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Analysis and Implement of Grid Connected System Using fly back converter and H-bridge inverter Deployment on Highway

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ABSTRACT

In today's time, the problem of a power cut is a lot. The demand for electric cities grows day by day. The world's energy consumption rises as a result of modern industrialization and population development, and many investments in alternative energy solutions are being made to improve energy efficiency and power quality. Last month Ratan India Power operated an Amravati power plant in Maharashtra and shut down one of its units due to a coal shortage resulting from insufficient rake allotment by the southeast center zone railway. This problem is overcome by renewable energy resources. The Indian government has announced plans to create an electric expressway between the national capital Delhi and Mumbai in an effort to address the growing issue of rising pollution.This paper deal with solar system deployment on Delhi Mumbai expressway.This paper deals with the simulation of a three-phase grid-connected inverter using a interleaved flyback converter and H – bridge inverterin MATLAB SIMULINK software. Only at extremely low power as a micro inverter, PV inverter technology is promoted, taking advantage of the easy and affordable benefit of the flyback technology.Grid-connected system deployment on the highway.

Keywords- Grid connected system, interleavedfly backconverter, MPPT, and H- bridge inverter.

I. INTRODUCTION

As the world's energy consumption rises as a result of modern industrialization and population development, many investments in alternative energy solutions are being made to improve energy efficiency and power quality. Because there are various countries in tropical and temperate climates where direct isolation intensity can reach up to 1000W/m, photovoltaic energy is considered a key resource. In comparison to standard asphaltroadways, the E-Highway is a completely different kind of highway. These kinds of roadways are built to give moving cars a high voltage supply. The first "e-highway" design is one with a designated lane on the highway with high-tension electric cables running the entire length of the road. The name "e-highways" refers to a range of highway configurations. In this paper it is use solar system deployment on highway. The advantages of traditional stand-alone solar systems include a straightforward system configuration and control architecture. However, battery banks are required in these systems to pull maximum power from PV arrays and store excess energy. Only a modest quantity of current and voltage is generated by the solar cell array. To accommodate a

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high load requirement, the solar cell array must be divided into modules, and the modules must be divided into arrays. Solar radiation and ambient temperature affect the output voltage of a PV array. To connect to the electrical grid, the PV array's output voltage must be fixed and converted to an AC voltage that is compatible with the grid's ac voltage. Engineers and scientists have recently faced tremendous difficulty in generating energy from clean, efficient, and environmentally acceptable sources. Ainterleaved fly back converter to optimize PV output and a DC/AC inverter to convert the DC output voltage of the solar modules into the AC system connect the PV array to the utility grid. The inverter's DC input must be constant, and it is controlled by a PI control circuit. To provide a clean current injection to the grid, an LC filter has been added. In MATLAB/Simulink Software, the proposed model of the full components and control system is simulated.

II. MODEL OF A POWER SYSTEM.

Photovoltaic generators aren't fixed current or voltage sources, but they can be thought of as current generators with variable voltage sources. The solar cell is not an active gadget when it is dark. It doesn't produce any current or voltage. A p-n semiconductor junction is required in a solar panel cell. A current is generated when a material is exposed to light (DC). With increasing sun irradiation, the produced current changes linearly.

The solar cell circuit's I-V characteristics can be changed. The current flowing through the diode is calculated as follows:

.

$$I_D = I_O \exp\left(q(V + I_{RS})/KT\right)$$

The solar cell output current, on the other hand, is:

$$I = I_L - I_D - I_{SH} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 2$$

$$I = I_L - I_O[\exp\left(q(V + I_{RS})/KT\right)) - 1] - (V + I_{RS})/R_{SH} \ldots\ldots\ldots\ldots\ldots\ldots\ldots 3$$

Where:

I: Solar cell current (A)

: Light generated current (A) [Short circuit value assuming no series/ shunt resistance]

: Diode saturation current (A)

q: Electron charge (1.6×10-19 C)

K: Boltzmann constant (1.38×10-23 J/K) T: Cell temperature in Kelvin (K)

V: solar cell output voltage (V) Rs: Solar cell series resistance : Solar cell shunt resistance (Ω)

We obtain the features I-V and P-V curves of the PV-cell by executing this mathematical model in MATLAB for constant temperature and solar irradiation. When the irradiance and cell temperatures are changed, the current-voltage and power-voltage properties vary.

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III. . GRID-CONNECTED PV SYSTEM CONTROL

Two structures compensate for the grid-connected PV system's control structure. Seize control.

1. The MPPT Control's main function is to get the most power out of the PV generator.
2. Inverter control, which has the following primary goal:

A. CONTROL OF MPPT

The maximum power that a PV panel can deliver is highly dependent on the level of insulation and the operating temperature. As a result, it's critical to always keep track of the maximum power point. The operation of a PV system varies practically all of the time due to weather and load fluctuations. To get the most power out of the photovoltaic arrays, a dynamic tracking system is required. Perturb and observe (P&O) is the method utilized. This algorithm causes a small amount of system disruption. This perturbation causes the power of the solar module to vary. If the disturbance causes an increase in power, the perturbation will continue in the same direction. The perturbation then reverses when the peak power is reached since the power at the MPP is zero and then lowers in the following instant. When the stable condition arrives, the algorithm oscillates around the peak power point. This method makes use of a simple feedback system with few measurable parameters. The perturbation size must be kept minimal to keep the power variation low.

itis simulating MPPT .in MPPT simulation we are using a component PV array. two constants are connected to the PV array and the value of the constant is 1000w/m^2- and 25-degree c.

Implement of PV array built of a string of PV modules connected in parallel. each string consists of a module connected in series.

Parameter of PV array:

Parallel string=5

Series connected modules per string = 1

Maximum power (w) = 213.15

(V)= 36.3

The voltage at maximum power point (V) = 29

Temp coefficient of (% deg. C) = -0.360

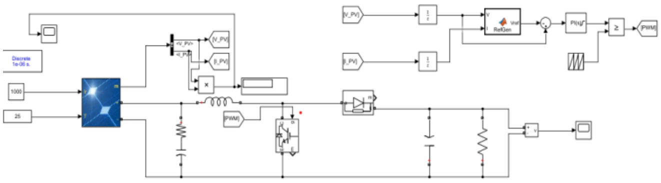

Fig 1 Simulation of MPPT using P& O method

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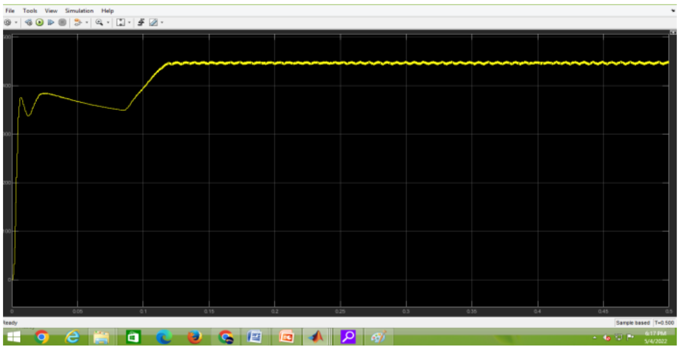

fig 2.outputvoltage of MPPT

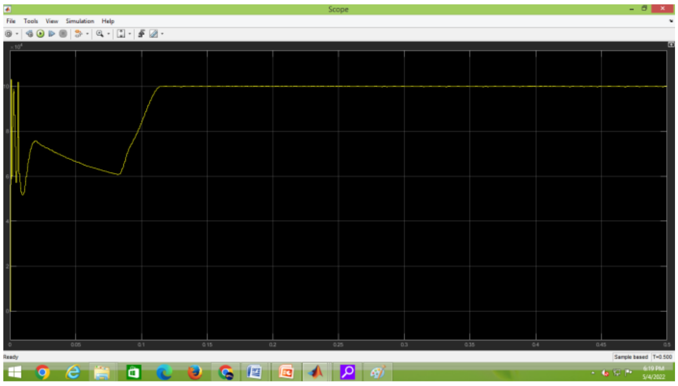

Fig 3. The output power of MPPT

B. Controlling the inverter

Interfacing PV modules with the grid via an inverter entails two key activities. One is to make certain that the PV module(s) are operating at their maximum output (MPP). Injecting sinusoidal current into the grid is the second option. Different inverter topologies and controllers have typically been utilized to interface the PVG and the utility grid in grid-connected PV systems. H-bridge inverter is use.

C. Inverter with self-commutation

These inverters are more complex, requiring switching devices (IGBT and MOSFET) to manage the switch-on and switch-off times, as well as adjust the output signal to the grid. Because of its capacity to control the voltage and current output signal (AC side), regulate the power factor, and eliminate harmonic current distortion, self-commutated inverters are the most common technology in PV power sources. This operation principle offers the capability to cover numerous services and fly back resistance to grid disturbances, which is especially important now that the role of the PV inverter has become more important. They control voltage or current depending on the type of pulse.

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D. Inverter with a voltage source

These inverters are more complex, requiring switching devices (IGBT and MOSFET) to manage the switch-on and switch-off times, as well as adjust the output signal to the grid. Because of its capacity to control the voltage and current output signal (AC side), regulate the power factor, and eliminate harmonic current distortion, self-commutated inverters are the most common technology in PV power sources. This operation principle offers the capability to cover numerous services and boost resistance to grid disturbances, which is especially important now that the role of the PV inverter has become more important. They control voltage or current depending on the type of pulse.

E. Inverter with current source

The DC source appears as a continuous current input in CSI, while the voltage varies with the load. Normally, the protection filter is a capacitance connected to the DC source in parallel. When using PWM and low pass filters, self-commutated inverters also provide excellent sine wave outputs.

IV. MATLAB SIMULATION

This system model is a two-stage three-phase grid-connected solar inverter. it is used a PV array and Flyback converter, inverter, followed by an LCL filter.

PV array parameter is: -

Parallel string = 47

Series connected modules per string = 10

Module data

Module = 1Sotech 1STH- 215-P

Maximum power(W) = 213.15

Open circuit voltage (V) = 36.3

The voltage at maximum power point (V) = 29

Temp coefficient of (% deg.c) = -0.360

Cell per module = 60

Short circuit current (A) = 7.84

Max power point current Imp (A) = 7.35

Temp coefficient of (% deg.c) = 0.102

Light generated current = 7.8649

Diode saturation current = 2.9259e-10

Diode ideality factor = 0.98117

Shunt resistance = 313.3991 Ω

Series resistance = 0.39383 Ω

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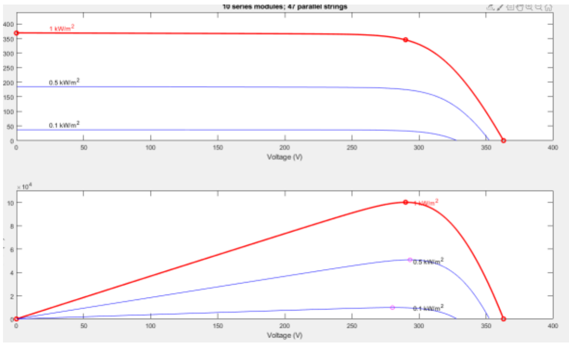

Fig 4   I V and P V characteristics of PV Module

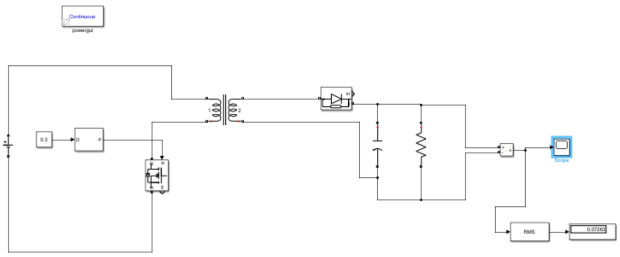

fig 5 fly back converter

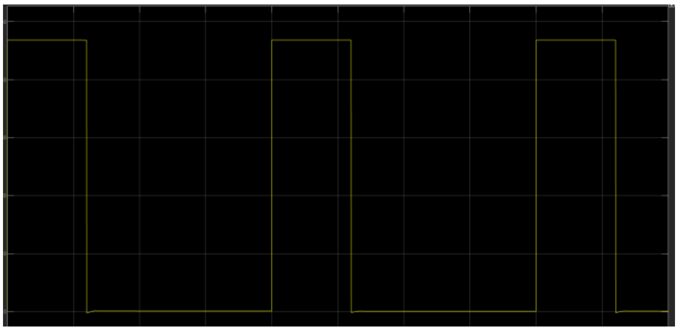

Fig 6. The output of the fly back converter

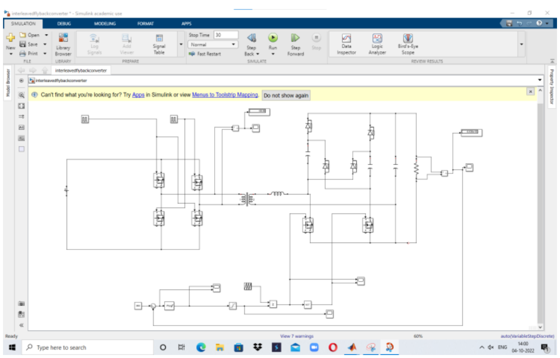

Fig 7 . Interleaved fly back converter

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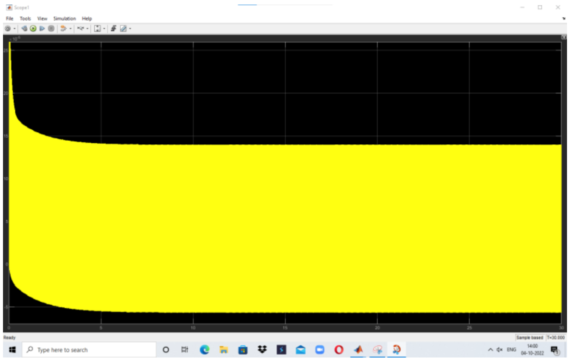

Fig 8. Output of interleaved fly back converter

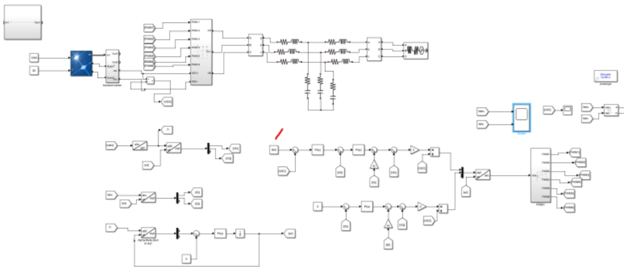

Fig 7 two stages three phases solar inverter

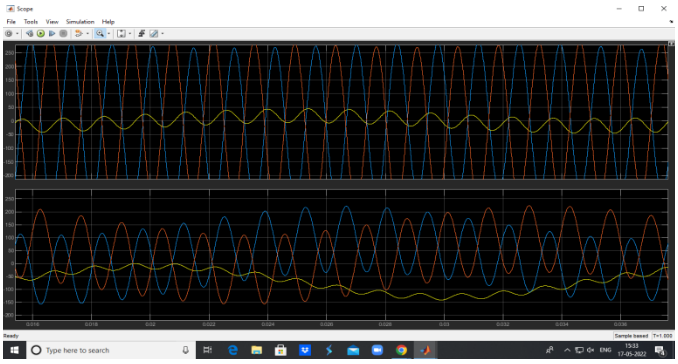

Fig 9 output of current and voltage

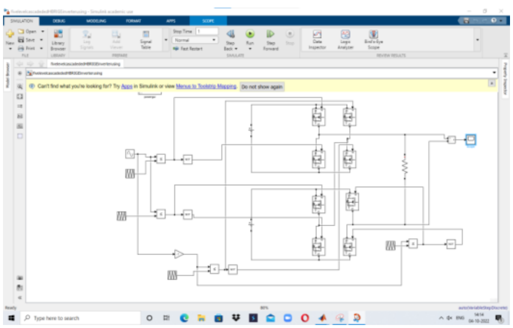

Fig 10 H- Bridge inverter

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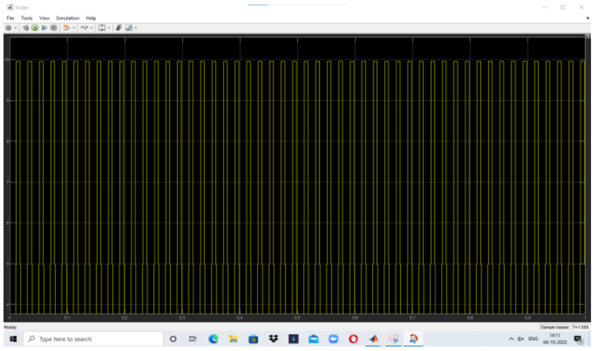

Fig 11 output of H-bridge inverter

V. CONCLUSION

A solar cell is produced with the provided equations which operate at an effective voltage and current by the inputs of temperature and irradiance.The MPPT approach is used to track maximum power in a grid-connected system study that supplies electricity to a specific load.The system's efficiency can be raised by using the maximum power point tracking technique with a precise PV model. For simulation, MATLAB-SIMULINK is used to implement the P&O MPPT method and a PV grid connected to it. It uses a interleavedfly back converter to replace the boost converter. The fly back converter is a more efficient voltage gain. The PV system's dynamic and constant state performance can both be enhanced by the MPPT method that is simulated in this paper.and five level H- Bridge inverter is use. SPWM Technique is use in H-Bridge inverter and improves the efficiency of overall circuit.

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