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Designing and analysis of Microgrid Implementation with Solar Photovoltaic Power Plants

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***Abstract*- Solar energy is a renewable energy that is found abundantly in nature. It is green energy that can be utilized throughout day, therefore maximum energy has to capture from the panel. MPPT algorithm is incorporated to capture maximum energy. A multilevel inverter is a power electronic converter that synthesizes a desired output voltage from several levels of dc voltages of dc voltages as inputs. With an increasing number of dc voltage source, the sinusoidal waveform is obtained by the output voltage, while using a fundamental frequency-switching scheme. The advantage of multilevel inverter is very small output voltage, results in higher output quality and lower switching losses. This paper proposes a MPPT controller based solar power generation system, which consist of dc/dc converter and multilevel level inverter. In solar photovoltaic power generation systems, photovoltaic panels take a large amount of cost, if improve the use of photovoltaic battery and transform the solar battery plate absorption power into alternating current for use by the user as much as possible, will save a lot of money. Based on the equivalent circuit of solar cells, this paper analyzed the characteristic curve of solar cells through the MATLAB simulink model.**

***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 (such as 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 greenhouse 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 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 proposed developments include the creation of lightweight

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(solar energy), automatic reduction and applications with two types of solar cells, such as monocrystalline silicon and polycrystalline silicon. This paper introduces the results of the model and demonstrates the effect of two-axis 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 experience 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 efficiency of solar power plants depends to a large extent on weather conditions and seasons. Therefore, during the implementation of Microgrid the solar irradiance level in a particular region, which is often presented as a daily graph for each calendar month, should be taken into account? Also, during the calendar year, the daily load profile changes. The overlay of these two charts allows predicting the share of electricity that will be consumed by Microgrid.

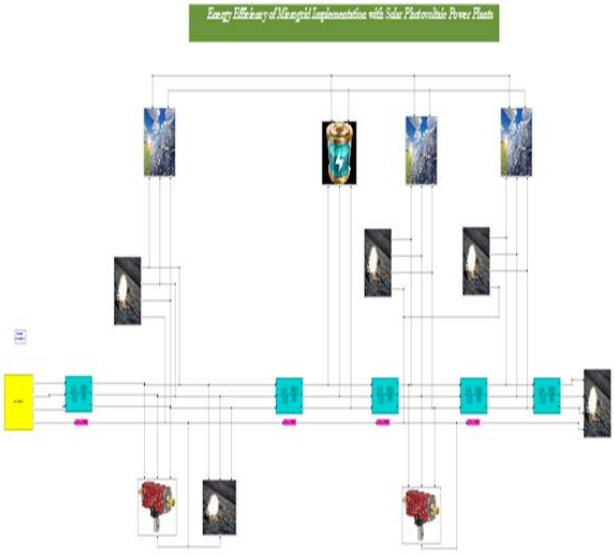

Fig 1. Proposed System Model.

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 effect is achieved by using active power filters that compensate reactive components of currents and pulsations of instantaneous active power. (In fractions of the average useful power of Pusf) losses power after using the PAF 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 perfect PV 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.

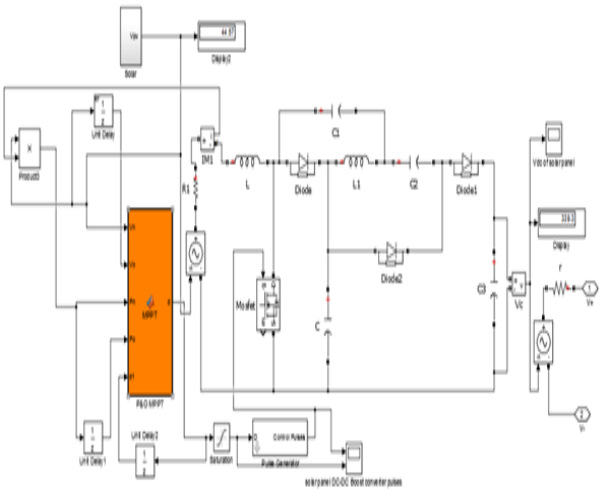

Fig 2. MPPT Model.

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

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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

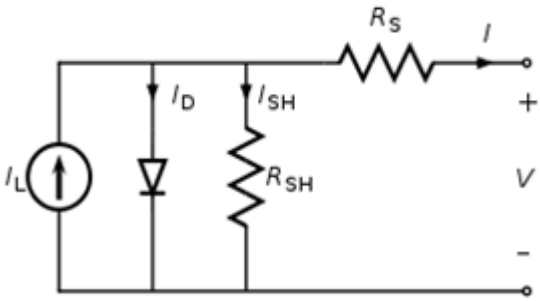

Fig 3. Single Diode Equivalent Circuit Models.

It is based on the Shockley diode analogy, which is considered 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 with I-V and P-V characteristics.

Using Matlab / Simulink [4], a general photovoltaic model was developed to visualize and validate the I-V and P-V nonlinear forms of the photovoltaic module. The implementation of the proposed model is shown in Figure 3.

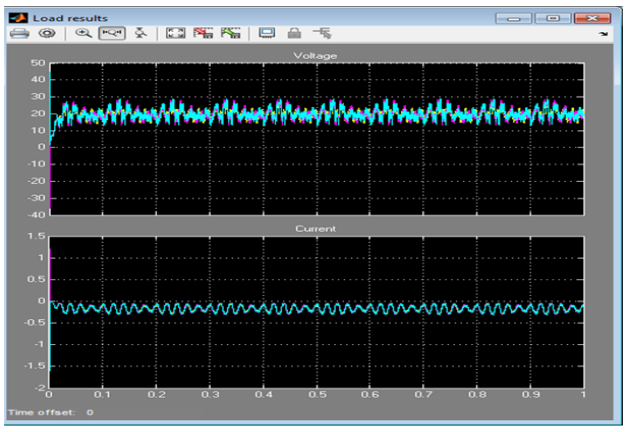

Fig 4. Load result of solar plant 1.

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.

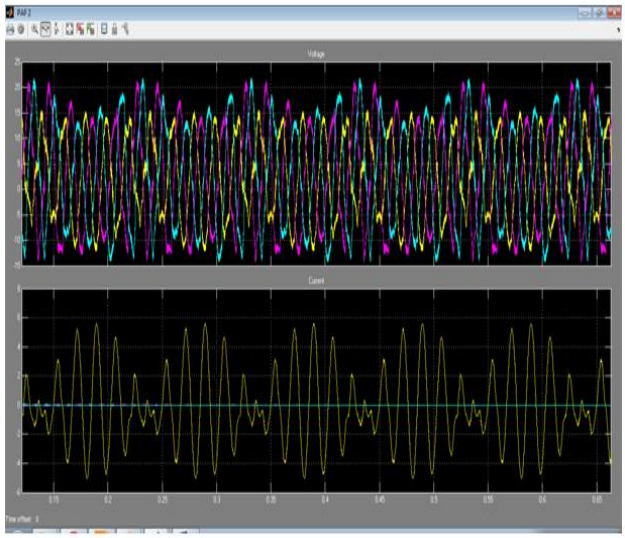

Fig 5. Voltage and current of system.

Figure 6 shows the comparison of the traditional ESS and the unidirectional energy flow from the micro grid.

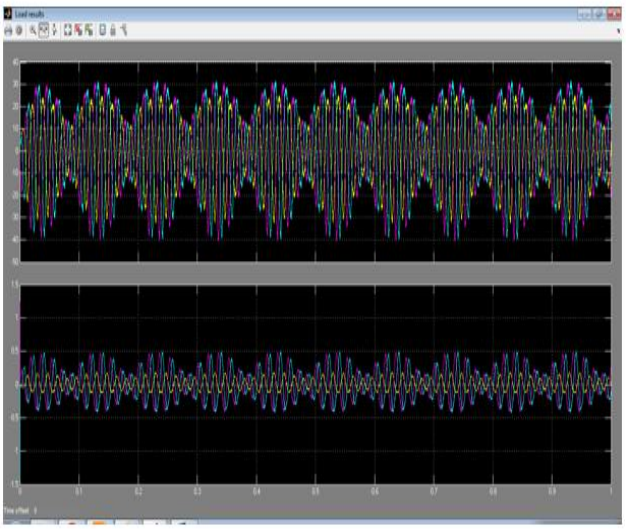

Fig 6. Load result of solar plant 2.

Determine the three RX loads. Nominal frequency fn 400Vn (Vrms nominal frequency fn (Hz): 50 QL output

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power (variable voltage): sensing three-phase control. When choosing an external switch, the Simulink logical signal is used to control The Operator Transformers:

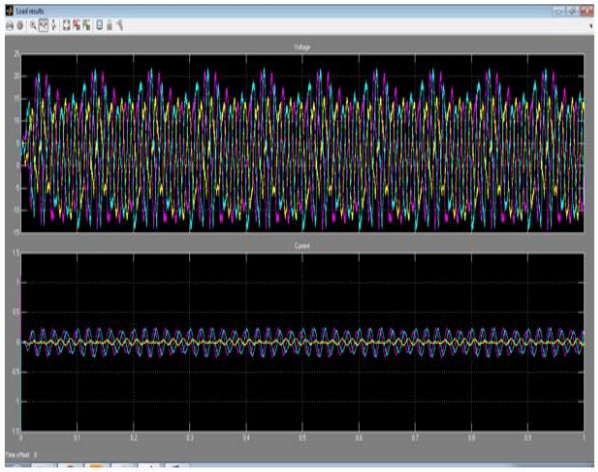

Fig 7. Load result of solar plant 3.

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

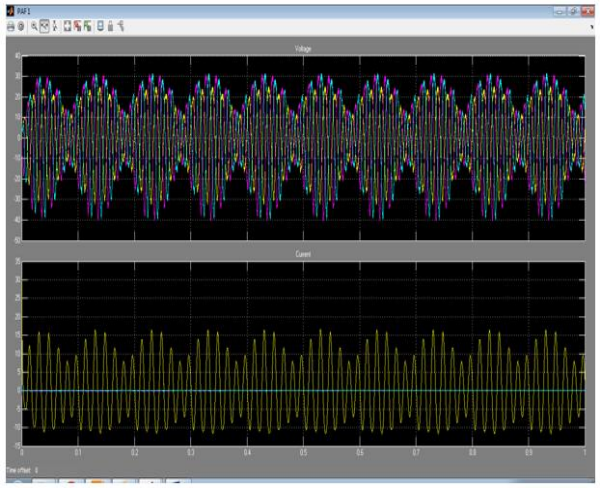

Fig 8. Voltage and current of system.

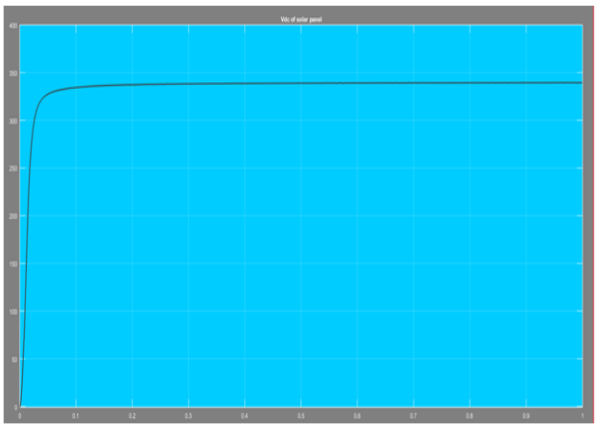

Fig 9. VDC - Solar Panel.

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.

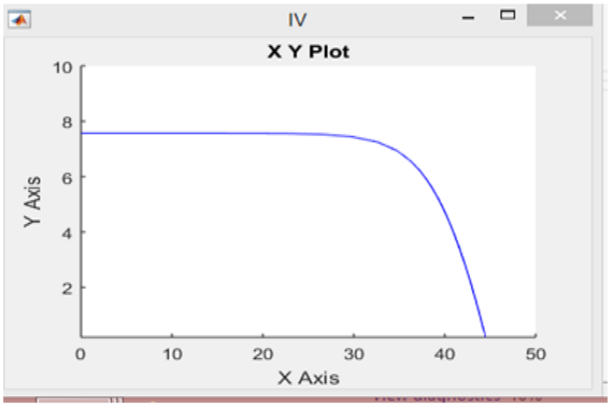

Fig 10. PV Characteristics Waveform.

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 components: the first is related to standardizing power consumption 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 simulate PV 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

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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.

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