Power Blackout: A Black Day in North India (Power Outage in 2012)

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***Abstract*— Modern life is impossible to visualize without electricity. Every segment of modern society is largely dependent on power from domestic, farming and industrial to service and governmental operations, all require electricity and energy to function, without which the world, regardless of a specific sector, would come to a standstill. It starts by identifying the reasons for power blackout. They are more fatal than are commonly assumed. The disagreement is made that they are getting vulnerable. Increasing numbers of blackouts are expected because of greater uncertainties in supply and enlarging certainties in demand.**

This article seems at what happens when the power goes off. An enormous power cut blacked out the entire Northern side India, 300 million people are left without power, shutting down hydro-plants. On account of this, hundreds of trains are stranded during July 2012. It is considered as black day in north side of India in utmost decade. In this paper possible recommendations to prevent such kind of technical lapses are suggested.

Worldwide blackouts of "7.30" & "7.31" occurred in India in 2012.

The fundamental reasons & trigger factors are analyzed in this paper suggestions are proposed to improve the security & stability of large power grid with coordinated control system. Here, we will discuss about what is power blackout, causes of power blackout, power blackout in India & affect of power blackout.

Keywords*— Blackouts, power grid and disturbances, Causes and Effect of power blackout, Power blackout in 2012, future power grid in India.

INTRODUCTION

Blackout: A blackout is a complete loss of power within an area or sector and is the most critical form of power disruption that can happen.

Causes of blackout: There are so many causes of power collapse in an electrical network. Various causes include faults at power stations, hazard to electric transmission lines.

Power blackout in India: Two serious power blackouts affected most of northern and eastern India on 30 and 31 July 2012. The 30 July 2012 India blackout affected over 300 million people and was the then-largest power outage in history, counting number of people affected, beating the January 2001 India blackout.

Causes of power blackout in India: Effect of power blackout in India: Twenty of India's 28 states were striked by power cuts, when three of the country's five electricity grids failed at afternoon time.

On July 30th and 31st of 2012, large portions of Northern, Eastern and North-Eastern areas of India consummate an electric power outage. The outage was affected 300 million people and 48,000MW of electric load in the many northen sides states of India. A major grid failure happened at northern areas at 02.33 hrs on 30-07-2012 and again at 13.00 hrs on 31-07-2012 resulted in collapse of Northern, Eastern, and North-Eastern regional grids.

POWER GRID

The All India demand met is of the order of 110,000 MW currently. The synchronic attached Grid consists of the Northern, Western and North-Eastern Grids are meeting a order of about 75,000 to 80,000 MW. The Southern Grid which is attached to new Grid a synchronically can meet a demand of about 30,000 MW.

Grid is disturbed due to below reasons:

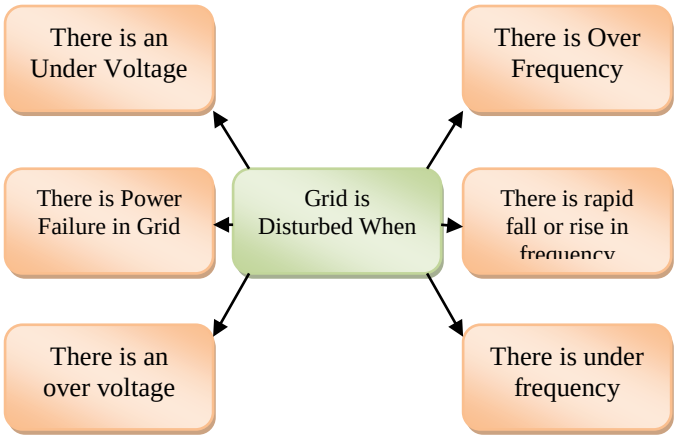

FIG.1.GRID DISTURBANCES

CAUSES OF POWER BLACKOUT

1. **Cascade failure:** A cascading failure is a failure in a system of interconnected parts in which the failure of a part can trigger the failure of successive parts. Such a failure may happen in many types of systems, including power transmission, computer networking, finance, human bodily systems, and bridges. Those nearby elements are then pushed beyond their capacity so they become overloaded and shift their load onto other elements. Cascading failure is a common effect seen in high voltage systems, where a single point of failure (SPF) on a fully loaded or slightly overloaded system results in a sudden spike across all nodes of the system. Cascading failure is happen in power grids when one of the equipment fail (completely or partially) and shifts its load to nearby elements in the system. This surge current can induce the already overloaded nodes into failure, setting off more overloads and thereby taking down the entire system in a very short time.
2. **Natural cause:** The Edison Electric Institute states that 70% of power outages in the U.S. are weather related. Lightening, rain, snow, ice, wind and dust, such type of natural weather phenomenon can cause power failure. While it is more difficult to safeguard from major power failure from natural calamities like floods and severe storms, it does not take much to safeguard your electrical systems from the effects of water and dust. Water results in short circuits and power failure. The expensive damage can be caused due to water in electrical circuits. So we should have to ensure that we are well protected from it. Electrical switchboards, wires, and circuits should be protected from exposure to water. Dampness and excessive wetness can also lead to serious damages. If we live in areas with high levels of humidity, we should consider investing in specially sealed circuit protection devices. Natural disasters have historically been at the root of the world's most severe power outages. Hurricanes, floods, wind storms, earthquakes, tsunamis, and other severe weather can cause complete damage to power infrastructure and result in outages that leave expansive geographic areas without power for days, weeks, and even months.
3. **Short circuit:** A short circuit is the most frequently used term to describe the origin of a power failure. So, what is a short circuit, and how can we protect our equipment from its effects? A short circuit take place, when an electric current travels towards a path that is different from the intended one in an electrical circuit. When this situation arrives, there is an immoderate electric current which can lead to circuit damage, fire, and explosion. In fact, short circuits is one of the main causes of electrical fires throughout the world.
4. **Power surges:** A power surge can lead to rapid overheating and loss of complex and costly equipment. Power surges are the ruin of any electrical system. Fortunately, protection of such surges is done by using surge protectors and circuits breakers. Surge protection should ideally be homogenized into your main power switchboard itself. Smaller setups, which have a limited number of critical pieces of equipment, can choose to utilize portable surge protection devices that plug in to the power grid
5. **Electrical trees:** Electrical treeing is such a phenomenon that affects high power installations like high voltage power cables, transformers, etc. Any impurities or mechanical inperfection in the equipment used in high voltage installations can lead to partial electric discharges in the equipment. The damaging process demonstrate itself in a tree-like pattern, hence the name electrical treeing. Over a period of time, if it goes undetected, this phenomenon can lead to a continuous degradation of the accessories and eventually result in a total breakdown.
6. **Uplifting the generation units to Peak Load** for very long period nearly all the thermal Generating units within the Central Grid were operated with their peak capacity for prolonged period.
7. **Under-utilized water Power generation:** All Hydro Units being built produce just 39% of the site potential, produce very less power in winter and nothing when flows and therefore potential is extreme for 16 days of high sediment flows.
8. **Scarcity of Regulation:** among SLDCs Regulators did not integrate 50,000MW Standby Power with the grid. Domestic Load, commercial Load, essential services like hospitals and industries are attached to customer feeders and hence the priority based load shedding was impossible. System not designed to re-establish power to important services in minutes. No program to preserve energy and absence of load shedding policy.
9. **Poor frequency outline:** The Indian grid Systems experienced poor frequency outline. In the North grid, more loads were encounter with available generation at the cost of frequency. System was subjected to operate in the range of 48-51.5 Hz. Power quality and Grid security was compromised during this period. The reactive power consumption was very high.
10. **Trigger factors:** The direct reason of Indian blackout is that some areas kept over consumptions of enough electric power under the condition of shut down of transmission lines which consequently lead to overload operation of the grid system.

EFFECT OF POWER BLACKOUT

The effects of prolonged duration power blackout will be very critical to our modern social life. Human sophistication has only existed with the help of electricity. Several factors have entitled extensive population growth on the planet. EMP attack would likely to ruin approximately 90% of people. Several effects of power blackout are as follows:

- **Customers and revenue loss:** lost in customers in revenue may occur due to power outage. Suppose for example when this tragedy happens customers can not access the internet websites like Amazon or flip cart and there is no chance of purchasing the products.
- **Danger to electrical appliances:** continues switching of power can lead to severe damage of electrical equipments.
- Day to day life gadgets like televisions, computers, radios, telephones and air-conditioners & many other types of equipment will stop working.
- **Effect on transportation system:** the transportation system in affected areas comes to a halt.
- **Petrol, diesel pumps & gas stations stop operating.**
- **Effect on economic systems:** several money making systems, bank ATM, transactions & economic systems collapse.
- **Result on food systems**: food storage and dispersal gets terminated.
- **Domestics Problems:** unable to cook with electrical appliances.
- **Impact on hospitals:** Modern medical appliances are based on electric power. Medical & hospital technology rely on electricity.
- **Emergency cases like police & fire will cease.**
- **Desperate severity and social chaos.**

POWER BLACKOUT IN 2012:

On 30th and 31st July 2012 two serious power black outages impact on most of the north and east India. The largest ever power blackout happened in history was affected over 300 million people.. The outage affected approximately over 300 million people, about 9% of the world population, or half of India's population, spread across 20 to 22 states in North, East, and Northeast India. An assessment 32 giga watts of generating capacity was taken offline in the outage. An article in the wall street journal stated that of the affected population, 320 million initially had power; while the rest of the impacted population lacked direct access electric service was restored in the impacted localities between 31 July and 1 August 2012.

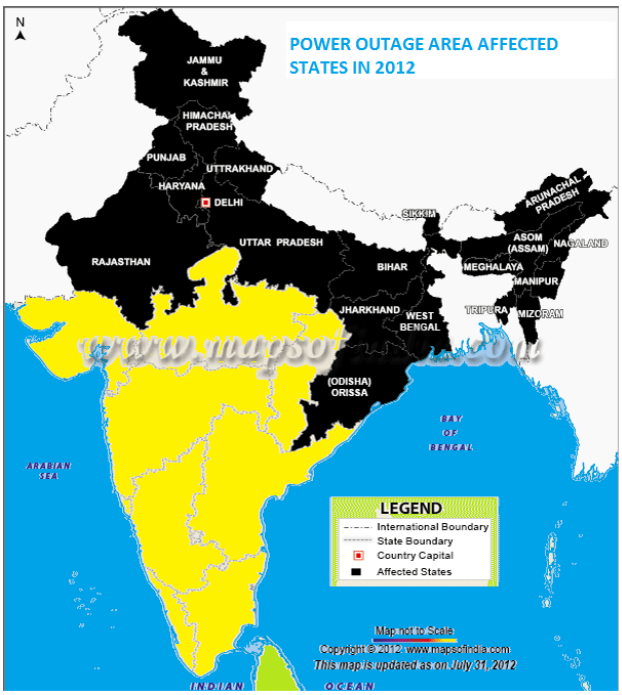

PHOTO.1. POWER OUTAGE (BLACKOUT) AREA AFFECTED STATES IN 2012

SEQUENCE OF EVENT:

29th July-Evening before blackout:

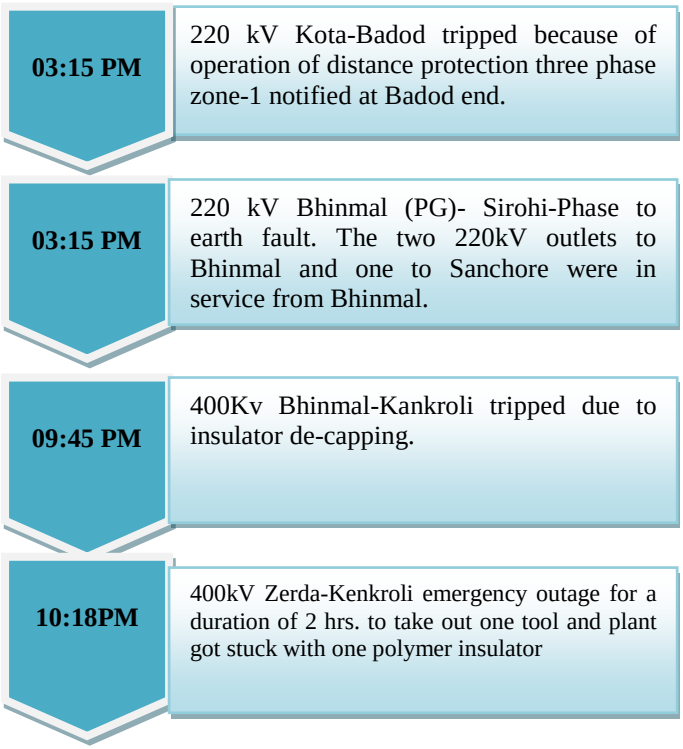

FIG.2.FLOW CHART SHOWING EVENTS BEFORE BLACKOUT

DURING BLACKOUT

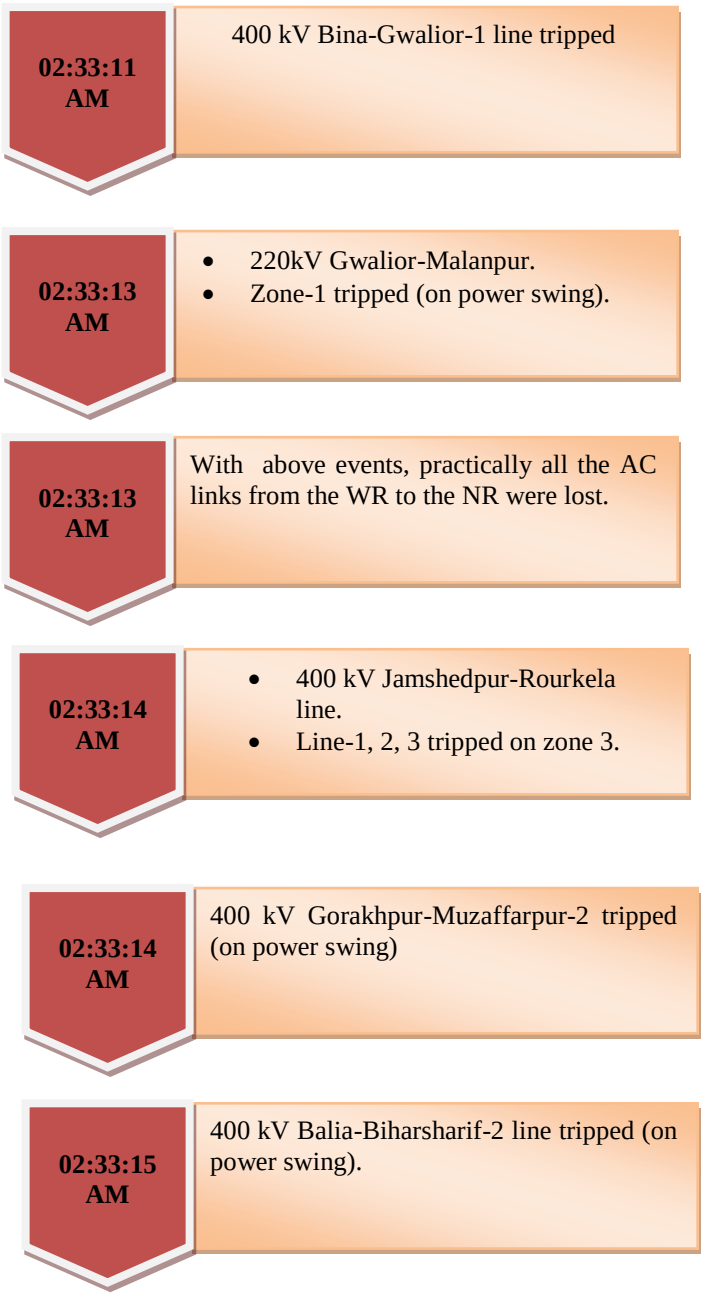

FIG.3. FLOW CHART INDICATING THE SEQUENCE OF EVENTS

SOLUTIONS TO THE REMEDY

Measures to prevent blackout

In the power supply networks the power generation and electrical load demand should be maintained equal so as to avoid overloading of network equipments. Protective relays and fuses are used as protective devices to automatically sense overloading and to disconnect the circuits. such type of conditions can lead to current fluctuations to neighboring segments of the electrical network. Consequently cascading failure occurs on the large section of the electrical network. The designation of modern power systems is done in such a way that it should be resistant to such type of cascading failure even if it is unpreventable. Moreover, since there is no short-term economic advantage to restrict rare large-scale power outages. some observations have expressed concern that there is a ability to erode the flexibility of the network over time, which is only corrected after a major failure occurs. It has been protested that minimizing the credibility of small outages only increases the credibility of larger ones. In this case, the short-term economic benefits of keeping the individual customer satisfaction increases the credibility of large-scale power outage.

- **Using Renewable (non-conventional) Energy with Storage:** metamorphosis to non-conventional energy sources like hydro generating units, solar power plkants, wind power generation, tidal energy generation, ocean thermal energy plant and solar with storage capabilities is one approach. A proposition to shift 100% renewable and keeping the power grid stable by depending on storage to ignore the power outages is done by a panel of investigetors led by Stanford University. Significantly a strong financial benefit was shown by their research. The cost per unit of energy, including health and climate costs would save 75% of the costs associated with the current energy structure.

- **Adding Storage potentials to the Current Grid:** Incorporating storage into the subsits electrical power grid is a more immediate option for avoiding power blackouts. The Massachusetts Department of Energy Resources is requiring utilities to homogenize large-scale batteries into their systems. These batteries can apprehend energy from the power grid, store it during non-peak times, and then convey it when demand get multiplied.

- **Designing Micro or Customer Grids:** Microgrids are small-scale operations functioning independently from the main grid. Few depend on non-conventional energy and storage, or storage to hold grid-produced power generated in non-peak times to control their power supply. Microgrids can vary in size, from a neighborhood business district to a single location like an residence or airport.

- **Vanadium batteries:** Vanadium batteries can provide various benefits of energy storage, including a lo**n**ger cycle than lithium ion batteries and endurance spans than lead acid or lithium ion options, up to 25 years, without any indignity in capacity. Size versatility enables vanadium batteries to be used widely, from small utilities to large utilities.

CONCLUSION:

From this paper we get to know about power blackout, its causes, effects & prevention methods. We also saw power blackout in India in 2012.

ACKNOWLEDGEMENT

We offer our sincere and hearty thanks, with a deep sense of gratitude to our Guide Prof. **Prof.Mahesh Yadrami** for his valuable direction and guidance to our paper, his meticulous attention towards our paper work without taking care of his voluminous work.

We are grateful to the Head of Department **Prof.S.S. Sankeswari** for providing all facilities to carry out this technical work and who seen couraging part has been perpetual source of inspiration.

We are thankful to our Principal **Dr. B. I. Khadakbhavi** for his encouragement towards our paper.

Last but not Least we thank my parents, Electrical, Electronics
and Power Engineering staff and friends. We are indebted for their constant help, encouragement and without whom this technical task would not have been a success.

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