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BIDIRECTIONAL CONTROL OF HYBRID AC/DC MICROGRID INVOLVING ENERGY STORAGE, RENEWABLE ENERGY AND PULSED LOADS

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***Abstract*— Microgrid comprises of micro-energy resources, loads together with energy storage devices with single controllable system to provide power to small area.A hybrid grid consists of both DC and AC grid, where AC grid includes AC power sources, AC loads and DC grid includes DC power sources, DC loads. Both DC and AC network are connected together by bi-directional power electronics converters with common energy storage devices. This project proposes co-ordination control and operational analysis of Hybrid Micro grid consisting PV panel ,generators , battery and bi directional ac and dc converters. Hybrid micro grid operates in grid tied or in grid connected mode. Co-ordination control mechanisms are implemented for power electronic converters for smooth power exchange between DC and AC links and for stable operation under various resources and load conditions. Proposed small hybrid micro grid is considered, modeled simulated and analyzed using MATLAB/ Simulink.**

***Index Terms*— Micro-Hybrid grid; Grid connected model; Bidirectional power electronics converter**

I. INTRODUCTION

Depending on domestically available electricity resources, Hybrid Micro grid structures can be evolved regularly in amalgamation with a element to in shape the to be had strength with the load. Many cumulations are feasible depending on nearby conditions, inclusive of Wind-Diesel, Wind- Bio, Wind- Battery, Hydro-Bio, Wind Solar, Hydro-Solar and so on. Storage Systems consists of Fuel Cells, Battery, Super Capacitor, Pump Storage, and Flywheel.

As electric distribution technology steps into the next century, many trends are becoming salient that will transmute the requisites of energy distribution. These modifications are being driven from both the injuctive authorization side where higher energy availability and efficiency are desired and from the supply side where the integration of distributed generation and peak shaving technologies must be accommodated

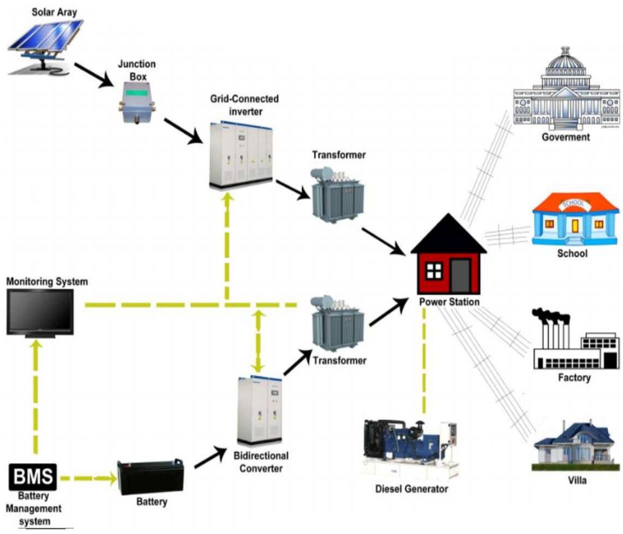

Fig 1.1 Microgrid power system

Power frameworks presently experience impressive change in working necessities chiefly because of deregulation and because of an augmenting measure of dispersed vitality assets (DER). As a rule DERs incorporate diverse advancements that endorse age in tiny scale (microsources) and some of them benefit from sustainable power source assets (RES, for example, sun oriented, wind or hydro vitality. Having microsources proximate to the heap has the benefit of decreasing transmission misfortunes and also turning away system blockages. Besides, the likelihood of having a puissance supply interference of end-clients associated with a low voltage (LV) dispersion framework is lessened since contiguous microsources, controllable burdens and vitality stockpiling frameworks can work in the islanded mode if there should arise an occurrence of thorough framework perturbances. This is recognized these days as a microgrid. Figure 1.1 delineates a run of the mill microgrid. The microgrid frequently supplies both power and warmth to the clients by betokens of blended warmth and power plants (CHP), gas turbines, energy units, photovoltaic (PV) frameworks, wind turbines, and so on. The vitality stockpiling frameworks routinely incorporate batteries and flywheels.The putting away contraption in the microgrid is equipollent to the pivoting store of cosmically monstrous engenderers in the traditional matrix which discovers the harmony between vitality age and utilization particularly amid quick changes in load or age

There are sundry favorable circumstances offered by microgrids to come full circle purchasers, utilities and society, for example, changed vitality productivity, limited general vitality utilization, decreased ozone depleting substances and contamination emanations, revised settlement quality and dependability, cost effective power foundation supersession

II. PROPOSED SYSTEM

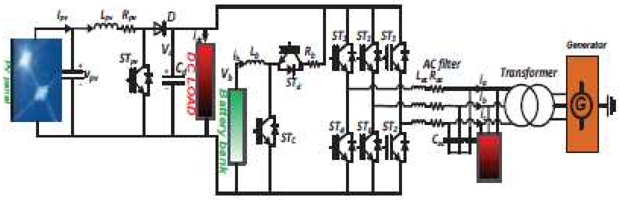

Fig 2.1 Proposed system

The proposed technique proposes a control and power administration framework for PV-battery frameworks, which is a unified control framework that adaptably and adequately controls control streams among the power sources, burdens, and utility grid.The yield voltage is controlling the voltage on both DC and AC transports, exchanging between lattice associated and islanded working modes easily, and adjusting power rapidly in the cross breed PV-battery framework. Continuallyincreasing interest for vitality and concerns of ecological weakening have been spurring electric control specialists to discover reasonable techniques for powergeneration. Appropriated ages (DG) as renewableresources, for example, sun oriented vitality, are accepted to give an effective answer for diminish the reliance on conventionalpower age and to upgrade the dependability and qualityof control frameworks . Photovoltaic (PV) control frameworks havebecome a standout amongst the most encouraging sustainable generationtechnologies due to their appealing attributes such asabundance of sun powered and clean vitality. Quick PV technologydevelopment and declining establishment costs are likewise stimulatingthe expanding arrangement of PV in control systems.However, because of the idea of sunlight based vitality and PV panels,instantaneous control yield of a PV framework depends largelyon its working condition, for example, sun powered irradiance andsurrounding temperature, bringing about steady changes inthe yield control . In this way, to keep up a reliableoutput control, battery stockpiling frameworks are generally integratedwith PV frameworks to address the fluctuation issue. a half breed microgrid framework comprising of a PV exhibit that contains various PV boards, battery bank for control stockpiling, and a unified bidirectional inverter thatinterfaces the DC to AC control framework. A unidirectionalDC/DC converter is introduced to control the powerof PV clusters, while the battery bank is charged/dischargedby controlling a bidirectional converter that extensions the batteryand the DC transport. DC loads are provided through directconnection to the DC transport and AC loads and the point ofcommon coupling (PCC) is situated on the AC side. Beforeconnecting to the utility lattice, a transformer is utilized tostep up the AC voltage to that of the matrix. The PV-batterysystem can be working in either framework associated or islandedmodes by changing the breaker status at the PCC, subject tothe state of the framework and the matrix, e.g., a genuine faulton the AC transport may require opening the breaker to preventthe back-encouraging current from the lattice . Since PV outputpower and stack request may change continually amid a day,the control administration calculations for PV-battery framework arerequired to deal with the power stream and instantly react toany change to keep up the harmony between control productionsand utilizations. Besides, both DC transport and AC busvoltages must be settled paying little heed to changes in the systemto guarantee a dependable power supply.In this topology, the PVarray is interfaced with the DC transport by a DC/DC boostconverter while the battery bank utilizes a bidirectional DC/DCconverter to control the charging and releasing procedures. Acentralized inverter is introduced to interconnect the DC and ACnetworks. DC stack piece by and large speaks to the heaps that areconnecting at the DC transport, which can be numerous kinds of loadssuch as electric vehicles or office structures. There are likewise ACloads devouring force at the AC transport. This is an ordinary PV battery microgrid framework and comparable or same configurationshave been generally utilized and explored The proposed CAPMS is a brought together power managementsystem comprising of a supervisory module that screens therequired constant parameters fromthe PV-battery framework and various controllers for every one of thepower converters. As per the circumstance of the observed parameters, CAPMS chooses the situations and select specificcontrol plans to be connected to the converters to guarantee areliably control condition. In spite of the fact that the proposed CAPMSis composed in light of the PV-battery framework setup, for different designs, for example, systemswith decentralized inverters or numerous battery banks, similarapproach might be material with legitimate adjustments. Detailedschemes of the CAPMS, considering both framework associated and islanded modes, are delineated , whichindicates the conceivable working situations of the PV-battery microgrid and how CAPMS reacts to control and balancethe framework.

III. BI DIRECTIONAL CONVERTER

Bi-Directional DC/DC Converter Control The bi-directional DC/DC converters are utilized to associate the battery banks to the DC transport. In framework associated mode, those converters just manage the battery banks (or PEVs) charging rates. In view of the SOCs of the battery banks and the power stream conditions in the AC side, the charging/releasing current references are produced to control the present stream in the converters. Every battery has its own bi-directional DC/DC converter, which implies they can have diverse charging rates. By doing this, the battery banks can infuse energy to or assimilate control from the DC transport, and considerably exchange vitality between various battery banks if fundamental. For this situation, just a single current control close circle with PI controller is sufficient to direct the current. The bi-directional DC/DC converters of the battery banks assume a vital part in islanding mode to manage the DC transport voltage. A two-circles control is utilized to direct the DC transport voltage. The control plot for the bi-directional DC/DC converter is appeared in Fig. 8. The external voltage controlled circle is utilized to create a reference charging current for the internal current controlled circle. The blunder between the deliberate DC transport voltage and the framework reference DC transport voltage is set as the contribution of the PI controller, and the yield is the reference current

IV. Control Strategy

Hybrid micro grid can be operated in two modes namely grid-connected mode and autonomous (isolated) mode. In this paper, grid connected mode of operation is modeled, simulated and analyzed for the proposed system. In the WTG the AC/DC/AC converter is used to extract maximum power from solar panel, to regulate the rotor side current and to synchronize with the AC grid. In this mode, the utility grid is connected to the hybrid grid and the utility grid will acts as a swing bus and any power demand is balanced by the utility grid. The excess power will be transferred to the utility grid, in case, of any power surplus on the DC side. At this condition the main converter will acts as inverter. In grid connected mode, the energy storage system function is to prevent the frequent power transfer between DC and other grids. The main function of the bidirectional (main converter) is to maintain smooth power transfer or exchange between DC and AC grids and to provide stable DC voltage.

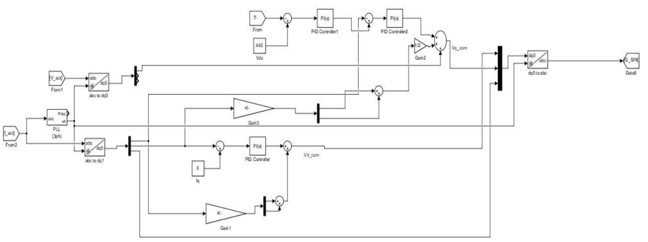

Fig 3.1 Control circuit for grid

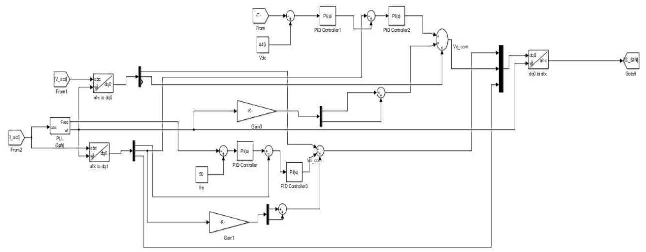

Fig 3.2 control circuit for islanded mode

V. Results

Grid mode

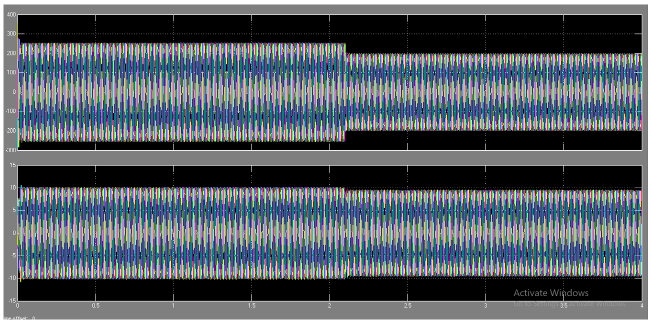

Fig 4.1 Grid mode results

Fig. above show the AC bus voltage and current. The AC bus voltage transient response during the pulse load connection is shown in Fig. The AC voltage amplitude returned to its normal value in less than three cycles. When the pulse load was connected to the AC side, the current flow through the AC bus increased immediately, and after the pulse load disconnected from the AC side, the current slightly decreased to keep the system in balance.

Island mode

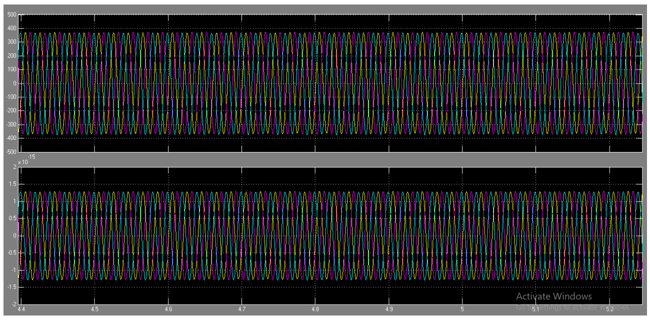

Fig 4.2 Island mode results

The same islanding mode operation without DC side support.When the 10 kW resistive pulse load was connected to the AC bus, the total load in the AC side was 14 kW which exceeded the generator's output limitation by 0.2 kW.Fig. shows the AC side generator's voltage, current and output power.

VI. Conclusion

A coordination power flow control method of multi power electronic devices is proposed for a hybrid AC/DC microgrid operated in both grid-connected and islanding modes. The microgrid has a PV farm and a synchronous generator that supply energy to its DC and AC side. Battery banks are connected to the DC bus through bi-directional DC/DC converter. The AC side and DC side are linked by the bi-directional AC/DC inverter. The system topology together with the control algorithms under both modes are tested withthe influence of pulse loads and renewable energy farm output power variances. The simulation results show that the proposed microgrid with the control algorithm can greatly increase the system stability and robustness.

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