Comparative Analysis of Indian States For Solar Energy

Two recent legislative developments in India aim to boost domestic manufacturing and reduce dependency on Chinese imports: the Approved List of Models and Manufacturers (ALMM) and production-linked incentives for solar cells and modules. In India, having a house is essential for life, and maintaining an electricity connection comes at a high expense. On the other hand, a solar-powered home may produce its own solar energy and save money on electricity and reduce the burden on the government and encourage economic growth at the same time.

Policies in states like Tamil Nadu, Karnataka, Rajasthan, Gujarat, and Andhra Pradesh encourage the production of solar energy from the roofs of homes, businesses, and industries. Following the announcement in 2010 of a grid-connected national solar goal to generate 20,000 MW solar capacity generation through grid appliances by 2022, Rajasthan and Gujarat are leading the way in the installation of solar electricity. Given the abundance of sunshine in the state, the Gujarat State Government took the initiative to increase the installation of grid-based solar power. With the assistance of the Gujarat Energy Development Agency (GEDA), the state nodal energy agency for renewable energy, the government began large-scale projects and grid-connected rooftop solar power projects.

The primary benefits of this approach include choosing the solar panel type based on the customer's preferences and accounting for basic information about the local meteorological conditions at the site under study. Figure 4

explains the solar energy for individual home when constructing home with a solar installation and signing a contract with the installation firm, consumers should be better informed thanks to the created application's practical usage.

Figure 4: Solar Energy for Individual Home

IV. RESULTS AND DISCUSSIONS

The current study carefully evaluated a suggested solar panel by gathering voltage, current, and power data through exact tests. Using specialist tools, the data collecting procedure was carefully designed and carried out. The experimental configuration controlled variables like temperature and irradiance to mimic real-world situations. Precise measurements were obtained using sophisticated sensors and data systems. Key performance indicators were shown by the essential I-V and P-V curves that were based on the data. A single petal module's outside measurements and the simulation results were closely examined in order to validate the suggested model.

The purpose of this assessment was to verify that the model could accurately depict the panel's behaviour in a range of scenarios. The standard conditions 1000 W/m2 of irradiance and a module temperature of 25°C were chosen for their practicality and experimental significance. Determining the computed parameters from input variables involves analytical processes. The implicit transcendence equation below links the terminal voltage V and current I.

$$\boldsymbol{I = Iph - Isat\ [exp\ (V + IRsn\ NsVth)] - V + IRs/sh} \quad \textbf{(1)}$$

where $= \boldsymbol{kTq} = \mathbf{25.\ 7\ mV\ at\ 25\ C}$.

The basic element necessary for the selection of photovoltaic panel technology depending on customer preference is to determine the ratio of preferred quality with respect to preferred price, using the following formula:

$$\boldsymbol{z = x + y = 100\%;\ x = z - y = 100\% - y;\ y = z - x = 100\% - x} \quad \textbf{(2)}$$

where

x: preference level of photovoltaic panel with lower prices (determined by the customer), %;

y: preference level of higher quality photovoltaic panel (determined by the customer), %;

z: overall preference level, %.

The basic formula for determining the temperature reached by a photovoltaic panel under certain conditions of solar irradiance and ambient temperature, using the NOCT (Normal Operating Cell Temperature) parameter, is as follows:

$$\boldsymbol{Tcell = Tambient + (NOCT - 20) * E800} \quad \textbf{(3)}$$

where

Tcell: the temperature reached by the photovoltaic cells in the photovoltaic panel under defined conditions of insolation and ambient temperature

NOCT: Normal Operating Cell Temperature in degrees Celsius according to the characteristics of the cell;

E: insolation level, W/m^2.

In modifying this formula for the purposes of the study, the following assumptions were used:

Thus, the overall matching factor of a photovoltaic panel to customer preference can be written as follows:

$$\boldsymbol{wi = x * aiamax + ys * bibmax + yf * cicmax} \quad \textbf{(4)}$$

where

w_i: the matching factor of the i-th technology to customer preferences;

x: lower priced photovoltaic panel preference level (determined by customer), %;

a_i: amount of points awarded for the i-th type of solar panels based on their ranking in the "Price" category. As solar radiation rises, more photons will be accessible to interact with the semiconductor material, increasing the electron excitation rate and the production of electric current. The power production of solar panels is strongly influenced by temperature fluctuations. The experimental data that was gathered made it possible to examine in depth how the panel behaved at various temperatures.

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Figure 5: Independent Solar Power Energy

Figure 5 explains the Independent solar power energy system when it gives to limitless attributes, solar electricity is more dependable than other sources. There will be a scarcity of energy in the future because of the finite availability of coal. Even more likely than domestic commerce between nations will be the importation of coal from foreign nations. Coal prices may increase as a result of this technique. In this scenario, solar energy will be the most viable option in attractive locations with significant solar energy potential.

Table 2: Advanced Roof Top Solar Power System Method

Methods	Tcell (%)	NOCT (%)	Power Produced (%)	Accuracy (%)
PV	89.24	87.45	88.23	89.54
SHC	90.12	90.34	87.59	91.67
ARTSPS	97.23	97.16	98.67	98.12

From Table 1 explains the results of Advanced Roof Top Solar system Method. The proposed methods compared with existing solar methods are PV and SHC. While comparing the existing methods the proposed ARTSPS gives the better results and also increase the high power energy produced.

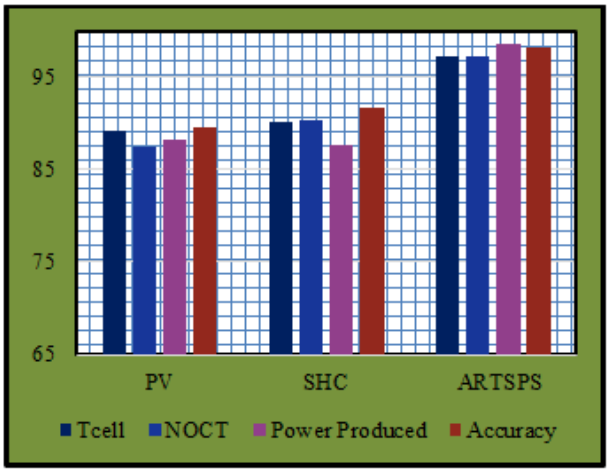

Figure 6: Advanced Roof Top Solar Power System Method

From Figure 6 explains the results of Advanced Roof Top Solar system Method. The proposed methods compared with existing solar methods are PV and SHC. While comparing the existing methods the proposed ARTSPS gives the better results and also increase the high power energy produced.

As fossil fuel supplies decline and the effects of climate change worsen, renewable energy is the greatest option for coming generations. The grid's energy mix will rise mostly through grid-based solar development thanks to renewable energy. To create demand for renewable energy, the nation's renewable purchase obligation (RPO) will grow.

VII. CONCLUSION

India is consuming good weather system to relate the solar power system to individual home for people's regular day to day working devices. The present investigation introduces an innovative approach involving designing, producing, and evaluating a specialized in Advanced Roof Top Solar System helps to improve to recharging the home appliances like refrigerator, washing machine, lighting system, fan, heater, kitchen appliances etc., very easily without expecting the normal electricity power system. Auto recharging is applicable from home light system to car recharging using Advanced Roof Top Solar system. To make policy decisions for the greater use of solar energy in the States, thereby leading to more sustainable development for the country. The electricity connection is costly and the connection process is also so long. While using Advanced Roof Top Solar Power energy applied in every home in India that can able to reduce the electricity energy and also individual home can able to create a solar energy. So reduce the burden to government as well as this system increase the economic growth in India.

CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interest.

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Dr. Ravichandran is currently working as Professor and Head in the Department of Chemistry at DRK Institute of Science and Technology, Hyderabad. He has 18 years of Teaching and Research experiences and published 175 International papers. He has published 16 patents and 12. Textbooks and 60 book chapters. He has received Bharat Shiksha Ratan award and Lifetime achievement award from Global society in 2012, 2013 from New Delhi. He has also received the award of Academic Excellence by Arab Translators Association, Bahrain on 24th November 2021 in recognition of research publications achievement. Received the Life Time Achievement Award with medal from Blue Bird Welfare Association, Prayagraj in a National Conference on Recent Trends in Science, Technology and Management conducted by Madhu Vachaspati Institute of Engineering and Technology, Kaushambi (UP) on 13th February 2022. Received the Life Time Achievement Award with medal from Sansnow's Nobel Professional Foundation, He has received the Incredible Researcher of India Award with medal from Record Owner, Government of India, Ahmedabad on 30th August 2022. Very recently he has received the best Teacher Award for his outstanding contribution and recognition in the field of Chemistry on the occasion of 6 th International Conference on Cutting-Edge Solutions in Science-Agriculture, Technology, Engineering and Humanities organized by Kumaun University, Nainital, Uttarakhand during 24-26 August 2024. He has been serving as Editor-in Chief and Editorial board members in many reputed journals. He has been a Life membership (L36754) in Indian Science Congress Association, Kolkata. His current interest is to focus on the development of novel greener methodology for a Sustainable Development.