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STUDY OF AN ACTIVE ISLANDING DETECTION FOR CURRENT CONTROLLED INVERTER

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Abstract-This paper presents an active islanding detection technique suitable for current controlled inverters. Active methods are shortcomings implementation of passive methods by introducing perturbation in the inverter output. In this method, all such occurrences are needed to be detected as early as possible in order to safely shut down the distributed generators. This is because; continued operation of these generators under islanding can lead to multitude of operational hazards or challenges to the generators and to connect loads. So the simple and fast response current control circuits is use to inverter control to detected islanding condition and disconnect distributed generators immediately after the occurrence of islands. Active method are better at sensing islanding disturbances and reducing or eliminating the Non Detection Zones (NDZs) that the passive method cannot do, but at the cost of system performance.

Keywords- distributed generators, inverter, islanding protection, islanding detection techniques method -active methods.

I. INTRODUCTION

In modern utility, uncertainties surrounding fuel availability and financing requirements have made it increasingly difficult to add large-scale capacities or new interconnections to the power supply and delivery system. A variety of new technologies are either under development or being implemented to satisfy the load demand. The installed Distribution Generation (DG) may make a contribution to improve quality of power, minimize peak loads and eliminate the need for reserve margin. Moreover, trends in power system planning and operation are towards maximum utilization of existing infrastructures with tight operating margins due to the constraints placed by economical, political, and environmental factors. The Distributed Generation (DG) system is one of the most possible solutions to deal with the aforementioned problems. The DG is based on the renewable energy sources such as fuel cells, photo-voltaic, and wind power, as well as combined heat and power gas turbine, micro turbine, etc.

An islanding operation is said to when the DG continues supplying power into the network after power from the main utility is interrupted. If islanding occurs, the entire distribution network becomes out of the utility's control. The occurrence of islanding complicates the orderly restoration of the utility supply to the network. Therefore the detection and protection against islanding for Distributed Generators (DG) becomes an important and emerging issue in power system.

II. ISLANDING DETECTION

Islanding is a condition in which a distributed generator continues to feed the load even when the electrical grid supply is disconnected. When several numbers of distributed generators is apply then obviously reasons the numbers of are increasing and so is the problem of Islanding. Islanding consists of detection zone and non detection zone. The study of Islanding can be divided into three parts as follow,

A. Formation of Islanding
B. Operations during Islanding
C. Resynchronization

A. Formation of Islanding:

Islanding occurs when a portion of distributed power system becomes electrically isolated from the rest of the power system or grid or main supply yet continues to be energized by distributed generators. Islanding formed due to changing magnitude of parameter and sudden fault occurred in the distribution grid system. It is also formed due to maintenance of distribution system and variable load. In case, if the capacity of DG is nearly equal to total load, island can be formed.

B. Operations during Islanding:

When Islanding occurs, the performance of distribution generation is tested in the changing load and fault condition by the frequency and voltage at particular limit. Islanding are detected by the active islanding method with injecting the disturbance signal and operated by the current control circuit in the inverter.

C. Resynchronization:

In resynchronization, on grid mode and off grid mode both these conditions are performed. Before resynchronization of islanding, normally distribution generation has to disconnect and islanding part connect to the main grid. In this case several load back to grid supply from faulted parts.

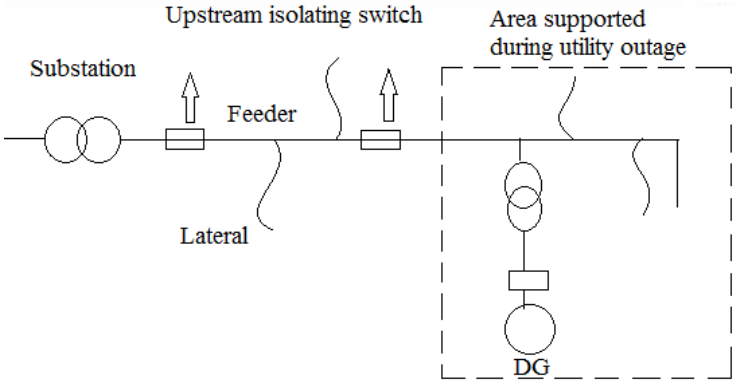

Figure 1: Islanding condition

ACTIVE ISLANDING DETECTION METHOD

Active methods try to overcome the shortcomings of passive methods by introducing perturbation in the inverter output. Active methods could detect islanding in almost every situation. Other active methods can be implemented in remote control external devices. They rely on a transmission of data between the inverter and the grid, when the DG is connected to the grid. Active schemes are better at sensing islanding disturbances and reducing/eliminating the non detection zones. In active detection methods involve perturbations of the Active and Reactive Power/Current/Voltage level.

FLOWCHART OF ACTIVE ISLANDING DETECTION METHOD

Figure 2 shows flowchart of active islanding detection methods. As can be seen a disturbance signal is injected into PCC continuously or periodically depending on the working principle of particular method. Then the parameter variation is observed and if the threshold for

voltage/frequency is crossed, islanding flag is raised which alerts the DG and disconnects it from the load.

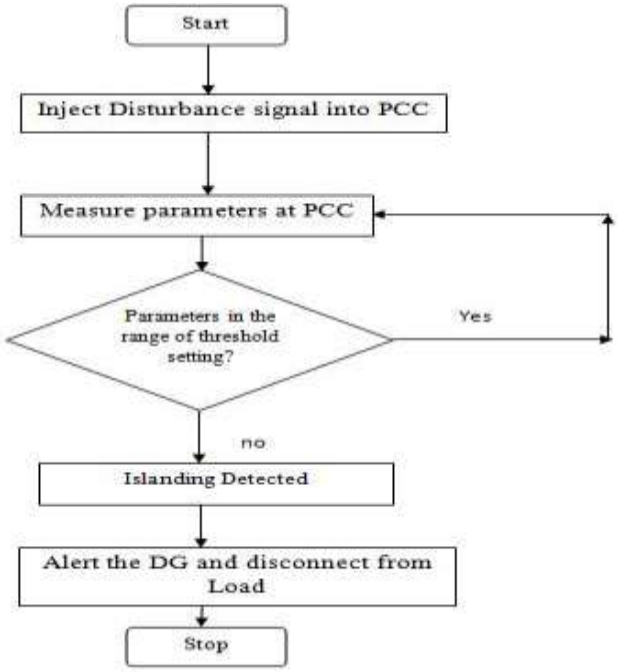

Figure 2: Flowchart of Active Islanding Detection Methods.

In case of On grid mode, Distribution generator is connected to the grid and PCC are coupled between the load and inverter. When the circuit breaker is closed and the load is connected, real and reactive powers (*PDG* and *QDG* respectively) flow from the PV inverter to PCC, and active power *PLOAD* and reactive power *QLOAD* flow from PCC to the load. The power flows at PCC (*P* and *Q)* are the real and reactive powers flowing into PCC from the load. If the PV inverter operates with a unity power factor that is, the PV inverter output current is in phase with the voltage at PCC, then *QDG* = 0 and *Q* = *QLOAD*. Active power (*P*) and reactive power (*Q*) at the instant before the switch opens to form the island.

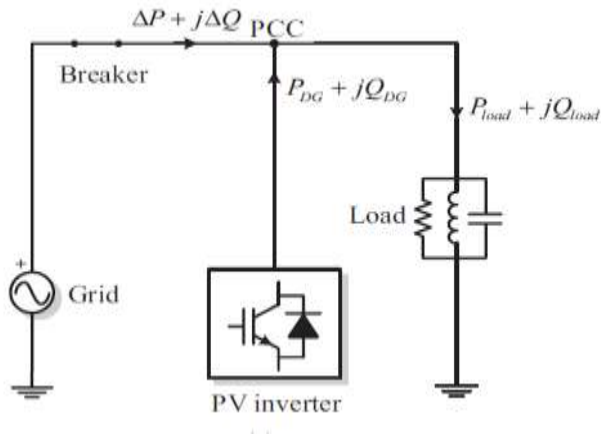

Figure 3: Before Islanding (Load is fed by inverter in on-grid mode)

In second case off grid method, if the grid active power (*P*) is not zero, the amplitude of phase voltage *V* will change, and the active method can detect the change and prevent islanding.

If reactive power from the grid (Q) is not zero, the load voltage will show a sudden shift in phase. Then the inverter control system causes the frequency of the inverter output current, and voltage to change until Q is zero. This change in frequency, voltage, current, etc. can be detected by the active method. In active methods, a small several disturbance signal is injected to the PCC. The simply idea in this method is that whenever the islanding is happening the disturbance will be amplified and the distributed generator is stopped injected from delivering the power to the load. There are many anti islanding detection techniques by which we can detect the given condition with use additional circuit.

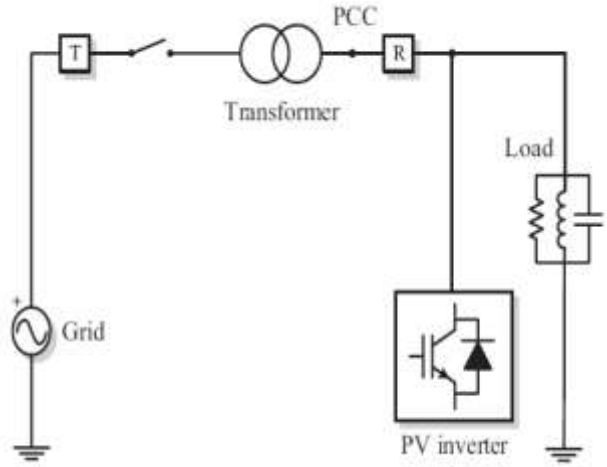

Figure 4: After islanding (Load is fed by inverter in off grid mode)

III. RESEARCH MOTIVATION

An Active islanding detection method is useful for continued operation of these generators under islanding can lead to multitude of operational hazards/challenges to the generators and to connected loads. In this study, an active islanding detection technique is proposed for grid connected inverters and active techniques, which intentionally introduce disturbances at the output of the inverter and observe whether the parameters outlined above are affected.

IV. RESEARCH OBJECTIVE

Objective of the study is to develop an active islanding detection technique for single phase current controlled inverters.

1. Detection of islanding technique at on grid and off grid mode by the Active methods.
2. To mitigate the current control inverter problem by the Hysteresis current controlled.
3. Technique is useful for amplify the fault and measure the some parameter as voltage, current, frequency, etc.
4. To select the best suitable control technique for distribution generator in islanding detection method.
5. To control the device in order to obtain desired performance.

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VI. CONCLUSIONS

The thesis presents an active islanding detection technique suitable for grid connected current controlled inverters in DG system. The method is based on changing the magnitude of the injected current and monitoring the voltage at the point of common coupling (PCC). Under grid failure, the change in voltage at the PCC exceeds the allowable range and islanding is detected. The perturbations caused by this method does not affect the zero crossing of the converter current nor introduce any disturbance as in case of other active anti islanding techniques.

The performance of the proposed technique applied to a current controlled inverter is simulated in MATLAB/Simulink environment.

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