Harmonics Analysis in Distribution System With Integration of PV System

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Abstract- *The harmonic characteristics of the system are analyzed by using a theoretical model and simulation results. The results show that, when the PV system is integrated into the distribution system, the total harmonic distortion in the system increases significantly. A comparison of the total harmonic distortion with and without the PV system is provided to analyze the impact of the PV system on the system. Furthermore, the harmonic resonance effects caused by the integration of the PV system into the system are also discussed in detail. The proposed work provides a useful tool for the harmonic analysis of a distribution system integrated with a PV system.*

I. INTRODUCTION

The battery energy storage system can provide flexible energy management solutions that can improve the power quality of renewable-energy hybrid power generation systems. Several control strategies and configurations for hybrid energy storage systems, such as a battery energy storage system, superconducting magnetic energy system (SMES), a flywheel energy system (FES), an energy capacitor system (ECS), and a fuel cell/electrolyzer hybrid system have been proposed to smooth wind power fluctuation or enhance power quality.

II. SYSTEM ANALYSIS

This concept involves the integration of a solar photovoltaic system with a distribution system to analyze harmonic distortions in the system. The components of the system include a solar panel, Maximum Power Point Tracking (MPPT) controller, DC to DC converter, Pulse Width Modulation (PWM), Harmonic Current Compensator, AC Voltage Supply, SAHF filter, and Non-Linear Load.

The solar panel will be used to capture solar energy and convert it into electrical energy. The MPPT controller will be used to maximize the solar energy that is converted into electrical energy. The DC to DC converter will be used to convert the electrical energy from the solar panel into a usable voltage for the system. The PWM will be used to control the energy flow from the solar panel to the other components. The Harmonic Current Compensator will be used to reduce harmonic distortions in the system. The AC Voltage Supply will provide the main source of voltage for the system. The SAHF filter will be used to reduce noise and interference in the system. Finally, the Non-Linear Load will be used to represent the other loads connected to the system.

The system analysis will involve analyzing the power flow and harmonics in the system. This will involve determining the magnitude and phase of harmonic currents and voltages as well as the power factor of the system. The analysis will also involve determining the effects of the PV system on the harmonics in the system, as well as the effects of the harmonic current compensator and the SAHF filter on the system. The analysis will also involve determining the efficiency of the system and any potential issues with the system.

III. PROPOSED MEODOLOGY

The system implements a new methodology called Segmented Storage Energy System. The system provides the solution for power wasted by the photovoltaic when the battery is in full charge condition. The system has a two or more number of batteries which is integrated with the inverter hence the power can distributed to the batteries one by one and it is stored. (i.e., Instead of using dump load, we use an additional battery to store the excessive power) Fuzzy logic control strategy is implemented. To get a pure sine wave output we also introduce a modified sine wave topology.

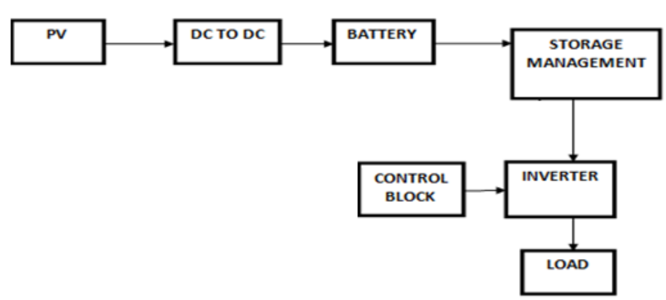

Figure1.Block Diagram

IV. SYSTEM DESIGN

Solar Panels: Solar panels will be installed and connected to the distribution system.

MPPT Controller: An MPPT (Maximum Power Point Tracking) controller will be used to optimize the power output from the solar panels.

DC to DC Converter: The DC-DC converter then converts the DC power from the MPPT controller to the desired voltage level.

PWM (Pulse Width Modulation): This will be used to control the output of the DC to DC converter so that the solar power is fed into the distribution system at the desired voltage.

Harmonic Current Compensator: This will be used to reduce the harmonic currents in the distribution system caused by the non-linear load of the solar panels.

AC Voltage Supply: This will be used to provide the necessary voltage to power the non-linear loads in the distribution system.

SAHF Filter: This will be used to filter out high frequency noise and harmonics in the distribution system.

Non-Linear Load: This will be used to provide the necessary load on the distribution system to enable the solar system to work effectively.

V. EXPRIMENTAL SETUP

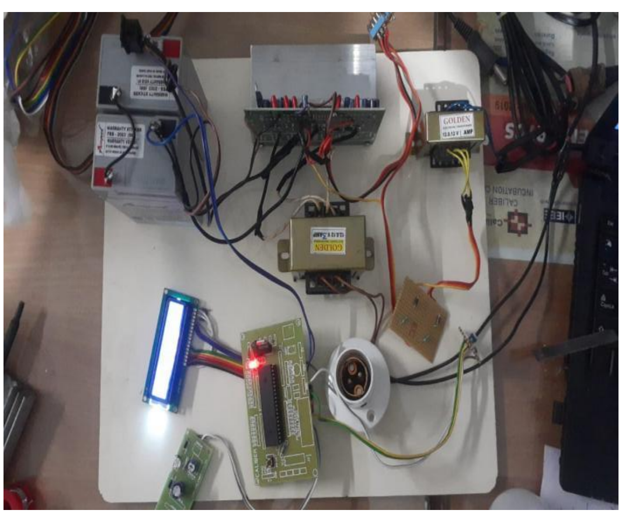

Figure2. Experimental Setup

The experiment setup includes the integration of solar PV system with a distribution system. The setup consists of a solar panel, an MPPT controller, a DC-DC converter, a PWM unit, harmonic current compensator, an AC voltage supply, a SHA filter, and a non-linear load.

The solar panel supplies DC power to the MPPT controller, which in turn regulates the power output from the panel. The DC-DC converter then converts the DC power from the MPPT controller to the desired voltage level. The PWM unit is then used to modulate the power from the DC-DC converter to the desired level.

The harmonic current compensator is then used to reduce any harmonic distortion in the current produced by the DC-DC converter. The AC voltage supply is then used to supply the power to the non-linear load. The SHA filter is then used to reduce any harmonic distortion in the output of the non-linear load.

Finally, the harmonic current of the system is measured using a harmonic analyzer. The results of the analysis are then used to assess the performance of the system and to make necessary corrections if needed.

Figure3. Result

S.NO	EXISTING SYSTEM	PROPOSED SYSTEM
1	SUCK MORE POWER	SUCK LESS POWER
2	EFFICIENCY 85%	EFFICIENCY 97%
3	HIGH COST	LOW COST
4	OCCUPIED LARG AREA	OCCUPIED SMALL AREA

Table. 1 Comparison of proposed system with existing system

VI. RESULT AND DISCUSSION

Harmonic analysis in distribution systems with integration of PV systems is an important concept as it helps to identify the sources and effects of harmonic currents present in the system. The analysis helps in understanding the system's behaviour in terms of current and voltage distortions, and in mitigating the effects of the harmonics. This concept is important in order to ensure a safe and efficient operation of the system.

The integration of PV systems in the distribution system can cause an increased level of harmonics which can lead to malfunctions and even system failures. Hence, it is important to analyse the system and identify the sources and effects of the harmonics. The analysis helps in mitigating the effects of the harmonics, such as voltage and current distortions, as well as in ensuring the system's safe and efficient operation.

The analysis of the harmonics present in the system is done using different methods such as Fourier analysis, wavelet analysis and the short-time Fourier transform (STFT). The analysis helps in identifying the sources of the harmonics and their effects on the system. The results of the analysis can then be used for mitigation of the harmonics and for efficient operation of the system.

Overall, harmonic analysis in distribution systems with integration of PV systems is an important concept which helps to identify the sources and effects of the harmonics present in the system. The analysis helps in mitigating the effects of the harmonics and in ensuring the safe and efficient operation of the system.

VII. FUTURE SCOPE

The future scope of harmonics analysis in distribution system with integration of PV system is immense. With the increasing demand for renewable energy sources, there is a need to integrate these sources into existing distribution systems. With this integration, the harmonics analysis should be enhanced to ensure the reliability and safety of the system.

VIII. CONCLUSION

In conclusion, harmonics analysis in distribution systems with integration of PV system can provide a reliable and efficient energy supply. It allows for the integration of renewable energy sources and allows for a more balanced and reliable energy supply.

The harmonics analysis also helps to reduce the risk of power quality problems and provides a more reliable energy system. The integration of PV systems into the distribution system also helps to reduce the cost of energy as well as the negative environmental impacts associated with traditional energy sources.

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