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"GRID STABILITY DUE TO THE PENETRATION OF SOLAR ELECTRONS BASED ON POWER AT POWER PLANTS"

GUNASEKARAN.N[1], ARULKUMAR.C[2]

PG student, Department of EEE, Paavai Engineering College, Namakkal, Tamil Nadu, India[1]

Asso Professor, Department of EEE, Paavai Engineering College, Namakkal, Tamil Nadu, India[2]

Abstract: It is common knowledge that emissions from power plants pose a threat to global warming. Because it damages the brain system, mercury contamination from thermal power plants is extremely harmful to human health. As a result of these unsettling realities, developed nations are now shifting their attention to renewable energy sources in order to provide sustainable, emission-free power. We are far away from Significantly different from typical generation properties, high PV dispersion levels can occupy both the steady state and transient stability of the systems. This generation is seen as being largely conservative. Replaced with increased PV attribute in cases of high PV generation.

Keywords: Integration of Grid, PV Cells, PV Module, Array, Boost Converter, Fuzzy Logic, Harmonics Analysis.

1. INTRODUCTION

It is common knowledge that emissions from large-scale power plants are posing a threat to global climate. Because mercury damages the brain system, it poses a serious threat to human life and is produced by thermal power plants. One of the most significant negative effects on human society is the influence on children born with mental disabilities. In light of these unsettling realities, developed nations are increasingly focusing more on renewable energy sources to connect with nature in a sustainable and emission-free manner.

Given the concerning changes in the global climate, solar energy is undoubtedly the most important energy source. Solar energy collecting is a rather straightforward technique. Through the solar panel or collector, the solar radiation is captured and transformed into usable electric energy. The most powerful alternative energy source now accessible to humans is solar energy. We are aware that a significant amount of energy may be obtained from renewable sources that emit no emissions and have a sizable potential for energy. This energy can be used by making a variety of devices available. With the development of technology, energy consumption in the household and industrial sectors can be readily reduced with minimal upkeep.

1.1 The Environmental of constrain leading to the need of renewable energy:

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1.2 Meaning of renewable energy:

Project of wind power

As is well known, the kinetic energy is what produces the name advice energy of the air flow that produces the electricity. Currently, the industry offers wind turbines with ratings ranging from 600KW to 5MW.The abrupt change in load output accompanied by variations in wind speed is caused by the non-linear relationship between the turbine's

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power and speed. Modern technological advances lead to improved wind turbine designs with more wing-like shape. This cleverly designed turbine performs better because of its aerodynamic structure.

Project of Biomass:

Electricity is produced by the biomass project using solar energy that is obtained during photosynthesis. Solar energy can be stored naturally using biomass as a battery.

Project of Geothermal energy:

Energy that is stored in the earth's layers will be used to generate power. This project's placement close to the boundary of tectonic plates presents a significant obstacle. The limitations imposed by geography are being addressed by technological advancements. Geothermal energy generated by an inclination must be the source of the superheated steam. The turbine can be spun with this extra superheated steam to produce power.

2. LITERATURE REVIEW

Mosobi, Toko Chichi and Sarsing Gao focus on the breakdown of power quality of the integrated renewable energy system. The main aim of this paper was to supply electrical energy to the community residing in rural or far from the grid supply. In this paper main focus was on the solar system, a micro hydro system and a wind energy system to work in integrated manner for the supply of the load. With the photovoltaic system most commonly used the maximum power point tracking system is applied in order to achieve reliable supply of power output.

Huijuan Li, Yan Xu were able to interface power electronic devices with the photovoltaic system and regulate both reactive and actual power using appropriate algorithms. This work presented an algorithmic concept for a three-phase, single-stage grid-connected photovoltaic inverter that can be used for reactive power control or actual power booster. They face the difficulty of designing a control strategy without a DC-DC booster while the PV inverter is operating at its peak power using reactive power control. This study discusses the issue of PV DC voltage give way and its underlying causes. To ensure that the PV inverter output was forecasted using a voltage stability approach based on significant improvement.

Mr. Chaitanya J. Kadam examined the operation of a five-level, single-phase, multistring inverter with a grid connection. Five layers are produced by the way the PVA string is arranged (in parallel). They employ a smaller-sized filter. Utilizing inverters at a higher level permits. They discovered that this arrangement had additional benefits in addition to an enhanced waveform, including a notable decrease in the THD component. The system's electromagnetic interference is reduced to a level that is understandable. Because of unforeseen developments, even the load projection is not very close to the actual future requirement. Therefore, expansion should be arranged easily, and this system analysis truly follows the expansion's ease of arrangement.

3. MODELLING AND DESCRIPTION OFCOMPONENTS

3.1 Photovoltaic cell:

This is the fundamental structural component of a solar panel, which uses the photovoltaic effect to transform solar radiation into a form of usable electric energy. The photovoltaic effect is explained by the idea of energy band gap and photon energy. When photon energy surpasses band gap energy, electrons are released from their separate orbital’s, causing current to flow in the external circuit.

3.2 PV module:

It is the arrangement of cells structurally based on the energy's state. Their power generation capability, which ranges from 60W to 170W, is used to categorize them even when they are available in the for-profit sector.

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3.3 PV array:

It features a more expansive configuration of PV cells in series or parallel during the relationship. These two relationship-building techniques are used based on the output's state. Combining in series produces a large array current value, while combining in parallel increases the voltage magnitude. The cell, array, and module arrangements are displayed in Fig. 3.1.

Fig 3.1. Arrangements of cell, module and array.

3.4 PV modeling:

By using a reversed diode with a parallel current source connection, one can model a photovoltaic cell. The grouping exhibits unique resistances in series and parallel.While parallel resistance results from the escape current, series resistance must be achieved because the p-n junction makes it impossible for electrons to flow. An internal electronic field is created in the PV cell when radiation strikes it. The absorbing material's positive and negative charge carriers are isolated by the electric field created during this operation (adjacent p-n type).

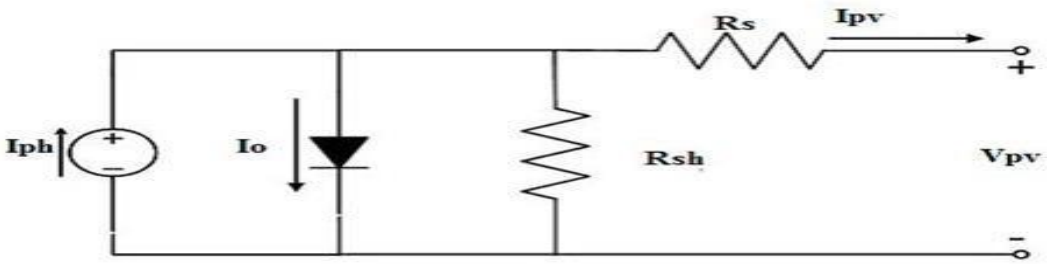

Fig 3.2. Equivalent PV cell circuit.

Symbols have their standard meaning.
Iph- current source.
Io - diode current.
Rsh-parallel resistance.
Rs -series resistance.
Ipv-PV panel current.
Vpv- PV panel voltage.

The correctness of the PV cell model's modeling has a significant impact on the simulation model's accuracy. In order to simulate a genuine cell in the given environmental conditions, its I-V and P-V characteristic curves must be determined. The modeling of an ideal solar cell might link the current source in parallel with a diode alone, but since an ideal solar cell cannot exist without a series resistance, we must include one in the form of the fig 3.2 series resistance. Fig 3.2 displays a variety of resistance types, a current source, and a diode.

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3.5 Characteristic of a PV cell:

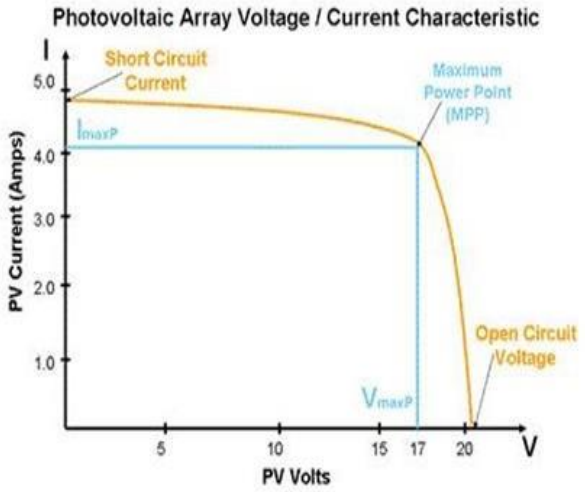

Fig 3.3. V-I characteristic.

It is evident from Fig. 3.3 that a PV cell's characteristics are primarily determined by three parameters.

• Open circuit voltage (V0) is the first.

• Short circuit current (Is) comes in second.

Point of maximum power (Impp, Vmpp).

The maximum powers that can be extracted are at the maximum power point, as explained by the PV cell's characteristic graph. These specifications are typically established by the manufacturer.

3.6 Use of Material in PV cell:

Selection of material is important factor due to its physical and chemical properties which plays deciding role in the performance of the PV cell.

Few frequently used materials are listed below:

- Mono-crystalline Silicon
- Polycrystalline Silicon
- Micro-crystalline Silicon

3.7 Boost converter:

A boost converter's primary function is to step up an input voltage of 840V to an output voltage of 1680V. Another name for it is a step-up converter. It is a grouping of switch mode power supplies, or SMPS. It is essentially composed of a transistor and a diode, two semi-conductor devices. The switch in the diagram below is either an IGBT, BJT, or MOSFET. Reducing power signal ripple is the goal of adding an inductor or a combination of capacitors and inductors. It uses a high frequency to function. The number of victims can be reduced by using switches that operate at a high frequency.

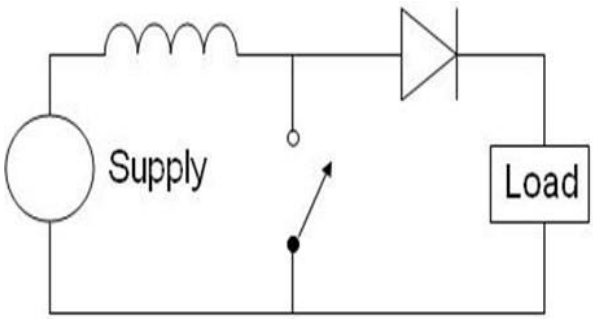

Fig 3.4. Equivalent circuit of Boost converter.

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4. SIMULATION, RESULTS ANDANALYSIS

4.1 Simulation model.

The Simulation Design with unlike machinery is implemented in the MATLAB. Power system with high PV penetration exists originally.

In this simulation model, the PV panel's power output is maintained continuously from beginning to end, and breakers are used to connect and disconnect the diesel producer from the grid at predetermined times. The process of integrating a renewable energy source into the main grid connection and analyzing its isolated state thoroughly involves collisions. For the diesel generator, we use PQ control, and for the PV panel, we use fuzzy logic.

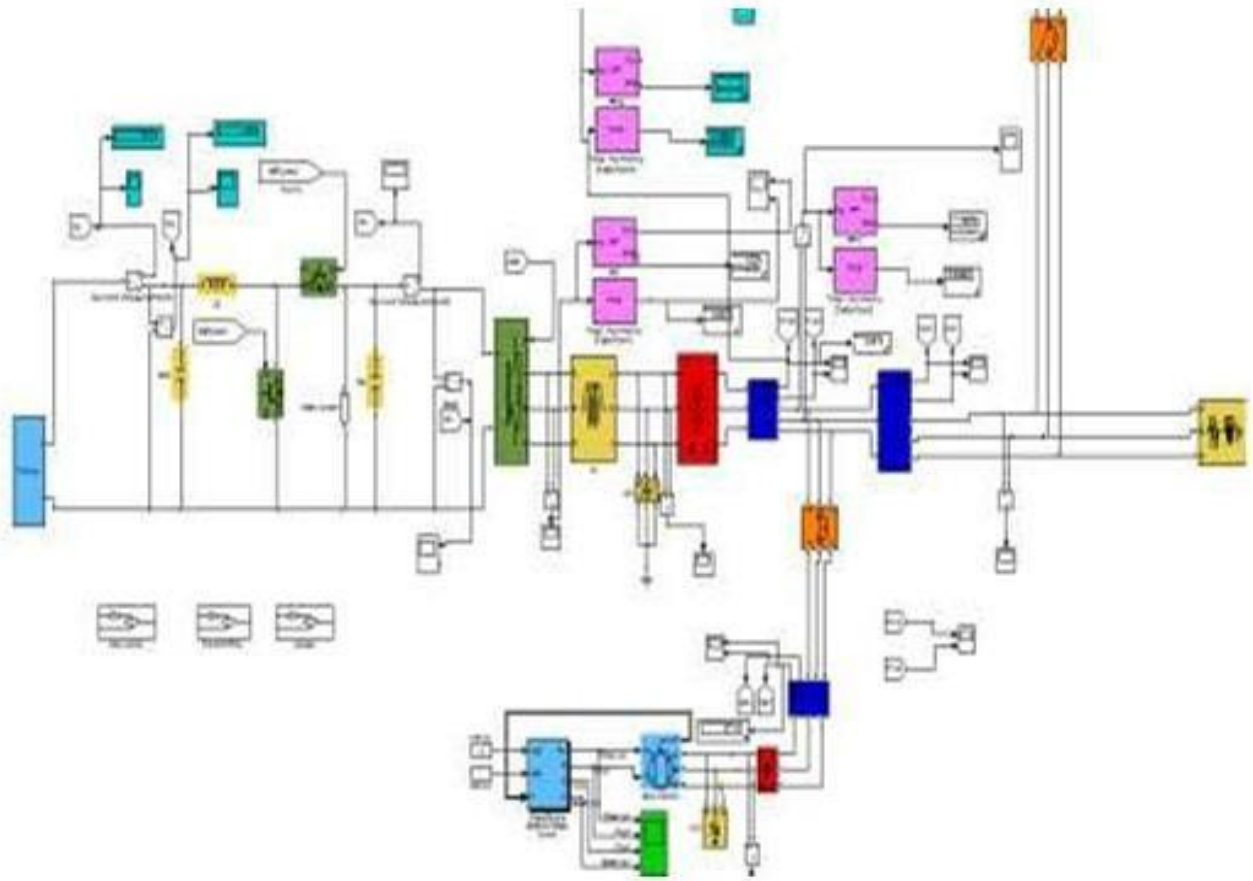

Fig 4.1. Simulation model.

4.2 Result:

The Output voltage when connected to the load.

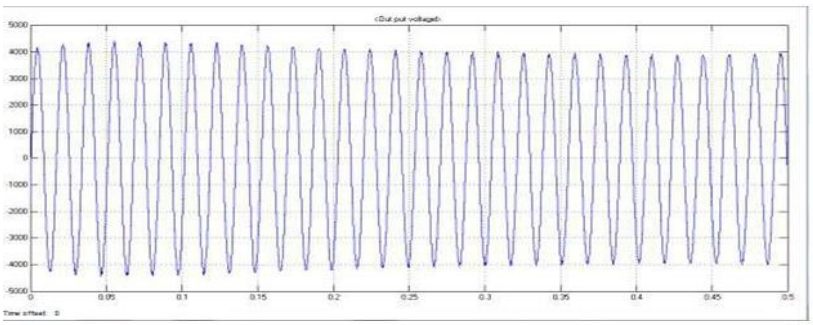

Fig 4.2. PV Voltage output.

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The output's peak voltage value is really close to the voltage that was calculated. The output graph makes it clear that the output voltage's magnitude and variation should be constant. On the output graph, it is evident that when the PV panel is first turned on and the load receives power, the voltage output shoots slightly upward before stabilizing after 0.15 seconds. As of right now, the PV panel's main responsibility is to supply power to the load. The reason for analysing this circumstance is to identify the sites where a PV module alone is sufficient to meet the load requirement. If there are any exploration centers in the desert region with sporadic loads, let us know. Only PV-generated power will be able to meet the load requirement in such a situation. The possibility of an isolated PV producing plant is demonstrated by this experiment.

5. CONCLUSION

The currently, electricity serves as the primary force behind every significant component that has a significant impact on human existence. Even the developed nation or developing country principle reports the per capita electricity consumption. Over the past few decades, the transmission system has not kept up with the increased demand for and production of electricity. Consequently, the transmission system is currently severely overloaded. This is the rationale behind the integration of renewable energy sources into the grid near the point of load nowadays.

Table 5.1. Tuning value of inductor.

S.No.	Parameter(L)	Peak Voltage OUTPUT	Thd(%)
1	70µH	4000	26.98
2	700µH	444	17.92
3	7µH	394	48.41

PV panels are successfully combined in this project with an isolated load system and a breathing grid. The voltage and associated THD module are analyzed without grid combination in the initial section of the simulation. The integration of the diesel generator is finished in the second portion of the simulation, and several components as well as THD satisfied are analyzed. The addition of PV and a diesel generator with grid is finished in the third and final section. Table 6.1 summarizes the THD analysis and verifies the possibility of an integrated system.

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