Global Scientific JOURNALS

GSJ: Volume 6, Issue 12, December 2018, Online: ISSN 2320-9186

www.globalscientificjournal.com

ISLANDING OPERATION OF DISTRIBUTED GENERATION SYSTEM AND IT'S DIFFERENT ASPECTS

Abdullah Al Mahfazur Rahman
rajib.aust.eee@gmail.com

Abstract— **As the penetration of renewable energy sources are increasing in the distribution grid, distributed generating system is becoming more popular. Recently the islanding operation of distributed system with distributed generation has become of the one of the biggest area of concern. The islanding can occur intentionally or unintentionally. The intentional islanding operation is providing many benefits to the distribution system operators and is becoming popular day by day. This paper basically focuses on the different aspects of intentional islanding operation of grid.**

Keywords—Distributed Generation (DG), Distribution System (DS), Grid Codes, Low Voltage Ride Throurh (LVRT).

I. INTRODUCTION

All over the world, the stable operation of power networks are mostly depending upon the performance of large power plant connected with the power networks. This dependency has many logical reasons and one of them is the less production cost of large station compare with the small unit. But due to deregulation of energy market and more awareness regarding environmental issues, more concentration is going on the distributed generation of electricity where the small generating units are connected to the distribution grid to feed the energy to the consumer locally. In distributed generation systems renewable energy sources are the primary sources of energy. Recently the penetration of renewable energy sources in distribution generation system has increased enormously. In deregulated energy market distributed generation system with distributed generators have unlock new dimension and prospects to provide uninterrupted power supply. But this type of system has to meet some challenges and one of them is the islanding operation of distributed generation system.

Islanding is the operating condition of the distribution grid when it is isolated from the main grid due to fault in the main grid side and at the same time it is energized by its local generation units to meet the local energy demand. Islanding operation of distribution system may be intentional or unintentional. According to [1] the reliability of the distributed generation system can be achieved through intentional islanding operation. For many distributed generation systems it can give suitable solution as it can supply power to the load through locally distributed generators. It can earn more money for the distribution grid operators by providing uninterrupted power supply to the consumer and through additional energy supply during disturbance in the grid. According to the standard discuss in [2], the distributed sources can be disconnected when islanding occurs. But due to the rising penetration of distribution generation in the distribution grid can make the situation of islanding worse if it is disconnected from the distribution grid. That's why the solution is not perfect and a solution is proposed in [3] considering intentional islanding. This islanding cannot occur in a system in haphazard way otherwise the system will be hampered. To control the power flow of distribution grid and the power penetration from the distributed generation (mostly the renewable) sources the system operators all over the world impose some connection criteria known as grid codes.

This article discuss on the grid code requirements for renewable energy source during islanding mode of operation, detection methods and protection system of islanding when it is required.

II. ANALYSIS ON LOW VOLTAGE RIDE THROUGH

The grid codes are static and dynamic. But during islanding operation of grid, dynamic grid codes especially low voltage fault ride through capabilities is essential for generating units to comply. According to [4], this is the ability of the generating unit to connect with the grid during the fault

for a certain period of time and to a certain value of nominal voltage which is specified in the grid codes. The main product of this LVRT is the voltage dip, which may arise due to fault in the grid side and in consequence islanding of the distribution grid.

There are various resemblances between the grid codes of different system operators. All of them have a common policy regarding LVRT containing voltage and frequency levels USA is shown in figure 1. The most common characteristic of the profile is that, during fault in the main grid side or isolation from the main grid the generating units have to connect with its distribution grid for a certain period of time with its minimum capacity.

within which the distributed generators have to comply for their operation. As explained in [5], the transmission system operators of Germany and Denmark have polices that do not differentiate between the sizes of generation units. Through this process they have forced the small generation units to participate in a large scale and follow the codes like a big generation unit. A comparative low voltage ride through profile of TSO's of Denmark, Scotland, Ireland, Sweden and

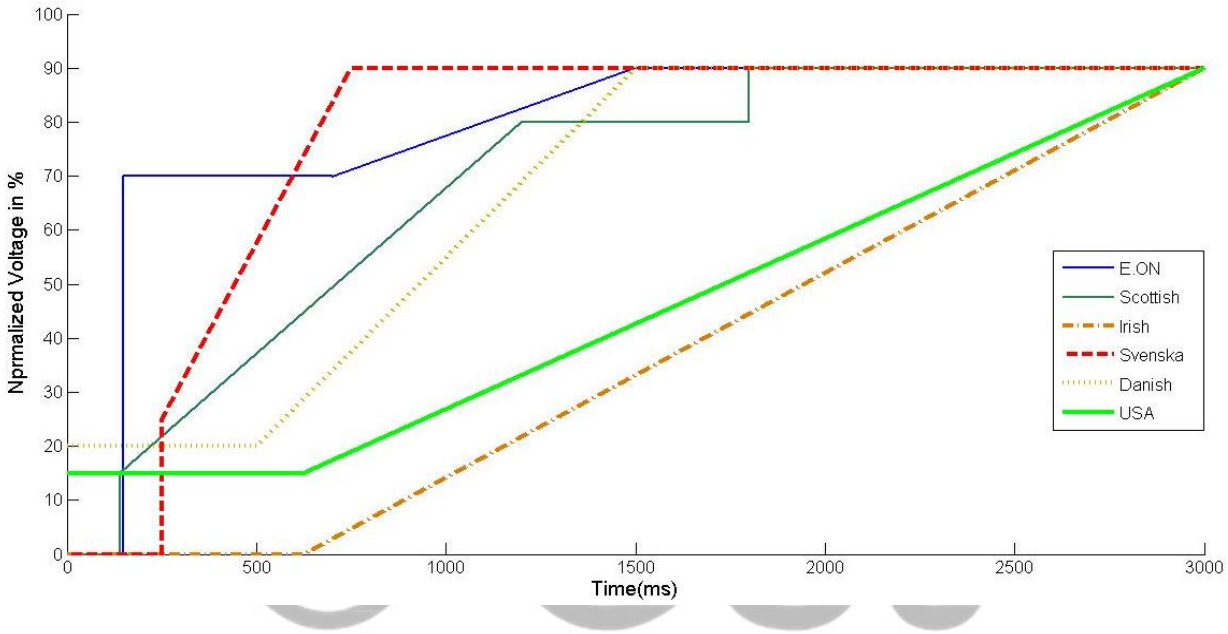

Figure 1: A combine form of Low voltage Ride through Profile of different TSO

III. Detection Methids of Islanding

During islanding the system parameters like frequency and voltage change in a significant amount and depending upon these changes the islanding is detected in most of the cases. According to [6] Islanding detection can be classified as:

- Local detection method
- Remote detection method

Local detection method: This method is the most common method of islanding detection. As in [7] this method can be classified as:

- passive detection method
- active detection method

Passive methods: Using this method an islanding can be detected by sensing the variation of system voltage and frequency. This sensing is done on the basic of threshold level of these parameters. Small value of threshold level can result in an unwanted tripping of the distributed grid. Because when in a distribution grid generation and load are closely matched with each other a small variation will exceed the threshold and the result is unwanted tripping of generators.

Active method: Using numerical technique active method can provide appropriate detection of islanding even with a very closely matched generation and laod.

Remote Detection method: This method use remote sensing device and communicate through SCADA system to detect and function the islanding operation. But the communication is needed between utilities and DGs. It has better consistency compare to other method but expensive.

IV. Protection System of Islanding

To prevent the system from unwanted tripping and at the same safe operation of loads and generators a proper protection scheme is needed. It is obvious that the magnitude of fault

current depends on the strength of sources. In comparison, a transmission grid system has multiple time higher fault current with respect to a small distributed generator. As a result, the fault current is less in the distribution grid when it is disconnected from the grid. So for less current if the time to clear the fault is long it can damage the system components including load and distributed generators. So protection system should be designed in such a way so that, it can disconnect when the voltage goes low for a certain time period. It also very challenging to design a protection for islanding with grid connected mode, because without proper coordination it can result in unwanted tripping. That's why a protection system without adaptive control and state detection can be a solution [6]. Using this procedure the protection system will change its setting for grid and off grid modes. The protection system will change its setting when it is in grid connected mode and move to another setting when it is in off grid mode.

V. CONCLUSION

Distributed generation system with islanding capabilities can improve the stability and reliability of power supply when power outage is occurred in the upstream of grid. There are various issues with islanding. But many challenges have to overcome regarding detection, control, operation, control and protection during islanding in distribution grid. It is found that active detection technique is more popular than passive detection technique. Remote detection technique is expensive but more accurate. Remote detection technique with IoT can open a new direction towards more accurate performance of islanding.

REFERENCES

[1] H. Zeineldin, E. F. El-Saadany, Member, IEEE, and M. M. A. Salama, "Intentional Islanding of Distributed Generation," IEEE Power Engineering Society General Meeting, 2005.

[2] Filippos Kalofotias IEEE Std. 929-2000, "IEEE recommended practice for Utility Interface of Photovoltaic (PV) Systems", April 2000.

[3] IEEE Std. 1547-2003, IEEE Standard for interconnecting Distributed resources with electric power systems, 2003.

[4] Abdullah Al Mahfazur Rahman, Muhammad Usman Sabbir," Grid Code testing by Voltage Source Converter", LAP Lambert Academic Publishing.

[5] Niklas Stråth, "Islanding Detection in Power Systems", Licentiate Thesis, Department of Industrial Electrical Engineering and Automation, Lund University, 2005.

[6] Pukar Mahat, Zhe Chen and Birgitte Bak-Jensen, "Review of Islanding Detection Methods for Distributed Generation", DRPT2008 6-9 April 2008 Nanjing China.

[7] Redfern, M. A., Usta, O., & Fielding, G., "Protection against loss of utility grid supply for a dispersed storage and generation unit", IEEE Transactions on Power Delivery, 8(3), 948–954. doi:10.1109/61.252622.