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Comparative Analysis of Electric Power Generation and Demand Forecast in Nigeria

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ABSTRACT : *This paper analyzes the statistics of power generation and power transmitted in Nigeria over the period spanning from 23rd February to 8th June 2015. The data used for the analysis were collected from the periodic update of power statistics on the official website of the Federal Ministry of Power in Nigeria. The results showed that the highest peak generation occurred on the 16th of March when the value stood at 4,115.10 MW. The maximum average power generated and average power sent out over the same period occurred on the 23rd of February when the values were 3,699.23 MWH/H and 3,623.11 MWH/H respectively. Although the average efficiency of transmission system over the period under review was 97.76%, the best efficiency figure recorded for the system was 97.94 % which occurred on the 23rd February. The overall averages for the peak generation, energy generated and energy sent out were 3,639.82 MW, 3254.52 MWH/H and 3181.83 MWH/H respectively. These results also show that an average of about 72.69 MWH/H of energy was being lost between the generation and transmission subsystems. These figures clearly show that power generation in the country is still a far outcry from the peak demand forecast for the country which is 12,800 MW as projected by the Federal Ministry of Power.*

Keywords - *peak generation, energy generated, energy sent out, efficiency*

I. INTRODUCTION

The inadequate generation of power, poor transmission and distribution infrastructure among other problems have remained a recurring decimal in the Nigeria's power sector resulting in huge adverse economic consequences [1]. Although in recent past, the Federal Government of Nigeria has taken several measures in order to tackle these teething problems and ensure that sufficient power is made available to drive the economy of the nation. However, the results these efforts particularly the huge investments to the tune of billions of US dollars so far gulped by the power sector are yet to be fully harnessed by the majority of Nigerians. In acknowledging the fact that adequate and reliable energy supply has become the bedrock of economic development and enhanced productivity anywhere in the world, it is obvious that Nigeria's power supply as at June 2015 is grossly inadequate having only a meager peak generation of about 3,691MW for a population of about 180 million people (see Table I).

In its bid to address the problem of low power generation in the country, the Federal Government in 2004 initiated the National Integrated Power Projects (NIPP). The major aim of this project (NIPP) was to boost the generation capacity of the nation and at the same time end the environmental challenge of gas flaring in the Niger delta region of the country [2, 3]. It must be noted however that while substantial progress have been recorded in terms of building power plants under NIPP, issues of gas supply and disruption of supply still greatly affect the overall generation and distribution of power in the country [3].

II. RECENT TREND INPOWER GENERATION IN NIGERIA

Having noted the inadequacy in power generation in Nigeria, it is necessary also to capture the recent developments in the power sector with respect to the tangible efforts being made the federal government to increase the generation capacity in the country. Table I shows the Completed Generation Projects spanning the period from January 2011 to December 2012 [4]. The table shows that the incremental additions to the generation capacity resulted in a cumulative increase in generation of 1687.5 MW. This obviously impacted positively on the power system as reflected in the peak generation of 4517.60 MW recorded in December 2012 [5]. Incidentally this figure was the highest peak generation value recorded between December 2012 and June 2015.

Table I: Completed Generation Projects from January 2011 to December 2012

S/No	Power Station	Date	MW	Cumulative MW
1	Olorunsogo	Jan-11	112.5	112.5
2	Olorunsogo	Feb-11	112.5	225.0
3	Olorunsogo	May-11	112.5	337.5
4	Sapele	Aug-11	112.5	450.0
5	Olorunsogo	Nov-11	112.5	562.5
6	Sapele	Feb-12	112.5	675.0
7	Alaoji	Apr-12	112.5	787.5
8	Omotosho	Apr-12	112.5	900.0
9	Olorunsogo	Jul-12	112.5	1,012.5
10	Sapele	Aug-12	112.5	1,125.0
11	Omotosho	Aug-12	112.5	1,237.5
12	Alaoji	Sep-12	112.5	1,350.0
13	Omotosho	Oct-12	112.5	1,462.5
14	Sapele	Oct-12	112.5	1,575.0
15	**Omotosho**	**Dec-12**	**112.5**	1,687.5

Source: Federal Ministry of Power

It is therefore obvious that this significant progress achieved was not sustained by the managers of the power sector. If the same amount of generation capacity was continually added to the power system over the period from January 2013 to October 2014, the overall generation capacity would have maintained a steady increase and would likely hit close to 8000 MW by the end of 2016.

III. ANALYSIS OF CURRENT NIGERIA POWER STATISTICS

The summary of the data collected over the period under review is depicted in table II.

Table II: Summary of Nigeria's Power Statistics for the Period under Review (Feb – June 2015)

POWER STATISTICS									
Date	Peak Generation (MW)	Energy Generated (MW H/H)	Energy Sent Out (MW H/H)	Power Lost (MW H/H)	% loss	Efficiency %	Difference b/w peak generation and energy generated (MW)	Peak Demand Forecast (MW)	Highest Peak Generated since Dec 2012 (MW)
23/02/15	3,866.80	3,699.23	3,623.11	76.12	2.06	97.94	167.57	12,800.00	4,517.60
25/02/15	3,224.80	3,131.08	3,063.23	67.85	2.17	97.83	93.72	12,800.00	4,517.60
03/03/15	3,730.10	3,479.55	3,406.00	73.55	2.11	97.89	250.55	12,800.00	4,517.60
08/03/15	3,941.10	3,575.85	3,505.00	70.85	1.98	98.02	365.25	12,800.00	4,517.60
11/03/15	3,770.30	2,747.45	2,676.54	70.91	2.58	97.42	1,022.85	12,800.00	4,517.60
15/03/15	4,016.80	3,556.91	3,477.65	79.26	2.23	97.77	459.89	12,800.00	4,517.60
16/03/15	4,115.10	3,680.63	3,602.08	78.55	2.13	97.87	434.47	12,800.00	4,517.60
31/03/15	4,011.40	3,540.42	3,465.36	75.06	2.12	97.88	470.98	12,800.00	4,517.60
05/04/15	3,885.60	3,550.21	3,467.32	82.89	2.33	97.67	335.39	12,800.00	4,517.60
12/04/15	3,263.60	3,060.37	2,988.72	71.65	2.34	97.66	203.23	12,800.00	4,517.60
26/04/15	3,267.10	2,896.91	2,834.30	62.61	2.16	97.84	370.19	12,800.00	4,517.60
05/05/15	3,114.60	2,880.72	2,817.05	63.67	2.21	97.79	233.88	12,800.00	4,517.60
11/05/15	3,413.10	2,585.80	2,524.37	61.43	2.38	97.62	827.30	12,800.00	4,517.60
31/05/15	3,388.50	3,163.41	3,085.77	77.64	2.45	97.55	225.09	12,800.00	4,517.60
02/06/15	3,537.20	3,164.61	3,091.00	73.61	2.33	97.67	372.59	12,800.00	4,517.60
08/06/15	3691.00	3359.24	3281.84	77.40	2.30	97.70	331.76	12,800.00	4,517.60
Average	3,639.82	3,254.52	3,181.83	72.69	2.24	97.76	385.29	12,800.00	4,517.60

The data in Table II were used to generate several plots which were used to evaluate the performance of the Nigerian power sector in terms of how much power was generated and how much was distributed to the consumers.

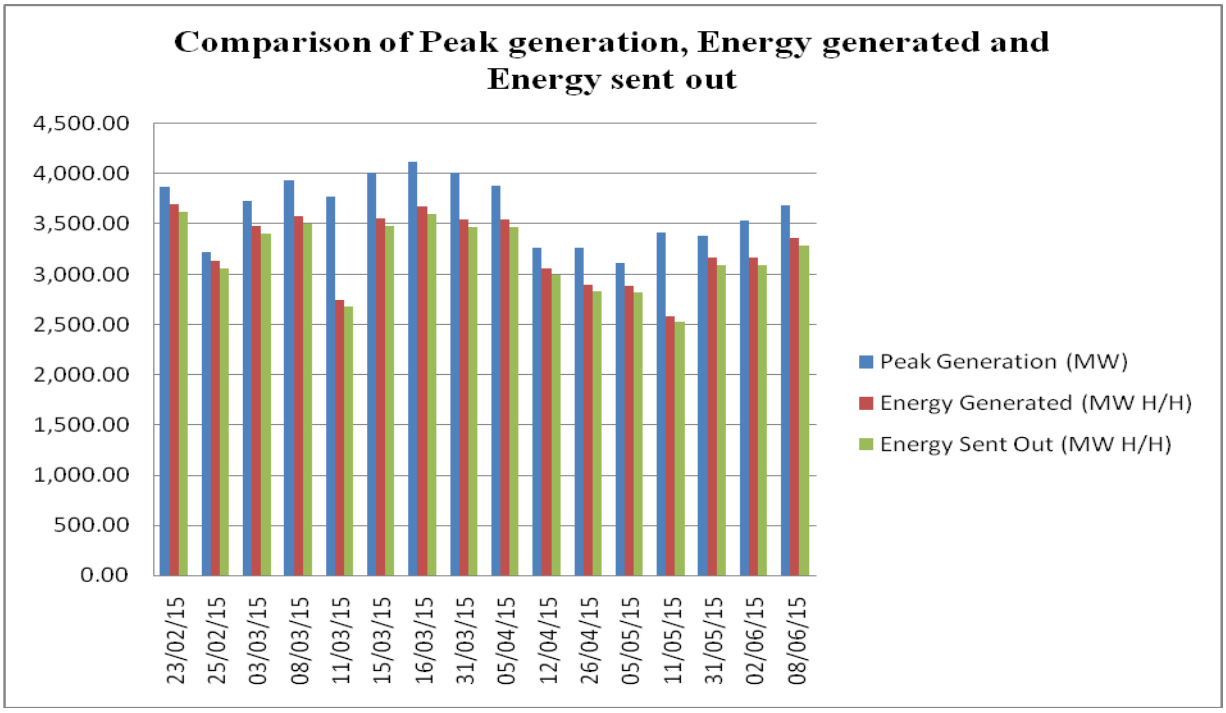

Figure 1: Comparison of Peak generation, Energy generation and Energy sent out

Fig. 1 is a chart showing the peak generation, energy generated and energy sent out over the period under review. This chart clearly shows that throughout the period under consideration, there is always a significant shortfall between the peak generation and average energy generated (energy generated) and also between average energy generated and average energy transmitted (energy sent out) to consumers. The implication of this result is that although the total generation is grossly insufficient to supply the customers, the power system cannot maintain the peak energy generation for a long period of time. Also the consistent shortfall between energy generated and energy sent out throughout the period also shows that the transmission network is always not able to evacuate all the power generated at any point in time. From the chart, it can be seen that the best performance of the system was recorded on 25th February 2015 when the difference between the peak generation and the energy generated was the least recorded with a shortfall of 93.72MW.

Fig. 2 shows the variation of peak generation, energy generated and energy sent out over the period under review. These plots clearly show that throughout the period, the power system continued to experience fluctuations in the amount of energy generated and transmitted. For example between 25th of February and 16th of March fairly significant increase in peak generation was recorded. However, the values started falling immediately after 16th of March and eventually got to its lowest over the period on the 5th of May

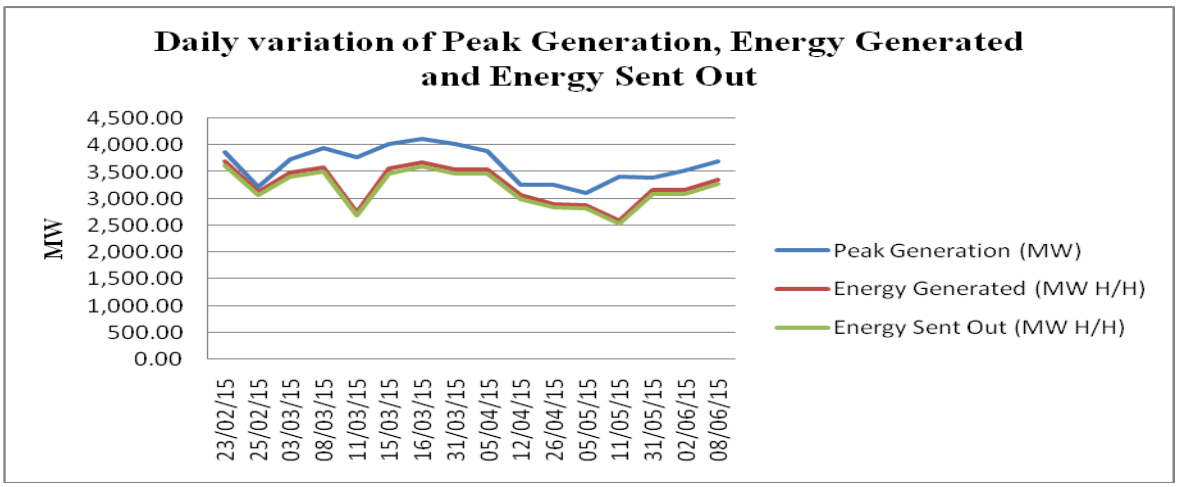

Figure 2: Variation of power generation and transmission from 23rd Feb to 8th June 2015

Another noticeable fact from the graphs in Fig. 2 is the persistent gap between the peak generation and the average generation for each date throughout the period. This information is better illustrated in Fig. 3 which shows a chart of the daily difference between the peak generation and the energy generated.

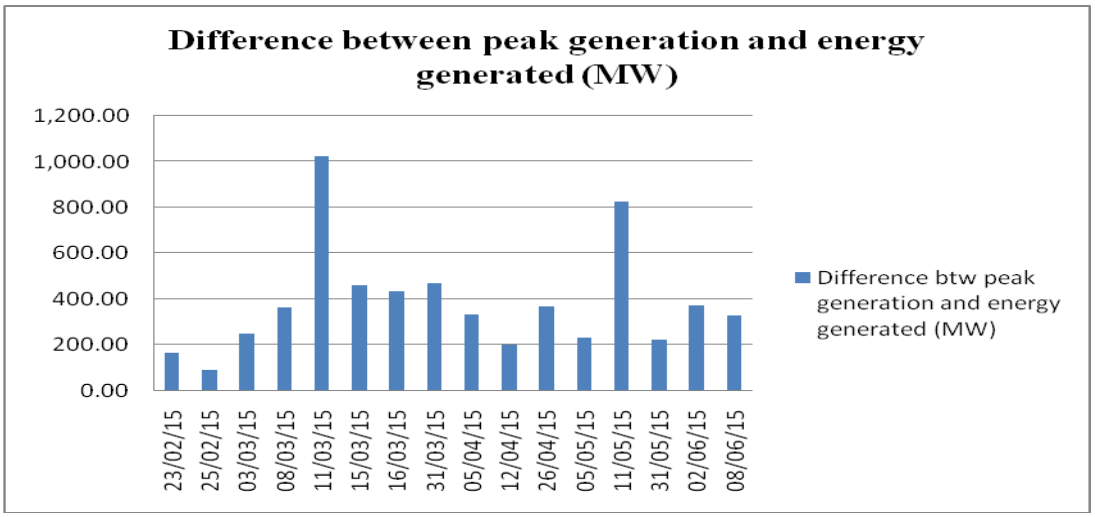

Figure 3: Difference between peak generation and energy generated

This chart clearly shows that the Nigerian power system so far cannot boast of maintaining its daily average energy generation very close to the peak generation. The closest difference was recorded on 25th February (93.72 MW) while the largest difference was recorded on 11th March (1022.85 MW). The average difference for the entire period was found to be 385.29 MW. The implication is that if the system was able to maintain daily power generation very close to its peak value for the day, an additional 376.66 MW of power per day would have been available over the period under review with 97.76% average efficiency.

A chart of the daily power lost between generation and transmission is shown in Fig. 4. The chart shows that between 61.43 MW and 82.89 MW of power were usually lost on daily basis throughout the period. The average value over the period was found to be 72.69 MW. Although the calculated average efficiency of the system (i.e. 97.76%) sounds good enough, the 2.24% lost which amounted to 72.69MW is quite significant suggesting that there is still need to improve the transmission network of the system.

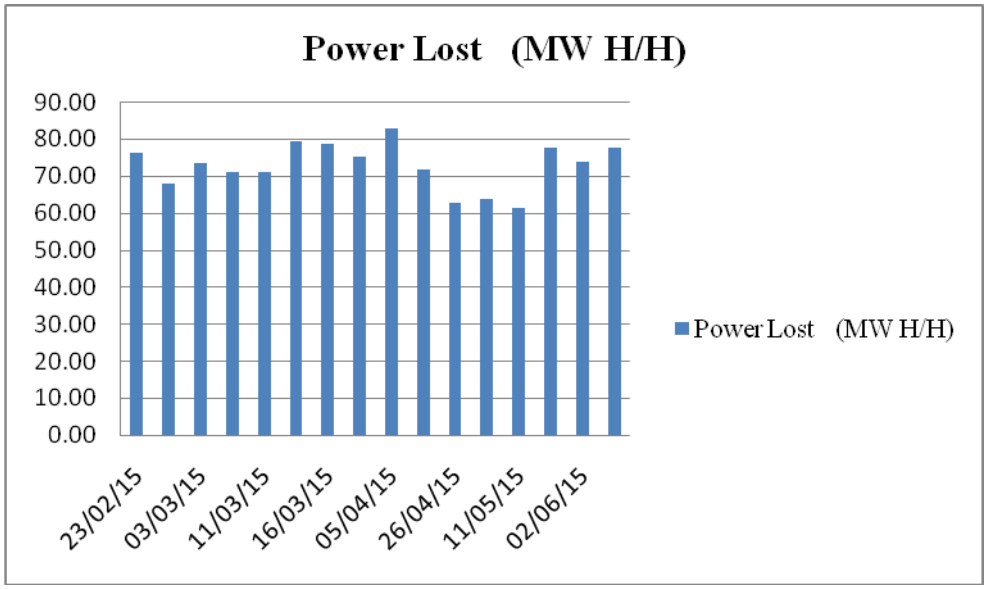

Figure 4: Power lost between generation and transmission

According to the Federal Ministry of Power, the highest peak ever generated since the year 2012 was 4517.60 MW while demand forecast till date stands at 12800MW [3]. A comparison of the peak generation over

the period under review with the quoted figure for highest peak and demand forecast is presented in Fig. 5. From the graph, it can be seen that after about two and half years of reaching highest peak of 4517.60 MW, the closest the peak generation could get to this figure was 4115.10MW (a difference of 402.5MW) which occurred on 16th March 2015. Considering the calculated average of peak generation (3639.82MW) over the period under review, it is obvious that no significant progress was made in terms of the overall amount of power available to the consumers over the past two and half years.

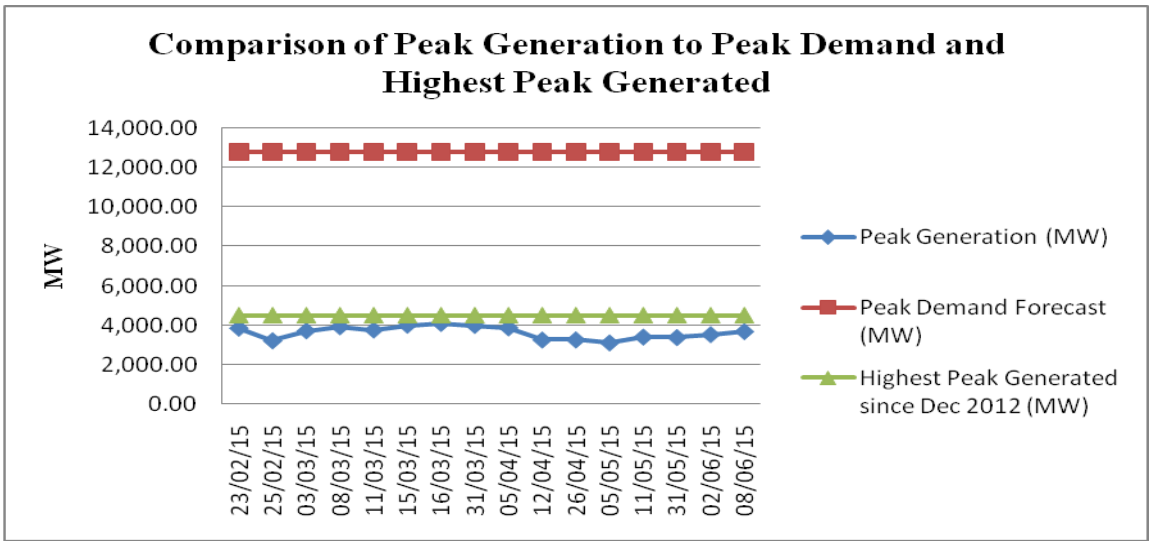

Figure 5: Comparison of the Peak Generation to Peak Demand Forecast

Going forward, in order to achieve the projected demand forecast in the nearest future, the average peak generation during the period under review must be increased by about 9160.18 MW. This figure certainly is a huge challenge to overcome.

IV. CONCLUSION

An analysis of the Nigeria's power statistics for the period spanning through 23rd February to 8th June 2015 was presented in this work. Major observations made based on the analysis show that there is persistent fluctuating trend in peak generation, energy generated and energy sent out for most part of the period under review. The study carried out also shows that there is need to improve the transmission network in order to ensure that the bulk of energy generated is completely evacuated to the consumers. Therefore, for the demand forecast to be met, Government should for once develop the political will to fully and religiously implement the National Integrated Power Projects [6]. It is obvious and understandable that lack of political will and policy inconsistency by several successive governments and power generating companies are responsible for the non-attainment of the set demand forecast.

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