Analysis of 100kW Grid Connected Solar PV System Using INC based MPPT

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ABSTRACT:

Renewable Energy Source is now takes more concentration for transforming the new generation of electricity. The reason is its reliability and never finishing stoke. Now a day's solar based generation is become more famous for producing the electricity in small scale to large scale. Here in this paper discuss the recent work development in the field of solar integration in the power world. This paper is concentrated for technical aspect of the MPPT application of different authors or researcher's work. Also the major problem of the working algorithm is discussed. This paper describes the comparative simulation study of Grid connected two MPPT (Maximum Power Point Tracking) algorithm. MPPT algorithms are important in PV systems because it is cost efficient as it reduces the number of PV panels required to achieve the desired output power. The two algorithms used in this paper for comparison are P&O (Perturb and Observe) and Inc (Incremental Conductance). These algorithms are widely used because of its minimum cost and ease of realization. The important parameters such as voltage and power output for each different combination have been taken out for both algorithms. MATLAB Simulink tool box has been used for performance evaluation by a 100 kW

KEYWORDS: *RES, GDP, GHG, PV. MPPT, P & O, INC etc.*

1. INTRODUCTION

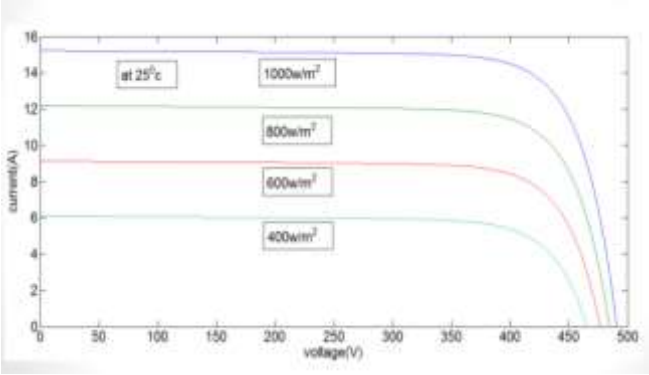
Solar energy is non-conventional type of energy. Solar energy has been harnessed by humans since ancient times using a variety of technologies. Solar radiation, along with secondary solar-powered resources such as wave and wind power, hydroelectricity and biomass, account for most of the available non-conventional type of energy on earth. Only a small fraction of the available solar energy is used. Solar powered electrical generation relies on photovoltaic system and heat engines. Solar energy's uses are limited only by human creativity. To harvest the solar energy, the most common way is to use photo voltaic panels which will receive photon energy from sun and convert to electrical energy. Solar technologies are broadly classified as either passive solar or active solar depending on the way they detain, convert and distribute solar energy. Active solar techniques include the use of PV panels and solar thermal collectors to strap up the energy. Passive solar techniques include orienting a building to the Sun, selecting materials with favourable thermal mass or light dispersing properties and design spaces that naturally circulate air. Sustainability, change in climate, increased fossil fuels costs as well as an energy independence political imperative have joined together to raise interest in using renewable energy sources to meet growing demands on electricity and to displace part of current thermal generation. Current power systems are still dominated and operated on supply following the changing demand by the generation of fossil fuel-based power. In nuclear and coal-fired systems, they are usually used as base load plants, whereas other power plant types, such as hydro or natural gas, balance demand variability. Renewable energy resources can be divided into two groups:

considered to be a viable way to reduce emissions of greenhouse gases. However, VRES have challenging operating properties, such as low and variable capacity factors and variable intermittent availability, compared to conventional power generation facilities.

A dynamically growing RES market and an increasing share in the renewable electricity sector characterize the development of the electricity supply market. It will preferably act and compensate for the progressive decommissioning of nuclear power and reduce the number of fossil fuel plants needed to stabilize the grid. By 2050, approximately 92% of electricity would be produced through a power station fired from renewable energies, which will provide 71% of electricity generation for wind, PV and solar thermal. The installed output would increase by 1149 GW from 52% by 2030 to 94% by 2050. So for achieving these values it required new trends of development in the field of generation of the RES with new technology. Here in this paper discus the various type of work in the field of generation of the RES.

2. WORK IN PV BASED RES

The solar irradiance is dynamic in nature with temperature. Therefore an online algorithm is necessary which calculates dynamically the solar panel operating point. With the Maximum Power Point Tracks (MPPT) algorithm, efficient solar energy conversion is possible. In paper [1] talk about numerous methodologies for tracking maximum power points (MPPs) for PV arrays. It includes all the techniques in this area. At least 19 different methods were already introduced. It was shown. A PV-PC for lead-acid battery is guiding a high-frequency photovoltaic pulse charge for the purpose of maximum power point tracking to eliminate sulphate crystallization on the LAB electric plate and extend the battery life by a PV-PC implemented by a Boost Current Converter (BCC) [2]. Four solar insulation changes scenarios have been examined, which are also compared to the INC MPPT, to describe the photovoltaic PI-INC MPPT behaviour in the PV-BC system. The algorithm of incremental and instantaneous conductance of a PV-Array for tracking Maximal Power Point (MPP) is discussed in [3]. The drawbacks were analyzed of Perturb and Observe method and it has shown that even in fast changing atmospheric conditions the incremental conductance algorithm has been successfully monitored. Simulation and graphs performed the work. In paper [4] proposed a new MPPT method for PV array feature and theory of operation called the CVT (Constant Voltage Tracking) analysis. A photovoltaic (PV) lower power system has been designed with a simple structure. This approach has been checked by PV charging system and has shown that the PV array MPP can be easily tracked using the charger controller.



Variations of V-I Curve with solar Irradiations

In [7] implemented maximum power point tracking algorithm using the solar energy systems with artificial neural network. The maximum power point of a solar array can be efficiently tracked by using three layers of a neural network and some simple activation functions. A low cost PIC16F876 RISC-microcontroller with no external sensor unit has successfully implemented the tracking algorithm integrated with a solar-powered battery charging system. The test results with a commercial solar panel showed that the algorithm proposed outputs the conventional controller with respect to tracking speed and the mitigation of fluctuations in static operation. The overall efficiency of the system was well over 90%.

2.1Maximum Power Point Tracking (MPPT)

A photovoltaic panel that uses open circuit voltage and short circuit current to have a quick and accurate Maximum Power Point Tracking (MPPT) algorithm is proposed in [8]. For the development of the algorithm were used mathematical equations which described the nonlinear V-I features of the PV panel. The MPPT algorithm is valid under various degradation levels, isolation and temperature. The algorithm is checked by MATLAB and the results obtained using the algorithm are very close to the theoretical values in a variety of temperatures and lighting. For the lights and temperatures normally met by a commercial PV panel, the maximum deviation in the maximum power was less than 1.5%. A modelled three separate solar farms with a capacity of 15kW, using real-time analysis software from MATLAB/Simulink is proposed in [9]. In all converters with a Perturb & Observe (P&O) based structure the energy conversion was carried out using maximum power point tracking (MPPT) algorithms. These were collected in a DC bus bar with an inter-phase transformers parallel connection (IPP). The voltage was applied to a full-bridge inverter to create3-phase AC voltages at the inverter output which was controlled with SPWM. A new solar-battery charging controller has proposed in which the combination of MPPT and over-voltage control systems is as a single function is used [10]. In this design where two-loop control configuration is used with the smaller signal model of the lead acid battery was detailed. In SIMULINK / SIMPOWER, case studies were then conducted to evaluate the designed controller's performance in terms of transient response and voltage overflow. With only small voltage shock, the designed control was shown to have a good transient response. A photovoltaic (PV) solar system addition with Maximal Power Point Tracking (MPP) controller using a load current to maximize solar output power is discussed in [11]. The cost and size of the proposed circuit were reduced when compared with the existing MPPT controller circuit, which requires multiply of sensed PV panel voltage and current to produce panel power. Simulation results validated the tracking performance of the proposed MPP controller. The new algorithm of

MPPT, mainly for applications considering constant voltage loads for battery charge is given in [12].

simplified the structure of the system, increased tracking speed and accuracy. This paper adopts an optimal charging strategy for battery charge management, the charge control system combined MPPT charging and intermittent variable current charging increases the charge speed and the charging status. Uses an efficient and reliable rule to establish the battery's loading end, prevents battery overload and extends battery life.

2.2 DC-DC boost converter

DC Converter is used to increase the level of output voltage the above diagram shows the simple construction of DC to DC Converter using iGbt technique the high frequency square waveform, is used for the switching operation of the igbt only on the igbt side conduction will be possible due to negative connected to diode it acts as high impedance path. No output will be appered Across the capacitor after switchig voltage will be added to the vdc+vl where vl is induced voltage from the inductor since load gets voltage as well as capacitor capacitor start charging when igbt gets enabled with high then capacitor will give power to the load as in direction of supply. But in the circuit, we are trying to give the supply from the dc booster converter to inverter to convert into AC power to meet the load voltage and grid requirements

A reference value (set point) of the control system was used as the calculated maximum power. To control the operation of a Buck chopper, the ON / OFF power controller with hysteresis band has been used to ensure that the PV module always operates with maximum calculated power from the MPPT. The main difference between the algorithm proposed and other techniques was that the algorithm proposed was used to directly control the power derived from the PV system.

In [18] describe the limitation of Perturb & Observe (P&O) method which changes constantly with changing of environmental conditions. A variable step-length algorithm was proposed, which reduced the drift by evaluating the whole trend in a voltage / power curve. The technique proposed in [19] achieves: firstly, adaptive tracking; thirdly, no stable state oscillations of MPP; and lastly, a generic design core, which is not required for predefined system-dependent constants. The experimental application of the proposed technique presents an example of a design. For validating the proposed technique, practical results for the set-up at different irradiance levels will be illustrated. An adaptable step-size Digital MPPT Single Photovoltaic Sensor Controller with adaptive-perturbation frequency is given in [20]. This paper features an adaptive step-size and an adaptive-perturbation-frequency algorithm for the digital load-current maximum power point monitoring (MPPT) controllers. A proof-of-concept experimental Prototype is used to present, analyze and evaluate the concept and operation of the MPPT Controller for the adaptive sized and adaptive perturbation frequency. The PV Modules Using a 2-dimensional Lookup table as the Simple and Efficient MPPT Scheme is presented in [21]. A simple and effective MPPT system with a 2-dimensional Lookup Table is offered in this paper. The results demonstrate a better stable performance, precision and efficiency in the proposed method. Detailed mathematical modelling of the PV, dc-dc and MPPT algorithms is also discussed in this paper. A new MPPT P&O scheme based on linear tangents is presented in [22]. This document provides an overview of traditional MPPT algorithms for maximum power points. Using analog or digital devices traditional algorithm can easily be implemented. In this paper a novel MPPT scheme is proposed, using Linear Tangents-based Perturb and Observe, since traditional algorithms suffer from low efficiency, oscillations in static power and poor dynamic power. The scheme and other traditional algorithms will be simulated with MATLAB / Simulink to validate their performance. Simulated results show that the proposed method is more precise, more efficient, less oscillated, better stable and dynamic than traditional methods.

New algorithms based on a Perturb and Observe (P&O) modified algorithm for maximum strength tracking is discus in [23]. The algorithm being proposed is dual mode one and is based on the value of the power derivation as to voltage at solar panel output which must be zero at the highest power point. The power derivative is a two-mode one. The first mode, the conventional P&O, is activated when a derivative value exceeds a threshold and the second mode is activated, which prevents voltage at solar panel output from being far removed from the maximum voltage point (Vmpp). The second one is the conventional P&O mode. A new solution in order to balance the performance of the MPPT method with the cost is shown in [24]. The disturbance step dimension is determined offline based on local irradiance data for a particular location. The Support Vector Machine (SVM) uses historical irradiance data for automatically classifying desert or coastal locations. The disturbance step size for better system performance is optimised without increasing the control complexity. Simulations and experiments to verify that the proposed method is effective and superior to the existing approaches have been conducted.

3. PROBLEM IN PV BASED RES

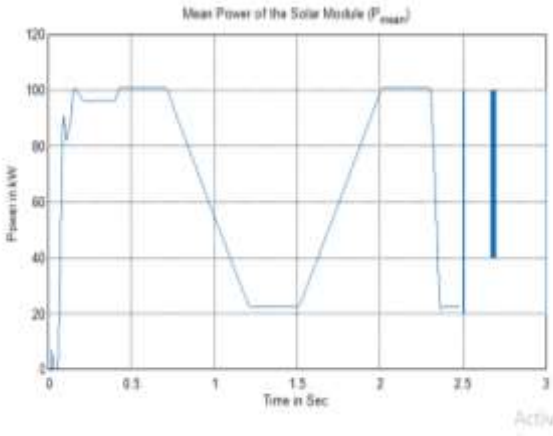
Solar power is a potential source of energy that comes directly from the sun. To harvest this type of energy, a photovoltaic system is required and the power supply must be effective in order to maximize its collection. When the PV works at its maximum power point, dependent on irradiation and temperature, the maximum efficiency is achieved. Since irradiation and temperatures always change over time, it is necessary to develop a PV system that can track the maximum power point to generate more energy. Photovoltaic is necessary to harvest solar power, and it has certain advantages, such as low maintenance and environmentally friendly costs. It needs a high system cost and low efficiency (less than 20%) are the major disadvantages of photovoltaic. A PV must work at the maximum power point in order to increase its efficiency, which is always dependent on solar radiation and temperature. The maximum power point is shifted by change in temperature and Irradiation, and PV efficacy is reduced. Usually an electronic power circuit that provides an interface between PV and load is used as the Maximum Power Point Tracking (MPPT). Certain scientists employed certain methods to optimize the use of solar photovoltaic systems such as continuous voltage control, perturbation and observation, incremental conductance, fuzzy logic, and the neural network.

Methods for perturbation and observation are well known methods for tracking maximum power point in PV system because they are simple to implement. One disadvantage of this method is that its distortion increases as the power increases and, after the PV power peaks, power decreases and the disturbance increases. It introduces an oscillation at the maximum power point area and is not suitable for an environment that suffers from rapid temperature changes and radiant. Fuzzy Control and Neural Network are other alternatives to MPPT methods..

4. RESULTS AND DISCUSSION

The basic component generate power using solar energy is photo voltaic cells array they generates a solar power which is not sufficient to meet the load voltage. since for that reason we need to boost up the voltage to increase the voltage level by using DCDC converter(boost chopper)

Parameter	Previous Work	Proposed Work
MPPT Algorithm	P & O based MPPT	INC based MPPT
Switch used for Boosting Voltage	MOSFET	IGBT
VSI Module	2 Level`	3 Level
Frequency used for Switching	20 kHz	5kHz
Rated Power	50 W	100 kW
Maximum Voltage	171.1 V	280 V
Grid Interface	No	Yes



5. CONCLUSION

In the recent year due to rapidly change in power generation from conventional to non-conventional system a solar system based renewable energy system increase day by day. The growth of application of solar system is due to its reliability and easy to install. So for new development it is require studying the previous work associated with the existing system. Here in this paper discuss the technical work associated with the solar system based energy generation. Majorly here in this paper discuss the MPPT based work in the PV based RES.

Also here the main drawback of the applied system is discussed.

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