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Power Instability, Illegal Connection and its Consequences in Nigeria

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Abstract: For any nation to grow economically, it requires steady power supply. Majority of people, industries, companies, hospitals, schools requires power for their daily activities. This paper x-rayed the power instability, illegal connection and its effects. From the research, it was discovered that power instability leads to economic lost, lost of properties, fire outbreak and even death. This can be minimized by upgrading the power systems, changing of outdated conductors with standard sizes, replacement of old transformers and installing of new ones and building of more power plants for generation of more electricity to meet up with the current development, urbanization and industrialization in Nigeria.

Key words:

INTRODUCTION

Power system forms a majority of electrical engineering studies. This is mainly concerned with the production of electrical power, its transmission and distribution to consumers. The power at the consumers end is often subjected to changes as a result of the usage of different loads. This may also result to the disturbances induced within the long distances of transmission line, hence stability is very necessary. Power system stability is the ability of the system to bring back its operator to a steady state situation within a minimum possible after it might have being subjected of transience or disturbance in the line transmission [1].

Moreover, in recent times, majority of power generating station over the whole world mainly relied on the alternating current distribution system as the most effective and economical option for the transmission of electrical power [2]. Electrical energy availability plays a vital role in the economic growth and development of any nation. Most importantly, the economic growth of any nation strongly depends on the long term supply and availability of power system at low cost with less instability or collapse [3]. In Nigeria mainly, hydro and thermal generation are used o generate electricity. These two systems of power generation are not steady and sometimes lead to system breakdown, collapse or instability [4].

Electric Power Generation and Transmission/ Distribution: Electric power system includes power generation, electrical power transmission and distribution, control, power system protection, electrical switch gears, power transformers, control and protection relay, transmission and distribution substations and all switch yard equipments. Electrical energy is mostly generated in large quantities through hydroelectric, thermal and nuclear power stations [5]. Electricity generation is the process of converting non-electrical energy to electricity. Electricity is mostly generated at the power station by electromechanical generator, which is driven by heat engines fueled by chemical combustion or nuclear fusion and also by other means such as hydroelectric, wind, photovoltaic and biomass [6, 7]. The generated electrical power is connected to the national grid, then transmitted to the transmission station and finally to the distribution station where it is connected to the consumers. Electric power transmission is a process of delivery of electricity to consumers. The maximum generated voltage in advanced countries is 33kV and that of underdeveloped countries like Nigeria is 11kV. Then the amount of power that is needed to be transmitted through transmission lines is very large to accommodate line current and power losses. The power transmission is between the power plant and the substation near a populated area. Due to the large amount of power involved, transmission normally takes place at high voltages (i.e. 110 kV and above).

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The voltages after being stepped up to 110 kV and above using a transformer is usually transmitted over long distances through overhead power transmission lines or underground power transmission to densely populated areas. The voltage is later stepped down to 66kV or 33kV and the receiving sub-stations. Then at the secondary sub-station, the voltage is finally stepped down to 33kV or 11kV and the power is fed into the primary distribution system. The 33kV or 11kV distribution lines otherwise referred to as feeder as the case may be starts from the secondary sub-station and terminate in distribution sub-station. In distribution sub-station, step down transformers are located in convenient places in which power is to be supplied. In some cases, this distribution sub-stations consists of pole mounted transformers which is installed at the road side. At this point, the voltage is stepped down to 400 volts (i.e. distributors) and these are laid along the road and service connections to the consumers [8]. The underground cable power transmission is more advantageous over overhead transmission because of its neatness in the environment; it emits no electric field and magnetic fields, better power loss characteristics and can absorb emergency power loads leading to better power stability [1,6]. Most importantly, underground cable system of transmission and distribution of electricity are less prone to natural hazard like rain, wind, lightning and it does not interfere to other amenities [7]. The transmission lines and feeders are 3 phase 3 wire circuits while the distributors are 3 phase 4 wire systems [5,6]. Also the standard frequency for most countries is 50 Hz [4].

Electric Power System Stability: Power instability results in varying degrees if stability limit is exceeded. Power stability limit is the maximum power permissible to flow through a particular point or a part of the system during which it is subjected to line disturbance or as a result of faulty flow of power. In power plant, a lot of synchronous generators with different voltage ratings are connected to the bus terminals with the same frequency and phase sequence as the generators. The consumer ends are connected directly from those bus terminals. Hence, for stable operation, it is necessary for the bus to be well synchronized with the generator over the entire duration of transmission to reduce instability. This reasons referred the power system stability as synchronous stability, which is the ability of the system to return to synchronism after it might have undergone some disturbances as a result of line transience [1,3].

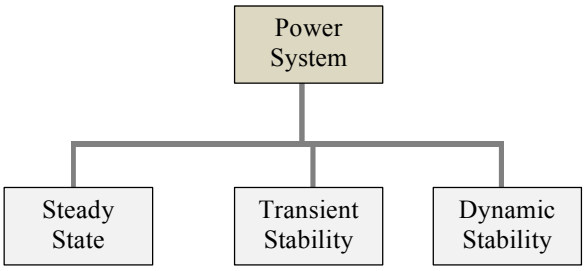

Fig. 1: Nature of Power system stability state

Types of Electric Power Stability: Power system stability can be classified thus as shown in Figure 1.

- Steady state stability
- Transient stability
- Dynamic stability

Power System Steady State Stability: Steady state stability of electric power system is the ability of the system to bring back to its stable configuration following a small disturbance in the network such as normal load fluctuations, or action of automatic voltage regulator. This can only be considered during a very gradual and infinitesimally small power change. In power system, if the power flow through the circuit exceeds the maximum power permissible, chances of machines to cease to operate to synchronism results and more disturbances enhanced. And in this case, steady state stability limit of the power system has been reached. The steady state stability limit of the power system refers to the maximum amount of power that is permissible through the system without loss of its steady state, otherwise known as power instability [1,3].

Power System Transient Stability: Transient stability of electric power system is the ability of the system to reach a stable condition as a result of large disturbance in the network [1]. The steady state stability of a particular power system is the maximum power that can be transmitted on the receiving end without loss of synchronism [3]. These include sudden application or removal of load, switching operations, line faults or loss due to excitation of the system. Moreover, transient stability is the ability of the system to retain synchronism after a disturbance sustaining for a reasonably long period of time. This can also be referred to the maximum power that is permissible to flow through the network without loss of stability following a sustained period of disturbance and if maximum permissible power is exceeded, the system results to power instability [1].

Dynamic Stability of a Power System: Dynamic stability of a power system refers to the artificial stability that is given to inherently unstable system by automatic controlled means. This is generally concerned to small disturbances lasting for about 10 to 30 seconds [1,3].

RESULTS AND DISCUSSION

Figure 1 showed the man that was electrocuted by high tension voltage at Agba Abor Isu, Onicha LGA of Ebonyi State Nigeria on June 27, 2015. Figure 2 showed the man that was electrocuted at opposite Federal Teaching Hospital (FETHA 2) Abakaliki, Ebonyi State on 25th September, 2015 [8]. From the research, it was discovered the deceased were contracted to change the phase from the one that has no current to the phase that has light. These areas have power instability and sometimes remained in darkness for days. Because of urbanization, industrialization the transformers in such places are overloaded and the conductors used were weak and it needs total overhauling. The Electricity Generation, transmission and Distribution Company in Nigeria should upgrade some transformers in Ebonyi State and install new ones to meet the demand of the people due to increase in load as a result of increase in population, industrialization and urbanization and this will drastically reduce the power instability and chances of illegal connection. Moreover, the weak conductors should be changed and normal rated conductor be installed according to IEEE Standard.

Fig. 2: The Electrocuted man at Agba Abor Isu

Fig. 3: The man electrocuted at opposite Federal Teaching Hospital, Abakaliki Ebonyi State

CONCLUSION

Steady power supply enhances social activities and increases the economic status of any nation. Because of increase of population, urbanization and industrialization, the quest for power consumption increases everyday and this deeply effect the electrical power generation. Increase in the usage of electricity results to overload and this adversely affect the power production which result to power instability and sometimes results complete breakdown of the system. From the research, it was observed that in attempt for consumers to get this power, they engage to illegal connection which sometimes leads to death. Most consumers of electricity in Nigeria have lost their life, properties and millions of naira because of voltage instability resulting to electrical fire outbreak, some resort in burning of fuel or diesel in generators or plant to generate electricity for their usage and this is not healthy to the environment due to pollution. Many people have lost their life from the fumes that they inhaled from this generators coupled with the high cost of fueling the generators. Power system sector in Nigeria should be improved upon to avert this menace that results to voltage instability.

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