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HARMONICS MITIGRATION OF A MICROGRID SYSTEM USING UPQCMETHOD

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ABSTRACT

The best attributes of the present power framework withdispersed energy assets (DER) shaping the microgrid is the dependability of the power supply and resistance to different power quality (PQ) issues. It is critical to inspect PQ issues emerging from the presentation of DER and conduct of microgrid with infiltration ofdifferent burdens. In this proposition work, per user is acquainted with significant power quality issues in the microgrid. Various answers for tackle these issues and their working standard are likewise made sense of. Notwithstanding the customary power quality issues, load beats are every now and again experienced and should be handled with extraordinary consideration in microgrid.

Step by step there is expansion being used of sustainable sources like sunlight based, wind for creating power in view of de- wrinkle in accessibility of non-inexhaustible assets of energy like coal, natural gas, oil and huge improvements in energy capacity gadgets. Microgrids consolidate enormous measure of non-customary and traditional appropriated age (DG) that are associated with the framework either straightforwardly or through power electronics (PE) interface. To use most extreme measure of sustainable power, energy the executive's regulator has been created by analyst before however later it is observed that they are wasteful. As they control the stockpile side and request side contingent upon all out power produced and consumed without relegating any need to supply the heap.

I. INTRODUCTION

Microgrid is a scaled down variant of self-supported energy modelwhich can be utilized to produce, convey and control the bi- directional progression of force inside its limit of activity in a plannedcontrol, savvy and effective way with an emphasis on combination ofefficient power energy sources.

One of the primary obligations of a utility framework is to supply electric power as sinusoidal and flows with fitting sizes and recurrence for the clients at the marks of normal coupling (PCC).

Albeit the created voltage of simultaneous machines in power plants are practically sinusoidal, a few unsighted circumstances, for example, lightning and short out issues and non-direct loads cause consistent state blunder or transient voltages and current aggravations.

Energy the board is the technique for control a wide range of energy inside a venture. Energy the executives framework (EMS) is framework in view of checking and determining of genuine energy age and utilization. EMS makes it simple for administrators of utility to control the age and dispatch in view of burden estimating. Energy the executives can be acknowledged with the ideal present moment or long haul programs for age, utilization and buying of energy at the endeavor to decide the examination of energy costs, financial variables, energy accessibility. The enormous measure of EMS frameworks empowers generally straightforward administration of the fundamental framework parts. The framework measures and examinations the genuine power con-sumption of the primary framework gadgets. At the point when the pinnacle loads show up in framework, the EMS guarantees switching off the controllable gadgets, while during times of low power utilization the EMS actuates these purchasers. This is conceivable exclusively by guaranteeing a continuous progression of force at appropriate voltage and recurrence levels. Accordingly, Realities gadgets and Custom power gadgets are acquainted with electrical framework to further develop the power nature of the electrical power. Withthe assistance of these gadgets, we are skilled to diminish the issues connected with power quality. There are many kinds of Custom Power gadgets. A portion of these gadgets incorporate Dynamic Power Channels (APF), Flood Arresters (SA).

Microgrid

Microgrid is the bunch of little sustainable power sources and its reach is from 100 to 200kW [1]. In prior days

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the creating units are in one spot and the produced power is communicated to the heap through a long transmission and dissemination framework, subsequently there will be a power misfortune because of long transmission line and the influence request is high which leads decrease in effectiveness of the framework .to defeat thedownsides of customary electrical network framework the idea of microgrid matrix framework was proposed. Here the general chart for microgrid framework with shunt dynamic power channel was displayed in Fig.1.It comprises of little miniature sources, for example, PV, battery and wind interconnected with primary electrical lattice framework, AC transport, DC transport, straight and non - direct loads. The miniature sources are associated with DC transport bar through power converters and are associated with the electrical matrix through AC transport bar. This framework comprises of numerous feeders wherein miniature sources and various burdens are associated. Feeder a comprise of PV as an electrical source and is straightforwardly associated with DC transport. Feeder B has battery as miniature source and Feeder C has wind turbine as its electrical source and is associated with DC transport through AC-DC converter. Loads are associated with AC transport line which might be straight and non-direct loads [6]. The power nature of the framework can be improved by interconnecting shunt dynamic power in the middle among source and burden at the Purpose In like manner Coupling (PCC).

UPQFC (Unified Power Quality Conditioner)

The performance operation of the filter is decided using control strategy. The circuit diagram for control technique is shown in Fig. 3. It consists of major parts such as controller circuit, control technique part and pulse generation-

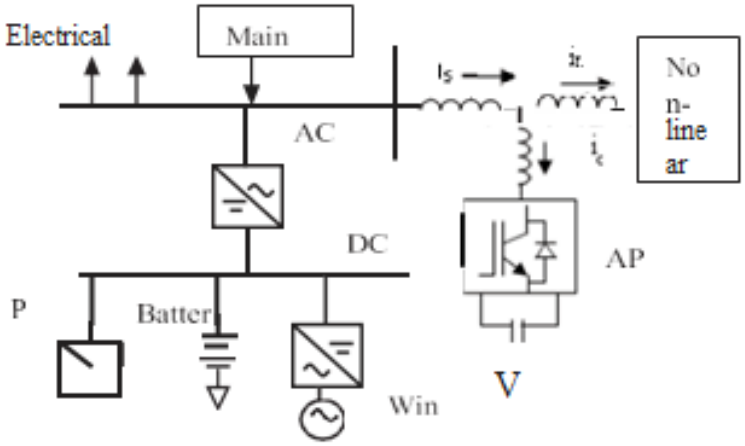

Fig. 1. General diagram of microgrid with shunt active power filter

Shunt active power filter

The diagram for shunt active power filter is shown in Fig. 2. Series Active Filters (SAFs) are essential for improving power quality in microgrid systems. In microgrids with diverse renewable sources, energy storage, and various loads, SAFs play a pivotal role. They effectively mitigate harmonic distortions, canceling out undesirable currents to ensure a cleaner and stable power supply. SAFs also regulate voltage, compensating for sags and swells during transient disturbances. Additionally, they balance loads, distribute power evenly among sources and loads, and provide rapid response to transient voltage fluctuations. For microgrids with variable renewables, SAFs reduce voltage flicker, enhancing power quality. Overall, SAFs are integral to maintaining reliable and high-quality power delivery in dynamic microgrid environments.

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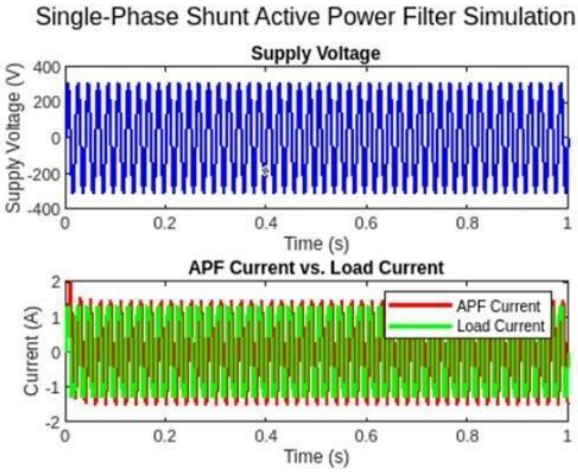

Fig.2. Shunt active power filter

The results underscore SAF's effectiveness in addressing harmonic issues in microgrids with non-linear loads. By actively canceling out harmonics, SAF improves the powerquality, leading to increased operational efficiency and reduced equipment wear. This technology is particularly beneficial in microgrids with variable-speed drives and other non-linear loads.

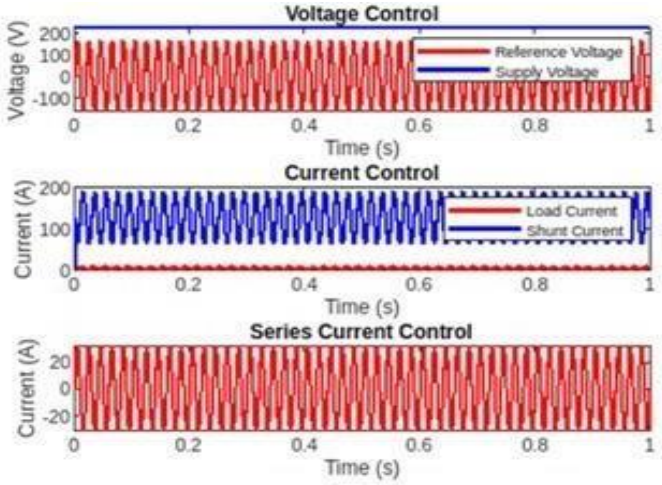

Fig.3. UPQFC (Unified Power Quality Conditioner)

- UPQFC provided comprehensive power quality control, addressing voltage regulation, harmonics, and power factorcorrection.
- Adaptability of UPQFC to changing microgrid conditions wasevident.
- Enhanced reliability and resilience of the microgrid observed.

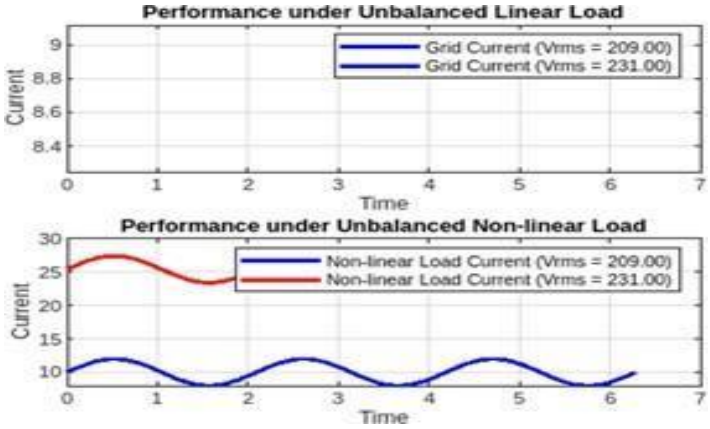

Fig.4. Unified Power QualityConditioner

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The results highlight UPQFC as a versatile solution for power quality improvement in microgrids. Its ability to address multiple power quality issues simultaneously ensures a high-quality power supply to critical loads. The adaptability of UPQFC to changing conditions, such as grid-connected and islanded modes, further enhances the microgrid's reliability and operational resilience.

Generation of reference signals

$$vc\ (t) = (VL - Vs+)\sin(\omega t + \phi+) - Vs-(t) - Vs0(t) - \sum vsh\ (t)$$

$$ic\ (t) = IL+co\ (\omega t + \delta+)\ sin\theta L + iL\ (t) + iL0\ (t) + \sum iLh\ (t)$$

This ensures that pure sinusoid current and voltages are obtained from the supply as well from the load. These are generated, tracked, and observed. The UPQC analyses reference signals system of control.

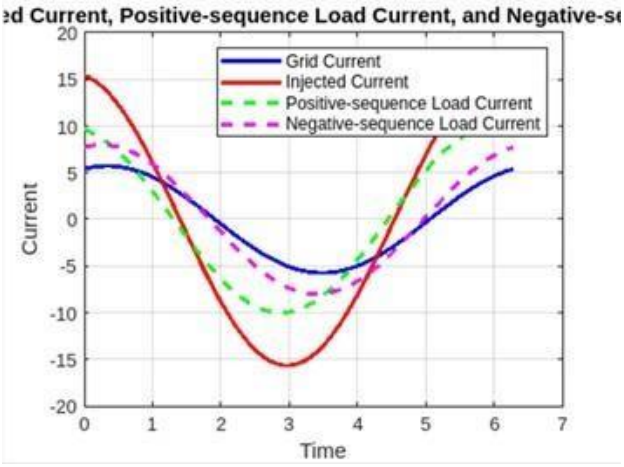

Fig-5: Generation of reference signals

II. SIMULATION RESULT AND DISCUSSION

Not be a cost-effective solution as DVR always demands a source for active power. Hence, back-to-back configuration of DSTATCOM and DVR was introduced and named Unified Power Quality Conditioner. UPQC mitigates reactive power as well as oscillating components of real power.

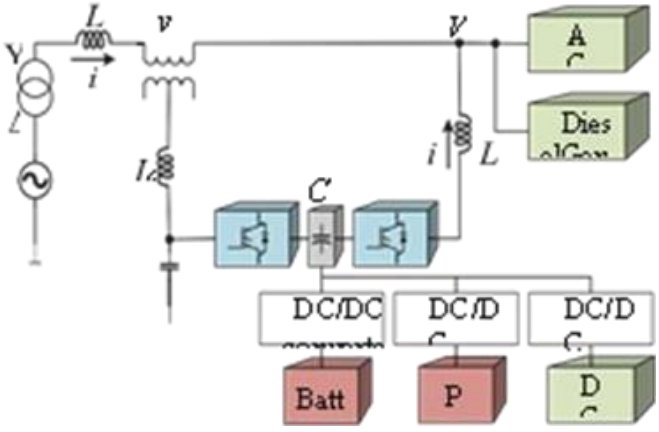

Fig-6: Block diagram of unified power quality conditioner

III. CONCLUSION

A microgrid is the composition of electrical systems along with conventional or renewable energy sources constituting a grid which feeds a significant number of small distributed loads. Although all sources are primarily electrical sources, their operating characteristics and nature of supply depend largely on the load connected to them. As a result, the overall system can have highly nonlinear characteristics of operation.

While this is not a point of great concern when several distributed generations (DGs) are tied to the grid; The changeover of the microgrid from on-grid to the isolated (islanded) mode or, the islanded mode to on-grid conditional so introduces certain PQ issues and reliability issues. The nonlinear loads connected to the micro

grid can have deteriorating effect on system in comparison to the conventional grid and hence issues must be tackled with great concern. UPQC is a combination of two important types of compensators namely shunt and series compensators. The shunt compensator is normally designed to mitigate current related issues and the series converter is most suitable for voltage related issues e.g., voltage harmonics sag/swell, flicker.

However, installing two separated evinces may

In this theory, work has been finished to look at series, shunt, and series-shunt compensators. Execution examination has been finishedby contrasting the power nature of each compensator.

The ever-increasing complexity of the microgrid with deep penetration of linear and non-linear load as well as no. of Distributed Energy Sources has aggravated power quality issues and poses a serious challenge for the large user as well as utility. Harmonics are found to have deteriorating effects on the microgrid. Hence, investigation on harmonics generated due to various filtering and loading conditions is carried out. It has been found that the input current THD of Adjustable Speed Drive ranges from 40 to 130%.

Additionally, various power quality issues occurring in the microgridare studied.

A number of solutions have been reported in the literature for the mitigation of power quality issues in the microgrid. The most commonly employed solutions such as Active Power Filters, DSTATCOM, DVR, and UPQC are discussed with their operating principle and control algorithm. The solution to power quality issues is not limited to the primary compensation devices. Multi- functional DGs can compensate for many PQ issues in addition to the active power transfer between source and grid.

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