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INTEGRATED AC AND DC MICROGRID OF POWER MANAGEMENT SCHEME

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ABSTRACT: In this paper the integrated AC to DC micro grid of power management scheme is implemented. Generally there are some drawbacks in existed power management schemes they are interlinked with sharing of power and they regulate the voltage of the interlinked microgrids without considering the specific loading conditions. Hence to overcome these issues autonomous integrated power management scheme is implemented. This scheme will use the special loading conditions before the power is imported to the interlinked AC micro grid. This proposed scheme will reduce the converters in operation while regulating the voltage in DC micro grid. Especially for plug-n-play features for generators and tie-converters the proposed scheme is fully autonomous. Hence by using different scenarios the proposed scheme is validated. Therefore the proposed scheme will give manage the power in effective way by maintaining better voltage regulation.

KEY WORDS: AC micro grid, DC micro grid, voltage regulation, tie convertors, autonomous power management scheme.

I.INTRODUCTION

A Microgrid scale framework is a gathering of interconnected conveyed vitality assets and burdens that goes about as a solitary controllable substance with in obviously characterized electrical limits as for Equivalence . The specialized improvement in real life of bringing assets into compelling of elective vitality innovations and Renewable assumes a significant job in power hardware. While meeting load necessities their Overall point of system topology and control to make as conceivable the advantages prevalently decided [1]. Elective vitality and inexhaustible advancements are bringing into viable activity widely.

The principle objective is to use more advantages from elective vitality and inexhaustible assets of these improved system models. For instance at least two interlinking small scale micro grids, it will hold up recurrence and voltage, adaptability of interlinked miniaturized scale frameworks, make conceivable save sharing lastly generally dependability increment [2].

The interconnecting between at least two miniaturized scale lattices game plan or with valuable networks relies upon the general objectives for the most part, and furthermore utilized the administration and control plot in single smaller scale frameworks. At the point when diverse working frequencies as well as voltages have at least two smaller scale lattices are for the most part utilized the fitting tie-converters.

These days, due to high entrance levels of sustainable power source assets, the ordinary case of small scale micro grids (MGs) and Distribution generation (DG) are increasing essential job in force and appropriation frameworks. MGs are arranged as air conditioning MGs, DC MGs, and crossover air conditioning DC MGs. Since an impressive part of sustainable power source assets, for example, wind turbines, photovoltaic (PV), energy components and vitality stockpiling frameworks, and numerous cutting edge loads, for example, correspondence innovation offices, server farms, and engine drives is DC-type, elements and controls of rectifiers and DC MGs are increasing high intrigue [3-4].

The expanding organization of appropriated frameworks in power frameworks half breed AC/DC small scale network. Numerous smaller scale lattices are utilized for interlinking air condiationing/DC converter with appropriate force the executives and control technique. Since most of the force lattices are directly air conditioning type, air conditioning smaller scale networks are as yet prevailing and simply DC miniaturized scale matrices are not expected to rise only in power frameworks.

In this field, smaller scale frameworks have become a generally acknowledged idea for the predominant association of DGs in power systems. Relating to the traditional force frameworks, air conditioning small scale networks have been built up principal and an assortment of studies have been accounted for especially regarding the matter of intensity sharing of equal associated sources [5].

Since most of sustainable power sources create DC force or need a DC interface for Equivalence association and because of expanding present day DC loads, DC miniaturized scale lattices have as of late developed for their advantages as far as proficiency, cost and framework that can dispense with the DC-air conditioning or air conditioning DC power change stages and their went with vitality misfortunes. Nonetheless, since most of the force networks are directly air conditioning type, air conditioning small scale frameworks are as yet predominant and simply DC smaller scale matrices are not expected to rise solely in power lattices.

In this manner, DC miniaturized scale frameworks are inclined to be created in air conditioning types despite the fact that in subordinate. Subsequently, connecting air conditioning small scale lattices with DC smaller scale matrices and utilizing the benefits of the both miniaturized scale frameworks, has gotten intriguing in late investigations.

The primary thought is to utilize the privately produced vitality and diminishing the force draw from the lattice. An organize control conspire is created so as to deal with the entire framework in various working conditions.

A small scale Equivalence is a controllable segment of the savvy framework characterized as a piece of conveyance arrange equipped for providing its own neighborhood load even on account of separation from the upstream system. Small scale matrices fuse enormous measure of inexhaustible and non-sustainable distribution generation (DG) that are associated with the framework either straightforwardly or by power electronics (PE) interface.

The requirement for miniaturized scale lattices is so noteworthy for some reasons however the most significant issue is to the need to move to sustainable wellsprings of vitality with less carbon discharge. During unsettling influences, the age and comparing burdens can isolate from the dissemination framework to confine the miniaturized scale network's heap from the aggravation (giving UPS administrations) without hurting the transmission Equivalence 's honesty.

This capacity to island age and loads together can possibly give a higher nearby dependability than that gave by the force framework all in all. In this model it is likewise basic to have the option to utilize the waste warmth by setting the sources close to the warmth load. The small scale framework idea disposes of the requirement for a transmission framework. Whatever force is created will be expended locally.

During unsettling influences, the age and comparing burdens can isolate from the dispersion framework to disengage the miniaturized scale network's heap from the aggravation (giving UPS administrations) without hurting the transmission Equivalence 's uprightness. This capacity to island age and loads together can possibly give a higher nearby unwavering quality than that gave by the force framework in general. In this model it is additionally basic to have the option to utilize the waste warmth by setting the sources close to the warmth load. The miniaturized scale network idea disposes of the requirement for transmission framework. Whatever force is produced will be devoured locally.

II. AC TO DC MICRO GRID

Hybrid ac/DC micro grids have been planned for the better interconnection of different distributed generation systems (DG) to the power grid, and exploiting the prominent features of both ac and DC micro grids. Connecting these micro grids requires an interlinking AC/DC converter (IC) with a proper power management and control strategy.

During the performing activity of the half and half air conditioning/DC miniaturized scale lattice, the IC is planned to play the job of provider to one small scale network and simultaneously goes about as a heap to the next smaller scale framework and the force the board framework ought to have the option to share the force request between the current air conditioning and DC sources in both small scale matrices. This paper considers the force stream control and the board issues among different sources scattered all through both air conditioning and DC miniaturized scale networks.

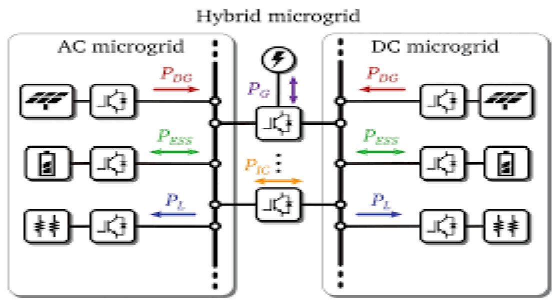

Fig. 1: AC and DC micro grid

In this paper, Hybrid Converter is also designed. Hybrid Converter work as both Inverter & Chopper. Working of Hybrid Converter depends on the switching of MOSFET. Input of Hybrid Converter is DC and it gives AC & DC as output with the help of Inverter and Chopper and then it is supplied to the loads.

Replacing the controllable switch in the boost circuit either with a single phase or three phases VSI leads to the realization of hybrid converter. Micro grid consists of four parts:

1. Distribution system
2. Distributed generation sources (DG)
3. Energy storage (ES)
4. Controllers and loads

Nowadays, fuels of fossil is perceived as a principle reason of air contamination, particularly in carbon emanation. Vitality source is changed from petroleum product to eco-accommodating source by methods for sustainable power source. Vitality stockpiling is utilized to improve the unsteadiness and unusualness because of inexhaustible source. Sustainable assets are photovoltaic framework, sun based cell, wind turbine, battery and practically all that kind of things additionally can be worked in DC power. Hence, DC conveyance framework or DC miniaturized scale network is being created.

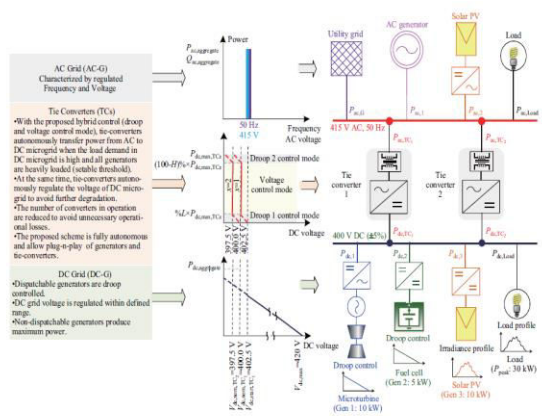

Fig. 2: Block diagram of existed system

With the increase in load demand due to technological developments and increase in population, decaying of fossil-fuel and environmental concerns such as air pollution, climate change is increasing rapidly.

In current scenario, for professionals the photovoltaic technology presents an exciting and bright future. Nano-micro grids are being interfaced with different grid formed which contains power from different conventional or non-conventional energy sources. This interfacing is done by using different power electronic converters. With this in mind, to drive DC and AC loads simultaneously from a DC input in a single step, a new topology of Boost Derived Hybrid Converter (BDHC) is implemented.

The objectives of this paper are to proposed DC micro grid to controls onsite generation and power demand to meet the objectives of providing power and injecting power into the utility grid if required. The micro grid controller becomes essential for balancing power and load management.

III. INTEGRATED AC AND DC MICROGRID

The power rating of dispatch able generators or storage systems for firming the renewable capacity depends on the variability of the renewable source and loads in the micro grid. The high variability of renewable and loads requires dispatch able generators or storage systems with a high power rating, which may or may not be a viable solution.

Alternatively, the micro grid with inadequate generation capacity could be interconnected with another micro grid or utility grid, directly or through harmonizing converters. The tying of a DC micro grid with an AC micro grid or utility grid is only possible through tie-converters.

In the proposed interlinked system, the AC micro grid is characterized as a regulated voltage and frequency system with adequate generation capacity, whereas the DC micro grid is characterized as a droop controlled system with inadequate generation capacity due to the high variability of the renewable and loads. During the peak demand or the low renewable power output, the power deficit in the DC micro grid is managed by importing power from the AC micro grid.

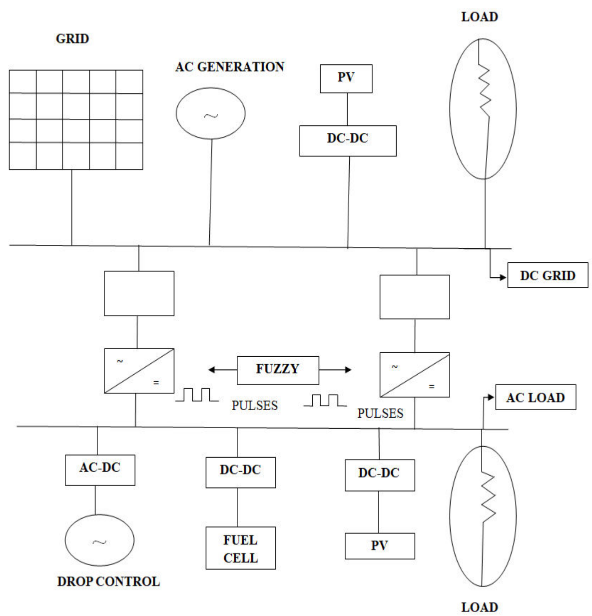

Fig. 3: Block diagram of Integrated AC and DC micro grid

Ideally, it can be achieved efficiently and autonomously with the proposed control of the tie-converters. he control scheme of the tie-converters is developed based on the following objectives: 1) To transfer power from the AC to DC micro grid during the peak load demand or generation contingency in the DC micro grid; 2) To minimize the power transfer losses, e.g., tie-converter should operate only during the peak-load demand in the DC micro grid, and the number of tie-converters in operation should be based on power transfer demand; 3) To regulate the voltage of the droop controlled DC micro grid; 4) To achieve fully autonomous control without depending on the communication network; 5) To enable the plug-n-play feature for tie-converters and generators.

The tie-converter 1 beginnings in hang 1 control mode when the voltage in the DC miniaturized scale Equivalence drops to the set edge of VDC, start, TCx. This voltage edge infers that all the generators in the DC small scale framework are intensely stacked (for example over 80% stacked). The beginning of the tie-converter in the hang control mode empowers a smooth change to the voltage guideline mode at the set condition i.e., PDC, TCx > L% × PDC, max, TCx. During the voltage guideline mode, the tie-converter imports power from the AC miniaturized scale lattice to meet the DC small scale Equivalence top force request just as direct its voltage to be set to the ostensible estimation of VDC, nom, TCx.

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The proposed control strategy ensures efficient operation during all operating conditions without compromising the inherited flexibility of the droop based scheme. The allocation of the tie-converter's power for droop 1 and droop 2 control mode depends on the chosen value of L% and H% which is user definable, and should be tuned to allow smooth transition between different modes while considering the voltage and power measurement tolerance/errors in the considered micro grid. The below figure shows the circuit diagram of PV cell.

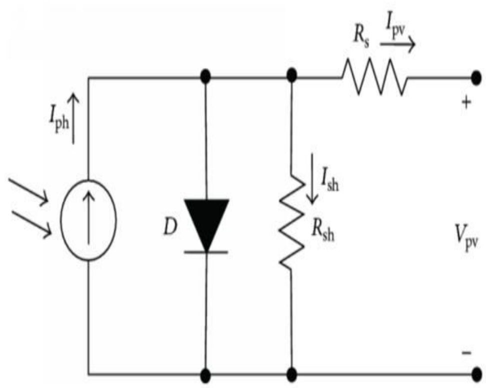

Fig. 4: Circuit diagram of PV cell

With the proposed voltage guideline mode, the general voltage guideline execution of the DC miniaturized scale lattice can be improved. Specifically during the pinnacle load request, the voltage of the DC small scale lattice is controlled at the ostensible worth, which isn't the situation with the current force the board plans for interlinked smaller scale frameworks. The presentation of the proposed plot has been approved for various burden tasks. The below figure (5) shows the circuit diagram of fuel cell.

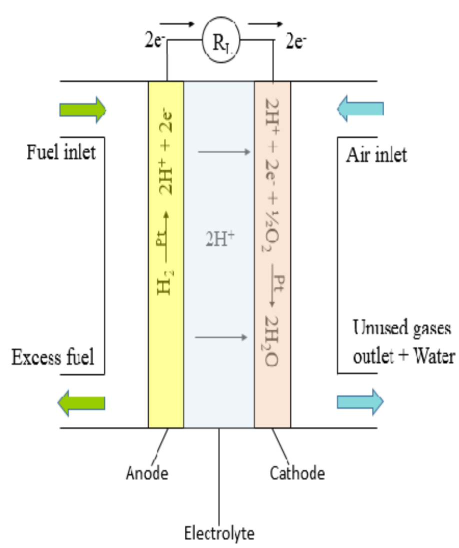

Fig. 5: Circuit diagram of fuel cell

The below figure shows the circuit diagram of wind turbine and its components. In this rotor system, gear box, generator, nacelle, meteorology, converter is used.

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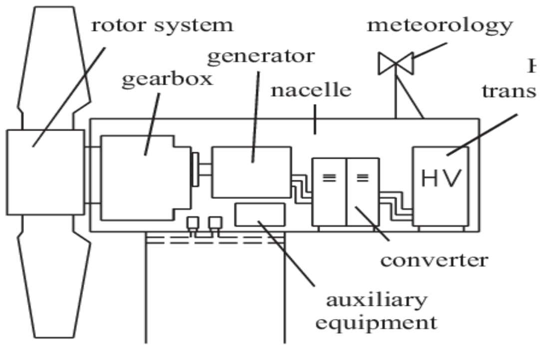

Fig, 6: Circuit diagram of Wind turbine and its components

IV RESULTS

The below figure (7) shows the output waveform of generator and bit-converter power.

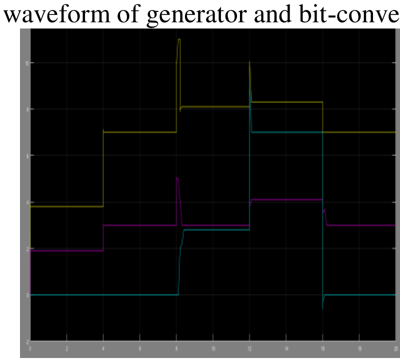

Fig. 7: Generators and tie-converter power (X-Time & Y-Power) of AC and DC Mirco grid system

The below figure (8) shows the output waveform of DC Micro grid Voltage of AC and DC Mirco grid system **.**

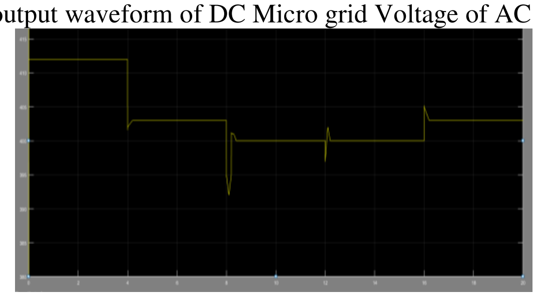

Fig. 8: DC micro grid voltage (X-Time & Y-Voltage)

The below figure (9) shows the output waveform DC microgrid load demand of AC and DC Mirco grid system

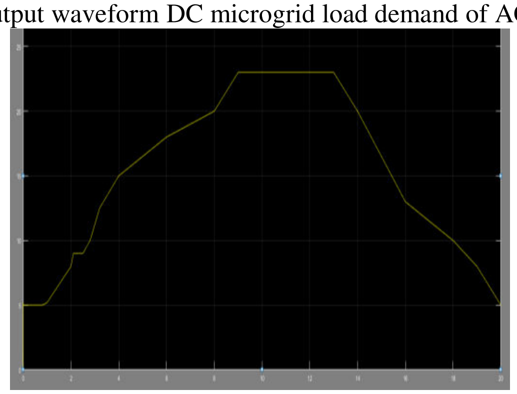

Fig. 9: DC microgrid load demand

This expected performance can be witnessed from the results shown in Fig. 9. At the highlight point 1, at 8 s, the voltage of the DC microgrid decreases below 400 V followed by the step load change from 10 kW to 15 kW. This voltage drop triggers tie-converter 1 to start in droop 1 control mode at point 2. After starting in droop 1 control mode, the tie-converter control mode is immediately transitioned to the voltage regulation mode at point 3, since the set threshold (PDC,TC1 > 10% × PDC,max,TC1) is satisfied. At 12 s, the load in the DC microgrid is further increased from 15 kW to 20 kW, and the power transferred from the AC microgrid is increased accordingly. Throughout the peak-load demand in the DC microgrid from 8 s to 12 s, tie-converter 1 remains operational and regulates the voltage of the DC microgrid. Once the load demand in the DC microgrid is decreased at the highlighted point 4, at 16 s, the tie-converter turns off automatically after a short delay at point 5, as shown in Fig. 9. As demonstrated, tie-converter 1 only operates once all the DC generators are heavily loaded. During its operation, the voltage in the DC microgrid is regulated to the defined nominal value of 400 V. Therefore the proposed strategy has better voltage regulation performance and ensures efficient operation.

The below figure (10) shows the output waveform DC microgrid load demand of Integrated AC and DC Microgrid system.

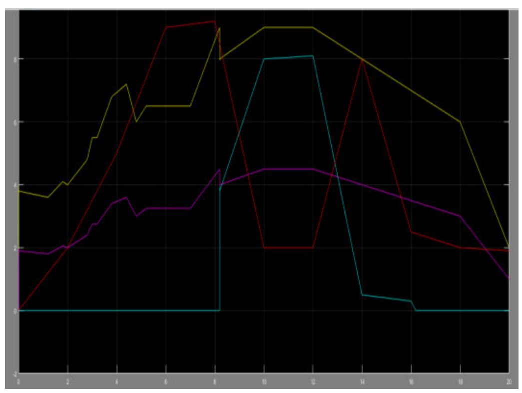

Fig. 10: Generators and tie-converter power (X-Time & Y-Power)

The below figure (11) shows the output waveform DC microgrid load demand of Integrated AC and DC Microgrid system.

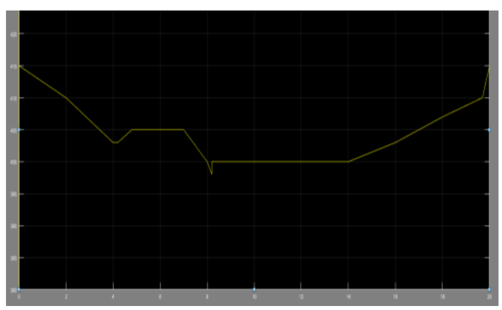

Fig. 11: DC micro grid voltage (X-Time & Y-Power)

The power output of the solar PV system is based on a continuously varying irradiance profile. The load in scenario 2 also has a varying profile with a peak demand of 25 kW. This test scenario is developed to further demonstrate the effectiveness of the proposed strategy for various practical operating conditions of renewable generation and load demand. The load in the DC micro grid increases gradually to the peak value 24.5 kW, and then decreases, as shown in Fig. 11.The loading on the DC generators increases with the increasing load demand. At the highlight point 1, the loading on generator1 and generator 2 exceeds 80% and the voltage of the DC micro grid drops below the set threshold of VDC,start,TC1 =402.5 V when the load demand is very high and the solar PV output is less.

In agreement with the proposed control, tie-converter 1 starts at highlighted point 1 and imports power from the AC micro grid to overcome the power deficit in the DC micro grid while regulating its voltage. Tie-converter 1operates in the voltage regulating mode from point 2 at 8.5 s to point 3 at 14.2 s. From point 3 and onward, the load in the DC micro grid deceases such that the tie-converter power output is below 10% × PDC,max,TC1 and this condition requires the tie-converter to operate in the droop 1 control mode before it turns off at highlighted point 4 at 16.4 s. From point 4 and onward, the load demand in the DC micro grid is less than the generation, hence it can be met by the local generators. As expected, it has been demonstrated that the tie-converter only operates during the power deficit in the DC micro grid. In addition, the voltage of the DC micro grid is also regulated by importing power from the AC grid. This behaviour depicts the grid-connected

V. CONCLUSION

An autonomous power management scheme has been presented for interlinked AC-DC micro grids having different configurations. The proposed scheme manages the power deficit in the DC micro grid efficiently and autonomously. The number of tie-converters in operation has been reduced with the proposed prioritization to avoid unnecessary operational losses. The scheme has demonstrated better voltage regulation in the DC micro grid. The performance and robustness of the proposed scheme have been validated for two different scenarios of the DC micro grid at variable load conditions.

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