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A Review on "Power Quality Improvement"

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Abstract: A Healthy power system plays very important role in transmission line, but due to non linear load it can't possible. A Power quality problem is an occurrence express as a nonstandard voltage, current or frequency that results in a failure or a mis-operation of end user equipments. There are many facts devices are used to improve power quality, such as SVS, STATCOM, TCSC, and SSSC and so on. But commonly we can use STATCOM for reduction of power quality problems, because STATCOM is used for low voltage also. Shunt connected STATCOM mainly used for enhancement voltage stability. This paper present review about overview of Power Quality problems and corrective methods.

Keywords: Power quality, STATCOM, Voltage sag, and Voltage swell.

I. INTRODUCTION

Power Quality may be defined as "a set of electrical boundaries that allows equipment to function in its intended manner without significant loss of performance or life expectancy." A recent survey of Power Quality (PQ) experts indicates that 50% of all Power Quality problems are related to grounding, ground bonds, and neutral to ground voltages, ground loops, ground current or other ground associated issues. Electrically operated or connected equipment is affected by Power Quality.

The commonly used terms those describe the parameters of electrical power that describe or measure power quality are Voltage sags, Voltage variations, Interruptions Swells, Brownouts, Blackouts, Voltage imbalance, Distortion, Harmonics, Harmonic resonance, Interharmonics, Notching, Noise, Impulse, Spikes (Voltage), Ground noise, Common mode noise, Critical load, Crest factor, Electromagnetic compatibility, Dropout, Fault, Flicker, Ground, Raw power, Clean ground, Ground loops, Voltage fluctuations, Transient, Dirty power, Momentary interruption, Over voltage, Under voltage, Nonlinear load, THD, Triplens, Voltage dip, Voltage regulation, Blink, Oscillatory transient etc. To overcome the problem related to the power quality custom power device is introduced. A number of power quality problem are provide by custom devices. At present, a wide range of flexible AC controller which is capitalized on newly available power electronic components is emerging for custom power application solutions.

II. IMPACT OF POWER QUALITY PROBLEMS

Deprived of the good power, an electrical device may breakdown, fail hastily or not function at all. There are countless ways in which electric power can be of deprive superiority and numerous more reasons of such deprived quality power. Some of the most shared power supply difficulties and their possible effect on sensitive equipment:

1. Voltage surges/spikes: Voltage surges/spikes are the conflicting of dips –an increase that might be closely instantaneous (spike) or takings place over a lengthier duration (surge). A voltage surge taking place when the voltage is 110% or more overhead usual. The best common reason is heavy electrical apparatus being turned off. Underneath these circumstances, computer systems and other high tech apparatus can knowledge flickering lights, errors, and equipment shutoff or memory loss. Likely Solutions are surge suppressors, uninterruptable power supplies, voltage regulators, power conditioners [4].

2. Voltage Dips Short duration under-voltages are called "Voltage Sags" or "Voltage Dips [IEC]". Voltage sag [5, 6] is a reduction in the supply voltage magnitude followed by a voltage recovery after a short period of time. The main reason of voltage dips on a resource system is a fault on the system, i.e. adequately distant electrically that a voltage break does not happen. Additional sources are the preliminary of large loads and, infrequently, the supply of big inductive loads [6]. The effect on consumers may Range from the irritating (non-periodic light flicker) to the thoughtful (tripping of sensitive loads and stalling of motors.

3. Under Voltages: Extreme network loading, incorrectly set transformer taps, loss of generation and voltage regulator malfunctions, reasons under voltage. Loads with

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a deprived power factor or an over-all lack of reactive power provision on a network also donate. Below voltage can also circuitously lead to overloading difficulties as equipment takes an amplified current to uphold power output (e.g. motor loads) [5].

4. High-Voltage Spikes: High-voltage spikes occur when there is an unexpected voltage top of up to 6,000 volts. These spikes are typically the out comeof close lightning strikes, but there can be other reasons as well. The belongings on susceptible electronic systems can comprise loss of data and burned circuit boards. Likely Answers are using Surge Suppressors, Uninterruptable Power Supplies, Voltage Regulators, and Power Conditioners [7].

5. Frequency Variation: A frequency difference includes an alteration in frequency from the usually stable utility frequency of 50 or 60 Hz, contingent on geographic site. This may be produced by unpredictable operation of extra generators or unbalanced frequency power sources. For sensitive apparatus, the outcomes can be data loss, equipment lock-up program failure or complete shutdown. Likely Solutions are using Power Conditioners and Voltage Regulators [7].

6. Power Sag: Power sags are a mutual power quality difficult. Notwithstanding being a small duration (10ms to 1s) occasion during which a decrease in the RMS voltage magnitude taking place, a lesser reduction in the system voltage can reason serious penalties. Sages are typically produced by system faults, and frequently the result of switching on loads with great request start up currents. Possible Solutions are using Uninterruptable Power Supplies, Voltage Regulators and Power Conditioners [8].

7. Electrical Line Noise: Electrical line noise is defined as Radio Frequency Interference (RFI) and Electromagnetic Interference (EMI) and reason sun solicited properties in the circuits of computer systems. Sources of the difficulties comprise relays, motors, motor control devices, microwave radiation, broadcast transmissions, and distant electrical storms. RFI, EMI and other frequency difficulties can reason equipment to lock-up, loss and data error. Possible Solutions are using Uninterruptable Power Supplies, Voltage Regulators and Power Conditioners [7].

8. Brownouts: A brownout is a stable lower voltage state. A case of a brownout occur During peak electrical request in the summertime, when utilities can't continuously meet the necessities and must inferior the voltage to boundary maximum power. When this occurs, systems can practise malfunctions, data loss and also equipment failure. Likely Solutions are by Uninterruptable Power Supplies, Voltage Regulators, and Power Conditioners [9].

9. Blackouts: A power let-down or shutdown is a zero-voltage condition that continues for more than two series. It may be produced by tripping a circuit breaker, power distribution let-downor utility power let-down. A blackout can reason data loss or dishonesty and equipment destruction. Likely Solutions is using Generators [10].

10. Very short interruptions: Total interruption of electrical supply for duration from few milliseconds to one or two seconds. Mainly due to the opening and automatic reclosure of protection devices to decommission a faulty section of the network. The main fault causes are insulation failure, lightning and insulator flashover. Consequences of these interruptions are tripping of protection devices, loss of information and malfunction of data processing equipment [11].

11. Long interruptions: Long interruption of electrical supply for period better than 1 to 2 seconds. The key fault reasons are Equipment disappointment in the power system network, tempests and objects (trees, cars, etc) striking lines or poles, spirit, humanoid mistake, bad coordination or disappointment of protection plans. An importance of these interruptions is slowdown of all apparatus [1].

12. Voltage swell: Brief upsurge of the voltage, at the power frequency, external the normal acceptances, with period of more than one cycle and characteristically less than a rare seconds. The chief reasons are Start/stop of heavy loads, critically dimensioned power sources, critically regulated transformers (mainly during off-peak hours).Significances is Flickering of lighting and screens, data loss, stoppage or damage of sensitive apparatus, if the voltage standards are too great [11].

13. Harmonic distortion: Voltage or current waveforms undertake non-sinusoidal form. The waveform resembles to the amount of diverse sine-waves with dissimilar magnitude and phase, having occurrences that are multiples of power-system frequency. Key Reasons are typical sources: electric machines employed overhead the lap of the magnetization curve (magnetic saturation), welding machines, arc furnaces, rectifiers, and DC brush motors. Contemporary sources: all non-linear loads, such as power electronics equipment including ASDs, data processing equipment, and switched mode power supplies, high efficiency lighting [11].
Penalties are increased likelihood in incidence of resonance, neutral overload in 3-phase systems, loss of efficiency in electric machines, overheating of all cables and equipment, electromagnetic meddling with communication systems, and mistakes in actions when using nuisance tripping of thermal protections average reading meters.

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14. Voltage fluctuation: Swaying of voltage worth, amplitude modulated by an indication with frequency of 0 to 30 Hz. Reasons are arc furnaces, frequent start/stop of electric motors, oscillating loads. Significances are most penalties are common to under voltages. The most noticeable consequence is the lambent of lighting and screens, generous the impression of wobbliness of visual perception [1].

15. Noise: Overlaying of high frequency signals on the waveform of the power-system frequency. Chief Reasons are Electromagnetic interferences motivated by Hertzian waves such as television diffusion, microwaves and radiation due to arc furnaces, welding machines, and electronic equipment. Indecorous grounding may also be a reason. [12].

III. CORRECTIVE METHODS

Power quality problems cannot be completely removed but it can be minimized up to a limit for the limitation of this various methods are used-

1. Power factor correction circuit: Single-phase and three-phase automatic power factor correction systems have certain reactive current corrective power ratings. When the detected reactive power absorbed by the load is greater than the compensator rating, the power factor will not be corrected to unity, but certainly will be improved and the apparent power supplied by the ac supply will be reduced. And the quality of power supply is improved. [5]

2. FACTS devices: Flexible Alternating-Current Transmission Systems (FACTS) is a new technological growth in electrical power systems. Owing to the, each time higher necessities of the responsibility and superiority of the electricity the establishment of devices accomplished of guaranteeing these requirements will keep increasing. FACTS devices are refining the action of an electric power system. The effects of such devices on steady state variables (transmission losses, voltage levels and generating costs) are very extraordinary power quality benefits. [9]

3. Filters: Filters are generally used for power quality improvement by minimizing various problems like poor power factor, voltage distortion, current distortion etc. there are three types of filters being used passive filter, active filters and hybrid filters. Passive filter are based on the R, L and C loads .Active filters are very reliable and mostly used power quality improvement equipment in power system. Hybrid system is combination of both active and passive system and works very effectively for harmonic and other waveform distortion in the system.

IV. CONCLUSION

The always growing demand of power there is a essential to enlarge and improvement of the modern power system for the reliability and steadiness of the power system network, it is vital to up hold noble quality of power supply. This paper presents a review on power quality terms, impact of power quality problems and their corrective methods. A Poor power quality can create many serious effect on our power system like overheating in system equipment, over loading, harmonics generations, distortion of waveform etc. which can be alleviated through numerous techniques through filters, the FACTS devices and power factor modified circuits etc.

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