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# A Review Report on Power Quality Improvement Features for Grid-Connected Dual Voltage Source Inverter

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***Abstract*** *– This paper is a review of grid connected dual voltage source inverter methodology to increase power quality. The planned scheme is comprised of 2 inverters that permit the microgrid to exchange power generated by the distributed energy resources (DERs) and additionally to compensate the local unbalanced and nonlinear load. The planned scheme has increased reliability, lower bandwidth demand of the main inverter, lower value because of reduction in filter size, and higher utilization of microgrid power whereas using reduced dc-link voltage rating for the main inverter.*

***Keywords****: Grid-connected inverter, instantaneous symmetrical component theory (ISCT), microgrid, power quality.*

## I. Introduction

Flexible operation of distributed generation (DG) units may be a serious objective in future sensible power grid [1]–[4]. The majority of dg units are interfaced to grid/load via power electronics converters. Current-controlled voltage-sourced inverters (VSIs) are usually used for grid connection [5]. under the sensible grid atmosphere, dg units ought to be included within the system operational management framework, where they will be accustomed enhance system responsibility by providing backup generation in isolated mode, and to provide auxiliary services (e.g. voltage support and reactive power control) inside the grid-connected mode. These operational management actions are dynamic in nature as they depend upon the load/generation profile, demand-side management control, and overall network improvement controllers (e.g., grid reconfiguration and superior management actions) [4]. to achieve this vision, the dg interface ought to provide high flexibility and robustness in meeting a good vary of management functions, like seamless transfer between grid-connected operation and islanded mode; seamless transfer between active/reactive power (PQ) and active power/voltage (PV) modes of operation inside the grid connected mode; robustness against islanding detection delays; providing minimal control-function switch throughout mode transition; and maintaining a hierarchical control structure. Technological progress and environmental issues drive the power system to a paradigm shift with additional renewable energy sources integrated to the network by means of distributed generation (DG). These weight units with coordinated management of native generation and storage facilities type a microgrid [1]. During a microgrid, power from different renewable energy sources like fuel cells, electrical phenomenon (PV) systems, and wind energy systems are interfaced to grid and loads using power electronic converters. A grid interactive inverter plays a very important role in exchanging power from the microgrid to the grid and additionally the connected load [2], [3]. This microgrid inverter will either add a grid sharing mode whereas supplying partity of local load or in grid injecting mode, by injecting power to the main grid.

This work demonstrates a dual voltage source inverter (DVSI) scheme, within which the power generated by the microgrid is injected as real power by the most voltage supply converter (MVSI) and additionally the reactive, harmonic, and unbalanced load compensation is performed by auxiliary voltage source inverter (AVSI). This has an advantage that the rated capability of MVSI will always be used to inject real power to the grid, if sufficient renewable power is offered at the dc link. Within the DVSI scheme, as total load power is provided by 2 inverters, power losses across the semiconductor switches of every inverter are reduced. This will increase its dependability as compared to one inverter with multifunctional capabilities. Also, smaller size standard inverters will operate at high switch frequencies with a reduced size of interfacing inductor, the filter value gets reduced. Moreover, because the main inverter is supplying real power, the inverter must track the basic positive sequence of current. This reduces the bandwidth demand of the most inverter. The inverters within the proposed scheme use 2 separate dc links. Since the auxiliary inverter is supply zero sequence of load current, a three-phase three-leg inverter topology with one dc storage capacitor may be used for the most inverter. This successively reduces the dc-link voltage requirement of the most inverter. Thus, the use of 2 separate inverters within the planned DVSI scheme provides increased dependability, higher utilization of microgrid power, reduced dc grid voltage rating, less bandwidth demand of the most inverter, and reduced filter size. Control algorithms are developed by instantaneous symmetrical element theory (ISCT) to operate DVSI in grid-connected mode, whereas considering non stiff grid voltage. The extraction of basic positive sequence of PCC voltage is completed by dq0 transformation. The control strategy is tested with 2 parallel inverters connected to a three-phase four-wire distribution system. Effectiveness of the planned control algorithmic rule is valid through elaborate simulation and experimental results.

## II. Literature Survey

M. V. Manoj Kumar et. al. [1] “A Grid-Connected Dual Voltage Source Inverter with Power Quality Improvement Features”, in this paper A DVSI scheme is projected for microgrid systems with increased power quality. Management algorithms unit developed to induce reference currents for DVSI victimization ISCT. The projected scheme has the capability to exchange power from distributed generators (DGs) and conjointly to compensate the native unbalanced and nonlinear load. The performance of the projected scheme has been valid through simulation and experimental studies. As compared to 1 convertor with multifunctional capabilities, a DVSI has many advantages like, increased reliability, lower value because of the reduction in filter size, and additional utilization of convertor capability to inject real power from DGs to microgrid. Moreover, the use of three-phase, 3 wire topology for the most inverter reduces the dc-link voltage demand. Thus, a DVSI scheme may be a suitable interfacing possibility for microgrid supplying sensitive loads.

Soeren Baekhoej Kjaer et. al. [2] “A Review of Single-Phase Grid-Connected Inverters for Photovoltaic Modules” This review focuses on inverter technologies for connecting photovoltaic (PV) modules to a single-phase grid 1) the kind of power decoupling between the PV module(s) and also the single-phase grid; 2) the amount of power process stages in cascade; 3) the kind of grid-connected power stage. Varied inverter topologies are given compared, and evaluated against demands, lifetime, part ratings, and cost, and 4) whether they utilizes a transformer (either line or high frequency) or not. This review has covered a number of the standards that inverters for PV and grid applications should fulfill, that focus on power quality, injection of dc currents into the grid, detection of is landing operation, and system grounding. A very important result's that the amplitude of the ripple across a PV module should not exceed three.0 V so as to have a utilization efficiency of 98 at full generation.

Sachin Jain et. al. [3] “A Single-Stage Grid Connected Inverter Topology for Solar PV Systems with Maximum Power Point Tracking”, in this paper author proposes a high performance, single-stage inverter topology for grid connected PV systems. The projected configuration won't only boost the usually low photovoltaic (PV) array voltage, however can in addition convert the solar dc power into high-quality ac power for feeding into the grid, whereas tracking the maximum power from the PV array. A survey of the present topologies, appropriate for single-stage, grid connected PV applications, is carried out and a close comparison with the projected topology is presented. The projected topology has several desirable options like higher utilization of the PV array, higher efficiency, low value and compact size. Further, because of the very nature of the projected topology, the PV array seems as a floating supply to the grid, thereby enhancing the safety of the system. During this work, the importance of single-stage grid connected PV systems has been highlighted. A single-stage topology with improved options has been projected. The topology is easy, symmetrical and simple to manage. the opposite fascinating options include sensible efficiency due to optimal range of device switch and reduced switching losses.

Rosa A. Mastromauro et. al. [4] “A Single-Phase Voltage Controlled Grid Connected Photovoltaic System with Power Quality Conditioner Functionality”, in this paper presents a single-phase photovoltaic system that gives grid voltage support and compensation of harmonic distortion at the point of common coupling (PCC) because of a repetitive controller. Future ancillary services provided by photovoltaic (PV) systems might facilitate their penetration in power systems. The PV converter is voltage controlled with a repetitive algorithmic rule. An MPPT algorithmic rule has been specifically designed for the projected voltage controlled convertor. The designed PV system provides grid voltage support at fundamental frequency and compensation of harmonic distortion at the point of common coupling (PCC).

Juan C. Vasquez et. al. [5] “Adaptive Droop Control Applied to Voltage-Source Inverters Operating in Grid-Connected and Islanded Modes”, in this paper proposes a completely unique control for voltage source inverters with the capability to flexibly operate in grid connected and islanded modes. The controller provides a proper dynamics decoupled from the grid-impedance magnitude and phase. The control has 2 main structures. The first one is that the grid parameter estimation, which calculates the amplitude and frequency of the grid, as well because the magnitude and phase of the grid impedance. Owing to the feedback variables of the estimator, the system dynamics is well decoupled from

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the grid parameters. The results point out the applicability of the projected control scheme to dg VSIs for microgrid applications.

# III. Method

## *III.1. Microgrid*

A microgrid is also a small-scale grid which will operate severally or in conjunction with the area's main electrical grid. A microgrid may be a little energy system capable of balancing captive provide and demand resources to maintain stable service at intervals a defined boundary.

Any small-scale localized station with its own power resources, generation and loads and definable boundaries qualifies as a microgrid. Microgrids are usually supposed as back-up power or to bolster the most power grid during periods of significant demand. Often, microgrids involve multiple energy sources as however of incorporating renewable power. Different functions embrace reducing costs and enhancing reliability.

Microgrids combine numerous distributed energy resources (DER) to form an entire system that's larger than its parts.


Fig.1 Microgrids Combine Various Distributed Energy Resources (DER)

Most microgrids are often additional represented by one of five categories:

Off-grid microgrids: as well as islands, remote sites, and different microgrid systems not connected to a local utility network.

Campus micro grids: that's totally interconnected with a local utility grid, however may also maintain some level of service in isolation from the grid, like throughout a utility outage. Typical examples serve university and company campuses, prisons, and military bases.

Community micro grids: that's integrated into utility networks. Such micro grids serve multiple customers or services within a community, usually to provide resilient power for very important community assets.

District Energy micro grids: that offer electricity in addition as thermal energy for heating (and cooling) of multiple facilities.

Nanogrids: comprised of the smallest discrete network units with the capability to control severally. A nanogrid are often defined as one building or one energy domain.

## *III.2. Grid-connected inverter*

Produce the pure sine wave that's compatible with the alternating current wave form produced by your utility company. Wave inverters are somewhat dearer; but they are compatible with most instrumentation and appliances that may be operated with power that comes from the grid. These multifunction inverters in addition permit you to send excess power to your utility company, in essence storing excess energy within the grid. Grid-connected inverters are used to keep a back-up battery bank charged for emergency power just in case of a utility power failure.

A grid-connected inverter could be a power inverter that converts direct current (DC) electricity into alternating current (AC) with a capability to synchronize to interface with a utility line. Its applications are changing DC sources like solar panels or small wind turbines into AC for tying with the grid.

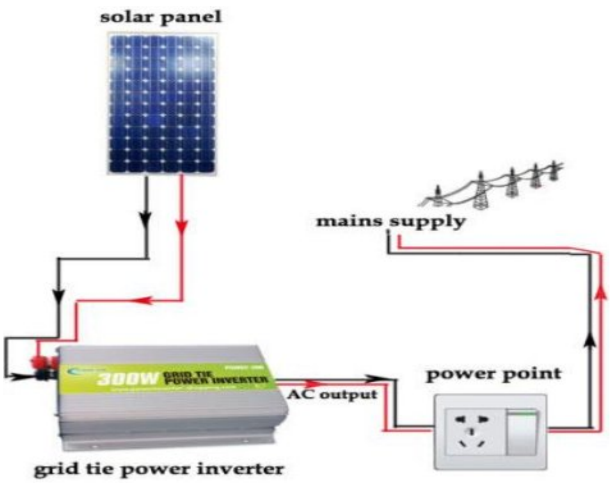


Fig.2 grid Tie Power Inverter

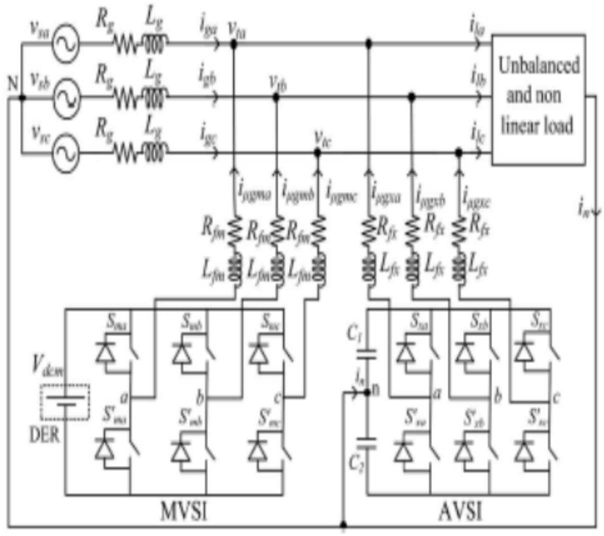


Fig.3 Circuit Diagram of a Proposed DVSI Scheme

## IV. Conclusion

This paper has reviewed the mainly latest analysis trends and planned dual voltage source inverter methodology. The planned scheme has the capability to exchange power from distributed generators (DGs) and additionally to compensate the local unbalanced and nonlinear load. The performance of the planned scheme has been validated through simulation and experimental studies. As compared to one inverter with multifunctional capabilities, a DVSI has several advantages like, increased reliability, lower value because of the reduction in filter size, and additional utilization of inverter capacity to inject real power from DGs to microgrid.

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