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ICIREST-19 An Innovative Design Strategies To Control Grid Connected Intentional Islanding Operation Of Distributed Power Genration

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Abstract*: A micro grid is a cluster of interconnected DG, loads and intermediate energy storage units that co-operate with each other and is to be collectively treated. Intentional islanding is a situation in which a micro grid which consist of load and dg is isolated from the reminder utility system. Under normal condition that is dg in grid tied mode it operates in the current source control mode and when the grid is isolated from the utility that is in intentional islanding condition this operating condition changes to voltage source control mode. In this mode the micro grid will provide a constant voltage to the local load. From the other renewable energy sources, PV sources is the most suitable source for clean generation and suitable for any area application. Islanding should be detected in the minimum possible time of occurrence to ensure continued stable operation along with the safety of linemen and customers equipment. This paper describe the control strategy implemented for both grid connected and grid disconnected that is intentional islanding operation of distributed shedding algorithm.*

Keywords: *DG- Distributed Generation, grid connected operations Intentional islanding.*

I. Introduction

Nowadays for a gradually growing fraction of the total energy supply a renewable energy resources such as wind and PV (photo voltaic) has been accounted. A shift from a non-renewable generation ad development of micro grid system is complementary. A micro grid is a localized group of electricity sources and load that normally operates connected to and synchronous with the traditional wide area e synchronous grid. The establishment of micro grid system within the network appears as an alternative that may well be used for modern society which is fully dependent on electricity. Micro grid can effectively integrate with various sources of distributed generation, especially renewable energy sources. The key feature of micro grid is its ability to separate from the main network during the unscheduled period of interruption to continue feeding. A very important feature is to provide multiple end-use needs as heating, cooling and electricity at the same time since it allows energy carrier substitution and increased energy efficiency due to waste heat utilization for heating, domestic hot water and cooling purposes. A micro grid is capable of operating in grid connected and stand-alone modes and handling the transition between the two. The DG operates in two modes, in grid connected and disconnected that is in islanding mode. The flexibility, voltage rise, reduced power losses, improved security are the main advantages of the DG. Islanding is a condition in which the DG continues to supply power to the location even though electrical grid power is no longer present. There are two types of islanding modes mainly, Intentional islanding that is planned and unintentional islanding that is unplanned. The purpose of intentional islanding is to sectionalize the utility system in order to create a power island during an occurrence of disturbances.

There are different methods available in the literature to detect islanding. They are mainly local method and remote methods. Remote methods are based on the communication between local DG and the utility grid where as local methods rely on monitoring parameters like voltage and frequency at the DG sites.

This paper presents control strategy for both grid connected as well as grid disconnected that is islanding mode of operation. When the DG is grid connected it operates in the current sources inverter and when intentional islanding occurs it operates in voltage source inverter. The load shedding algorithm during islanded operation is also been made. The results are simulated in MATLAB.

II. Description of Distributed Generation system

The system consist of the photo voltaic (PV)micro sources in the distributed generation. The DC voltage generated by the pv sources is inverted to get smooth 3phase sinusoidal waveform. The filter circuits are present to suppress the transient present in the inverter output. The self commutated inverter uses IGBT as a switching device. When DG is connected to the grid at the pcc that is at point of common coupling the voltage is

maintain at the grid value. When the islanding occurs that is suppose the DG is isolated from remaining utility in such condition the voltage and frequency values changes from the original values. In such condition the PI control scheme or PWM techniques should b used by the controllers to detect the islanding and reset the inverter output voltage and frequency. The LC filter or RC filter or RL filter can be used as a filter circuit. RL filter is used to maintain the high frequency generated harmonics due to switching between DC to AC converter. The VSC controls the real/reactive power exchange with the grid. The PQ converter control operation will set the active and reactive power set point whereas the VSI controls set voltage frequency at predefined values. Maximum efficiency can be obtained from solar cell by particular operating point. Maximum power point tracking (MPPT) can be done by using observe or perturb method .Distributed Generations comprises large amount of prime mover technologies. The mainly distributed generations are using renewable and non-renewable energy resources. Distributed energy resources are part of micro-grid system. The choice of distributed energy resources are depending upon fuel availability and locating area. The simple definition of the DG is "a renewable energy resources of electrical power connected to the distribution network consumer side. But originally power system develops the generation supplying local demand. The DG is producing small amount of power. The some country saving/defined the DG in depending upon voltage level and it in load directly connected to the consumer's demands or load. The IEEE defined the DG is not directly connected to the large amount of transmission lines. The micro-grids are increasing overall efficiency, power quality etc. The IEEE definition of micro-grid as a group of interconnected load and DER within clearly defined an electrical boundary that acts a single controllable with respect to grid. The micro-grid operated parallel to the utility grid or island. When any type of events such as voltage collapse or fault occurs in the system then the micro-grid is operating islanding and it is isolate to main grid without any harming of transmission line. The micro-grid as combination of generation sources, energy storage and local. This combination unit is connected to the distribution network with the help of PCC. Some technical issues are power flow balancing, voltage control and behavior during the disconnection from the PCC. When micro-grids are operated islanded its characteristics different compare with conventional electrical system and it required different operation and control. The micro-grid control depending upon the inverter control.

III. Micro-Grid Configuration And Features

The fundamental miniaturized scale network engineering graph as appeared in figure1. As appeared in this figure comprises of four feeders and appropriation framework. The A , B and C feeders are touchy burden and it required neighborhood age yet some of non-delicate advertisement it don't required any sort nearby age. In this framework comprise of four smaller scale sources at hub 8, 11, 22, and 16. At the point when the issue emerges in the utility network then the static switch is open and detached the touchy burdens from the fundamental framework. At the point when the small scale network is framework associated control streaming the non-delicate burdens. The smaller scale framework comprises of ace controller or focal controller. It is controlling the task of smaller scale framework. This framework is arranged into three classes.

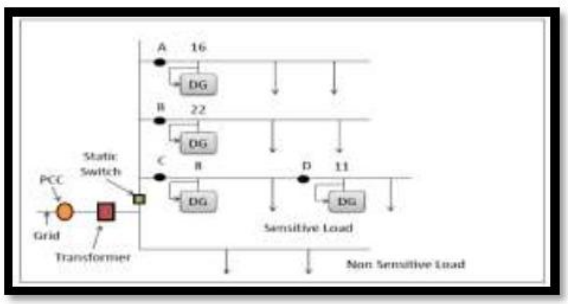


Fig.1. Basic Micro-grid architecture.

IV. Grid Connected Operation

In grid connected operation power factor is unity. The phase lock loop determines the frequency and phase angle at pcc. The grid current reference signal has to be in phase with the grid voltage. It operates in the current control mode in the grid connected operation. The error signals are been passed to PID controllers to generate inverter voltage reference which is then re-transformed into inverse of park transformation.

Mode 1: Grid Connected Operation The control structure for grid connected DG system implemented in Matlab/Simulink is shown in Figure 2. The grid side converter operates as a controlled power source and standard PI controller are used to regulate the grid current in the dq reference frame in the inner control loops. The converter does not take an account to maintain DC link voltage constant by regulating id and iq. The id

represents the active power component injected current into the grid and iq is reactive component. In this work id and iq reference values are given and they will fallowed by the actual values by the DG system. In order to obtain only a transfer of active power only a transfer of active power, the iq current reference is set to zero. The decoupling terms are used to obtain independent control of id and iq. A PLL is used to synchronize the converter with the grid frequency. The philosophy of the PLL is that, the difference between the grid phase and inverter phase angel can be reduced to zero using PI controller and locking the line side inverter phase to grid.

V. Control Strategy

The system consists of a micro source that is represented by the dc source. Under normal operation each DG inverter system in the micro-grid usually works in constant current control mode in order to provide adequate power to the main grid. If any problem arrived in grid side then the system will disconnect to main grid and it's operate intentional islanding mode. In this mode it operate voltage control mode and provide constant voltage to the local load.

This paper displays a total model of a common miniaturized scale network and ID of the required control procedures so as to work this new kind of intensity framework. Numerous issues tackle the utilizing of individual conveyance age. A superior method to understand the developing capability of appropriated age is to adopt a framework strategy which sees age and related loads as a subsystem or a "smaller scale grid". The miniaturized scale networks are new ideas of electrical power comprise of Distribution Generation, Renewable Energy Resources and Sensitive just as Non-sensitive burden. These sources are working in parallel to the lattice and it can work in islanding mode. Amid the unsettling influences the age and burden are not coordinate then the heap and age isolating islanding mode without hurting the transmission line or on the other hand matrix. Deliberate islanding portrays the condition in which a smaller scale network or a segment of the power grid, which comprises of a heap and a circulated age framework, is separated from the lattice framework. In this circumstance, it is essential for the smaller scale framework to keep on giving satisfactory capacity to the heap. Under typical task, every DG inverter framework in the miniaturized scale matrix generally works in steady current control mode so as to give a preset capacity to the principle lattice. At the point when the smaller scale lattice is detach from the principle network, every DG inverter framework must identify this islanding circumstance and must change to a voltage control mode. In this mode, the miniaturized scale network will give a consistent voltage to the nearby burden. This paper depicts a control system that is
utilized to execute lattice associated and purposeful islanding activities of conveyed control age.

VI. Islanding & Detection

Islanding is the condition which occurs due to the failure of grid. Mainly two important parameters which is grid voltage and grid frequency are used to determine the islanding. After detection of the faulty condition the micro grid is disconnected from the utility grid. This is required to be done immediately and within the 2sec.

VII. Simulation

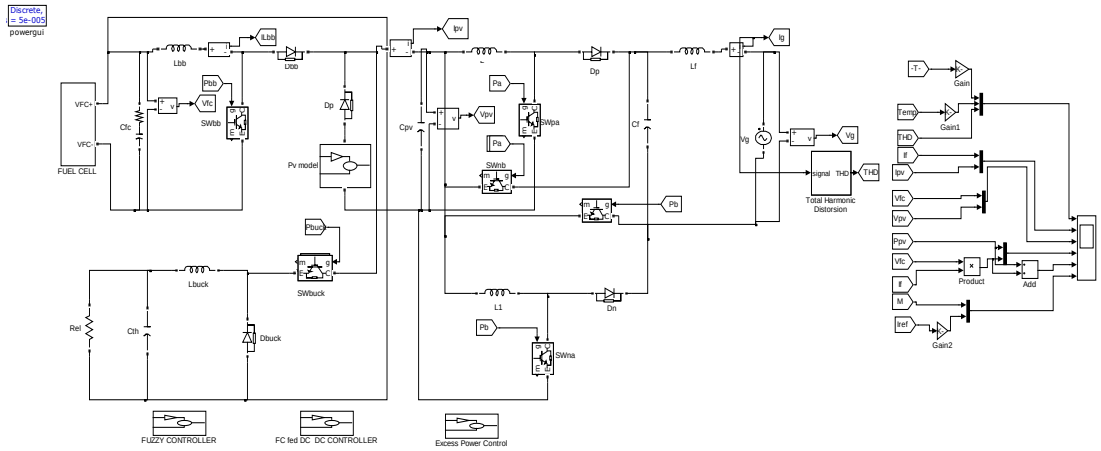


Fig.2

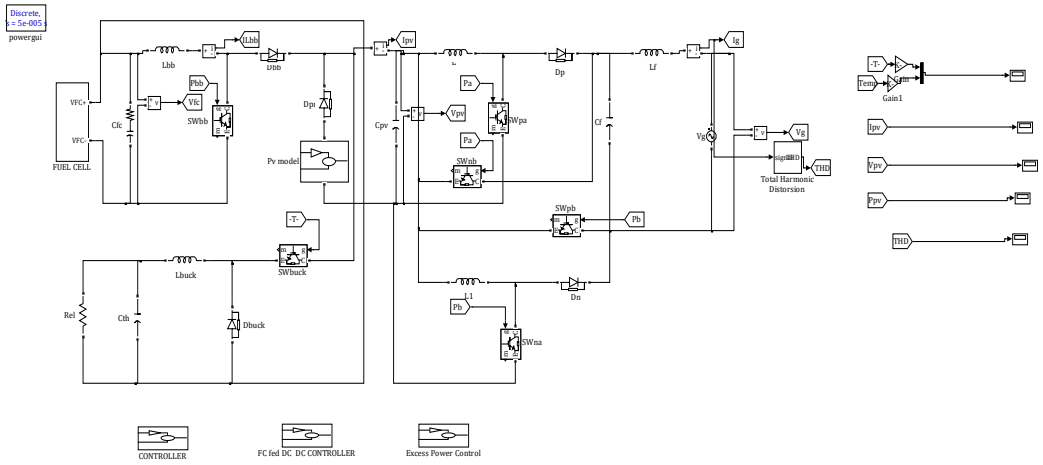
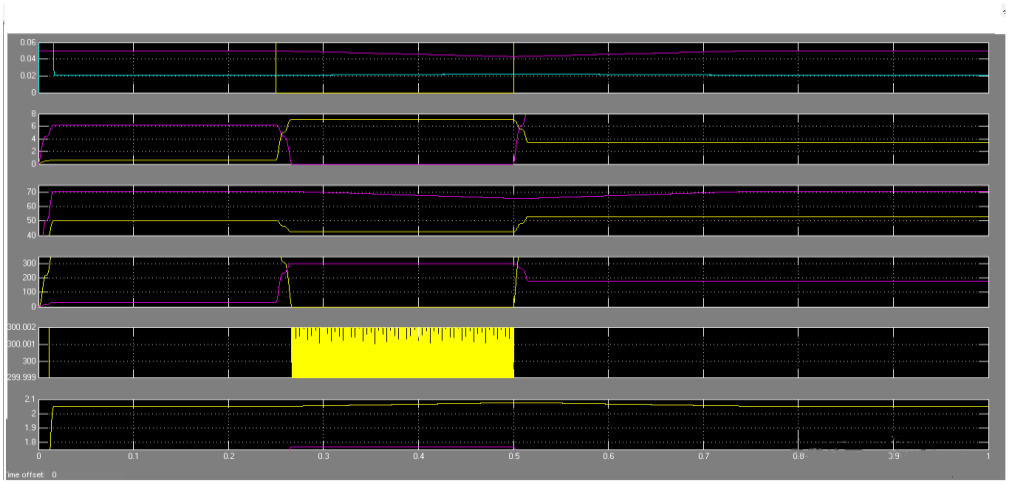
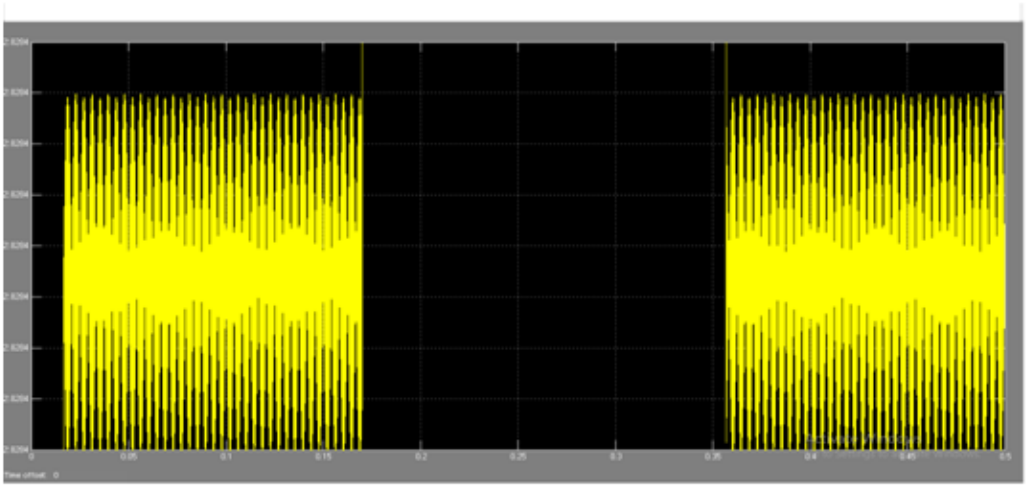


Fig.3

VIII. Simulation Results





IX. Conclusion

This paper proposed to inspect the miniaturized scale lattice idea and to recommend control methodologies that can dependably and proficiently work a decent 3 stage low-voltage smaller scale network in framework - associated and islanded modes. At the main phase of this paper, and so as to think about and dissect the conduct of a smaller scale framework, the basic parts in a normal miniaturized scale framework were recreated. A controller was planned with two interface controls: one for matrix associated task and the other for purposeful islanding activity. For the task of a smaller scale matrix amid network associated mode, steady current control plans were presented. For the task of a smaller scale network amid islanding mode, constant voltage control plans were presented. The two activities are reproduced and appeared

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