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Paper Authors **T. Murali Krishna, D. Bhargav Venkat, Bharatha Venkatesh, Engala Akhil Madhav, Gandikota Chiru Manikanta Kumar**

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A NEW POWER FLOW CONTROL APPROACH FOR POWER CONVERTERS IN SINGLE PHASE MICROGRIDS

T. Murali Krishna[1], D. Bhargav Venkat[2], Bharatha Venkatesh[2], Engala Akhil Madhav[2], Gandikota Chiru Manikanta Kumar[2]

[1]Assistant professor,[2]UG Student, Department of Electrical and Electronics Engineering

[1,2]Malla Reddy Engineering College and Management Sciences, Kistapur, Medchal-50140l, Hyderabad, Telangana, India.

Abstract:

Distributed electricity-based generators (DGs) play a major role in the production of electricity, with the increase in global temperature. The generation distributed through the use of wind, solar energy, biomass, mini-hydro and the use of fuel cells and micro turbines will provide significant momentum in the near future. Benefits such as environmental friendliness, flexibility and flexibility have enabled distribution to be distributed, supported by a variety of non-renewable and non-viable micro source resources, an attractive option for modern electricity grid preparation. The microgrid consists of a combination of loads and distributed generators that serve as one win-win system. As an incorporated vitality conveyance framework Microgrid can work in equal or separate from the fundamental force network. The microgrid concept introduces the reduction of multiple transformers into a single AC or DC grid and helps connect various AC and DC renewable sources and loads to power systems. The DG association of the activity/matrix through the electrical converters has been raised with worries about safe activity and hardware insurance. For customers a micro grid can be designed to meet their specific needs; for example, improvements in local reliability, reduction in food loss, support for local voltages, increased utilization of waste heat, adjustable voltage sag or uninterrupted power transmission. In the present work the performance of the hybrid AC / DC microgrid system is analyzed in grid-bound mode. Here the photovoltaic system, wind turbine generator and battery are used for microgrid development. Control systems were also developed to enable converters to integrate the AC grid into the DC sub grid. Results are available in MATLAB / SIMULINK environment.

Keywords: Hybrid power systems, micro grid, power management strategies, smart grid , MATLAB simulation

1. INTRODUCTION

1.1. General information regarding Micro grid

As electricity distribution technologies enter the next century, more and more methods are being introduced that will change the demand for energy. This refinement is driven from the demand side where high energy efficiency and efficiency is obtained and from the supply side where the generation of distributed generation and technological peaks occurs. The technical challenges related to microgrid performance and control are immense. To ensure stable performance during network disruption, maintaining the stability and quality of power in island operating mode requires the development of sophisticated control techniques of microgrid inverters to provide stable frequency and volume in the face of load loads.

Due to the increased installation of different types of power generation and the grid has raised serious concerns about existing AC systems. Most of the smaller grids are DGs and renewable sources of energy that work much like AC grids. Since most of the electric grids are now ac-type, the ac grids are still prominent and the smaller DC grids are expected to originate only from the electric grids. Therefore, smaller dc grids tend to be made in ac types even though less. As a result, linking ac ac grids with smaller DC grids and taking advantage of both smaller grids, has become of interest in recent studies. The idea is to integrate the ac and DC micro grids through the ac / dc converter and to implement a hybrid ac / dc micro grid where the ac or dc type sources of power and loads can integrate between the smaller grids and the power can flow smoothly between two small grids. Like other small grids, a hybrid ac / dc micro

2. LITERATURE REVIEW

Farzam Nejabatkhah ; Yun Wei Li ,"Overview of Power Management Strategies of Hybrid AC/DC Microgrid", IEEE Transactions on Power Electronics (Volume: 30 , Issue: 12 , Dec. 2015)

This paper presents an outline of the energy management strategies of a hybrid ac / dc system, which has different system structures (ac-coupled, dc-coupled, and ac-dc-coupled hybrid microgrid), alternative methods, a comprehensive study of assorted power management and control schemes in both state and temporary situations, also as samples of power management and control strategies. Finally, discussions and suggestions for energy management strategies are presented for further research A. A. Eajal ; E. F. El-Saadany ; K. Ponnambalam "Inexact power sharing in AC/DC hybrid microgrids" , 2016 IEEE Canadian Conference on Electrical and Computer Engineering (CCECE)

This paper analyzes the functional aspect associated with AC / DC hybrid Microdide which is that the problem of poor power sharing. The simulation results indicate that the non-uniformly distributed power distribution of the AC microphone and also the partially active power distribution in DC computers will migrate to the AC / DC hybrid microgrid. The results of the study also show that convergent converters experience the identical problem of unequal power sharing. Reeka Narang, Varsha Sharma ," A Review on AC DC Microgrid System" , International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056 , Volume: 05 Issue: 12 | Dec 2018.

In this paper the robustness of the hybrid microgrid signal analysis for analysis. So as to cut back system fit and better analysis of the proposed droop controller, the dc springs and their integrated droops create one integrated DC source. this can be finished ac, dc and ac loads. The hybrid microgrid analysis is therefore simplified from an IC perspective. A recognized control strategy supported a modified three phase droop method for blurring the AC and DC voltages. the various varieties of modelling are AC Modelling, DC Modelling and IC Modelling. Using the proposed droop method, the IC is in a position to power the sharing between two microgres within the transition from grid connected to island input mode and through island operation. Use is guaranteed using MATLAB software.

3. PROPOSED SYSTEM

The relevant MATLAB program will be written with a simulink presentation to achieve minimum signal analysis of AC / DC micro grid modelling and IC Micro grid modelling. With the advent of the island and the droop control plan for each of the four small grids. Frequency-droop is a function of the voltage and voltage control function of the voltage- droop. A recognized control strategy based on two optimized stages of droop control of IC for dc transmission with small grids. Using the proposed droop method, the IC is able to generate power sharing between two small grids in the transition from the grid connected to the island input mode and during island operation. This paper aims at phase two modified droop methods for controlling the power of hybrid AC / DC Micro grid droop control scheme for individual AC grid and DC grid systems is a great idea to use locally generated power to

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reduce power draw on the grid. Through the use of droop power control, DC bus power is maintained within acceptable range. Integrating the smart DC grid with the AC grid to compress the DC bus power consumption using variable loads and achieving stable AC grid control using the grid side converter exiting DC and the AC micro grid. The main purpose is to work on a connected grid or ways to use an island to work.

Configuration of the hybrid micro grid

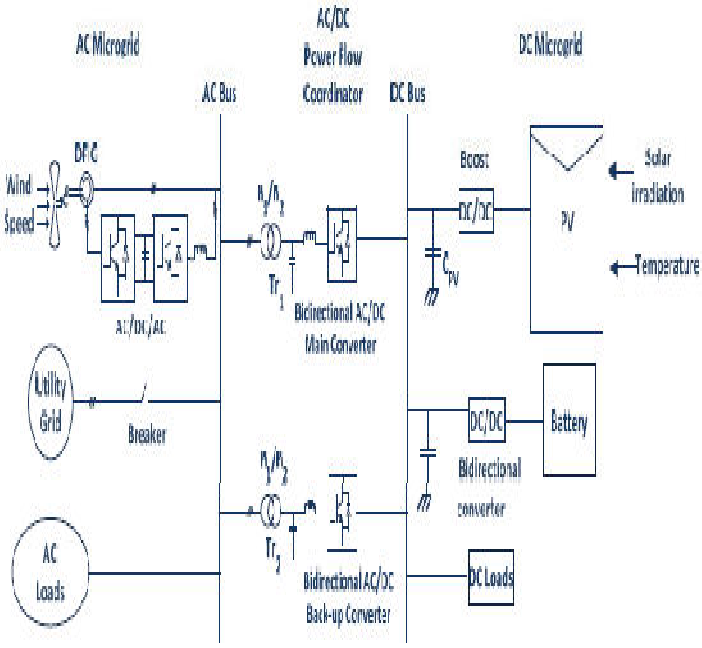

Figure 1: A hybrid AC/DC microgrid system

The hybrid system configurations are shown in Fig. 3 where the various AC and DC sources and loads are connected to the compatible AC and DC network. The AC and DC connectors are connected together by two transformers and two active three-phase transformers. The hybrid AC bus is tied to the utility grid. Fig. 3 describes the configuration of a hybrid system containing the AC and DC grid. AC and DC grids have their own associated sources, loads and power supplies, and are connected by a three-phase converter. The AC bus is connected to the power grid by means of a power switch and circuit breaker.

In the proposed system, the PV layout is connected to a DC bus by using a power switch to simulate DC sources. The DFIG air reproduction system is connected to the AC bus to mimic AC sources. The battery with a DC / DC converter is connected to the DC bus as a power storage. DC and AC separate loads are connected to their DC and AC buses to simulate various loads. photovoltaic modules are connected in series and in parallel. As the degree of solar radiation and temperature change the energy output of solar panel alters. A capacitor C is added to the PV circuit to compress the high frequency voltage of the PV.

4. SIMULATION RESULTS

To evaluate the effectiveness of the proposed power quality improvement programs in the distribution network, the various scenarios outlined in Section 3 are studied and investigated with models developed for MATLAB / Simulink. To study the effects of the same synergist on improving current quality (which is pulled from the AC network), two different regimes are considered. The first

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scenario includes a balanced three-phase 600-kW load and a 200-kVar active load, as well as a harmonic load including 150 A for 2ndoniconic, 500 A for 5thonic, and 200 A for 7thoniconic. The current waveform of phase A and the corresponding ionic waveform are shown in Figure 4a and 4b. In this case, the combined voltage (drawn from the transformer) and harmonic spectrum is shown in Fig 2c and 2d for the same phase.

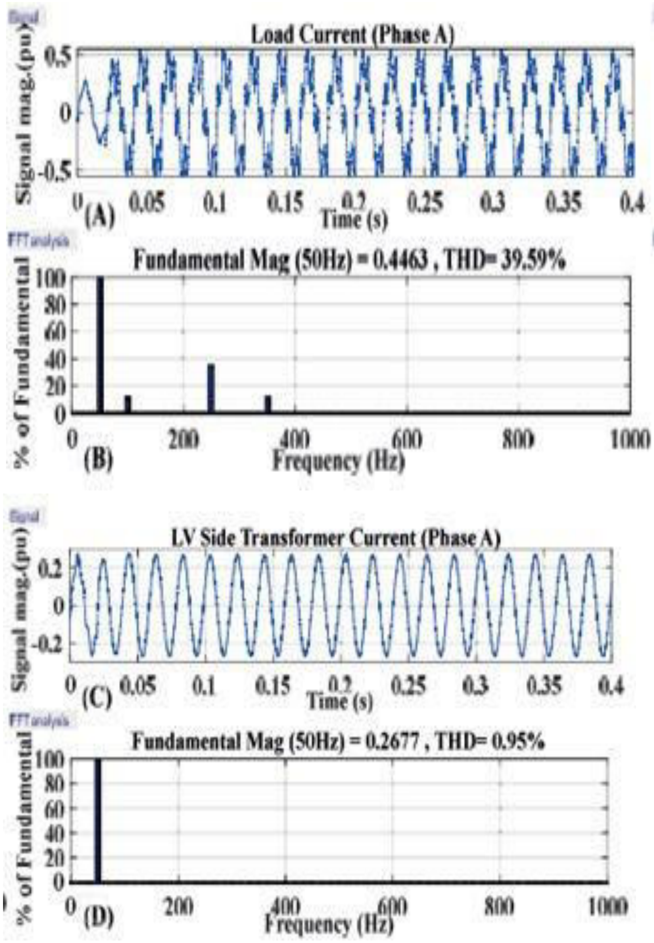

Figure. 2: Phase A and harmonic spectrum Current waveform: A, B) load current C, D) transformer current.

One of the purposes of a control system designed to keep the transformer voltage is close to the unit value under different load conditions. In this case, by looking at two different load balances and inequalities, In Fig 8 and 9, the power transformer power of each state is calculated.

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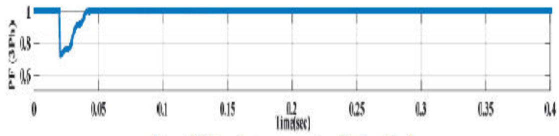

Figure 12. Power factor compensation of balanced load.

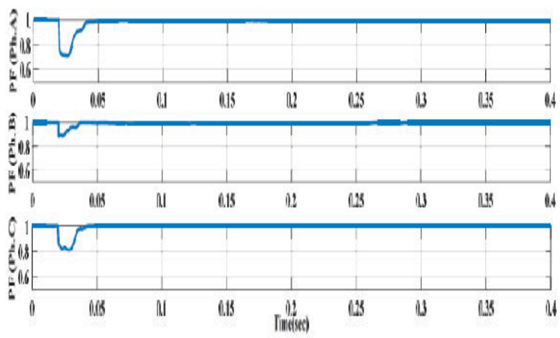

Figure. 3: Power factor compensation of unbalanced load.

To study the effects of series integrators on improving the quality of energy delivered to consumers, the worst gas state of the network is considered as follows. The AC grid power supply contains 25% 5thoniconic and 20% 7thoniconic. The steady-state voltage drop (due to line power input) is 7% and, finally, due to the high interference error (phase A down to 10 Ω of impedance) by 0.1 s (from 0.15 s to 0.25 s of simulation time), 33% voltage sag overlap.

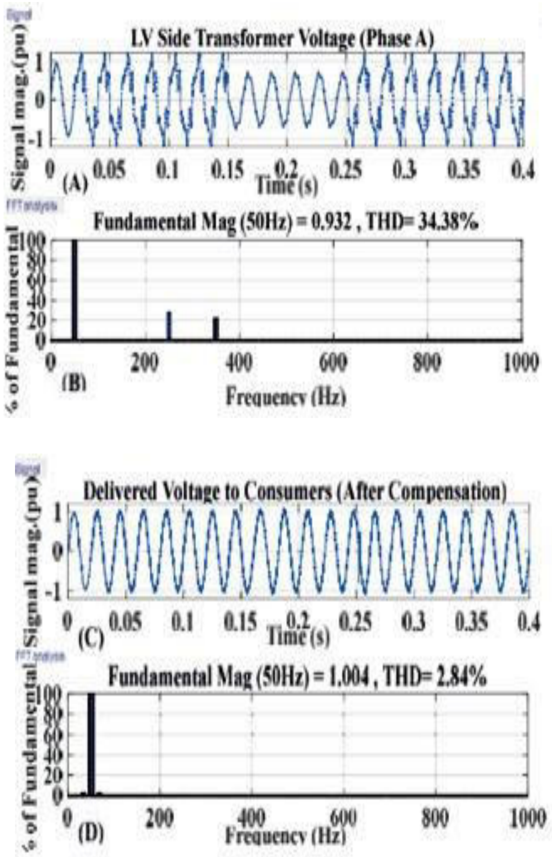

Figure 4: Phase A and harmonic spectrum Voltage waveform: A, B) transformer voltage; C, D) load

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voltage.

Based on the description of the control program, we can conclude that the proposed system can be implemented with a simple standard hardware, namely the ATXMEGA128A1 AVR microcontroller. However, IGBT modules of medium power, for example the FZ1600R12HP4, can be used as a power switch. Another machine used in this way is the super capacitor composed of the eighth series of 75-V, 94-F modules, the BMOD0094 P075 series from Maxwell Technologies. Later, other devices in the proposed construction can be started literally. In this paper, due to space constraints, only the criterion for expansion of energy quality is explained, so other challenges, including energy management, flow control, reliability, durability, and protection of the proposed hybrid AC / DC microgrid design, will be discussed in future studies.

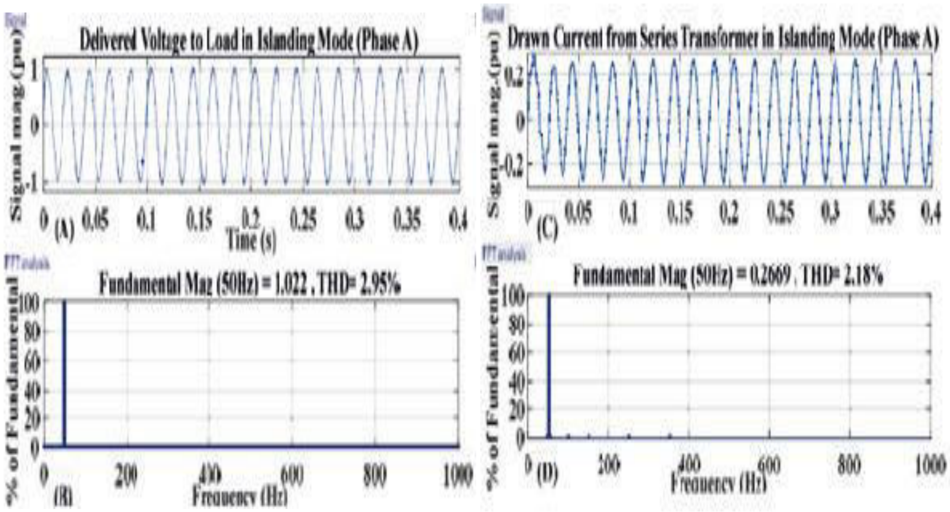

Figure 5: A, B) Voltage of microgrid and related waveform in islanded mode; C, D) current of series transformer and related waveform in islanded mode.

Complexities of Simulation to Real Challenges

4. CONCLUSION

The modelling of hybrid microgrid for power system configuration is done in MATLAB/SIMULINK environment. The present work involves hybrid bound mode for hybrid grid operation. In this paper, a new proposal was put forward to develop the conventional distribution networks into hybrid AC/DC microgrids through the utilization of the capacity of the DC microgrid and modi_cation of the designs of series and parallel controllers. In the proposed plan, the possibility of simultaneous realization of the goals of power quality and reactive compensation was provided in both the grid- connected and isolated modes of the hybrid microgrid.In summary, understanding the energy quality objectives includes maintaining the energy quality delivered to consumers, as well as the currents derived from the AC grid. As a new feature of the proposed scheme, where a hybrid microgrid is stationary in full island mode, series transformers have the role of generating three nearly sinusoidal voltage levels. In this case, the energy quality of the AC microgrid is guaranteed. Finally, once we investigated the effects of estimating specific conditions on poor power quality and the need for performance

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compensation, the proposed system design was studied.

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