

Why grid failure occurs, causing a blackout

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THE power grid failure that occurred in Bangladesh on 1-11-2014 was the worst blackout the country has ever experienced. The media gave different views and opinions which raised speculation about the cause. This article will try to give a brief description of grid system, its principle of operation, safety precautions and the logical reason for blackout.

Power grid system

Power grid system comprises generation, transmission, distribution and consumption. The backbone of the grid is the high-voltage overhead transmission lines that run across the country to remote areas. The power generated by the alternators in the power stations at 11KV is delivered, via step-up transformers, to the grid which transmits the electricity at 230/132 KV to the remote substations of the command centres. Distribution of electricity takes place through feeders from these substations after the line voltage is lowered back to 11 KV by step-down transformer. Medium-voltage distribution lines are erected in different places in the locality up to the step-down transformers, either at customer premises or at distribution poles, where the line voltage is further lowered down to 440/220 V, suitable for the ratings of the electrical appliances. From these field transformers, low-voltage service connections are given to the domestic and commercial customers.

In the existing grid system of Bangladesh, the network of high-voltage transmission line consists of 3,045 km at 230KV and 6,210 km at 132 KV. There are one station of 400 KV, eighteen substations of 230/132 KV and eighty eight substations of 132/33 KV.

The central load despatch centre monitors and controls the entire grid system from the work stations in the control room. It coordinates with generation and distribution to ensure a steady supply of quality electricity.

Generation in power stations

The generators in power plants are run by prime movers like turbines to produce alternating current (AC), generally at 11 KV and frequency 50 Hz, which is delivered

to the grid to serve the connected loads of the end users. Power plants generate as much electricity as is consumed at a certain time as there is no scope of storage. The tolerances of electrical parameters are voltage $\pm 10\%$ and frequency ± 2 .

A generating set is started and runs idly for some time for warming up and the governor is actuated to reach the rated speed for frequency of 50 Hz. Then using a synchroniser the set is engaged to the bus bar (which are rigid and fixed common rectangular conductors where incoming and outgoing cables are connected via breakers). In a similar way, the other sets are put on bus bar one-by-one to share the load, which is increased gradually.

When several sets run in parallel, one of them will act as the leading set. The generators can share load on auto/manual mode. The load balance done manually is more convenient, especially when some sets have capacity limitation.

Reason for blackout

Grid failure leading to blackout occurs mainly due to major imbalance between the real time generation and consumption. This is what happened on 1-11-2014 when incoming 344 MW supply from India suddenly ceased at Bheramara HVDC station. When a bulk input of power fails, the burden of this load falls on the running sets of the power plants. The sudden extra load grips the prime mover like a brake and reduces its speed momentarily. When the speed falls below the set limit of frequency, the low frequency safety guard disengages the set from bus bar. The phenomenon is termed the set tripped. A set, when it trips, is relieved instantly of the carrying load and its speed of rotation tends to increase. When the speed crosses the upper set point, the set stops due to over speed safety guard. Thus the imbalance between generation and consumption goes on increasing and the generators trip and stop in the power plants one after another, leading to

cascading failures causing a widespread blackout in the country.

Restoration of power supply

Restoration of power supply is a slow process. The first step is to disengage the feeders from the grid in the substations. The generating sets have to be started, brought to the nominal frequency and put on the bus bar. A feeder in the substation has to be closed, and when it holds another is closed. This way the generating sets and feeders are put on the grid step-by-step to the full load. The restoration process involves close coordination between power plants and the load despatch centre that guides the whole process.

Safety precautions

The normal safeties of the distribution system are over-frequency, under-frequency, over-voltage, under-voltage, over-current, short circuit and earth fault. The set points and timings of the protection relays have to be maintained uniformly. The control cabinet rooms have to be dust free and air conditioned to prevent malfunction.

The modern 400 KV, 500 MW back-to-back HVDC cross country transmission line between Bherampur and Bheramara is a new experience for Bangladesh. It is known that addition of HVDC system makes a weak grid strong and stable. The advantage of HVDC technology is that its converter station is capable of absorbing the fluctuations, and can prevent widespread blackout. Unfortunately, the HVDC back-to-back station at Bheramara failed to perform the duty of blackout preventer when a glitch, a transient fault, occurred, followed by countrywide power failure. The safeties and control strategy of the converter station needs attention and fixing based on performance analysis.

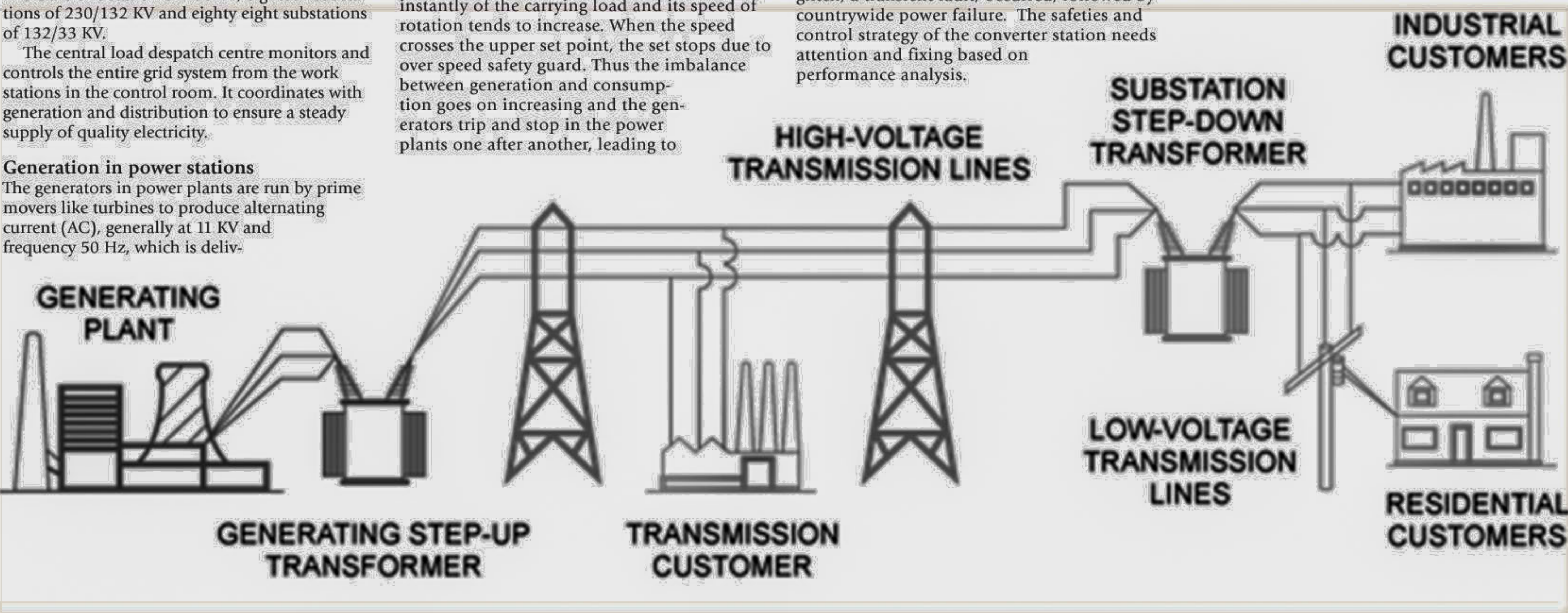
Development of grid system

The prime duty of the national grid is to ensure transmission and distribution of quality electricity with specified voltage and frequency. To ensure stability, the grid system should be balanced regionally to reduce line loss, be equipped with a smart data communication and monitoring system, have reliable safeties for the equipments, and capabilities to optimise the reactive power to improve efficiency.

Power Grid Company of Bangladesh Ltd. (PGCB) is looking after the operation, maintenance and development of the high voltage grid system. The existing grid is old and weak and there is scope for improvement according to the recommendations given by experts in the past. PGCB has to continue infrastructural development programmes to build new high-voltage transmission lines and substations to serve the upcoming new power plants to meet the ever increasing demand for electricity. It may also explore the possibility to make room for the captive power in the country to contribute to the system.

Blackout is an unusual occurrence in power supply system. Even a strong and stable grid can hardly withstand the thrust caused by a sudden disappearance of a substantial input from the system. The best way of prevention is round-the-clock liaison between generation and distribution. A power plant, when faced with a problem, can immediately alert the load despatch centre that can take cautionary steps before it is too late. The planned 1,000 MW HVDC stations, when built, will go a long way to prevent blackout in future.

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The fatalism we are living with

MARTIN ADHIKARY

WEEK after week has passed by since we have been living in a state of terror. Blockades and strikes appear to reign supreme in the lives of millions of helpless people in the country. These continue to haunt and hunt lives and properties of all kinds. None can be sure if there is any light beyond the tunnel for we are not even inside any tunnel whatsoever. Our country has been known for centuries, as a land where natural calamities like floods, tidal bores, cyclones, tornadoes, etc. take great toll of human lives and cause huge damage to properties. I was brought up in a village in the district of Barisal. I remember the devastations that cyclones, storms and floods used to cause so often. But these are natural calamities.

Most regrettably, we have been experiencing man-made calamity nowadays. Fire is being used for killing human beings for so-called political reasons. Many people are being admitted in

hospitals almost daily these days for treatment of burn injuries. The Dhaka Medical College Hospital Burn Units have been packed up with such people, many of whom die. Untold agonies and anguish in the hospitals; also anguish and trauma all over the country. Nobody knows whether he or she will or will not return safe to his or her own people while leaving them for another place. This uncertainty begets a kind of fatalism.

Wise men have said, not without reason, that there are seven real dangers for the human society. They are wealth without work, pleasure without conscience, knowledge without character, business without ethics, science without humanity, religion without sacrifice, and politics without principle. We long to live in a political culture that will facilitate our lives towards the path of social justice, peace and progress. Ours is a country with many frustrated hopes and dreams of the overwhelming majority of people, who are socio-economically very poor and backward. We have been freed for freedom's sake.

Yet our hopes and aspirations for an exploitation-free society is a far cry.

Precious lives are mercilessly taken by petrol bombs, Molotov cocktails, etc. What madness has got into us! I know that every day millions of religiously devout people of all faiths offer special prayers in mosques, temples, pagodas and churches in every nook and corner of the country for peace in the country, and for the Almighty to grant our political leaders all wisdom and insight that they will be guided by the very spirit and ethos that underlie our hard earned freedom. The image of our nation gets often tarnished because of the very intolerant attitude of some of our political and religious leaders towards others. We are in need of creating a culture of mutual respect and tolerance, a culture of respect for the self-evident truths about human dignity irrespective of religion, race, political or ideological affiliations, social status, gender and class.

Our people are socio-economically poor, but they are not poor intellectually, culturally and emotionally. Our

people are industrious, religious and patriotic. However, we lack one thing of supreme importance: we need honest leaders, leaders with genuine and selfless patriotism that Bangabandhu and some of his close aides had throughout their lives and work. They will be able to help nurture an atmosphere where people will create new visions leading to authentic growth and prosperity, where human life and dignity will be given due attention in the eye of law and common sense and sanity.

What are we after? Where is our nation heading to? We still seem to be a divided nation on the issues of who first declared independence of Bangladesh, the trial of the people who fought tooth and nail against our independence from Pakistani domination, whether national election should be conducted by a caretaker government or not, and a plethora of other issues of great national significance. We dream the long cherished dream of Bangladesh becoming a country where our people will live in a society where the curse of poverty, illiteracy and injustice will be things of the past.

One of the great things that

Bangabandhu said in his historic speech on March 7, 1971 made an indelible mark in mind heart and mind. He said: "I do not want the prime ministership of Pakistan. I want the freedom of my people." Everyone who heard his speech could not fail to understand that these words came from his very heart, from all his being. Today, we want and clamour for position and power, but we do not have enough love and vision for the wellbeing of the millions of poor, backward people of our country. It is their basic human rights that have been always at stake. We have not been able to achieve any consensus over vitally important national issues that affect the lives of the people, or an authentically democratic vision that will help us ushering in a just and peaceful society. "Without a vision people perish," says the book of Proverbs.

The writer is Principal, College of Christian Theology Bangladesh, and a social worker.

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QUOTABLE Quote

Life is what happens to you while you're busy making other plans.

John Lennon

CROSSWORD by Thomas Joseph

ACROSS

1 Mexican money

6 Bra part

11 Misbehave

12 Egypt's capital

13 Ineffective holder of office

15 Plaything

16 Cochlea setting

17 Plopped down

18 Jazz instruments

20 Football team

23 Took a risk

27 Pop's sister

28 Kilauea flow

29 Web-surfing need

31 Accepted applause

32 Mustard city of France

34 TV spots

37 Comic bit

38 Sense of self

41 Sports sub

44 "Cats" poet

45 German river

46 Impudent

47 Lugs

DOWN

1 Concord

2 Cave sound

3 Order to Fido

4 Arles assent

5 Butter or jam

6 Trembling

7 Road sealer

8 Borders

9 Region

10 Cruise stop

14 Crayon material

18 Unable to eat another bite

19 Stylist's spot

20 Sleuth Spade

21 Status-

22 German conjunction

24 Unrefined

25 Second person

26 Pop

30 Powerful

31 "Key Largo" star

33 Mouth part

34 Cain's brother

35 Sub shop

36 Salon sound

38 Throw off

39 Heredity unit

40 Valuable rock

42 Force member

43 Pi follower

Yesterday's answer

MADE	ALIT
DEBUT	LINEN
ADAPT	PESTO
MUSEUM	ERR
USED	ACACIA
PAD	EXISTS
SLITS	
CLAMMY	PEG
SEEYOU	AIDA
ERA	MAGNUM
LEGIT	VANCE
LAURA	EPEES
LEAP	REDS

CRYPTOQUOTE

ZWVBDTJB ZWXXIN GHOGZHOE QDH SZHVIHEDS, R GHOOQHOOE VBZV RV NBDTWE MO GDNVGDKOE.

-XRKNVDK UBTHUBRWW

Yesterday's CRYPTOQUOTE:

DRESS A MONKEY AS YOU WILL, IT WILL REMAIN A MONKEY STILL.

- SOURCE UNKNOWN

A XYDLBAAXR is LONGFELLOW

One letter stands for another. In this sample, A is used for the three L's, X for the two O's, etc. Single letters, apostrophes, the length and formation of the words are all hints. Each day the code letters are different.

BEETLE BAILEY

by Mort Walker

IN THE BEGINNING, THE WORLD WAS PEACEFUL...NO GUNS...NO WARS

FIVE MILLION YEARS AGO, A FISH DECIDED HE WANTED TO LIVE ON LAND

FOUR MILLION YEARS AGO, IT WAS UP WALKING AND GOING PLACES

THREE MILLION YEARS LATER, IT HAD GROWN AND LOST ITS TAIL

ANOTHER FEW MILLION YEARS AND IT WAS UP, DRESSED, BUILDING HOMES AND HAVING FAMILIES

BUT TODAY IT IS FULL GROWN AND CAPABLE OF DOING MANY THINGS

WHERE HAVE YOU BEEN?

THANK GOODNESS THERE ARE PLENTY OF THEM