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An Overview on Power Quality Issues In Smart Grid

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Abstract: *Power quality is a term used to describe a wide range of electrical power origin, monitoring and measurement. This paper presents an overview of power quality issues in smart grid. Power quality is related to the quality of power and it means to supply a stable continuous power. Power quality is a complex subject which requires some specific terminology in order to properly describe the situations and issues. So understanding and solving problems becomes possible with the correct information and interpretation. One of the properties of electricity is that some of its characteristics depends on the equipment manufacturers and customer and not only on the electricity producer/distributor.*

Keywords: *smart grid, power quality, power quality disturbances, power quality issues in smart grid, PQ monitoring.*

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I. Introduction

I. Smart grid

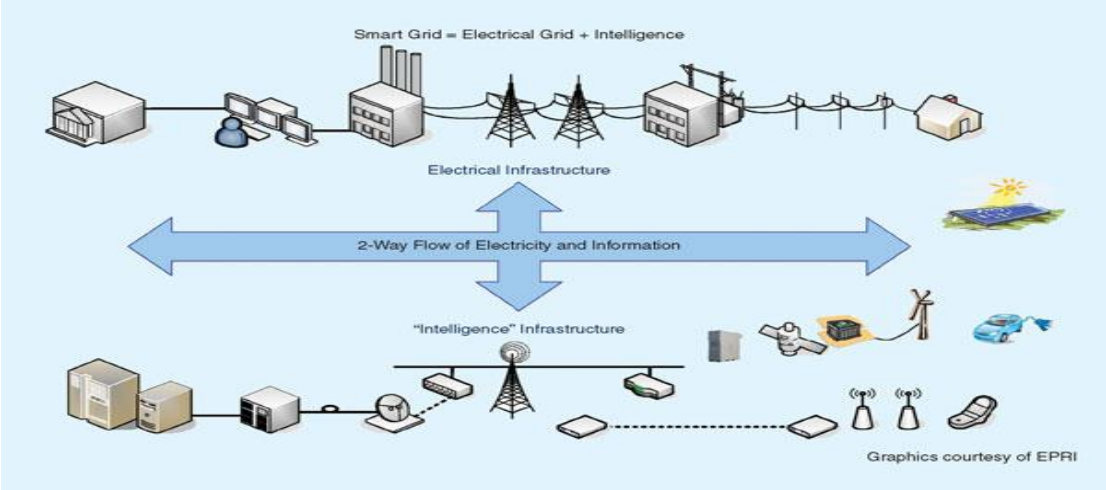

Fig. 1: Smart grid

Power grid of today is a development of a system which was first used almost a hundred years ago. There have been many new requirements put on it in the last decade in particular and it is clear to many that the existing basic design will soon become inadequate. Power system equipments such as, lines and transformers, are expensive and people are looking to communications and control to enhance their performance. So for this we implemented a smart grid technology throughout the whole system. In this consider that each local part of the power system will have its own particular requirements and that each part will develop its own "smartness". The emphasis in this approach is on "brain" rather than "muscle". Smart grid in one line we can say that it's a electrical grid With intelligence.

There are the aims of the smart grid which are:
1. Better, more efficient and more flexible use of the network.
2. Price reduction of the network use.
3. Introduction of more customer option.
4. Better PQ, especially in voltage control and voltage sag impact.
5. Self-healing to give better reliability

And these above can achieved by:

1. Parallel communication network with-two way communications, remote sensors.
2. Large data storage, analysis and fast simulation capability.
3. Some additional distributed actuators such as switches, reclosers, on-load tap changer.
4. Faster operation.

II. Power quality

Power quality means to supply a stable continuous power. Power quality involves or we can say it depends on three terms voltage, frequency and waveforms. Power quality issues can produce significant problems in some situations that include:

1. Important business application (banking, process control, inventory control).
2. Critical industrial processes (monitoring devices, safety systems, programmable process controls).
3. Essential public services (hospitals, police, air traffic control, paramedics). Power quality problems in the electrical system can also quite frequently be indicative of safety issues which may need immediate corrective action.

PQ DISTURBANCES

There are some power quality disturbances due to which our electrical system can disturb/violate. Some of them are given bellow:

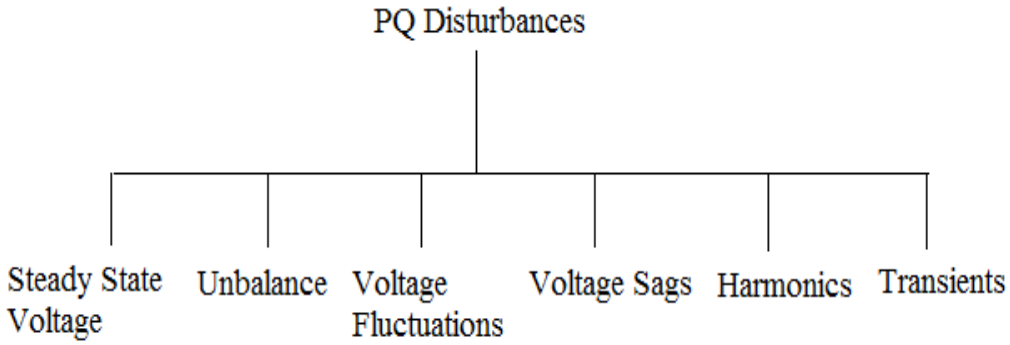

Fig. 2: PQ Disturbances

1. Steady state voltage(and power factor)

Voltage at the point of connection is a range of 230v-6% to 230v+10%. If voltages are greater than this range than it may cause equipment insulation degrade faster which results in reduced lifespan. And if voltages are less than this range than equipment may fail to operate. Motor-driven equipment may fail to start or motors might overheat and trip or be damaged.

2. Unbalance

The three voltages of the active conductors are ideally similar in magnitude and time-shifted by 1/3 of a period or 6.7ms. if the single-phase residences are drawing equal current and are properly distributed across the three-phases, than voltages will be balanced. In practice this is hard to achieve and the downstream voltages will in general be different in the three conductors. Such a set of voltages is said to be unbalanced and it can cause three-phase induction motors to overheat.

3. Voltage fluctuations

Some loads such as welders and rolling mills change in a cyclic manner with a period from a fraction of a second to several minutes. This gives an approximately cyclical change in voltage magnitude over a similar time second.

4. Voltage sags (also known as voltage dips)

RMS reduction in the AC voltage at power frequency from half of a cycle to a few seconds' duration.

5. Harmonics

Now a days modern electronics equipments are used which draws a current with a wave shape which is usually a series of positive and negative pulses which are narrower than would be expected from a sinusoid. This effect both reduces the voltage and also changes the wave shape. And this is called harmonic distoration.

6. Transients

Subcycle disturbance in the AC waveform evidenced by a sharp, brief discontinuity of the waveform. Very high current is injected into a power line during a lightning strike causing a high voltage of several hundred kv for duration of 100μs or more.

PQ ISSUES IN SMART GRID

In smart grid due to unbalance in voltage, current, frequency different power quality issues are created. Some of them are listed below.

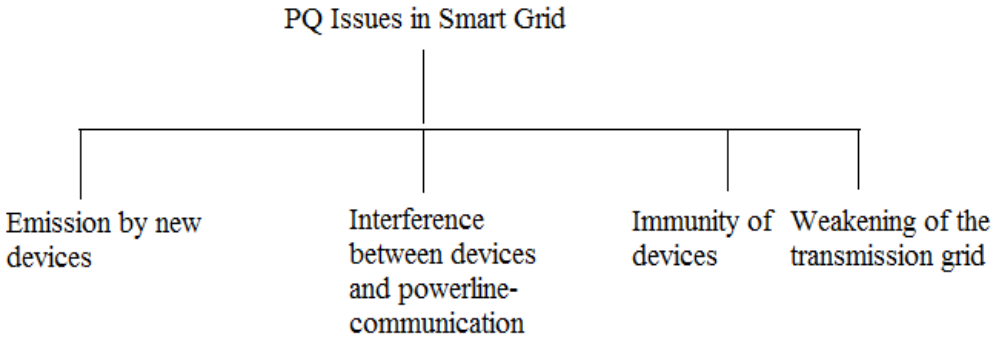

Fig. 3: PQ Issues

1. Emission by new devices

In smart grid we expect growth both in production at lower voltage levels (distributed generation) and in new types of consumption such as charging station for electric vehicles, expended high-speed railways, etc. some of these new types of consumption will emit power-quality disturbances, such as harmonic emission. But preliminary studies have shown that harmonic emission due to distributed generation is rather limited. Most existing end-user equipment which are like computer, television, lamps, etc emits exclusively at the lower odd integer harmonics (3, 5, 7, 9, 11, etc).

2. Interference between devices and powerline-communication

Smart grid have a ability to communicate between devices, customers, distributed generators, and the grid operator. So many types of communication channels are possible. Powerline-communication is a obvious choice because it is easily available. But the problems of disturbances can occur by choosing this communication. Powerline-communication could introduce new disturbances which results in further reduction in power line communication, it may also result in radiated disturbances, possibly interfering with radio broadcasting and communication.

3. Immunity of devices

Due to the voltage-quality disturbance or we can say due to the voltage dip there are a simultaneous tripping of many distributed generators can occure. And this is a very big problem. As a smart grid attempts to maintain a balance between production and consumption, mass tripping of consumption could have similar adverse consequences.

4. Weakening of the transmission grid.

The increased use of distributed generation and of large wind parks will result in a reduction of the amount of conventional generation connected to the transmission system. The fault level will consequently be reduced, and power-quality disturbances will spread further.

Pq Monitoring

To rectify above problems we require monitoring. There are some steps to rectify the PQ problems.

1. Continuous and extensive monitoring of different power system quantities.
2. Detection and identification of power quality related disturbances and categorizing them.
3. Analysis of the identified problems to their probable causes.
4. Prevention and corrections of the probable causes either automatically or manually.

PQ monitoring is an integral part of overall system performance assessment procedures. Power quality monitoring could be classified as bellow,

I. Local monitoring:

Its objective consists of determining the quality of power that is delivered to a single customer.

II. System monitoring:

Its objective consists of determining the quality of power and the behavior of the electrical system globally. From a pure measurement view point there is no difference between PQ measurement and the measurement of the voltages and currents, for protection and control purposes. The difference is in the further processing and application of the measured signals.

II. Conclusion

This paper presents a brief review of the power quality disturbances, issues in smart grid and its effect. From PQ monitoring we can explain that PQ monitoring plays an important role in an integral part of overall system performance. Hence there is a need to adopt recent advance communication technology to address and monitor the PQ problems to get quality and reliable power supply in the smart grid environment.

References

[1]. Philippe Ferracci, Cahier Technique Schneider Electric no. 199 / P.2, October 2001
[2]. Power Quality in Future Low Voltage Electricity Networks, Technical Note 12 May 2013
[3]. Integral Energy Power Quality Centre Technical Note No. 1, "Understanding Power Quality", June 1998.
[4]. Baggini, A, (ed) Handbook of Power Quality, Wiley, p.36 , 2008
[5]. S.Khalid&BhartiDwivedi"Power Quality Issues, Problems, Standards & Their Effects In Industry With Corrective Means" International Journal of Advances in Engineering & Technology, 1 Vol. 1,Issue 2,pp.1-11,May 2011.
[6]. Cooper, J., "Beyond Smart", July 2012,http://theenergycollective.com/johncooper/92111/stronggrid-beyond-smart, visited 28Oct2012
[7]. Electric Power Research Institute Portfolio 2014

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