Rover Publications
United International Journal of Engineering and Sciences (UIJES)
An International Peer-Reviewed(Refereed)Engineering and Science Journal;Impact Factor: 5.735(SJIF)
Vol-3,Issue-4 ,2022 ISSN:2582-5887 www.uijes.com

Analysis Of Critical Frequent Incidents in Power Sector Inimical to Rapid Industrialisation of Nigeria

Cletus U. Okoye &Najeem O. Adelakun
Department of Electrical/Electronic Engineering, The Federal Polytechnic, Ilaro, Ogun State, Nigeria.
Engineer/Researcher, Federal College of Education Iwo, Osun State, Nigeria.

Article Received: 02/06/2022, Article Accepted:07 /10/2022, Published online: 09/10/2022
DOI:10.53414/UIJES.2022.4.01

ABSTRACT

Since the privatization of the power sector in Nigeria in November 2013, Nigeria is yet to experience a stable, quality, and adequate supply of electricity. Daily power generation is at best between 3,000 – 3,500 MW, granted that there is no incidence of power outage. However, grid collapse with resultant widespread power a outage has become so common; too bad that the country recently recorded only 3 MW in power generation. This work explores the major frequent occurrences in the power sector that slow down productive activities and industrialization in Nigeria. In particular, it worries about falling capacity utilization, vandalism, over-dependence on self-generation, closure of industries, and high electricity bills. Remedial measures were proffered in good measure in order to ensure accelerated development of Nigeria.

Keywords: Capacity utilization,industrialization, power sector, self-generation, vandalism.

INTRODUCTION

Recently (Nnodim, 2022a; TCN, 2022a), Nigeria's power grid collapsed, causing power generation to crash from 3,900 MW to a terrifying 3 MW. Earlier in April 2022, the grid system collapsed on the 8th and 9thof April 2022 respectively (TCN, 2022b). This caused further reduction in capacity utilization of the existing power plants (NESI, 2022; Akintayo, 2022), resulting in low power availability.

Besides, the power outages accompanying such grid collapses can be outrageous in impact. In a study (Okoye & Omolola, 2019) covering the periods 2008 – 2017, it was disclosed that the number of forced and planned outages was 9,823 and 1,239 respectively. In fact, in 2011, there were 1,085 forced power outages, while there were 1,914 power outages in 2018 (Adelakun &Olanipekun, 2020). These were the outages that occurred on the 132 KV transmission network alone. Those on the 330 KV transmission line were not considered.

Worse still, vandals destroy electricity infrastructure and steal various electrical equipment/components such as copper conductors, aluminums', bolts, nuts, cables, and transformer oil (TCN, 2019; TCN, 2020; Okoye, 2015). With all these, electricity supply to consumers suffers. Nnodim (2022a)reports that as many as five states were thrown into darkness when power network in

the Central District, Abuja, was vandalized. Similarly, Eko Electricity Company disclosed that the grid collapse caused by the activities of vandals affected its entire power network.

With little or no power/electricity, consumers are forced to generate electricity. Most individuals and industries recently rely mainly on personal generators even in the face of high cost of diesel, gas, petrol and oil. The industries that cannot afford to own a generator or manage high cost of production simply close down. So many have done this (Anudu, 2022a; Okoye, et al 2018). Thus, it is not a surprise that the Ministries, Departments and Agencies (MDAs) submitted a whooping N104 billion generator budget to National Assembly for approval for the year, 2022.

With all these power-based challenges, this research work sets out to identify measures that would improve power availability and thus enhance rapid industrialization of Nigeria.

MATERIALS AND METHODS

The method used in this research involves data collection and analysis from several power regulatory bodies, and reviews of related literature.

FALLING CAPACITY UTILISATION

According to NESI (2021) and Akintayo (2022), the following hydro and thermal power plants under the Power Purchase Agreement (PPA) operated much below their original (installed) capacities as at July, 2021.

Table 1.0: Available capacities of power plants operating under Power Purchase Agreement (PPA) as at July, 2021

Power Plant	Installed (Original) Capacity MW	Available Capacity (MW)	Percentage of Capacity Utilisation
Kainji (hydro)	760	153	20.1
Jebba (hydro)	576	332	57.6
Shiroro (hydro)	600	248	41.3
Egbin (gas)	1100	606	55.1
Sapele	1020	46	4.5
Delta	900	281	31.2
Afam IV – V	776	67	8.6
Geregu	414	277	66.9
Azura	450	421	93.6
Agip	465	29	6.2
Shell	650	287	44.2
Olorunsogo	304	195	64.1
Omotosho	304	254	83.6
TOTAL	**25,065**	**3,196**	

Source: (TCN (2019; TCN, 2020)

The graphical representation of Table 1.0 is shown in Fig. 1.0

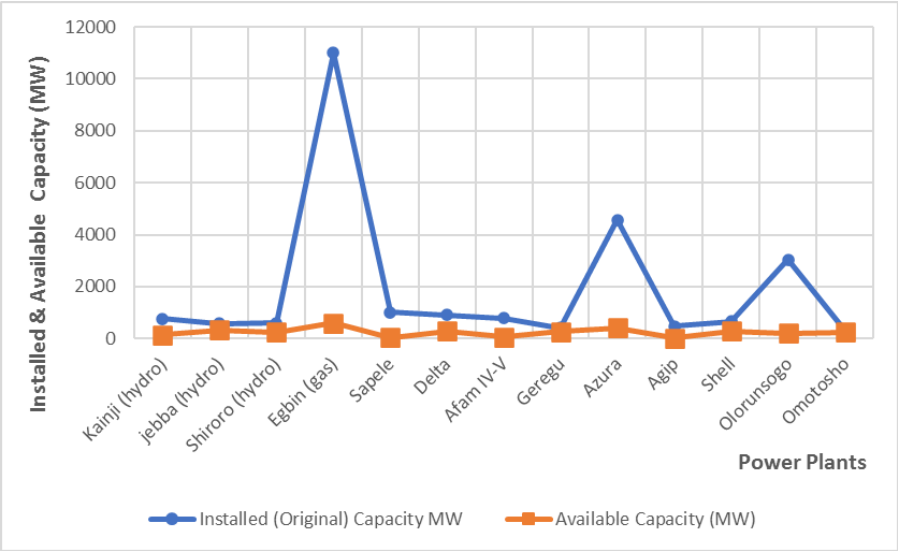

Fig. 1.0: Graphical illustration of installed and available capacities of power plants under Power Purchase Agreement (PPA)

Similarly, seven thermal (gas) power plants under the National Integrated Power Project (NIPP) within the same period experienced remarkable reduction in operating capacity as shown in Table 2.0

Table 2.0: Available capacities of Thermal (gas) power plants under the National Integrated Power Project (NIPP), as at July, 2021

S/N	Gas (thermal) Power Plants	Installed (Original Capacity) MW	Available Capacity MW	Percentage of Capacity Utilisation
1	Geregu	434	77	17.7
2	Sapele	450	33	7.3
3	Alaoji	960	58	6.0
4	Olorunsogo	675	23	3.4
5	Omotosho	500	43	8.6
6	Ihovbor	450	17	3.8
7	Calabar	563	236	41,9
	TOTAL	**4032**	**487**	

Source: (TCN, 2020)

The corresponding graphical representation of Table 2.0 is depicted in Fig. 2.0.

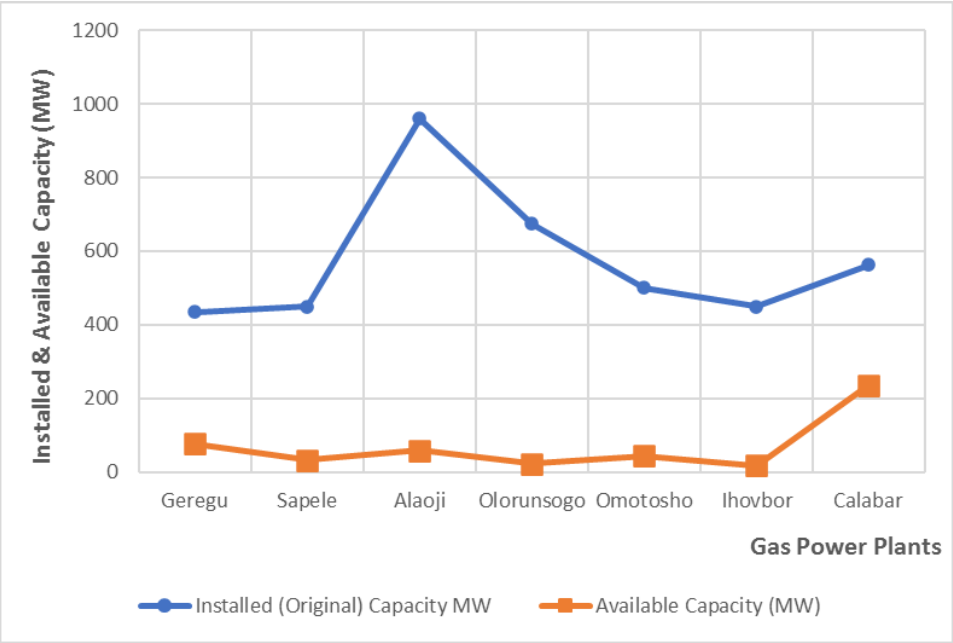

Fig. 2.0: The variation of installed and available capacities under the National Integrated Power Project

HIGH ELECTRICITY BILLS

Part of the problems facing electricity consumers in Nigeria today is the increasing cost of energy for various residential, commercial and industrial activities. At a time when power supply is erratic and unbearably unstable, most consumers are made to pay much for non-existent energy.

Besides, most organizations which enjoy at least 12 hours and above of energy/electricity everyday because they are in band A, B or C are even complaining bitterly. This is because, the Nigerian Electricity Regulatory Commission (NERC) since 1st January 2021 increased electricity tariff from ₦30.23 per KWH to ₦62.33 per KWH for customers in hand A, B and C respectively.

Take University of Lagos, for example. As at May, 2021, the bills being paid by the institution every month is shown in Table 3.0 (Unilag, 2021; Bello-Osagie, 2021).

Table 3.0: University of Lagos Electricity (Energy) Bill: January 2020 to May 2021

Date	Total paid (million Naira)
1st January, 2020	51,045,592.16
1st February, 2020	50,837,633.96
1st March, 2020	68,701,036.96
1st April, 2020	62,357,110.00
1st May, 2020	26,712,127.60
1st June, 2020	21,870,753.68
1st July, 2020	24,817,753.44
1st August, 2020	25,348,417.72
1st September, 2020	26,666,966.00

1st October, 2020	56,388,551.14
1st November, 2020	29,216,415.36
1st December, 2020	81,832,085.76
1st January, 2021	84,084,772.25
1st February, 2021	79,370,949.65
1st March, 2021	85,253,927.86
1st April, 2021	88,818,654.82
1st May, 2021	181,974,923.24
TOTAL	**1,045,297,671.60**

Source: (UNILAG, 2021)

The trend of the electricity cost is shown n Fig. 3.0

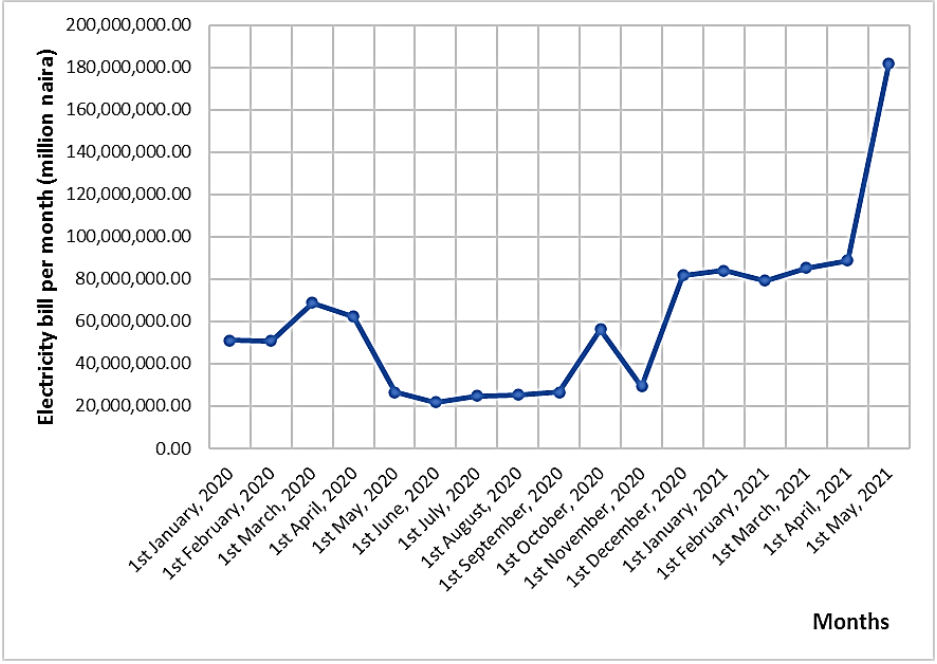

Fig. 3.0: Trend of electricity bill, University of Lagos (1st January 2020 – 1st May, 2021).

It should be observed (Table 3.0) that the cost of electricity came down during Covid-19 pandemic because schools were closed down in Nigeria for some months. It again rose from October, 2020 when students resumed classes. In sum, the university incurred a huge bill of ₦1,045,297,671.60 between January 2020 and May 2021.

Within the same period, the University of Jos spent 20 to 25 million naira monthly on electricity bill; Lagos State University, 19.8 million Naira; and Nnamdi Azikiwe University, Awka, Anambra, about 15 million naira respectively.

OVER-DEPENDENCE ON SELF-GENERATION

Due to acute shortage of electrical power (electricity) in Nigeria, individuals, organizations and agencies now depend largely on private generators for their energy needs. The Ministries, Departments and Agencies of governments of Nigeria are no exception.

Table 4.0: shows the proposed generator budget presented to the National Assembly for approval at the time (Akinkuotu, et al, 2021).

Table 4.0: Proposed Generator Budget by Ministries, Departments and Agencies (MDAs) of Federal Government of Nigeria for 2022

Federal Ministry of Finance, Budget and National Planning	₦82.03 billion for Purchase of power generating set
Federal Inland Revenue Service	₦250 million for maintenance of generator, One billion Naira for fuelling and ₦550 million for purchasing new generators Sub total = ₦1.8 billion
The Nigerian Army	₦971.7 million for generator fuel.
The Nigerian Marine time Administration and Safety Agency	Budgeted N946 million for generators
The Department of Petroleum Resources	₦118.7 million for maintenance of generators, ₦666.8 million for generator fuel, ₦120 million for the purchase of generators in its offices in Sokoto, Kano, Makurdi, Yenagoa, Ilorin and Umuahia; Sub-total = ₦905.5 million
Nigerian Ports Authority	₦798.2 million for purchase and maintenance of generators
The Standard Organisation of Nigeria (SON)	₦412 million on new generators and the maintenance of existing ones.
The Federal Airport Authority of Nigeria	₦400 million on generators
The National Inland Water-ways Authority	₦379.93 million for rehabilitation of a generator and ₦50 million for the procurement of a generator Sub-total: ₦429.93 million
Nigerian Civil Aviation Authority	₦240.57 million to maintain its generators and ₦124 million to procure a new one Sub-total = ₦364.57
Nigerian Defence Academy	₦373 million as generator budget for the year 2022 under discussion.
The Nigerian Immigration Service	₦86.9 million on generator fuel, ₦144.8 million on purchase of new generators and N65.09 million for generator maintenance. Sub-total: ₦296.79 million
The Nigeria Meteorological Institute	₦285 million on purchases, maintenance and fuelling of generators.
The Nigerian Export-Import Bank	₦217.67 million for purchasing, fuelling and maintenance of generators

Nigeria Correctional Service	Fuelling of generator: ₦134.9 million and ₦43.6 million for generator maintenance Sub-total = ₦178.5 million
The Office of the Head of Civil Service of the Federation	₦157.8 million for maintenance, fuelling and procurement of generators
The Federal Ministry of Health and its agencies consisting of 88 Federal Teaching Hospitals, medical centers and agencies	₦3.1 billion on generators
Nigerian Institute of Medical Research	₦230 million on purchasing generators, ₦5 million on fuel and one million naira on maintenance. Sub-total = ₦236 million
The Ministry of Education that supervises 197 federal secondary and tertiary institutions, departments and agencies	A total of ₦2.8 billion for generators. Out of this amount, the Federal Polytechnic Ekowe earmarked ₦237 million for the purchase of generators, ₦18.9 million for maintenance of generators and ₦8.2 million for fuel; making it a total of ₦264.1 million (the highest generator budget under the ministry for the year 2022).
The Nigerian Navy	₦344 million for maintenance, fuelling and servicing of generators.
The Economic and Financial Crime Commission	₦342.2 million on generators
The Accident and Investigation Bureau	₦323 million on generators
The National Youth Service Corps	₦100.2 million for maintenance, fuelling and servicing of generators
The Independent Corrupt Practices and Other Related Offences Commission	₦127.6 million
The Nigerian Airspace Management Agency	₦100 million for generator
Nigerian Postal Service	₦103.1 million for generator
The Nigeria Deposit Insurance Commission	N470 million for generator maintenance; ₦262.11 million for procurement of a generator. Sub-total: ₦732.11 million
The Federal Road Safety Corps	For generator maintenances fuelling and purchase of generators: N529.3 million
The Nigeria Police formations and Commands across the country	₦211.5 million on maintenance and ₦309.8 million on fuel for generators. Sub-total = ₦521.3 million
The Nigerian Communications Commission	₦500 million for running generators; ₦190 million for maintenance, ₦150 million for

	purchasing new generators and ₦160 million for fuelling generators Sub-total = ₦1 billion
The Bank of Agriculture	₦420 million for the purchase of generators
GRAND TOTAL	**₦104 BILLION**

However, some agencies did not show their generator budgets. Such agencies are the Joint Admissions and Matriculation Board, Central Bank of Nigeria, Federal Mortgage Bank of Nigeria, National Examination Council, the Independent National Electoral Commission, Nigeria Customs Services, National Information Technology Agency, and National Pension and Commission (among others). This implies that we would expect the generator budget for 2022 to be much higher than the estimated ₦104 billion. The researchers could not access the final generator budget approved for the agencies but the data is alarming enough.

CLOSURE OF INDUSTRIES DUE TO POWER SHORTAGE

Power or energy crisis in Nigeria has forced manufacturers to look for an alternative way of generating their own power. According toAnudu (2022b), manufacturers self-generate approximately 13,223 MW of power for their industries, using gas, black oil, diesel and petrol. Those who could not cope with increasing cost of self-generation have closed down (Okoye, et al, 2018; Okoye & Adejumobi, 2021).

According to MAN (2022) and Adebayo (2022)expenditure on alternative energy sources by Manufacturers Associations of Nigeria (MAN) members from 2017 to 2021 are summarized in Table 5.0 below.

Table 5.0: Expenditure on Alternative Energy Sources by Manufacturers Association of Nigeria (MAN) members (2017-2021)

Year	Expenditure (Billion Naira)
2017	117.38
2018	93.11
2019	61.38
2020	81.91
2021	71.22
Total	**N425 billion**

Source: (Anudu, 2022; MAN, 2022)

In fact, it is said that power takes up to 40 to 50% of production cost whereas in some countries, it takes 10% only (Olatunji, 2022). So bad are the power challenges that many industries no longer depend on the unreliable grid electricity for their productive activities. Such companies or industries are: Dangote Group, Flour Mills of Nigeria, Kam industries, Cadbury; Qualite Industries and Haffax Industries (among others). Worse Still, most of the multi-national companies such as Dunlop and Michelin have since relocated to neighbouring countries (Okoye et al., 2020; Okoye & Omolola, 2019)where they enjoy better enabling environment. Procter and Gamble and Glazo Smithkline have since shut down their manufacturing plants. Other industries that shut down recently

are: Technoflex, Sky Aluminium, Louis Carter Limited, Gorgeous Metal, Universal Rubber, Mother's Pride, Deli Foods and the Industrial and Foam Equipment respectively(Anudu, 2022b).

Even those companies that are surviving today are operating at depreciating capacity utilization (which has not reached 60% in over 10 years. In fact, in 2020, capacity utilization was 60% while in South Africa, it was 82% in 2021 (MAN, 2022).

VANDALISM AND THEFT OF ELECTRICITY INFRASTRUCTURE

There is a widespread wanton, deliberate destruction and theft of electricity infrastructure across Nigeria, mainly by Nigerians. TCN (2019), TCN (2020) and Okoye (2015)report that transmission pylons, distribution transformers, cables, aluminium and copper conductors, have been vandalised at various locations in Nigeria. Recently, (Nnodim, 2022_b)reveals that power network in the Central District of Nigeria's Federal Capital Territory was vandalised; causing unprecedented blackout in most areas. Several grid collapses in recent time have been attributed to vandalism of power infrastructure with power outages in as many as five States in Nigeria (Nnodim, 2022_C). The Eko Electricity Distribution Company confirmed that the grid collapse affected its entire network.

Transformers are vandalized in search of their copper windings, oil, bolts nuts and other accessories. Vandals look for angle irons, nuts and bolts (among other components) in a vandalized steel pylons/towers. In a study (Sithole, 2016), it was shown that some of the stolen transformer oil is used in restaurants to fry food edibles such as chips

CONCLUSION

A lot of evils have befallen power sector in Nigeria such that it will be unjust to blame only the government, individuals, or organizations for the unending power crisis Nigeria is currently facing. Inadequate gas supply and low water level are the common factors often attributed to low power generation. However, vandalism and theft of electricity infrastructure by the people of Nigeria are more difficult to contend with. As long as vandalism of gas pipelines transformers, cables, pylons, insulators and aluminium conductors (among others) continue in our society, the issue of grid collapse will go on unmitigated. Consequently, budgets on generators (purchase, fuelling and maintenance) will continue to rise; so also is the cost of production of goods and services. This will eventually lead to fall in capacity utilization, closure of many industries and unprecedented unemployment. Apart from these issues discussed in the study, crucial remedial measures aimed at mitigating grid collapse have been suggested among which is the modernization of Nigeria's electric power network and replacement of aging electrical equipment.

RECOMMENDATIONS

With the issues raised in mind, the following remedies are suggested:

- Modernization of power equipment should be encouraged as many are ageing very fast. Consequently, their efficiency has degraded over a long time they have been in service. Some are 35 years or even more. Nigeria can build 500 KV a.c. transmission lines.
- Vandalism of power equipment should be checked. ADLASH optic fibre cable between Benin T.S., Sapele and Delta Power stations; towers and pipelines have been vandalized by criminals (TCN, 2015). Use of local vigilante could be of help.

- Islanding should be built into our power network so that in the event of a large system collapse, some areas with a balance of generation and load are able to disconnect from the collapsing systems.
- Modern technologies such as high-speed automated controls should be incorporated in our power network to increase network efficiency.
- The electromechanical devices used for power flow and protection against overloads should be discontinued in favour of modern solid-state power electronics devices as they do not respond quickly to damaging rapid transients. For example, Flexible Alternating Current Transmission System (FACTS) can react instantaneously to system disturbances, increase power transfer capability of transmission lines and thus the overall system reliability.
- More Universities and Polytechnics should be encouraged to introduce Power System Engineering programmes with adequate funding to carry out Research and Development (R&D) in generation, transmission and Distribution network.
- Renewal energy sources such as wind and solar should be developed on a large scale and connected to the grid to increase energy security.
- The transmission and distribution system should be strengthened to improve network reliability, accommodate peak loads and diverse sources of power expected now and in the future.
- It is important that monitoring and decision support systems should be able to identify any equipment about to fail. In this way lives are saved, severe injurious reduced and property secured.

REFERENCES

[1]Adebayo, M. O. (2022), Chairman of Manufacturers Association of Nigeria, Gas Group

[2]Adelakun, N. O.& Olanipekun, B. A. (2020) Outage Analysis and System Disturbances on 330 kV and 132 kV Transmission System in Nigeria, **European Journal of Engineering Research and Science,**Vol. 5, Issue 1. Pp 100-102

[3]Akinkuotu, E., Olatunji, S. & Orjiude, A. (2021); Federal Government Budgets N104 billion to maintain, purchase generators in 2022; The Punch, 19th October, P. 19

[4]Akintayo, O. (2021), Federal Government Targets 5000 MW Amid Constant Grid Collapse, Others; The Punch, July 22.

[5]Anudu, O. (2022a), Over 50 Companies Shut Down Over Forex, Power Crisis; The Punch, 2nd May, P. 33

[6]Anudu, O. (2022b), Manufacturers' Spending on Alternative Power Soars to N425 billion, Disco Abandoned, The Punch, 31st May, p. 20

[7]Bello-Osagie, K. et al (2021). Power Cost Crippling Schools, The Nation, 10th June, p. 11

[8]MAN (2022); Manufacturers' Association of Nigeria, A Report.

[9]NESI (2021), Nigeria Electricity Supply Industry, July.

[9]Nnodim, O. (2022a). Power Generation Crashed to 3MW, Federal Government Begins Probe. The Punch, 22nd July, p. 20.

[10]Nnodim, O. (2022b). National Grid Collapsed Twice to 10MW, 33MW Last Week, The Punch, 12th April, p. 19.

[11]Okoye, C. U. (2015). Nigeria's 132/330KV Transmission Line: Issues, Challenges and Solutions, **International Journal of Scientific Innovation and Sustainable Development**, Vol. 5, No. 2, pp. 103-107.

[12]Okoye, C. U., Alao, M. J., Bitrus, I., Adelakun, N. O. & Abdulhamid, I. G. (2018), A Study and Analysis of Energy Generation and Consumption in Dangote Cement Plant, Ibese, Ogun State, Nigeria; **Global Journal of Advanced Engineering Technology and Sciences**, vol. 5, No. 11 pp. 20-27.

[13]Okoye, C. U. & Omolola, S. A. (2019). A Study and Evaluation of Power Outages on 132KV Transmission Network in Nigeria for Grid Security, **The International Journal of Engineering and Sciences**, Vol. 8, Issue 11, pp. 53-57.

[14]Okoye, C. U; Adejumobi, I. A.; Bitrus, I. & Adelakun. N. O. (2020); Analysis of Grid-Connected Independent Power Plant Capabilities on Electricity Generation Spectrum in Nigeria. **International Research Journal of Modernisation in Engineering Technology and Science**, vol. 2, issue 2. Pp. 528-536.

[15]Okoye, C. U. & Adejumobi, I. A. (2021). Increasing Energy Mix in Nigeria's Electric Grid Through Renewable Energy Development, **Iconic Research and Engineering Journals**, Vol. 6, No. 5, pp. 214-221.

[16]Olatunji, S. (2022), Power Sometimes Gulps 40% of Our Production Costs, The Punch, 1st June, p. 9.TCN (2015). Grid System Operations: Annual Technical Report, Transmission Company of Nigeria, Osogbo, Nigeria.

[17]TCN (2019). Grid System Operations: Annual Technical Report, Transmission Company of Nigeria, Osogbo, Nigeria.

[18]TCN (2020). Grid System Operations: Annual Technical Report, Transmission Company of Nigeria, Osogbo, Nigeria.

[19]TCN (2022a). Transmission Company of Nigeria, Osogbo, Nigeria Daily Report.

[20]TCN (2022b). Transmission Company of Nigeria, Osogbo, Nigeria Daily Report.

[21]Sithole, T. S. (2016). Theft and Vandalism of Electricity and Its Infrastructure – The Zimbabwean Story, African Utility Week, The Largest Global Meeting place from African Utilities, Cape Town, South Africa, 17-19 May.

[22]UNILAG (2021). University of Lagos, Akoka, Nigeria.

How to cite this article?
Cletus U. Okoye &Najeem O. Adelakun, "Analysis Of Critical Frequent Incidents in Power Sector Inimical to Rapid Industrialisation of Nigeria ",United International Journal of Engineering and Sciences (UIJES)3 (4), PP: 1-11,2022, DOI:10.53414/UIJES.2022.4.01