Active Power and Frequency Control Strategies for Island Microgrid: A Review

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***Abstract*: In this paper, an improved self-frequency control strategy is proposed for distributed generation units (DGs) connected in a microgrid. Microgrid works with two operating modes of operation such as grid integrated mode and islanded mode of operation. In case of grid connected operation micro grid is connected to main grid having large system inertia which helps to maintain micro grid frequency almost to nominal value. But in case of islanded mode operation micro grid must supply its own demand and maintain its frequency. There are various methods or control techniques for distributed generation to control active power sharing as well as frequency in islanded micro grids. Generally most commonly used method of control is droop control. In that active power – frequency is used for DG controller and frequency deviation is recovered by DG itself by self-frequency recovery control without using any secondary frequency control. But the electrical distance i.e. impendence between each DG and loads are different which may cause frequency deviation among the DG units. This difference are fed into the integrators of self –frequency recovery control which may cause the error in operation of active power sharing.So to solve this problem new technique or control method is developed which share active power more accurately. This method is compensation control method. In that active power sharing is done by considering droop coefficients of each of DGunits.**

***Keywords*: Self-frequency recovery islanded Microgrid, distributed generation (DG), Active power.**

I. INTRODUCTION

There have been several studies at developing frequency control strategies for islanded microgrid. The principal objective of self - frequency recovery control is to distribute the measure required to achieve frequency recovery among the DG units that participate in active power sharing using p-f drop control according to a predetermined ratio. The frequency deviation from the nominal value can be determined using droop control only.With droop controlthe exact load sharing among DG unit is proportional to the droop cofficients. This process can be implemented by exchanging the same output frequency of each DG unit in the steady state; however, because the frequency will inevitably deviate from the nominal value and must be restored according to the grid code requirementan additional control scheme for the frequency restoration is required.In this paper we propose a DG control method that simultaneously implements accurate active power sharing and self -frequency recovery. Using this control method, DG units share the changes in load with a predetermined ratio and are able to restore their output frequency to the nominal value autonomously (hence the term “self- frequency recovery”) immediately following a change in load.However the self-frequency recovery action may lead to errors in power sharing due to variation in the impedance among DG units. Therefore, following frequency recovery, the active power sharing among DG units is readjusted to the predetermined ratio using a compensation control scheme.

In active power–frequency (P–f) droop control was developed for active power sharing by emulating conventional power systems composed of synchronous generators. In oppose to conventional droop control, a tunable droop controller with two degrees of freedom was proposed, considering an adaptive transient droop function. Islanded microgrids were introduces for Single-master and multiple-master operating modes considering secondary load–frequency control for frequency recovery. A virtual impedance control scheme was used for decoupling the active and reactive power to enhance the control stability and power sharing ability. A method for determining the droop coefficient based on the generation cost of each DG unit was proposed. Control method was used rather than frequency droop in a constant frequency and the state of charge of a battery energy storage system was used to monitor changes in the system load.

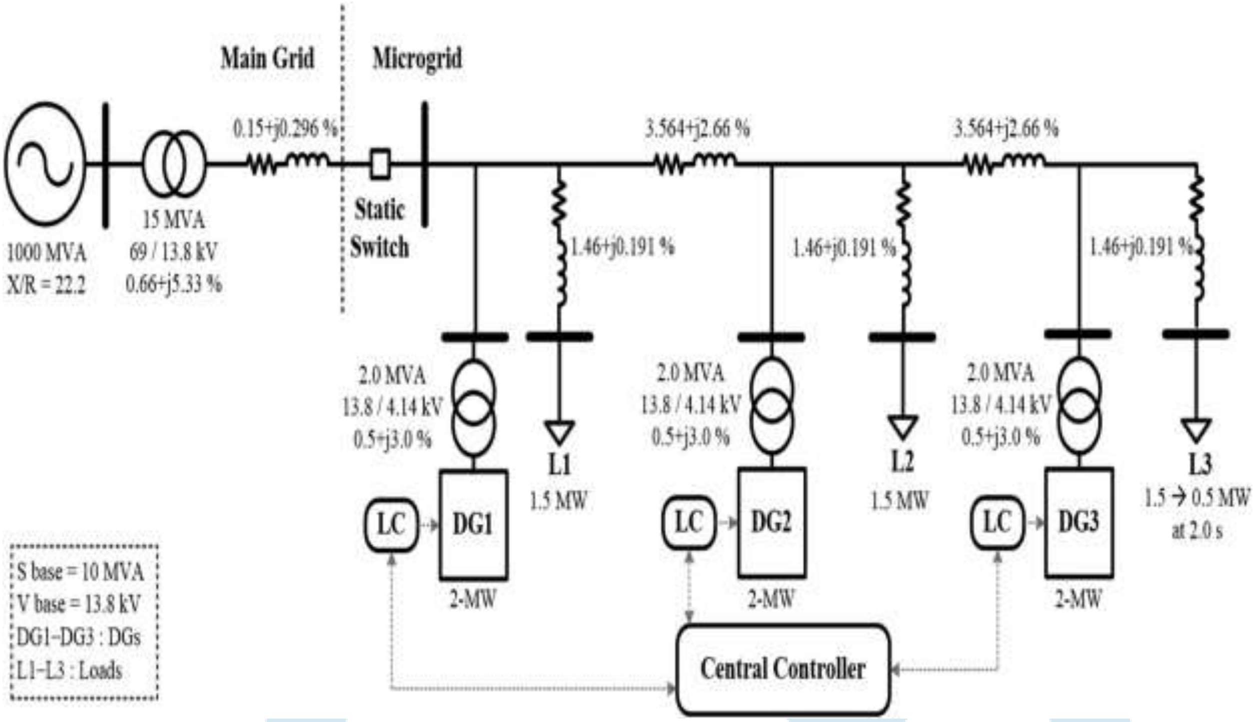

Fig 1:-Micro grid

Fig. 1 shows the configuration of the microgrid. The microgrid consists of a static switch, a CC, LCs, loads, and DGs. The static switch is located at the point of common coupling. By opening the static switch, the microgrid becomes isolated from the main grid. The CC executes overall control of the microgrid, including protection, power sharing, mode transition, and economic scheduling via a communications system. The main objectives of the CC are typically to maintain the system frequency and voltage at the specified level, as well as to operate the microgrid economically. Here, however, the CC was used only for compensation control, assuming that the dispatched output power for each DG unit has already been determined by the CC. The proposed compensation control method is used for a short duration to reduce the dependence of the DG control system on the communications infrastructure; this is important due to the potential for failure of the communications network, which decreases system reliability. The main function of the LC is to control the power and or frequency, as well as the voltage of DGs in response to a disturbance or change in load. In this study, because there are no controllable loads, the role of the LC is to control the DG units.

ISLAND & MICROGRID

Island grids are an electrical power supply task with a small number of power generating plants and consumers. Island grids do not have a synchronous connection to a large network and therefore have to be able to provide all tasks necessary for long-lasting and safe operation on their own. Island grids are typically the result of geographical circumstances that render the connection to a large network costly or even impossible.Islanding is the condition in which a distributed generator (DG) continues to power a location even though electrical grid power is no longer present.

II. LITERATURE REVIEW

[1] Mohamed Anwar, Mostafa I. Marei, and Ahmed A. El-attar

This paper describe a demonstrates a hierarchical controlapproach, comprising primary and secondary controllers, forislanded microgrids. At the primary level, each Distributed Generation (DG) unit adopts ageneralized communication-lessdroop-based primary controller, which allows the connectedDGs to autonomously share the total microgrid load inproportion to their capacities. Furthermore, the droopcontrollers apply an advanced scheme, based on the DGs' lineimpedances, to decouple the active- and reactive-powers ofeach DG for enhanced performance.

[2] Ahmed Bendib , Abdelhammid kherbachi, Kamel Kara

In thispaper, a droop control method based primary control for twoparallel single-phase VSIs forming an islanded microgrid ispresented. The proposed control consists of two DGs localcontrollers, where each controller includes voltage and current innercontrollers, virtual output-impedance loop and droop controlmethod.

[3] Rajashree Dhua, Debashis Chatterjee, and Swapan Kumar Goswami

In this paper, an improved load sharing strategy is proposed for distributed generation units (DGs) connected in a microgrid. Conventional frequency and voltage droop control result in unacceptable active and reactive power sharing. The proposed method formulates a suitable algorithm for load sharing in the islanded microgrid. The feeder power loss and the line impedance voltage drops are minimized so as to regulate the voltage at the point of common coupling (PCC) at its nominal value.

[4] Giuseppe Parise, Luigi Martirano, Mostafa Kermani
In this paper, power control based on active power method is analyzed thatDemonstrated frequency-load control, one of DG units is master and the other one is slave. Proposed controller based on energy storage system is designed according to load uncertain.

[5] Xiaoqian Zhou, Qian Ai
In islanded microgrids, traditional droop control tends to make the total operating costs higher as thepower is distributed by capacity ratios of distributed energy resources (DERs). According to equal increment rate criteria, to minimize the whole expenses, an interesting marginal costs-based economic droopcontrol is proposed in this paper, and the active power can be distributed by identical marginal costsamong DERs under economic droop control.

[6] A-Rong Kim , Gyeong-Hun Kim
This paper analyzes the operating characteristics of a superconducting magnetic energy storage (SMES) for the frequency control of an islanded microgrid operation. A test microgrid in this paper consisted of a wind power generator, a PV generation system, a diesel generator and a load to test the feasibility of the SMES for controlling frequency during islanded operation as well as the transient state varying from the grid-connected mode to the islanded mode.

[7] Wei Gu , Wei Liu
In this paper analysea multi-stage underfrequency load shedding (UFLS) approach to restore the frequency for islanded microgrid. The proposed approach takes the load stages into consideration, which can achieve frequency restoration mainly by adjustable loads shedding and ensure uninterruptible power supply of the most important loads.

[8] T.L. Vandoorn , J.D.M.DeKooning
This paper describe a control scheme for frequency compensation .As most DG units are power- electronically interfaced to the grid, specific control strategies have been developed for the converter interfaces of the DG units in islanded microgrids. This paper provides a survey of these control strategies and shows detailed figures of the control schemes.

[9] Dionne Soto, Chris Edrington
In this paper, voltage balancing and frequency control of converter-fed, islanded microgrids, using a novel time-domain technique which has not been applied for such applications is discussed in detail. The connection of single-phase loads to the islanded microgrid causes voltage unbalance and this is eliminated by supplying the negative-sequence component of the voltage from the converter.

[10] Jordi Pegueroles-Queralt, Fernando Bianchi
This paper describes the droop control to achieve the power balance in power system. It consists in a simple proportional control and the selection of its gains are commonly based only on a power balance criteria.

III. CONCLUSION

In the above literature survey the main problem is to control the frequency and power quickly. Islanded micro grids have low inertia, andso they are vulnerable to the frequency disturbances, and frequency recovery is important .Conventionally, frequency restoration is implemented via secondary frequency control units, where the active power sharing units and frequency control units are controlled separately.Frequency control units are required to account for changes in load, which may cause them to reach their output line more quickly and hence to increase generation cost exponentially.Hence it is desirable to share the frequency deviation among all DG units according to a predetermined ratio. This paper uses a self- frequency compensation method so frequency will settled to nominal value almost immediately.

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