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Analysis of Egbin Power Generation Station in Nigeria

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ABSTRACT: This paper evaluates the performance of Egbin Power Generation Station in Nigeria for a period of five (5) years (2013–2017). The evaluation indices were annual power generating capacity, annual power reduction and gross revenue loss. From the evaluation, Egbin Generating Station was to generate 26,515,118.04MWh of electrical energy for the said period but had electrical energy reduction of 13,207,059.04MWh due to annual power outages, thus rendering the generating capacity far below the installed capacity which in turn resulted to revenue loss of $20,125,274.06.

KEY WORDS: Generating Capacity, Installed Capacity, Megawatt Hour, Performance Index.

I. INTRODUCTION

A power station also referred to as a power plant or power house and sometimes the generating station or generating plant is an industrial facility for the generation of electric power. Most power stations contain one or more generators, rotating machine that coverts mechanical energy to heat energy and from heat energy to chemical energy and finally to electric energy. The relative motion between a magnetic field and a conductor creates an electric current. The energy source harnessed to turn the generator varies widely, most power stations in the world burn fossil fuels such as coal, oil and natural gas to generate electricity. Others use nuclear power, but there is an increasing use of cleaner renewable sources such as solar, wind, wave and hydroelectric [1]. A power station is usually or several kilometers away from the cities or the load centers, because of its requisites huge land and water demand, along with several operating constraint like the waste disposal, etc. For this reason a power generating station has to not only take care of efficient generation but also the fact that the power is transmitted efficiently over the entire distance [2]. And that's why transformers and switches required to regulate transmission voltage also become an integral part of the power part. With the growth in industrialization and population, there has been a very high increase in demand for electrical energy in Nigeria.

Power generation in Nigeria is mainly from three hydro-electric power stations, steam and gas thermal stations. Most of these facilities before deregulation were being managed by PHCN, a government owned utility company that coordinated all activities of the power sector in terms of transmission, distribution or marketing and sales[3]. Egbin is a thermal power station near Lagos in order to solve perennial problem of inadequate power supply in the nation. At that time Lagos metropolis power demand had grown to about 40% of the total energy generated. Egbin is a steam power plant with 6 installed units each having a capacity of 220MW totaling installed capacity of 1320MW.

From the recent survey, there is evidence that the power station performs disappointingly knowing so well that power is the basic need for the economic development of any country, because its availability has been the most powerful driving force of economic development and social change throughout the country. Therefore, investigating the performance analysis of this power station becomes very important through the critical analysis of the performance of each machine in relation to the power generated [4].

Considering the deteriorating condition of most of our generating stations particularly in Nigeria, there is need to gear up into substantial expansion in quantity, quality and access to infrastructural services especially the electric power supply as a fundamental issue to consider for rapid and sustainable economic growth and poverty reduction in every standard.

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II. LITERATURE REVIEW

The history of electricity generation can be dated to 1896, when the Public Works Department (PWD) had 2 number of 30KW generating plants powered by 2 davey-paxman locomotive type boilers double acting engines. The 60KW power generated by these 2 numbers of 30KW generators at 1000V was distributed along marina, Lagos using ten overheat circuits of 11swg solid copper wires carried on porcelain insulators supported by iron poles, interesting the frequency of the generators as at that time was so cycles power second. When all economic activities have started to expand, this expansion posed serious expansion challenges to the limited generating capacities of the available thermal plant [5]. Thus, the need arose for the development of alternative sources of electricity which would be large enough to produce abundant and cheap electricity to meet the growing demands of electricity. In order to minimize cost and maximize electricity production, hence meeting the above requirement effectively, it was felt that there was need to transfer electricity development from the proliferated bodies to a central or national body [6]. This was mainly necessary to avoid the duplication of effect which usually resulted in energy wastage. Due to the above given requirement, authorities as in Ibadan and Kano or by the public works departments as in Warri, and Port Harcourt were merged together when Nigerian colonial government passed the ordinance No. 15 of 1950 which set up the electricity corporation of Nigeria to control the development of electricity throughout the country. Electricity Corporation of Nigeria (ECN) was given such power and functions that constituted it into an electric autonomous commercial enterprise with a monopolistic setting for instance, it was the ECN in collaboration with the federal government of Nigeria in its search for alternative sources of electricity that commissioned several studies into the electricity potential of the Nigerian major rivers [7].

In further pursuance of the much needed abundant, cheap and uninterrupted power supply, the power and functions formally conferred on ECN have been transferred to the National Electric Power Authority (NEPA) through the federal military government degree No. 24 of June 27. Thus, the National Electric Power Authority (NEPA) in Nigeria context is a federal government established electricity industry challenged with the responsibility of generation, transmission and distribution of electric energy throughout the federation [8]. Due to increased activities in industrial, commercial and domestic sectors, the electricity industry (NEPA) was experiencing a high growth of industry demand day by day. This situation led to priority being given to the expansion and improvement in the generation, transmission and distribution system of NEPA. As at December 2009, the number of power stations in Nigeria was over 16, with installed capacity of 5000 but only 2900MW available. Thus 41% of the installed capacities were available [6].

The Nigerian power sector just like the down-stream sector of the oil industry has suffered ingloriously from poor maintenance problem [9]. The power stations could not follow their maintenance and as such most of the plant units in the stations always pack up. The country is wonderful in planning but implementation is zero. It is the government that approves fund for project because the industry is not fully deregulated. When fund is needed to overhaul a power station, the managers run back to government and if they do not provide funds, the units will be abandoned. One of the power stations that is worst hit is the Egbin power station and it is the focus of this research.

Egbin is a steam power plant with 6 installed units each having a capacity of 220MW totaling installed capacity of 1320MW. According to Omokodhe [5], Egbin power station is dual fired (gas and heavy oil) with modern control, single reheat; six stages regenerative feed heating. The first unit of the power station known as SG- 3 was completed and commissioned on 11th May 1985. The remaining five units were commissioned one after the other within intervals of 6 months. Therefore between May 1985 and November 1987, the entire six units were handed over for commercial operation in the order of 3, 2, 1, 4, 5, & 6 by Marubeni/Hitachi of Japan. Since commissioning, the station has remained the single largest power station in the country – contributing between 30% - 40% of the grid required. It is also the biggest power station in West Africa sub-region. The station was commissioned on oil firing. However, Gas firing started in October 1988 [6]. The power station has been generating power far below installed capacity due to maintenance problems. These problems have affected the availability and reliability of the power plant. However, the maintenance management functions include both reactive and preventive. The preventive maintenance type in place is time based, which is not effectively carried out, not to talk of practicing the state of art predictive maintenance. The preventive maintenance procedure and intervals are not well defined. Poor plant history records make it difficult to retrieve plant history and reports of plant/equipment, especially for old plants. This has resulted to generation of power below the station installed capacity. Hence the Power generation reduction was evaluated in order to determine the outage cost due to system downtime.

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According to Emovon et al. (6), there are four major components of the steam power plant namely: boiler, turbine, condenser and generator. The demineralized water is sent to the boiler drum before lighting off the boiler and is later introduced as make up water at the hot well to augment for losses. The boiler has 9 sets of natural gas fuel burners. The natural gas is supplied to Egbin by NGC – a subsidiary of NNPC. Two burners are lighted off to pressurize steam. The boiler has a capacity of generating steam at 705 t/h. The boiler is dual firing. It uses either natural gas or High/Low Pour Fuel Oil (HPFO/LPFO) [6].

The turbine is a Tandem Compound Double Flow Reheat condensing tube type with 19 stages of expansion. The high-pressure stage is an impulse- velocity compound type, while the LP stage is the reaction type. As the steam flows through the turbine blades, perpendicular force is induced on the rotor blade causing the rotor to revolve at high speed. The superheated steam at a pressure of 12500kpa and a temperature of 538 OC turns the turbine at a speed of 3000rpm. Turbine rating is 220MW [6]. The exhaust steam at a pressure of 8.5kpa from the LP turbine is condensed to water at the condenser. The condenser is a heat exchanger which is kept under vacuum through the steam jet air ejector. Circulating water from the lagoon goes through the condenser tubes while exhaust steam falls on the surface of the tubes which condenses to water and is recycled to the Boiler drum as feed water [6]. The generator is directly coupled to the rotor of the turbine so they both turn at 3000rpm. It generates a 3- phase AC power of 220 MW at full capacity. Its windings are excited with a DC 440v. The windings are cooled with hydrogen gas at a pressure of 210kpa. The generator current is 8.87A, with output voltage of 16kv, before being stepped up to 330kv by the generator transformer for onward transmission to load centres. The unit transformer steps down the voltage from 16kv to 6.6kv for Unit auxiliaries' use [6].

III. MATERIALS AND METHOD

The materials used for the investigation of the study included the existing data in the gas turbine plant in Egbin power generating station. The recorded data needed for the analysis included Gross energy generated (MWH), Energy used in the plant (MWH), Energy sent out (MWH), Fuel gas consumed (mmscf), Running hours (hrs), Equipment availability, Total number of forced and planned outages, Conditions responsible for forced outages , The unit heat rate (KJ/KWH), The unit net heat rate (K/KWH), Generator efficiency, Each generator, unit, installed capacity (mw), Generated capacity (MW), Plant energy balance diagram and Unit cost of power generator (kwh/w). Most of the data were collected from Proceedings of the World Congress on Engineering and Computer Science.

Since the study was geared towards providing a sufficient energy performance analysis of Egbin thermal power plant certain mathematical equations were formulated relying strongly on performance equations used in power plant analysis. Essentially, energy plays a vital role in country's economic standing and development, therefore it is important to adopt the application of the reliability-indices in accessing the performance evaluation via Performance indicators measurement (P_T), Annual power outage cost (P_A) for 'k' number of Turbine, Annual power generation (P_R) reduction of 'L' number of turbine, Annual power generation (P_r) for individual turbine and Annual power factor for ('P') number of turbine. Performance indicators were developed to evaluate the outage cost for the power station.

If performance indicator becomes:

$$P_T = \sum_{i=1}^{n} P_{Al} \quad (1)$$

Where

P_T = Total power outage cost due to system downtime for n number of years

P_A = Annual power outage cost for K number of Turbine

But $P_A = P_R \times P_F \times C_U$ (2)

Similarly,

$$P_R = \sum_{J=1}^{M} P_r \quad (3)$$

$$P_r = P_{IC} - P_{GC} \quad (4)$$

Where

P_R = Annual power generation reduction for K number of turbine

P_r = Annual power generation reduction for individual turbine

P_{IC} = Annual installed capacity in MWH for individual turbine

P_{GC} = Annual generated capacity in MWH for individual turbine

Evidently, the annual power factor, P_F for K number of turbine, can be represented as:

$$P_F = \frac{\sum G_c}{\sum I_c} \quad (5)$$

Where

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P_F = Annual power factor for K number of turbine
G_c = Generated capacity in MW for individual turbine
I_c = Installed capacity in MW for individual turbine
C_U = Unit cost of power
Assuming C_U = ₦500/MWH at $1.43

Table 1 Year 2013 Power Generation Parameters

Unit	Installed Capacity (MW)	Installed Capacity (MWH)	Generated Capacity (MW)	Generated Capacity (MWH)
SG-1	220	1,927,200	192.91	1689891.6
SG-2	220	1,927,200	172.5	1511100
SG-3	220	1,927,200	164.52	1441195.2
SG-4	220	1,927,200	0	0
SG-5	220	1,927,200	160.07	1402213.2
SG-6	220	1,927,200	0	0
Total	**1,320**	**11,563,200**	**690**	**6044400**

Table 2 Year 2014 Power Generation Parameters

Unit	Installed Capacity (MW)	Installed Capacity (MWH)	Generated Capacity (MW)	Generated Capacity (MWH)
SG-1	220	1,927,200	190.44	1668254.4
SG-2	220	1,927,200	170.62	1494631.2
SG-3	220	1,927,200	161.78	1417192.8
SG-4	220	1,927,200	0	0
SG-5	220	1,927,200	157	1375320
SG-6	220	1,927,200	0	0
Total	**1,320**	**11,563,200**	**679.84**	**5955398.4**

Table 3 Year 2015 Power Generation Parameters

Unit	Installed Capacity (MW)	Installed Capacity (MWH)	Generated Capacity (MW)	Generated Capacity (MWH)
SG-1	220	1,927,200	187.83	1645390.8
SG-2	220	1,927,200	163.19	1429544.4
SG-3	220	1,927,200	158.78	1390912.8
SG-4	220	1,927,200	0	0
SG-5	220	1,927,200	155.2	1359552
SG-6	220	1,927,200	0	0
Total	**1,320**	**11,563,200**	**665**	**5825400**

Table 4 Year 2016 Power Generation Parameters

Unit	Installed Capacity (MW)	Installed Capacity (MWH)	Generated Capacity (MW)	Generated Capacity (MWH)
SG-1	220	1,927,200	185.85	1628046
SG-2	220	1,927,200	162.52	14061552
SG-3	220	1,927,200	0	0
SG-4	220	1,927,200	0	0
SG-5	220	1,927,200	153.63	1345798.8
SG-6	220	1,927,200	0	0
Total	**1,320**	**111,563,200**	**500**	**4380000**

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Table 5 Year 2017 Power Generation Parameters

Unit	Installed Capacity (MW)	Installed Capacity (MWH)	Generated Capacity (MW)	Generated Capacity (MWH)
SG-1	220	1,927,200	182.85	1601766
SG-2	220	1,927,200	158.63	1389598.8
SG-3	220	1,927,200	0	0
SG-4	220	1,927,200	0	0
SG-5	220	1,927,200	150.52	1318555.2
SG-6	220	1,927,200	0	0
Total	**1,320**	**11,563,200**	**492**	**4,309,920**

Analysis 1-Scenario1: From table 1, determination of power factor (P_F) where $P_{F_8} = \frac{\sum G_c}{\sum I_c}$

$\sum G_c = 690$
$\sum I_c = 1320$
$P_{F_1} = \frac{690}{1320}$ and $P_{F_8} = 0.5227$

Scenario 2: Determination of annual power reduction (P_r) for individual turbines is given as:

$$P_r = P_{I_C} - P_{G_C}$$

Then $P_{r_1} = 1927200 - 1689891.6 = 237308.4$
Similarly, $P_{r_2} = 1927200 - 1511100 = 416100$, $P_{r_3} = 1927200 - 1441195.2 = 486004.8$,
$P_{r_4} = 1927200 - 0.00 = 1927200$, $P_{r_5} = 1927200 - 1402213.2 = 524986.8$ and $P_{r_6} = 1927200 - 0.00 = 1927200$

Scenario 3: Determination of annual power reduction for K number of turbines

$$P_R = \sum_{i=1}^{n=6} P_r = \left(P_{r_1} + P_{r_2} + P_{r_3} + P_{r_4} + P_{r_5} + P_{r_6}\right)$$

$$P_R = 237308.4 + 416100 + 486004.8 + 1927200 + 524986.8 + 1927200 = 5518800$$

Scenario 4: Determination of annual power outage cost (P_A) for K number of turbines in the year 2013
If $P_A = P_R \times P_F \times C_u$ where $P_R = 5518800$, $P_{F_8} = 0.5227$ and $C_u =$ ₦$500\ /MWH$ at \$1.43
$P_{A_8} = 5518800 \times 0.5227 \times 500 =$ ₦1442338380 = \$4,120,966.8

Analysis 2-Scenario 1: Calculation of annual power outage cost (P_A) for the year 2014 using table 2
$\sum G_c = 697.84$, $\sum I_c = 1320$, $P_{F_9} = \frac{679.84}{1320}$ and $P_{F_9} = 0.5150$

Scenario 2: If $P_r = P_{I_C} - P_{G_C}$

$P_{r_1} = 1927200 - 1668254.4 = 258945.6, P_{r_2} = 1927200 - 1494631.2 = 432568.8$
$P_{r_3} = 1927200 - 1417192.8 = 5100007.2$, $P_{r_4} = 1927200 - 0.00 = 1927200$
$P_{r_5} = 1927200 - 1375320 = 551880$ and $P_{r_6} = 1927200 - 0.00 = 1927200$

Scenario 3: $P_R = \sum_{i=1}^{n=6} P_r = \left(P_{r_1} + P_{r_2} + P_{r_3} + P_{r_4} + P_{r_5} + P_{r_6}\right)$

$$P_R = 258945.6 + 432565.8 + 5100007.2 + 1927200 + 551880 + 1927200 = 5607801.6$$

Scenario 4: Determination of annual power outage cost (P_A) for K number of turbines in the year 2014
$P_A = P_R \times P_F \times C_u$ where $P_R = 5607801.6$, $P_{F_9} = 05150$, $C_u =$ ₦$500/MWH$ at \$1.43
$P_{A_9} = 5607801.6 \times 0.5150 \times 500$, $P_R =$ ₦1444008912 = \$4,125,739,75

Analysis 3-Scenario 1: Calculation of annual power outage cost (P_A) for the year 2015 using Table 3
$\sum G_c = 665$, $\sum I_c = 1320$, $P_{F_3} = \frac{665}{1320}$ and $P_{F_3} = 0.5038$

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Scenario 2: If $P_r = P_{I_C} - P_{G_C}$

$P_{r_1} = 1927200 - 1645390.8 = 281809.2, P_{r_2} = 1927200 - 1429544.4 = 497655.6$

$P_{r_3} = 1927200 - 1390912.8 = 536287.2, P_{r_4} = 1927200 - 0.00 = 1927200$

$P_{r_5} = 1927200 - 1359552 = 567648$ and $P_{r_6} = 1927200 - 0.00 = 1927200$

Scenario 3: $P_R = \sum_{i=1}^{n=6} P_r = \left(P_{r_1} + P_{r_2} + P_{r_3} + P_{r_4} + P_{r_5} + P_{r_6}\right)$

$P_R = 281809.2 + 497655.6 + 536287.2 + 1927200 + 567648 + 1927200 = 5737800$

Scenario 4: Determination of annual power outage cost (P_A) for K number of turbines in the year 2015

$P_A = P_R \times P_F \times C_u$ where $P_R = 5737800$, $P_{F_{10}} = 0.5038$, $C_u = ₦500/MWH$ at $1.43

$P_{A_{10}} = 5737800 \times 0.5038 \times 500 = ₦1445351820$ = $4,129,576.63

Analysis 4: Determination of the power outage cost due to system downtime for N number of years

If $P_{A_{Total}} = \sum_{i=1}^{n=5} P_{A_1}$

$$P_{A_{Total}} = P_{A_1} + P_{A_2} + P_{A_3} + P_{A_4} + P_{A_5}$$

$= (1687560706 + 1414802433 + 1474420194 + 1431430384 + 1432401018)$

$= ₦17359223800$ = $20,597,782.29

Analysis 5: Determination of Cost for ideal installed generated capacity of N number of years

Since P_{IC} is the same for six number of turbines therefore

$P_{A_{IC}} = P_{IC} \times 6 \times Cu = 1927200 \times 6 \times Cu = 11{,}563{,}200 \times 500$ = ₦5,781,600,000

$$P_{AIC_{Total}} = \left(\sum_{i-1}^{n=5} P_{AIC}\right)$$

$P_{A_{Total}} = P_{AIC} \times 5$ = ₦16,518,857.14 x 12 = $198,226,285.7

Analysis 6: Determination of the deviation in cost between installed generated capacity $P_{A_{IC}}$ and the power outage cost $P_{A_{Total}}$

$P_{Available} = P_{A_{IC}} - P_{A_{Total}}$ = $198,226,285.7 – 49,597,782.8 = $148,628,502.9

IV. RESULTS AND DISCUSSION

The results are presented in tables 6, 7 and 8 respectively. Similarly, figures 1 and 2 display the results as clear as possible. The study considered a period of five years (5) under review. This work critically looked at annual power reduction for the individual turbine (Pr), the annual power reduction for the six (6) number of turbines which account for (PR) and the annual power outage cost (PA).

The results in table 8 and figure 2 showed that in the past five years there was power reduction of 1734480MWH of electricity from the year 2013 to 2017. The loss of revenue in dollars was calculated based on the power generation reduction. The results revealed that the total outage cost due to power generation reduction is $49,597,782.48 from 2013 to 2017.

Table 6 Performance Evaluation of Egbin Power Station

S/N	Power factor (pf)	Annual power reduction for individual turbines (Pr)	Annual power reduction for K number of turbines (MWh) (PR)	Annual power outage cost ($) (PA)
1.	Pf1 = 0.5227	Pr_1 = 237308.4 Pr_2 = 416100 Pr_3 = 486004.8 Pr_4 = 1927200 Pr_5 = 524986.8 Pr_6 = 1927200	PR_8 = 5518800	PA1 = 4120966.8

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2.	Pf2 = 0.5150	Pr_1 =237308.4 Pr_2 = 416100 Pr_3 = 486004.8 Pr_4 = 1927200 Pr_5 = 524986.8 Pr_6 = 1927200	PR_9 = 5607801.6	PA2 = 4125739.75
3.	Pf3 = 0.5038	Pr_1 = 281809.2 Pr_2 = 497655.6 Pr_3 = 536289.2 Pr_4 = 1927200 Pr_5 = 567648 Pr_6 = 1927200	PR_{10} = 5737800	PA3 = 4129576.63
4.	Pf4 = 0.3788	Pr_1 = 299154 Pr_2 = 521644.8 Pr_3 = 1927200 Pr_4 = 1927200 Pr_5 = 581401.2 Pr_6 = 1927200	PR_{11} = 7183200	PA4 = 3887137.37
5.	Pf5 = 0.3727	Pr_1 = 325434 Pr_2 = 537601.2 Pr_3 = 1927200 Pr_4 = 1927200 Pr_5 = 581401.2 Pr_6 = 1927200	PR_{11} = 7253280	PA5 = 3861853.51

Table 7 Evaluation of Annual Power Reduction (PR) and Annual Outage Cost (PA)

S/N	Years	Annual power reduction for k number of turbines (MWh) $\sum = (PR)$	Annual power outage cost ($) (PA)
1.	2013	5518800.00	4120966.80
2.	2014	5607801.60	4125739.75
3.	2015	5737800.00	4129576.63
4.	2016	7183200.00	3887137.37
5.	2017	7253280.00	3861853.51

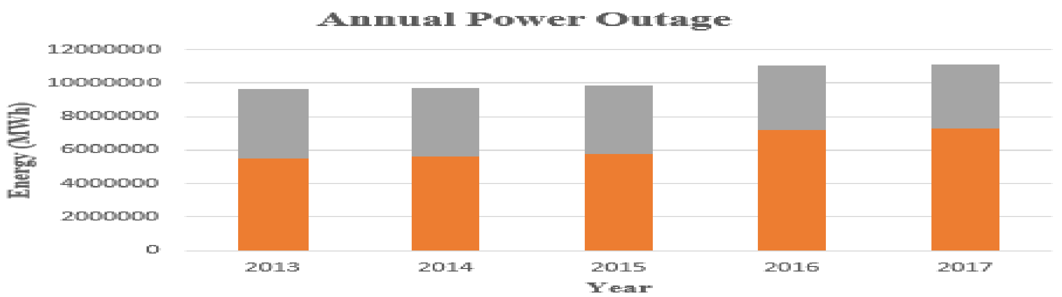

Figure 1 Composite Bar Chart showing the Annual Power Reduction and Power Outage Cost

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Table 8 Annual Power Outage Cost ($) with respect to year

Year	Annual Power Outage Cost ($)
2013	4120966.8
2014	4125739.75
2015	4129576.63
2016	3887137.37
2017	3861853.51

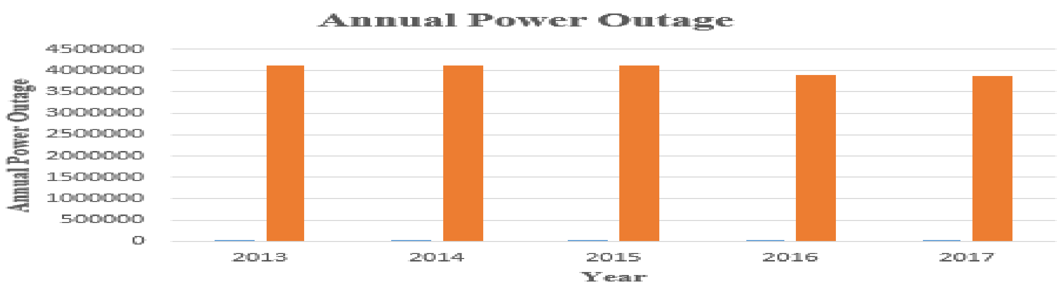


Figure 2 Shows Annual Power Outage Costs with Respective Year

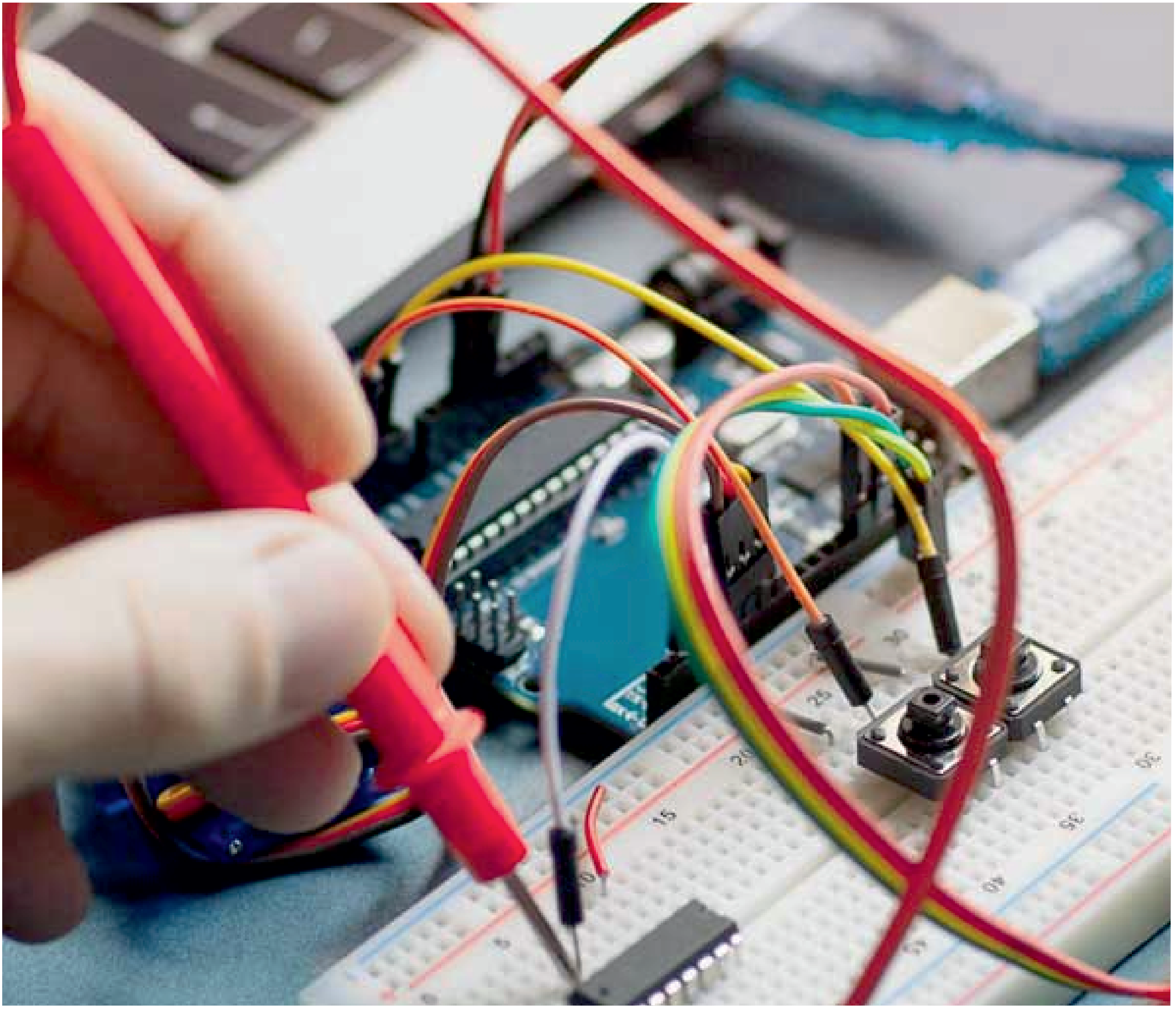
V. CONCLUSION

Performance analysis of Egbin thermal power station has been carried out with specific emphasis on the annual power generation reduction and the loss of revenue which is the annual power outage cost. For the five years under review (2013 to 2017), the study revealed that the plant performed below average capacity.

From the available records of Egbin thermal plant, there is no proper preventive maintenance programme in place. This and many other factors have made Egbin Power Station to generate power far below installed capacity. The analysis carried out revealed that the station was expected to generate a total of 26,515,118.24MWh of electricity from the year 2013 to 2017. However, there was power reduction of 13,207,059.20MWh. Further investigation which is the main objective of this paper revealed that the amount of power reduction led to a revenue loss of $20,125,274.06.

REFERENCES

[1] P. S. Utgikar, S. P. Dubey, R. P. J. Prasda, “Thermoeconomic Analysis of Gas Turbine Cogeneration Plant- A Case Study, Part A,” Journal of Power and Energy, (IMechE), 2010.
[2] P. O. Ademusuru, M. B. Ogunedo, V. I. Okoro, “Performance Evaluation of Gas Turbine Plant in Niger Delta Region of Nigeria,” 2017.
[3] H. A. Isam, “Energy and Energy Analysis of a Steam Power in Jordan,” Journal of Applied Thermal Engineering, pp. 124-128, 2009.
[4] O. P. Agboola, “Independent Power Producer (IPP) Participation: Solution to Nigeria Power Generation Problem,” Proceedings of World Congress on Engineering, vol. 3, pp. 6-8, July 2012.
[5] G. E. Omokodhe, “Egbin Electric Power Business Unit Nigeria, Private Communication,” Feb. 2011.
[6] I. Emovon, B. Kareem, M. K. Adeyeri, “Performance Evaluation of Egbin Thermal Power Station, Nigeria,” Proceedings of World Congress on Engineering and Computer Science, 2011.
[7] O. Usifo, S. Omoruyi, F. Igbinovia, P. Otasowie, “Electrical Power Sector Energy Reform Prospects in Nigeria,” Journal of Engineering Management, vol. 8, no. 3, pp. 1-4, 2007.
[8] O. I. Okoro, T. C. Madueme, “Solar Energy Investments in a Developing Economy,” Renewable Energy, vol. 29, pp. 1599-1610, 2004.
[9] M. Ayankola, “Revisiting the Power Sector and Poor Maintenance Culture,” Punch News Paper, 21st October 2008.



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