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# Energy Efficiency of Microgrid Implementation with Solar Photovoltaic Power Plants

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***Abstract*- The utilization of solar energy as a solar power plant can be a potential power plant to be developed. One of the problems in the solar power plant system is the power instability generated by the solar panels because it relies heavily on irradiance and relatively low energy conversion efficiency. To solve this problem, the Maximum control of Power Point Tracking (MPPT) is required by the Perturb and Observe (P&O) methods. This P&O MPPT control makes solar PV operate at the MPP point so that the solar PV output power is maximized. However, the MPPT P&O control that works at the MPP point makes the output voltage to the load is also maximum that causes overvoltage. The MPPT mode works when the solar PV output power is smaller than the reference power to maximize solar PV output power The aim of the work to design the distributed solar power plants, power consuming storage and power filtering devices using simulation tools. and energy efficiency assessment of local micro grid on the change of the concept of developing modern power engineering is conditioned by growing interest in renewable energy sources The most rapid pace of the development among low power distributed renewable energy sources is presented by private solar power plants, which operate both autonomously, and can be integrated into the industrial network which is designed to solve performing the function of the backup power supply in the autonomous operating modes of the system and the alignment of the load profile, that is, the elimination of daily peaks and failures in power consumption. The implementation of these functions, combined with the installation of power active filters will minimize losses in the line and elements of ESS and it will be perform on MATLAB simulation.**

***Keywords*- MPPT, Solar Power Plant, Boost Converter, PAF, Load.**

## I.INTRODUCTION

Solar technology uses the sun to provide heat, electricity, electricity etc. For real estate and industrial applications. As the consumption of conventional energy sources (suchas coal, oil and natural gas) decreases with the environmental damage caused by the use of these energy sources, investment in renewable energy resources is urgent. Provides sufficient energy for the future without damaging the environment due to green house gas emissions. The potential of solar energy, but despite limited solar resources due to limited efficiencies in the public sector, gathering energy is still a challenge. obtained from the sun. The optimum conversion efficiency of most solar cells in commerce is between 10% and 20 %% [1][8]. Although the decline in solar cell technology has seen significant growth, the fact that the highest efficiency of the cell is still decreasing in less than 20-% indicates that there is still much room for improvement. The purpose of this article is to define these spaces and how to improve them. One such space is a design and control system that activates or installs photovoltaic devices to transmit extended sunlight for maximum power. Another laboratory examines the types of solar cells that are past, present and future, and determine the source of the loss and how to mitigate the loss. Finally, some key features required for the efficient operation of the solar inverter system have been studied.[1][2]New energy technology is one of the five most crucial areas of world economic development in the 21st century. Solar energy is a clean, efficient and durable new energy source. In the new reality, the government will use solar energy resources as a national strategy for sustainable development. Photovoltaic power generation is safe and reliable; no noise no pollution, minor restrictions,

Low failure rate, easy maintenance, etc. It has many features. In these areas, the actual conditions are relatively poor and the economic situation is not good. It is convenient to build large-scale solar power plants on these changing soils and can supply electricity to people living there. Photovoltaic power generation is one of the most important forms of solar energy utilization. The solar cell

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industry has formed a certain scale. The research work in the new solar cell laboratory has been booming worldwide. In recent years, China's solar power plants have been producing rapidly. In 2007, the use of silicon solar cells accounted for 27% of the world, with productivity first in the world [3][4]

## II. RELATED WORK

**S.V.Mitrofanov et.al(2018)** This article introduces the simulation model for dual-axis solar solar automatic systems developed using MATLAB/Simulink.The prop osed developments include the creation of lightweight (solar energy), automatic reduction and applications with two types of solar cells, such as monocrystalline silicon and poly crystalline silicon.This paper introduces the results of the model and demonstrates the effect of twoaxis convergence accumulation in the solar model as compared to the statistical model. In addition, based on the analysis of solar power plants, the main criteria for photovoltaic electricity production are. The proposed model provides an opportunity to study the characteristics of solar power plants and to estimate the energy produced by solar panels in specific locations.[1]

**D.K Baykasenov et.al (2019)**This article provides expe rience with the use of a two-axis solar panel system for operating the solar power plant in Orenburg (Russia) in winter 2019. The "green" energy produced by a consistent solar panel and solar models for which monitoring systems have been compared and analyzed. The data of the camp measurement system is used as data to investigate the operation of photovoltaic power stations. The difficulty is developing a development system for remote monitoring and testing of the signs of the solar system and the state of the weather. The author examines in detail the structure and functions of the coil nature of the electrical body during the period above, and suggests ways to improve the efficiency of the power plant.[2]

## III. PROPOSED APPROACH

The model consists of three Solar Station units simulating Distributed solar power stations with a rated power of 10, 5 and 3 kW, an Energy Storage unit simulating a system drive, five Load 1-Load 5 units simulating linear active-reactive and non-linear loads, and two PAF 1, PAF 2 blocks imitating parallel power active filters. Consider the structure of the main blocks of the model The implementation of microgrid with solar power plants allows to increase the efficiency of the ESS. The reserve for increasing the efficiency through the implementation of microgrid has two components, the first one is related to the normalization of the power consumption mode, and the second one to the optimization of the structure of the network, when the distances between energy sources and consumers are reduced, and the density of the network energy flow and trunk line decreases. Moreover, the second component makes a more significant contribution Objects from the industrial network,taking into account the generation of alternative sources,and hence the reduction of the current density in the supply cable and the losses power from its flow. An additional energy saving to increasing the efficiency of the energy supply system

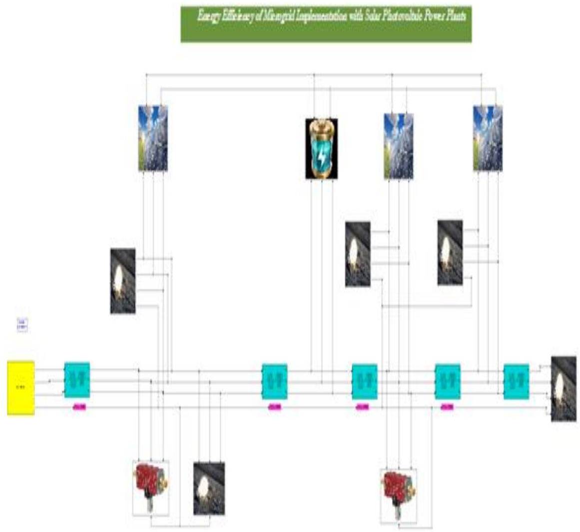

Fig 1. Proposed System Model.

effect is achieved by using active power filters that compensate reactive components of currents and pulsa tions of instantaneous active power.(in fractions of the average useful power of Pusf) losses power after using thePAF will consist of a relative minimum possible losses power Pmin*=Pmin/Pusf and relative losses power in PAF PPAF*= PPAF/Pus good compromise between simplicity and accuracy. Over the past four years, a mathematical PV model for computer simulation has been developed. Almost all of the perfectPV models determine the characteristics of the products especially the sunlight, battery temperature, and electrical load. Most of the models above do not consider the effect of shadow on PV properties.Select the Matlab/Simulink environment to learn the shading direction of the PV model display,

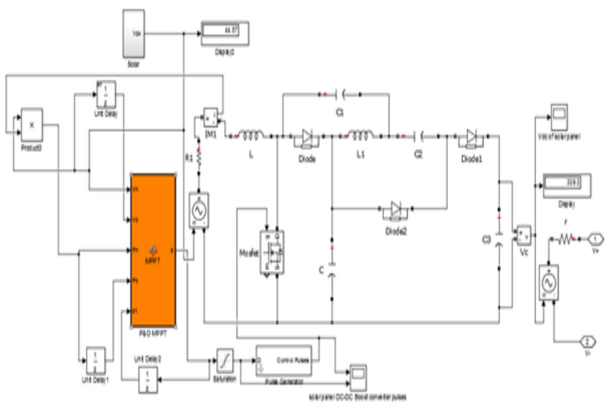

Fig 2. MPPT Model.

Maximum Power Point Tracking (MPPT) is an algorithm applied in photovoltaic (PV) inverters to incessantly adjust impedance understood by array of solar cells to keep photovoltaic scheme at or near photovoltaic panel in changing conditions. Maximum Power Point , such as the change in solar irradiance, temperature and charge. Engineers developing solar inverters use the MPPT algorithm to exploit power produced by photovoltaic systems. The algorithm controls power to ensure that scheme is operating at the "maximum power point" (or maximum voltage) on the supply voltage curve, as shown below.

The MPPT algorithm is generally used in the design of photovoltaic system controllers. The algorithm takes into account factors such as irradiance (light) and disease to ensure that the photovoltaic system produces the highest power. Final power monitoring is a method used by wind turbines and solar photovoltaic (PV) solutions to improve energy efficiency in all cases. Although it covers solar energy, the concept can be applied to light sources of light: for example, optical or photovoltaic energy transfer. Regarding inverter systems, external power networks, battery packs or other charges, the photovoltaic solar system has a variety of configurations. However, whatever the purpose of solar energy, the fundamental problem of MPPT's solution is that the energy transfer efficiency of solar cells depends on the amount of sunlight absorbed by the solar panels or the nature of the load. As the size of the sunlight changes, the nature of the load changes which gives the maximum acceleration. This dynamic is called the power point, and MPPT is the way to seek or maintain that consumption .

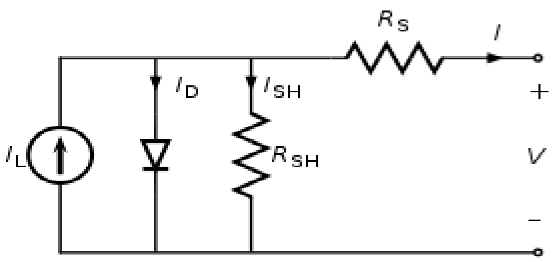


Fig 3. Single Diode Equivalent Circuit Models.

The photovoltaic module consists of a collection of solar cells that can convert energy from sunlight into electrical energy [11]. PV module can be modeled by an ideal current source, series resistance, and parallel resistances. The direct current generated from the ideal source of current sources is comparable to the light irradiation that the solar cell receives. Resistance series and parallel resistance present drop voltage and leakage current values . It is based on the Shockley diode analogy, which is cons idered to be a photovoltaic modulus. Models include temperature dependence of light source, current diode current, and series resistance. It is extremely important to establish a global model that is compatible with all cells modules, modules and arrivals. This model can be used in the design and analysis of the final power adapter .Bing batteries reflect light and convert part of the photovoltaic potential directly into electrical energy withI-V andP-V characteristics.Using Matlab/Simulink[4], a general photo voltaic model was developed to visualize and validate the I-V and P-V nonlinear forms of the photo voltaic module. The implementation of the proposed model is shown in Fig3.

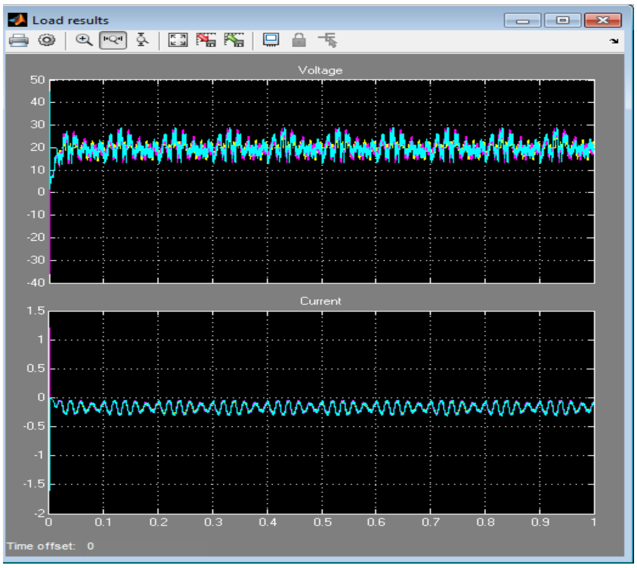


Fig 4. Load result of solar plant 1.

When the load is directly connected to the solar cell, the working area of the panel rarely reaches the apex. The disadvantages of the panel determine the direction of the solar panel. Therefore, by modifying the voltage on the panel, the transmission channel can be excited by the final power supply. Since the panel is a unit for DC, a DC-DC converter must be used to convert the duration of one area(source) to another area (load). As shown on the panel, changing the duty cycle to DC-DC makes it unstable

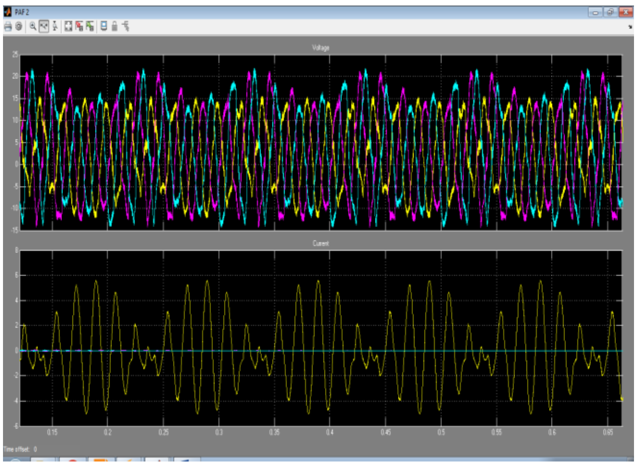

Fig 5. Voltage and Current of System.

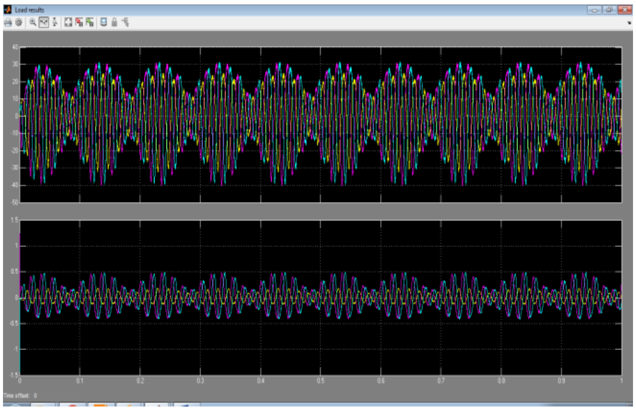

Fig 6. Load Result of Solar Plant 2.

Figure6 shows the comparison of the traditional ESS and the unidirectional energy flow from the micro grid, Determine the three RX loads.Nominal frequencies fn 400Vn (Vrms nominal frequency fn (Hz):50 QL output power (variable voltage): sensing three-phase control. When choosing an external switch, the Simulink logical signal is used to control The Operator Transformers:

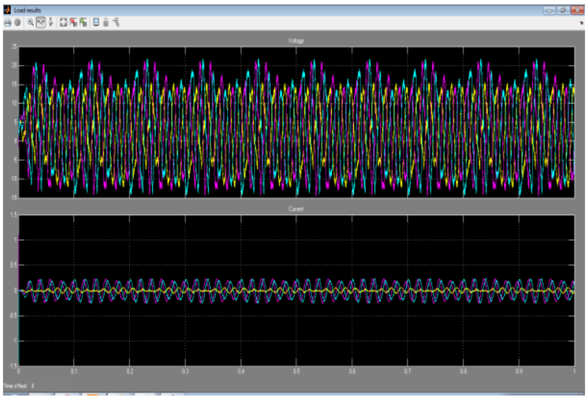

Fig 7. Load Result of Solar Plant 3.

The block can output the voltages and currents in per unit values or in volts and amperes.

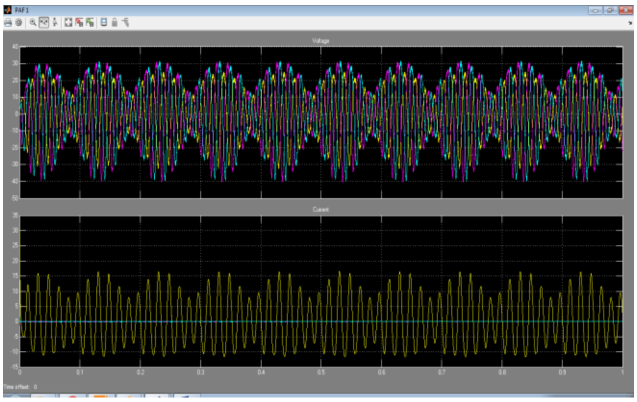

Fig 8. Voltage and Current of System.

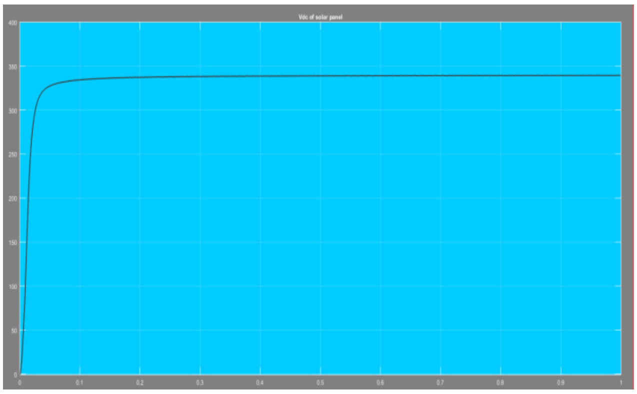

Fig 9. VDC-Solar Panel.

The power supplied by the PV cell reaches a maximum at these points. The short-circuit current is measured by short-circuiting the output terminal and measuring the terminal current. PV cells are made of semiconductor materials, and crystals and thin films are the main materials.

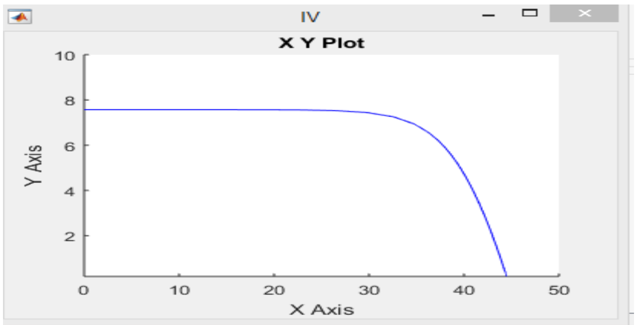


Fig 10. PV Characteristics Waveform.

PV properties and plotted X-Y coordinate voltage Vs current. The solar cell produces a maximum power of 230 Kw at the current voltage characteristic point, with the product of V and I being the largest, as shown in Figure 10 .which represents the PV characteristic and plots the X-Y coordinate voltage V's current. The solar cell produces a maximum power of 230 Kw at the current voltage characteristic point, with the product of V and I being the largest, as shown in. Plot the 230Kw axis and the x-axis maximum point 44I.

## IV. CONCLUSION

Using microgrids with solar power plants can increase the efficiency of ESS.The efficiency improvement reserve through the microgrid implementation has two comp onents: the first is related to standardizing power consum ption states, and the second is related to network structure optimization. When the distance between energy sources is reduced for users, the network's energy flow and the density of the trunk are reduced. In addition, the second component makes a greater contribution to improving the efficiency of the energy supply system. SIMULINK software has also developed a user interaction simulation model for PV cells. The software has been expanded to simulatePV arrays containing real-time parameters. The model developed in SIMULINK can effectively simulate the right photovoltaic array system. Uses interactive solar photovoltaic cell/array models using graphical interface features.Used for simulation study of grid connected inverter system based on solar cell solar cell production. The properties of the photovoltaic system used in the prototype circuit of the grid connected converter are used to verify the model. Also developed a new scheme that can operate PV array at maximum power point without using DC-DC converter.

At the design stage of the microgrid ESS it is necessary to compare energy efficiency indicators before and after its implementation. The specification of the energy efficiency indicators estimation is based on comparison of daily profiles of loading and of solar insolation in the course of the calendar year. The implementation of microgrid with solar power plants allows to increase the efficiency of the ESS. The reserve for increasing the efficiency through the implementation of microgrid has two components, the first one is related to the normalization of the power consumption mode, and the second one to the optimization of the structure of the network, when the distances between energy sources and consumers are reduced, and the density of the network energy flow and trunk line decreases. Moreover, the second component makes a more significant contribution to increasing the efficiency of the energy supply system.

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