“A COMPARATIVE STUDY ON GRID ENERGY AND RENEWABLE SOLAR ENERGY SYSTEM”

Sharad Kumar Srivastava
Research Scholar
Department of Physics

Received: 10th October, 2023; Revised: 03rd November, 2023 Accepted: 01st December 2023

Abstract: Solar energy is one of the most abundant energy resources on Earth. It is a renewable energy resource that can provide suitable power for our needs. It’s also continuously growing in popularity nowadays since it can provide significant benefits to human and environment. The use of solar energy is a great way to contribute to a cleaner future. This renewable resource is a clean and safe alternative energy solution that can help reduce the production of harmful pollution. Hence, utilizing solar power can be an excellent way to fight climate change and help reduce your home’s carbon footprint. It is also necessary to look into as day by day the demand for electrical energy is increasing. We can’t rely on conventional energy sources for meeting this increasing demand as they are depleting. So it is necessary to find an alternative method to harness the energy that we are lacking. Solar energy generation seems to be a promising technology for this dilemma. It is environmental friendly and infinite source of energy. Photovoltaic systems can be broadly classified into two-an on-grid system or an off-grid system. The energy generated from a solar PV system is based on several factors like irradiance, types of solar PV used and temperature. Analysing the existing system efficiency is of prime importance for the characterization of the problems and for the improvements. This study deals with the performance analysis of an on-grid and off-grid system. The analysis is carried out by modelling an existing system in MATLAB/SIMULINK which is already in operation. It can be extended to analyse the grid stability. This study aims the quantification of various performance parameters like power output, losses in the system, system efficiency and the total energy transfer.

Keywords: Solar energy, PVSYST software, Performance analysis, Performance ratio, Grid-connected solar PV plants

I. INTRODUCTION

There is a pressing need to accelerate the development of advanced clean energy technologies in order to address the global challenges of energy security, climate change and sustainable development. Solar Photovoltaic is a key technology option to realize the shift to a decarbonised energy supply and is projected to emerge as an attractive alternate electricity source in the future. The global cumulative capacity of installed and commissioned PV increased by more than 25% last year thanks to post-covid price hikes and geo-political strife. It reached about 1.2TW by the end of 2022, while China continued to be the country with the largest installed capacity, according to the Snapshot of Global PV Markets 2023 issued by the International Energy Agency (IEA). The growth trend is continuing and is likely to
explosion once the grid parity is achieved. India is located in the equatorial sun belt of the earth, thereby receiving abundant radiant energy from the sun. The India Meteorological Department (IMD) maintains a nationwide network of radiation stations which measure solar radiation and also the daily duration of sunshine. In most parts of India, clear sunny weather is experienced 250 to 300 days a year. The annual global radiation varies from 1600 to 2200 kWh/sq.m. Which is comparable with radiation received in the tropical and sub-tropical regions? The equivalent energy potential is about 6,000 million GWh of energy per year. The highest annual global radiation is received in Rajasthan and northern Gujarat. In Rajasthan, large areas of land are barren and sparsely populated, making these areas suitable as locations for large central power stations based on solar energy. The Indian government has launched Jawaharlal Nehru National Solar Mission (JNNSM) with a target of achieving 20000 MW by 2022. The goal is to make India one of the leaders in solar energy. Although solar energy is still expensive today, but costs are coming down with technology development, right governmental policies and R and D efforts. Last year, a total of 240GW of new solar PV systems were installed and commissioned worldwide, which resulted in the cumulative capacity reaching 1,185GW. China continued to dominate either new and cumulative capacity, as it added 106GW of capacity last year, or 44% of the global additions, with its cumulative installed capacity reaching 414.5GW. This growth followed that of previous years – 54.9GW in 2021 and 48.2GW in 2020. The European Union (EU) installed 38.7GW of solar capacity last year, increasing from the 27GW registered in 2021 and 20GW in 2020. Led by Spain (8.1GW), Germany (7.5GW), Poland (4.9GW) and the Netherlands (3.9GW), the EU was the second largest market in terms of cumulative capacity with 209.3GW. The US installed only 18.6GW last year, down from 27GW in 2021, under the combined influence of trade issues and grid connection backlogs which reached 1TW of solar projects waiting for interconnection access. India’s annual installed capacity reached 18.1GW, but its cumulative capacity only totalled 79.1GW, lagging behind Japan’s 84.9GW despite the East Asian country only adding 6.5GW of capacity in 2022. Sustainable source of bio fuel.

OBJECTIVES

Jharkhand (‘State’) is bestowed with significant reserves of fossil fuels, which supported India’s economic growth and development for several years now. The State contributes ~19 per cent of annual coal production in India. However, continued dependency on fossil fuels has brought adverse effects on the environment such as air pollution, land degradation, impact on local ecosystem, among others. India, eyeing to be the fastest-growing economy, has shown serious commitments towards adopting low-carbon and sustainable development pathways. The State is committed to supporting India’s concerted action against climate change by reducing its reliance on fossil fuels and diversifying the energy mix with various renewable energy sources, which would also improve the State’s energy security and provide sustainable livelihood opportunities to its people. The Government of Jharkhand recognizes the significant potential of solar energy due to its topography. The State has around 300 days of clear sun with high solar insulation in the range of 4.5 to 5.5 kWh/m²/day. Supported by technological developments and national mandate, solar energy has steadily grown with parity to conventional fuels. The State aims to take a systematic, transparent and streamlined approach to scaling the share of solar in its energy mix and reap the various socio-economic, health and environmental benefits it offers. These are the reasons why solar power is an excellent alternative energy resource.

It’s a Free Source of Energy

The sun is the largest source of free energy
you can utilize on this planet. It can provide enough power in just one minute that can supply the world’s electricity needs for a year. The renewable energy resource like the sun is also a sustainable and inexhaustible resource. Just like biomass, wind, hydro, and other renewable resources, solar energy is also an alternative energy resource that occurs naturally. It can provide your home with clean electricity and help power the place efficiently. Your photovoltaic cells can also help save money right from the moment you turn them on. The benefits you can get from utilizing solar power are best visible during the long run. The longer you use your solar power system, the more you can save money by reducing your utility bills. Just like Astral Energy and other alternative energy providers, utilizing solar energy can also help make your place more energy efficient cost-effectively. Apart from electricity, you can also use solar energy for your home’s heating purposes. You can do the process by installing solar thermal systems and provide your house with free heated water. The system is also low maintenance which makes it an excellent investment for your home.

It Can Make Use of the Underutilized Land: With the increasing needs for solar power nowadays, the use of this renewable power resource can become more accessible for every homeowner. Apart from providing suitable power for your home, solar energy can also make use of the underutilized land and generate substantial value for the area. There are vast land areas from various countries across the globe that are far away from big capitals or cities. Most of these areas might not be used for anything at all. However, solar energy can make use of this underutilized land more conveniently by installing photovoltaic solar panels on the area. Also referred to as a photovoltaic power station; solar farms are a vast, decentralized solar array that supplies energy to the power grid. The primary idea of having solar farms is providing suitable electricity for every homeowner even without installing these solar panels on their roof.

It Can Cause Less Electricity Loss

Electricity is transported from big power plants to consumers via extensive networks. It also travels through the power lines where a proportion of energy may be lost due to these lines’ resistance. Hence, long-distance electric transmissions would result in power losses.

However, utilizing solar energy as an alternative power resource can help reduce electricity loss. You can install photovoltaic panels on your roof to help generate suitable energy from the sun. Your rooftop solar power can also help increase electricity efficiency, especially on short distances. The energy generated from your panels can become domestic which helps you control your home’s utility bills and power usage effectively. Solar power systems are also durable, and reliable, so you can assure that they can provide enough energy to help power your home’s needs more conveniently.

It Can Make Your Home Go Off-the-Grid

Traditional electricity might rely heavily on fossil fuels such as coal. The power that they generate can be harmful to the environment since burning fossil fuels would emit the harmful greenhouse gases and other air pollutants. They also have limited resources which could result in a volatile market where energy prices become unpredictable. However,
utilizing solar energy can help boost your electricity independence. You can invest in solar power systems to help make your home go off the grid. The sun can provide your home with enough electricity that doesn’t increase in rate. It can also help protect you against the unpredictability of the utility price increase. You can install solar panels on your roof and technically reach an energy-independent status. You can also invest in solar battery storage systems to help store extra solar energy for later use. These solar batteries can provide your home with enough power especially during night time and rainy days.

**It’s good for the Environment**

One of the primary benefits of utilizing solar energy for your home is that it can provide a clean, green source of power. The use of solar power is an excellent way to help reduce your carbon footprint that’s harmful to the environment. It also doesn’t release any greenhouse gases and other toxic chemicals.

Solar power is a self-sufficient renewable energy resource. Installing solar panels on your roof is a clean and safe way to help make the future more sustainable. Solar energy is also an excellent alternative energy solution that can efficiently power your home and help preserve the environment cost-effectively.

**It Helps Improve Your Grid Security**

The solar cells installed in your roof functioned as a small power plant that can generate enough energy for your home. As a homeowner, installing these panels can help provide your place with efficient electricity and improve your grid security as well.

Moreover, utilizing renewables can help you save money by lowering your utility bills. It can also help avoid natural or human-caused disasters due to climate change. Since much of today’s energy providers can cause air pollution, then the use of solar power can be an ideal way to fight climate change and contribute to a more sustainable future.

**RESEARCH METHODOLOGY**

A descriptive analysis method was used for the present study to achieve the above mentioned objective. Procedure To achieve the above objective, first the investigator tried to view online all the available resources and websites during the years. The researcher also visited different libraries in search of journals to gather information. Participated in open discussions with others concerned persons on this topic.

**CONCLUSION**

There is a cost associated with electrifying houses in rural areas that increases with distance between the grid and the houses. Such instances where the cost of electrification becomes enormously high one can always use an off-grid PV system. Both type of systems viz. grid tied and off-grid PV systems have their own advantages and disadvantages. Depending solely on the need one can decide what they would want to go for. It is trend that one can observe is that the grid-tied system is mostly found in urban and sub-urban setting where electrification of the area has already been achieved. The off-grid system is more suited to areas where the electrification is yet to be accomplished and/or the consumer chooses not to supply back the energy generated at his/her end. This paper provides the methodology of designing an off-grid PV system. Using a bus shelter at EIU an PV system was designed that would house certain necessary equipment such DESIGN METHODOLOGY OF OFF GRID SOLAR SYSTEMS 21 as WIFI module, charging points, lights, and sensors that would provide service to the students who would be using it. The design methodology is not limited to only bus shelters but could also be used for
different purposes where ever a need of having an off-grid system arises. Economical aspect of the system has not been covered in this paper due to the availability of numerous vendors in the market. Upon identifying the system capacity, one can search the best option of different equipment depending on their financial preferences. Solar power is a powerful energy resource that can provide suitable electricity for your home. It’s the cleanest and most abundant renewable resource that can efficiently power your place cost-effectively. Hence, utilizing solar energy can provide you benefits such as those mentioned above and help preserve the Earth for the next generations to come.

REFERENCES


