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"Measurement and Investigation of PCC Point Harmonicsin a Grid Connected Photovoltaic system"

Ajay Yadorao Barbuddhye
M.tech (IPS Wainganga College of Engg & Management

Mr. Yuvraj Hari Chavhan
(Asst.Prof. Wainganga College of Engg & Management Nagpur

Dr. D.R.Tutakne (HOD of Electrical Dept. Wainganga College of Engg& Management Nagpur

Abstract

Renewable energy sources such as solar and wind are a way to increase energy demand. Renewable energy improves reliability and can provide continuous energy to meet energy needs of consumers. However, the integration of renewable energy sources into the supply grid affects grid design and affects the operation of the supply grid, such as voltage regulation, power quality, protection system, fault level and grid loss. The impact of the integration of renewable energy sources on current quality is related to important aspects such as harmonics, voltage flicker, decrease, and steady state voltage increase.The integration of renewable energy sources into the supply network takes place through power electronics converters. You can introduce RES harmonics connected to the converter. Injecting harmonics can distort the waveforms of voltage and current that can propagate through the power supply network. The waveforms of voltage and current show some significant properties, such as lower frequency, power correlation, and interharmonic. Harmonics degrade the quality of care. This work presents the solar system and the wind energy system, which are individually connected to the grid.

This project deals with the PCC point harmonics of the Solar System and the wind power system when connected to the grid. They perform the modeling and simulation of the solar system and the wind energy system under the changing environmental conditions. The analysis of total harmonic distortion shall be performed for both the grid-connected solar system and the wind energy system. Filters, such as the reduction of harmonic distortions, are designed to keep the harmonic level within the limits recommended by the IEEE standard. The aim of the project is to find the cause and effect of harmonics and possible corrective measures.

1. INTRODUCTION

The world has grown significantly in recent years and will continue to do so. Energy is vital to support a growing population. Due to the growing population and less supply of non-renewable energy sources, the world is facing an energy crisis and wants to find additional energy sources to meet its growing energy needs. One option is to increase the production of energy sources currently in use, such as nuclear energy and fossil fuels, which is not a viable solution to meet energy needs. The other is consideration for

renewable energy sources. Various renewable energy sources are emerging as cost-effective solutions, each with advantages and disadvantages. Renewable energy sources are first and foremost free and pollution-free. These factors encourage electricity.It is estimated that in 2017, 24.5% of the world's energy consumption was provided by renewable energy [2]. Renewable energy consumption worldwide, 2017, 1.1. As 24.5% of global energy is renewable, which indicates an increase in renewable energy consumption since 2010, it is only 16.3% [3]. The proportion of renewable energy consumption has increased year by year compared to recent years. This trend will continue in the future.1.1. According to the figure, the largest energy source is fossil fuels. Nuclear and hydropower are the most widely used sources of energy. Fossil fuels are not renewable and cause pollution when burned as an energy source. Nuclear power plants produce toxic nuclear waste that must be landfilled. Hydropower must build a dam or a well that changes its natural flow and affects its ecosystem.

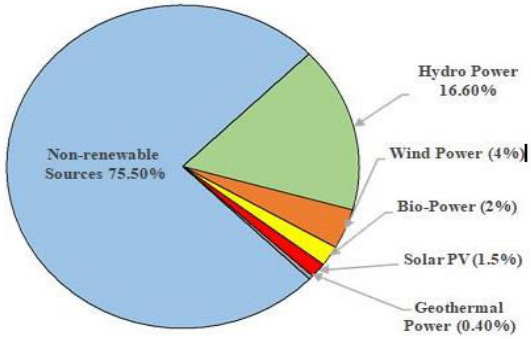


Fig.1.1: Renewable share of global final energy consumption,2017

2. Research and Motivation

Recently, the availability of electricity in India has not only increased but is also increasing, although demand has consistently increased more than supply. Therefore, unconventional sources become the center of attraction. Among these rapidly growing unconventional sources, wind energy systems and photovoltaic systems are very common. Now India has become fifth in installed capacity in wind and solar power generation. Pr. As of 30 September 2013, the installed wind power capacity in India was 19881MW. But because the wind is seasonal and region based, it is not very reliable, so we use a hybrid system for electricity production. There are many remote locations, especially in developing countries, where grid supply has not yet been achieved, but still with the availability of more solar-wind hybrid systems. In addition to the economic dependence on the decomposition of fossil fuels and the negative environmental impact of conventional power generation systems, renewed interest in renewable energy sources is created to build a sustainable energy economy. As wind-solar hybrid energy is the fastest growing energy source in the world, expanding globally at a rate of 25-35% per year over the last decade.

The benefits of using renewable energy sources for energy production on remote islands are clear, as the cost of transported fuel is often unaffordable by fossil fuels and that there are growing concerns about climate change and global warming. Electrical energy production systems, which consist of renewable energy and energy storage systems and conditioning systems, are known as hybrid power systems. The hybrid power system has the ability to deliver power for 24 hours with network quality to the load. This system provides better efficiency, flexibility in planning and environmental benefits. The system also provides an opportunity to expand its capacity to cope with future increases in demand. This can be done by upgrading either the rated battery, renewable generator or both.

The disadvantage of a hybrid power system that uses renewable energy is that the availability of renewable energy sources has a daily and seasonal pattern, making it difficult to regulate the output power to meet load demands. Very high initial investment costs are also required. Combining renewable energy production with energy storage systems allows power from renewable energy sources to be more reliable, affordable and used more efficiently.

3. Literature Survey

The paper given by the author**, AneesA. S,** titled as **Grid Integration of Renewable Energy Sources: Challenges, Issues and Possible Solutions** presents a Renewable Energy Sources (RES) are introduced in the distributed system to improve system performance and to avail the facility of clean energy. The challenges in connecting RES or microgrid or to the utility grid are broadly classified into technical and nontechnical and described below [7],

A. Technical Issues:

Technical issues are described as,

1. Power quality
   a. Harmonics
   b. Frequency and voltage fluctuation
2. Power fluctuations
   a. Small time power fluctuations
   b. Long time or seasonal power fluctuations
3. Storage
4. Protection issues
5. Optimal placement of RES
6. Islanding

B. Non- Technical Issues:

1. Scarcity of technical skilled workers.
2. Less capacity of transmission line to accommodate RES.

RES technologies are excluded from the competition which discourages the installation of new power plant for reserve purpose.

The paper given by the author**, H. R. Enslin and P. J. M. Heskes,** titled as **Harmonic Interaction between a Large Number of Distributed Power Inverters and the Distribution Network** presents a Integration of RES to the utility grid takes place through power electronic converters. With the new invention in power electronics and digital control technology, the RES systems can be controlled to improve power quality at PCC and enhance system operation. However, the extensive use of power electronic converter generates harmonic currents at PCC which may deteriorate the quality of power supply. Integration of RES has power quality issues such as Harmonics, voltage flicker, dips and steady state voltage rise. Converter connected to RES and Grid might introduce harmonics. The injection of harmonic currents can distort the voltage waveforms which can pass through the utility grid. The voltage and current waveforms present some significant characteristics such as distorted waveforms, harmonics and inter-harmonics [8].

Generally, Voltage Source Converters are used to interface the intermittent RES in power system. Recently, control strategies for grid connected converter to improve power quality have been proposed. A new control concept was proposed that provides sharing

of harmonic load currents between parallel-connected converters without mutual communication in paper given by the author**, U. Borup, F. Blaabjerg, and P. N. Enjeti,** titled as **Sharing of nonlinear load in parallel-connected three-phase converters**[9].

In order to provide harmonic load sharing with the harmonic controllers applied, a new control concept is derived from the well-known concept of sharing linear load by droop coefficients. But the exact calculation of network inductance in real-time is difficult and may deteriorate the control performance. A similar approach in which a shunt active filter acts as active conductance to damp out the harmonics in distribution network is proposed in paper given by the author**, P. Jintakosonwit, H. Fujita, H. Akagi, and S. Ogasawara,**titled as **Implementation and performance of cooperative control of shunt active filters for harmonic damping throughout a power distribution system** [10]

The active filter is characterized by behaving like a resistor for harmonic frequencies, thus resulting in damping out harmonic propagation. Moreover, the active filter equipped with automatic gain adjustment can damp out harmonic propagation without considering the circuit parameters of the distribution feeder. Active power filters (APF) are extensively used to compensate the load current harmonics and load unbalance at distribution level. This results in an additional hardware cost [11]. Use of passive filter is other solution. A control strategy for renewable interfacing converter based on p-q theory is proposed in [12]. In this strategy both load and converter current sensing is required to compensate the load current harmonics.

4.Results

The performance of a PV array system connected to a utility network is analyzed based on changes in solar radiation. It is assumed that the temperature of the PV array system is constant at 25 degrees Celsius until the total simulation time is shown in Figure. The change in radiation shows that the PV system injecting active energy is shown in Fig. 6.2. It varies with the solar radiation shown in Figure 6 and is shown in Figure 6.3. The voltage shown in the figure is almost constant during the 2-second simulation.

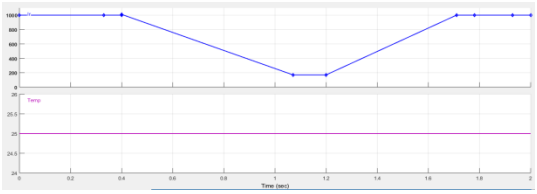


Fig.6.1: Variation in Irradiance (W/m^2) and Temperature (^0C)

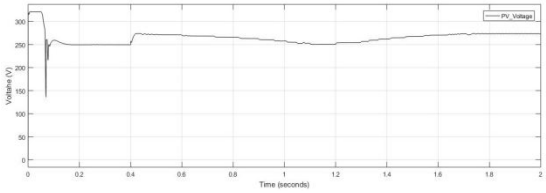


Fig.6.3: PV Array Voltage

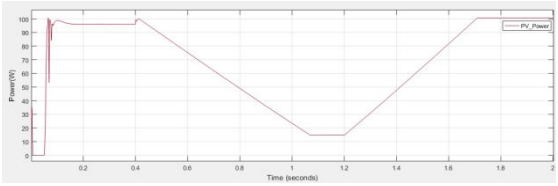


Fig.6.2: PV Array Power

The energy of the PV array is fed into the supply system through a three-stage VSC and a transformer. Some reduced performance can get on the B1 bus as shown in Figure 6.4. It is shown in the figure, which is approximately the same as the control methods for the B1 bus in the PV system. As the current deteriorates slightly, 6.6. As can be seen in the figure from 0.8 seconds to 1.6 seconds, the performance of B1 deteriorates, but the voltage is almost constant and the same with time and it is changed via VSC.

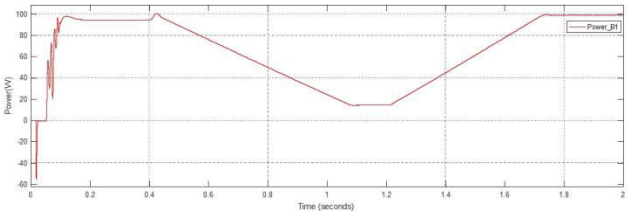


Fig.6.4: Power at B1

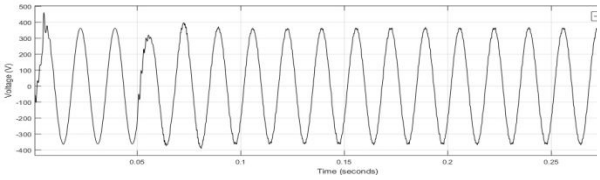


Fig.6.8: Inverter output Voltage with filter

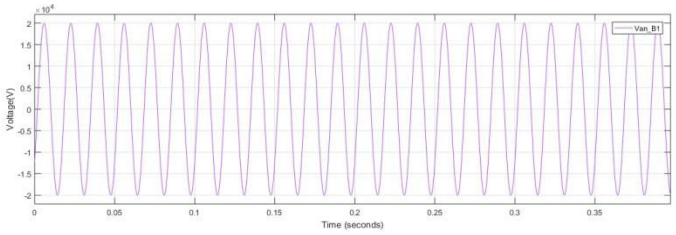


Fig.6.5: Voltage at B1

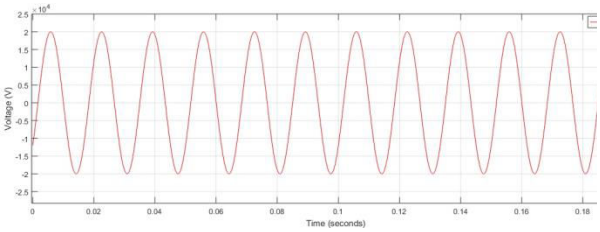


Fig.6.11: Voltage at Bus B2

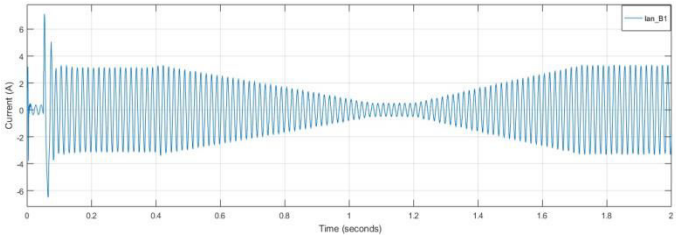
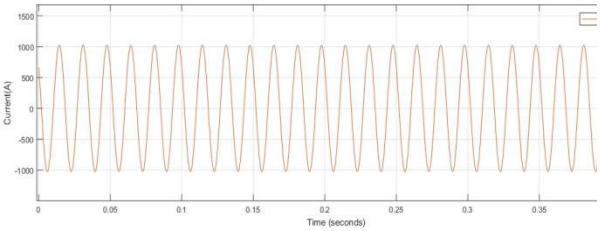


Fig.6.6: Current at B1



Conclusion

This work presents an example, an example of a 100 kW solar system that is connected to a utility for a continuous operation. The simulation model is simulated in MATLAB SIMULINK for solar for different environmental conditions. This project designed and developed the design of a PV classification system that is connected to a system function in MATLAB / Simulink and to accept solar energy and a function function that is not a technical control so that VSC can be assigned correctly In addition, the high power output path from DC to DC converter with precise control technology. This work demonstrates the impact of electrical materials on quality. The positive energy was improved with a vacuum filter. For the measurement of the analytical analysis, the THD without the filter was 42.20% and that of 2.13% with the added filter. The work focuses on reducing solar radiation, because the presence of solar radiation is the source of problems and renewable energy. The results of the experiment show that the total number of false positives of both elements violates IEEE standards, referred to in IEEE 519, when communicated without filtering. The suggested solution to this matching problem is to connect a filter that brings THD to IEEE limits and use multi-level VSC converter. After connecting the filter to the system, the simulation results show a reduction in material degradation and the Uniform Disruption of both materials complies with IEEE standards.

Reference

[1] G. Purevdorj and K. Enkjargal, "Ecological, economic and social aspects from the renewable energy and energy conservation" in International Forum on Strategic Technology, IFOST, 2007, pp. 20-23.

[2] "Renewables 2012: Global Status Report," REN21, 2018.

[3] "Renewables 2012: Global Status Report," REN21, 2011.

[4] A. Yazdani and R. Iravani, Voltage-Source Converters in Power Systems: Modelling, Control and Applications: John Wiley and Sons, Inc., 2010.

[5] N. Mohan, T. M. Undeland, and W. P. Robbins, Power Electronics, Converters, Applications and Design, Third ed.: John Wiley and Sons, Inc., 2003.

[6] Roger C. Dugan and Surya Sanoso " Electrical power quality", McGreaw-Hill, Second Edition, ch.1-6, Pages:1-294