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Optimised Multisource Integrated Smart Grid for Critical and NonCritical Load Applications

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ABSTRACT

In this paper, we propose a way to deal with decide the ideal activity procedures for a PV-diesel battery microgrid covering modern burdens under framework power outages. An extraordinary property of the modern burdens is that they have low power factors. In this way, the receptive power utilization of the heap can't be dismissed. In this review, a clever model of a PV-battery diesel microgrid is created considering the dynamic too responsive force of the microgrid parts. The DG unit is controlled with the recurrence of the microgrid while the inverter utilized in the PV framework directs the voltage at the purpose in like manner coupling. Essentially, on the off chance that the DG is wild because of any explanation, the PV framework is additionally added with a helper signal in view of the recurrence deviation to keep up with recurrence security

KEYWORDS:Voltage Source Inverter (VSC), Diesel Generator, Battery and PI Controller

1. INTRODUCTION

Diesel generators are widely used as backup power supplies to hide the masses during grid blackouts, which could be a major problem in many countries worldwide thanks to the technology development in recent years, it's possible to integrate renewable sources with conventional sources to make an area microgrid. However, many technical and economical complexities must be handled in very microgrid operation to produce reliable and cost-effective energy. The ideal plan and activity of a PV-diesel-battery microgrid are vigorously explored inside the writing. However, battery banks have some drawbacks like high cost of capital, cost, and battery efficiency reduction.

Subsequently, a battery-less pv-diesel microgrid is utilized as a savvy arrangement with an espresso cost of funding to supply constant power supply to the heap while lessening the fuel utilization of a diesel generator

A trial study was done to experience the presence of a pv-diesel framework without a battery under various working circumstances the outcomes show that the framework activity ought to be streamlined to support the framework proficiency in another work the exhibition of a battery-less pv-diesel microgrid was assessed north of one-year time frame and recommendations should broaden the benefit of the framework

In the size of a battery-less pv-diesel framework was advanced to diminish the web cost of the framework thus the consumed energy cost besides the add introduced an improved way to deal with chase out the ideal degree of the pv-exhibit and furthermore the ideal limit of the diesel generator utilizing a congruity search calculation an adaptable activity methodology was proposed to follow the greatest amount of force from the pv cluster managing the voltage of the heap and control the diesel generator motor during a pv diesel framework however without enhancing the adaptability stream inside the framework

As indicated by one more perspective the advancement proposed a customized control philosophy for responsive power age in an isolates breeze diesel structure a crucial limitation of the past assessments is that the ideal action issue of the cross-section related pv-diesel microgrid with various diesel generators under grid blackouts wasn't investigated

Moreover, a special property of the grid-feeding PV-inverters is that they will not operate within the island mode if there is not any grid-forming device for setting the voltage and frequency within the microgrid. This winds up in a very replacement constraint that should be held in dispatching the generated power from the PV array. during this paper, the model of the lattice associated battery-less PV-diesel microgrid is upgraded and new useful imperatives are added.

Additionally, a spanking new approach is developed to optimize the operation of the PV diesel microgrid which simultaneously minimizes the energy consumption costs and maximizes the dispatched power from the PV-array.

2. EXISTING SYSTEM

The chief test in a microgrid with Distributed Energy Resources (DER) is dealing with the discontinuous idea of sustainable power sources. Hence, the degree of a mix of the Battery Energy Storage System (BESS) has expanded as of late in a microgrid because of its flexibility, high energy thickness, and proficiency. By and large, BESS is a matrix-tied framework and has quick power changeability. Dubiously, during the independent mode, it can't work without even a trace of a nearby Voltage Source (VS) which goes about as a voltage and recurrence reference in the organization. To guarantee the dependable activity of a microgrid during utility framework blackout or non-accessibility of irregular Renewable Energy Sources (RES), it is important to work the BESS with the neighbourhood VS to dispatch the put-away energy.

This paper looks at the smart procedure that can be embraced for recognizing the most proper rating of the VS which can go probably as a voltage and repeat reference for the BESS using Mat Lab/Simulink. Further, an amusement was done against various weight characteristics, and it is seen that a Uninterruptible Power Supply (UPS) with a kVA breaking point of 35-45% of that of the BESS with an over-trouble cutoff of 50-200% can be picked as an achievable choice to go probably as the VS.

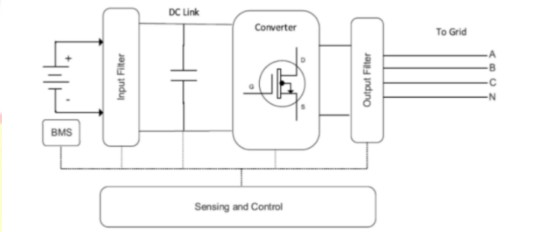

FIG 1. CIRCUIT DIAGRAM OF EXISTING SYSTEM

a) OBECTIVES OF THE EXISTING SYSTEM

The primary goal is: To plan a framework that keeps up with the voltage, recurrence and decreases the power misfortune in the Microgrid, and accomplishes conservative activity of the Diesel Generation unit with the assistance of PV by controlling the uncontrolled state.

b) DISADVANTAGES OF EXISTING SYSTEM

It has a lack of integrity in giving the correct measures of the grid and it consists of lack of availability and continuity of services

3. PROPOSED SYSTEM

MICROGRIDS with various sources are arising quickly in the circulation organization. With inexhaustible sources, these microgrids can be self-manageable wellsprings of energy. Control of the converter utilized in the sustainable sources becomes intricate because of the coupling of the situations on the AC side of the converter. The standard procedures to control such frameworks utilizes a method known as criticism linearization to decouple and linearize the conditions followed by either the use of PI regulators or sliding mode regulators.The power conveyed by the diesel generator relies upon the aggregate sum of force the IPP needs to convey as per its agreement. In the disengaged mode, which is achieved by the isolator switch, the complete power created relies upon the nearby burden level. The DG then, at that point, works inside the base and greatest level with the PV exhibit providing the leftover power. The wellsprings of force are associated with the lattice through a transformer.

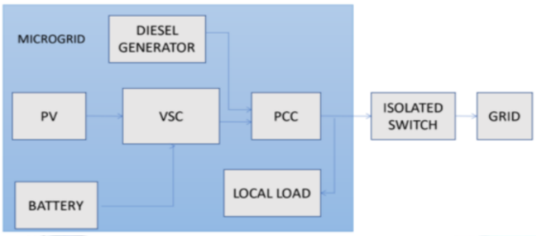

FIG 2. BLOCK DIAGRAM OF PROPOSED SYSTEM

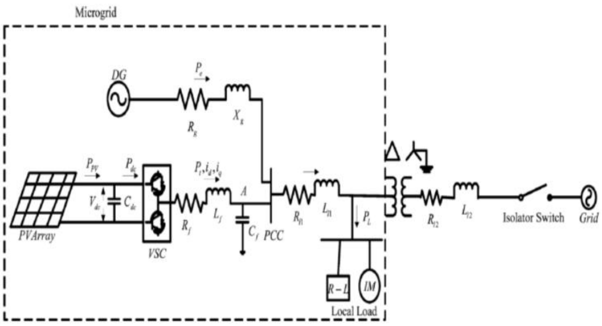

FIG 3. STRUCTURE OF SINGLE LINE DIAGRAM

a) CONFIGURATION OF PROPOSED SYSTEM

The structure of the proposed SPV exhibit took care of PV and diesel generator based microgrid driven power age framework utilizing a cuk converter is shown the proposed framework comprises of left to generator based microgrid and a power age the PV and diesel generator based microgrid has an inbuilt encoder the beat generator is utilized to work the cuk converter a step-by-step movement of the proposed system is made sense of in the going with fragment comprehensively

b) OBJEVTIVES OF PROPOSED SYSTEM

The SPV exhibit produces the electrical power interest by the motor pump. This electrical power is fed to the motor-pump via a CUK converter and a VSI. The SPV exhibit shows up as a power hotspot for the CUK converter as displayed Ideally, a similar measure of force is moved at the result of the CUK converter which shows up as an information hotspot for the VSI. By and by, because of the different misfortunes related with a DC-DC converter, somewhat less measure of influence is moved to take care of the VSI. The pulse generator generates, through the INC-MPPT algorithm, switching pulses for the IGBT (Insulated Gate Bipolar Transistor) switch of the CUK converter.

The INC-MPPT computation includes voltage and current as contribution from the SPV bunch and makes an ideal worth of commitment cycle. Further, it makes a genuine trading beat by differentiating the commitment cycle and a high repeat carrier wave. In this manner, the most outrageous power extraction and hereafter the viable progression of the SPV cluster is refined. The VS, changing over DC yield from a CUK converter into AC, takes care of the PV and DIESEL GENERATOR BASED MICROGRID to drive a power generator coupled to its shaft. The VSI is worked in principal recurrence exchanging through an electronic substitution of PV AND DIESEL GENERATOR BASED MICROGRID helped by its implicit encoder. The high recurrence exchanging misfortunes are accordingly dispensed with, adding to the expanded productivity of the proposed influence creating framework.

c) DESIGN OF SPV ARRAY

According to the conversation, the reasonable converters are related with power misfortunes. Also, the exhibition of microgrids is affected by related mechanical and electrical misfortunes by repaying the misfortunes, the size of the SV cluster is picked with a to some degree more zenith impact capacity to ensure the great action paying little brain to impact disasters. In this way, the SPV exhibit of peak power cut off ofPmpp = 3.4 kW under (STC: 1000W/m2, 25°C, AM 1.5), genuinely more than referenced by the engine siphon, is chosen and its boundaries are planned likewise. Sun oriented universes make Sun module Plus SW 280 mono [24] SPV module is decided to design the SPV show of a fitting size. Electrical subtleties of this module are recorded, and amounts of modules expected to interact in series/equivalent are surveyed by picking the voltage of the SPV exhibit at MPP under the worth of STC as is given as V MPP = 187.2 V.

d) ADVANTAGES OF PROPOSED SYSTEM

In the grid connected mode, greatest power is extricated from the PV exhibit as it works at its most extreme power point. The power conveyed by the diesel generator relies upon the aggregate sum of force the IPP should convey as per its agreement. In the withdrew mode, which is accomplished by the isolator switch, the total power made depends upon the level of the nearby burden. The DG then, at that point, works inside the base and most extreme level with the PV cluster providing the leftover power. The wellsprings of force are associated with the lattice through a transformer.

4. CONTROL STRUCTURE

A different control circle structure is proposed in this paper. The PV control circle is liable for the age of the terminating beats for the switches in the VSC while the optional/setpoint control circles are answerable for producing the setpoints/reference upsides of the PV control circle.

To see the capacity of the VSC to fulfil the responsive power need, the VSC is made at risk for the upkeep of voltage at point An and accordingly, no programmed voltage controller is available on the DG. To guarantee the fulfilment of the mode, the DG is made answerable for the support of recurrence in the microgrid.

a) WORKING MODE OF CONTROL STRUCTURE

WORKING MODE 1:

A different control circle structure is proposed in this paper. The PV control circle is answerable for the age of the terminating beats for the switches in the VSC while the auxiliary/setpoint control circles are liable for creating the setpoints/reference upsides of the PV control circle. To see the capacity of the VSC to fulfil the responsive power need, the VSC is made obligated for the upkeep of voltage at point An and along these lines, no programmed voltage controller is available on the DG. To guarantee the fulfilment of the mode, the DG is made answerable for the upkeep of recurrence in the microgrid.

WORKING MODE 2:

The power produced by the DG is characterized by the setpoint of its lead representative while the power removed from the PV cluster is reliant upon the episode sun-based illumination. In this situation, the microgrid is constantly thought to be associated with the fundamental network. With a fixed setpoint for the lead representative and a decent degree of nearby stacking, the power that is either consumed or conveyed by the fundamental network is reliant upon the degree of sun-based insolation. With the decline in sun-based insolation, the all-out power age in the microgrid might be lacking to satisfy the needs of the nearby burden and accordingly the shortage in power should be provided by the primary matrix. Under these conditions, since the recurrence of the framework is kept up with by the network, the recurrence control circle doesn't change the lead representative setpoints, and subsequently the DG doesn't go astray from its timetable. The DG power level is kept up with at the underlying setpoint level and in this manner the DG can keep up with its timetable. The progression of force between the microgrid and the network is additionally seen in this situation. Subsequently, the exhibition of the regulator in the matrix associated mode is approved.

c) SETPOINT CONTROL LOOPS

Three setpoints are required in this control structure, namely and. The first two setpoints are for the VSC while the third sets the mechanical power input of the diesel generator.

SETPOINT:

The control block chart to set the dc voltage reference for the PV cluster is acquired. In any method of activity, the DG yield should be more noteworthy than or equivalent to the base power level to accomplish fuel utilization economy. Essentially, since our energy the board system is PV first, it should work at MPPT whenever the situation allows. Along these lines, in the framework associated mode the setpoint should be gotten from the MPPT calculation. This is accomplished by drawing a lower line of zero on the integrator block, as the DG yield is dependably to its base level. When the microgrid gets disconnected from the fundamental network, the absolute age should be equivalent to the all-out load in addition to misfortunes in the line between the PCC and the neighbourhood load.

For this situation, when the complete neighbourhood load in addition to misfortune is not exactly the amount of greatest influence of the PV cluster and the base influence result of the DG, the PV exhibit should be derated to keep up with the DG influence yield at its base level. This can be accomplished by exploiting the inertial reaction of the DG following the confinement. As the PV power won't change except if the dc reference is changed, quickly following the disengagement under the previously mentioned working condition, the motoring of DG will happen as has been made sense of. subsequently, its electrical power result will fall beneath its base level. At right now, the blunder will be positive and along these lines the result of the integrator will increment with a positive slant until the mistake exits. Whenever this adds to the MPPT calculation yield, the dc voltage reference will expand, prompting a decrease in the result force of the PV cluster

Then again, when the heap situation powers the power created by the DG to be more prominent than its base level, the signal of error will be negative, and the integrator will begin to decrease its result until the error becomes zero. By drawing a lower line of zero on the integrator, it is guaranteed that the net dc voltage reference doesn't go underneath the MPPT esteem and subsequently the PV array always operates in the stable region of its power-voltage curve exhibit generally works in the steady locale of its power-voltage curve. The error in frequency is used when the DG is to be operated in an uncontrolled mode. Accordingly, the worth of is set as the setpoint of the DG and an auxiliary signal corresponding to the error of frequency is added to the loop.

Iq REF SETPOINT:

The control block graph to set the responsive power is shown. In both the lattice association and the segregated mode, the usefulness of this circle depends on the blunder between the voltage at point An and its reference esteem. This voltage reference is set as 1 pu. The receptive power reference esteem is gotten from the blunder in voltage at point A. The worth can be acquired from the receptive power condition.

By taking the recurrence mistake signal, the mechanical power setpoint of the DG is controlled. The lead representative for the DG has been demonstrated on the lines of the lead representative instrument made sense of. In the matrix associated mode, since there is no deviation in recurrence from the reference, the recurrence blunder will be zero and the setpoint will be as wanted? In the islanded mode, because of a crisscross in the age and burden levels, the recurrence will veer off from the reference and in this manner the setpoint will change to keep up withtherecurrence.

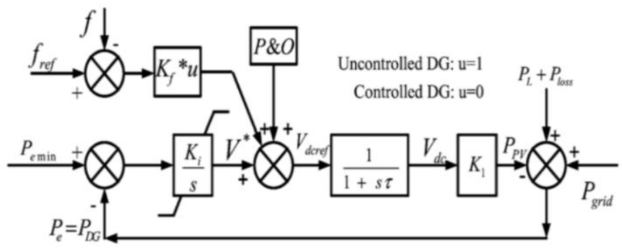

FIG 4. STRUCTURE OF CONTROL LOOP ALGORITHM

d) DESIGN OF CONTROL PARAMETERS

The parameters of the control structure must be tuned to ensure satisfactory operation. The control structure proposed has a combination of nonlinear and linear control elements. The PV control loop is nonlinear while the setpoint control loops are linear in nature.

PV Control Loop: Three parameter values must be tuned in the second order sliding mode control scheme. These parameters are and. Consider a process equation given by

$$\frac{dx}{dt} = f(x) = g(x)u$$

The state variable is while the control variable is the sliding surface for this equation can be defined as

$$S = x - xref$$

e) OPERATIONAL OF CONTROL STRUCTURE

The prime control objectives of hybrid AC/DC microgrids are AC and DC transport voltage regulation. The DC transport voltage can be constrained by Battery Energy Storage System (BESS) or BIC in DC VRM. The AC voltage/frequency regulation can be acknowledged with Utility Grid (UG), Diesel Generator (DG) or BIC in AC VRM. Subsequently, the working situations of mixture AC/DC microgrid can be arranged into 3 cases as displayed.

OPERATING SCENARIO 1:

In operating scenario 1, the DC bus voltage is regulated by the battery converter operating in DC VRM. If the microgrid is tied to UG/DG, the AC bus voltage/frequency is dominated by UG/DG accordingly. BIC will thus be scheduled to operate in PDM and the reference power is generated by the central controller.

Therefore, the Low Voltage (LV) side of DHFT is regulated and the High Voltage (HV) side can be regarded as a current source, whose current magnitude and direction is determined by BIC. The power flow in this scenario is bidirectional and transition between different directions is needed.

OPERATING SCENARIO 2:

In operating scenario 2, a BESS blackout has happened because of the inaccessibility of battery bank or converter shortcomings. The AC recurrence guideline or voltage is constrained by UG/DG, while the DC voltage transport is coordinated by BIC in DC VRM. In this manner, the HV side of DHFT is managed and the power stream is controlled by the power balance in the DC sub-framework. Assuming PV age surpasses DC load utilization, the overabundant power will stream to the AC sub-framework through DHFT and BIC. Then again, when the leftover power (the contrast between load power utilization and sustainable power age) is positive, power stream from the AC sub-network to the DC sub-lattice through DHFT/BIC happens.

OPERATING SCENARIO 3:

In operating scenario 3, neither UG nor DG is accessible. The DC transport voltage is managed by BESS and BIC is booked to work in AC VRM to control the AC sub-framework voltage and recurrence. Like working situation 1, the LV side of DHFT is controlled and the HV side power stream course and extent is resolved in view of the power balance in AC sub-lattice.

e) DHFT DESIGN

The criteria of DHFT design include the high conversion efficiency, rated conversion ratio with minimum voltage variations in different loading conditions and autonomous power flow and seamless transitions

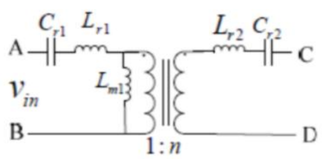

FIG 5. TRANSMISSION GAIN DIAGRAM

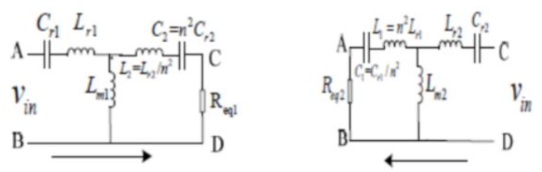

FIG 6. SCHEMATIC DIAGRAM OF DHFT DESIGN WITH CCLC TOPOLOGY

The schematic diagram of DHFT with CLLC topology is as shown in Fig 6 The resonant circuit is included the capacitors Cr1, Cr2, and Lr1, Lr2 of leakage inductance. Lm1 is the polarizing inductance for power change from AB to CD port. The equivalent circuit diagram of power flow transitions between LV and HV sides is as shown. The equivalent inductances are L1, C1, L2, and C2, and primary and secondary sides of the capacitance individually. Take the power flow from AB to CD, as an example, the transmission gain of the DHFT can be normalized as the relationship between the normalized gain and parameter g can be illustrated as shown by taking k=120 and h=1. It can be observed that the maximum gain point varies with different g selection, which indicates that the resonant point is related to the second capacitor. However, the maximum transmission gain has been kept almost constant with different g values. Consequently, in view of the DHFT plan, there are numerous mixes of Cr1 and Cr2 that can accomplish the ideal transmission gain. In the proposed hybrid AC/DC microgrid, DHFT works under the resonant condition to guarantee the greatest transmission power and diminish the losses of switching. Additionally, consolidating the examination, the planned DHFT can guarantee agreeable execution with different decisions, particularly for the resonant capacitors.

5. MODELLING AND SIMULATION

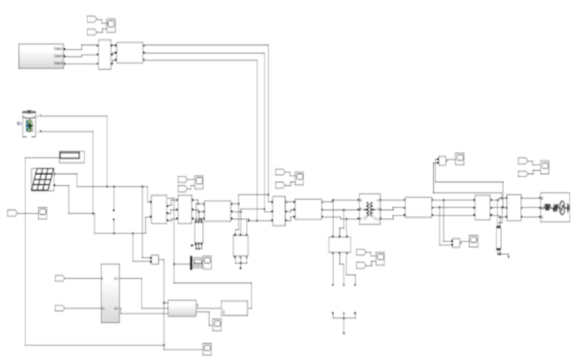

FIG 7. SIMULATION CIRCUIT DIAGRAM

The system described in FIG 7 has been simulated in SIMULINK®. Various scenarios have been considered to validate the proposed control scheme. In the first scenario, the need for the seamless controller is showcased with both the PV array and the DG being uncontrolled. The second scenario validates the performance in the grid connected mode with varying solar insolation. Thus, the flow of power between the main grid and the microgrid can be observed from this scenario. Further, with the initial DG power level at 25 kW and the initial solar insolation at 500 Wm, two separate scenarios varying in load pattern and insolation level have been considered. These scenarios show the performance of the control scheme when the microgrid gets isolated from the main grid. In this isolated condition, the power output of the sources has to be controlled according to the varying demand and the varying insolation. Further, the way of thinking of extricating the greatest power from the PV array while at the same time working the DG in a prudent way is likewise shown by these situations. The last situation is considered to approve the exhibition of the control conspire when just the DG is non-controllable.

This non-controllability of the DG emerges under the umbrella of the market interest of the sources. However, this method of activity is basically in a grid-connected system and has been seen from the subsequent situation, this situation shows the culmination of the consistent regulator in scheduling power between the sources even in the isolated mode with the limiting factor being the schedule of the sources. In the plan of. the control system, the resistance filter and the losses of the converter have been dismissed. Be that as it may, while running the simulation, these organization components have been addressed. With the addition of an integral controller in the PV control loop, this does not cause a problem in the performance as any slight variation in the network parameters is compensated by the integral control

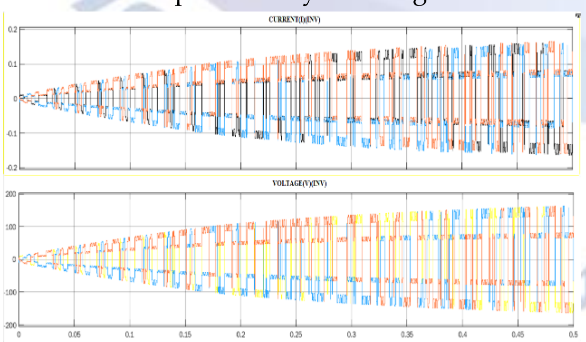

FIG 8. PV INVERTER VOLTAGE AND CURRENT

This is the PV Inverter Voltage and Current Measurement crossing the range More than 600 V and 0.6A of the rated to achieve a good amount of efficiency.

SCENARIO 1:

Even with a philosophy of extracting maximum power from renewable energy sources, a need arises at times to reduce the power extracted from such sources. To accomplish this a control approach is necessary that will plan the power created by these sources as needs to be. This situation features the activity of the framework when no control has been applied fairly of force produced by the sources. The system is operated with the setpoint of the DG being 10kW and the solar insolation level is assumed to be 500 Wm. From the PV curves, the power that is separated from the PV array apparently is 27 kW. The local load consists of a 10 kW, 5 kVAR static load and a 25 kVA induction motor dynamic load.

The level of load which is nearby is thought to be 20 kW with 10 kW of static load and 10 kW of dynamic loads, there is a generation surplus of 17 kW in the microgrid. In the grid-connected mode, this power (to the tune of 15 kW after losses) is pumped into the grid. At s, the microgrid is isolated from the main the local load level is assumed to be 20 kW with 10 kW of static load and 10 kW of dynamic load. Thus, there is a generation surplus of 17 kW in the microgrid. In the grid-connected mode, this power (to the tune of 15 kW after losses) is pumped into the grid. At s, the microgrid is isolated from the main grid and the system performance is as depicted. The dc bus voltage is the same as in the grid-connected mode. Thus, maximum power is extracted from the PV array even in the isolated mode, since there is very little change in the voltage levels, the power consumed by the loads remains constant. As the generation levels are higher than the load, it results in a rise in the frequency of the system as depicted.

The surplus power of 15 Kw that was previously exported to the grid, is now consumed by the DG resulting in the motoring of the DG. This can be observed from wherein the DG power is 10Kw before isolation and it drops to kW after isolation. A simple calculation reveals that the electrical power is now balanced in the system with the DG operating as a motor. However, the frequency continues to increase as the input mechanical power to the DG is constant resulting in the acceleration of the machine. Thus, it can be seen from this scenario that when the microgrid gets isolated from the main grid a suitable control scheme is required to reduce the generation levels and thus switch the operation of the control scheme from a - mode to a - mode.

SCENARIO 2:

The power generated by the DG is defined by the setpoint of its governor while the power extracted from the PV array is dependent on the incident solar irradiation. In this scenario, the microgrid is always assumed to be connected to the main grid. With a fixed setpoint for the governor and a fixed level of local loading, the power that is either consumed or delivered by the main grid is dependent on the level of solar insolation. With the decrease in solar insolation, the total power generation in the microgrid may be insufficient to meet the demands of the local load and thus the deficit in power will have to be supplied by the main grid. Under these circumstances, since the frequency of the system is maintained by the grid, the frequency control loop does not alter the governor setpoints, and thus the DG does not deviate from its schedule. The satisfactory performance of the control scheme can be observed from the Figure which shows the plots of the dc voltage of the capacitor, the power flows, and the frequency of the system. The insolation level is assumed to be 750 Wm until s. At this insolation level, the maximum power that can be extracted from the PV array is 41 power generation in the microgrid is 51 kW. The power level of the local load is 37 kW with 10 kW being a static load, 25 kW being an induction motor load and 2 kW being the losses. This load level is also maintained constant for the entire scenario. It can be observed that with these power levels, the microgrid has surplus power, and thus this extra power, to the tune of 14 kW, is sent from the microgrid. Due to further losses in the transformer and line, 11 kW of power is sent to the main grid. The dc voltage level, shown is maintained at the MPP value of 796 V.

At s, the insolation level is decreased to 500 Wm thereby reducing the maximum power extraction from the PV array to 27 kW. From the dc voltage plot, the MPPT algorithm successfully tracks the PV curve to extract the maximum power at a voltage level of 782 V. However, at this reduced insolation level, the total power generated in the microgrid is slightly insufficient to meet the local load demand and the losses. Thus 2 kW of power flows in from the grid into the microgrid. From the frequency plot of the Figure with the disturbance, there is a perturbation which thus causes a perturbation in the DG output power.

This however does not alter the governor settings during steady state as the grid frequency is maintained at 50 Hz. The perturbation in frequency occurs because of the sudden power mismatch that occurs. However, with the inflow of power from the grid, the mismatch is reduced. At s, the insolation level is further decreased to 300 Wm resulting in a larger inflow of power from the grid to the tune of 12 kW The DG power level is maintained at the initial setpoint level and thus the DG can maintain its schedule. The flow of power between the microgrid and the grid is also observed in this scenario. Thus, the performance of the controller in the grid-connected mode is validated.

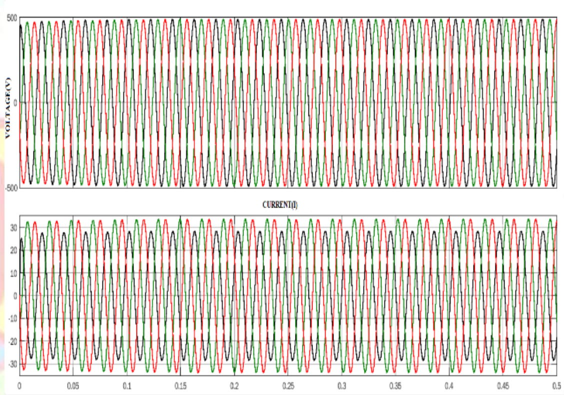

FIG 9. GRID VOLTAGE AND CURRENT

6. SIMULATION RESULT

This is the GRID Output Voltage and Current Measurement crossing the range More than 750 V and 0.7A which supply to the Grid with Surplus power coefficient.

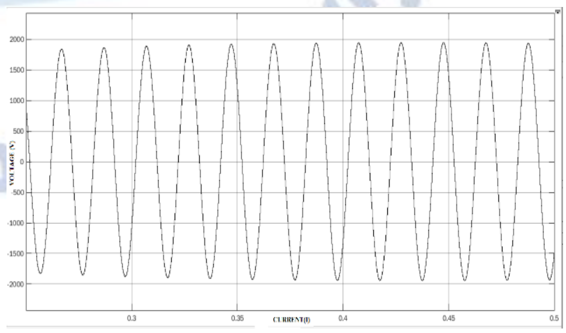

FIG 9. AFTER CREATING FAULT DIAGRAM

This is the Output Voltage when some fault occurs at Grid at any phase of the system that is total power load system

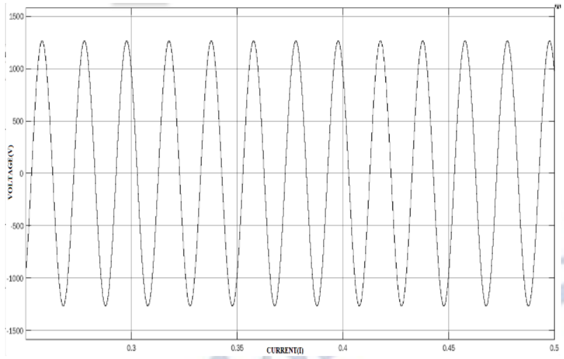

FIG 10. NO FAULT DIAGRAM

This is the Output Voltage when fault mitigation was cleared and able to find the steady state response at Grid at any phase of the system.

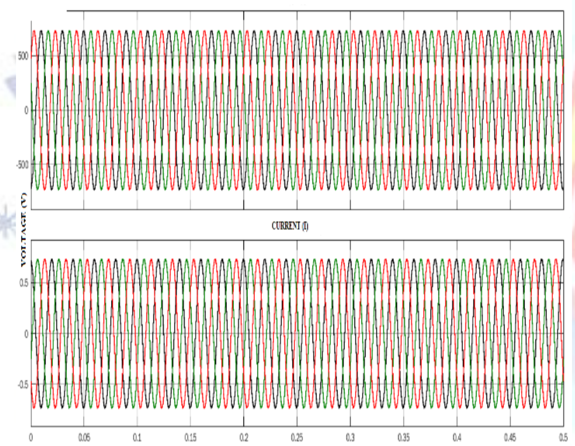

FIG 11. OUTPUT WAVEFORM

This is the output waveform which gives the value of 500V which describes the Supply load taken by the grid

7. CONCLUSION

In this paper, a seamless control structure for a PV-Diesel microgrid has been proposed to operate both in the grid-connected mode and in the isolated mode. The control structure can operate the PV array at its maximum power point level while operating the diesel generator at any level specified. The absolute power delivered by these two sources is then devoured to a limited extent by the local load and the excess is infused into the matrix. Without the necessity of an islanding detection mechanism, the same controller can meet the local load demand when the microgrid gets isolated from the main grid. Three setpoint control loops have been constructed to generate the required reference values for the main control loop. In the islanded mode, the controller ensures that maximum power is extracted from the PV array while operating the diesel generator at its minimum power level.

Conflict of interest statement

Authors declare that they do not have any conflict of interest.

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