

DYNAMIC MODELLING OF LOAD DEMAND FOR EFFICIENT POWER DISPATCH IN UMUAHIA METROPOLIS

Obi, P. I., Amako, A. E., Okorie, S. and Emeghara, M. C.

Department of Electrical/Electronic Engineering,
Michael Okpara University of Agriculture, Umudike, Abia State.

Email: patndyobi@gmail.com, ejikeamako@yahoo.com

Abstract

Despite Nigeria's key position in Africa, electric power crisis and frequent outages in the Nation have degenerated to a major acute problem. These problems are associated with inadequate generation, insufficient and unreliable evacuation/transmission of same. As a result, dispatch centers and distribution companies find it difficult to optimally dispatch the limited energy particularly to economic viable consumers considering the fact that the bedrock of every industry is primarily to survive extinction through revenue collection. However, this research is focused on presenting an efficient and economic power dispatch technique in Umuahia Metropolis. The materials used in this research include load data from eight EEDC Injection Substations in Umuahia Metropolis, MATLAB Simulation Software and Microsoft Excel. Also, the methods adopted are statistical method of interpolation and Mann-Whitney's test for data collection and evaluation. Load demand (daily, monthly and yearly) equations were used for data analysis and interpretation. Also, an economic load dispatch technique was developed using Microsoft Excel. This technique design has the ability to distribute available power (energy allocation) with respect to economically viable consumers. However, if these results are carefully implemented, it will afford EEDC the opportunity to serve their economically viable customers better and will also motivate other non-economic viable customers to improve. Thus, EEDC's general revenue collection will increase, since the main aim of every business owner is primarily to increase productivity and maximize profit (Optimization).

Key words: Load Demand, Optimization, Load Dispatch, Injection Substation

1.0 INTRODUCTION:

In the Nigerian electric power system, electric energy generation has been a bit balanced unlike in the very near past where more emphases were in hydro plants (Iloh and Obi, 2016). The intention to generate electrical energy has not been matched with a proportional interest to transmit same since there is lack of serious attention in building new transmission lines and substations. In addition there has been additional pressure on the system due to monthly growth in demand of electricity. The effect of such monthly increase in demand has been pervasive and increasing problems associated with maintaining an acceptable voltage profile. Despite the unbundling of Power holding Company of Nigeria (PHCN) into eighteen (18) distinct companies comprising eleven (11) electricity distribution companies, six(6) generation companies and one (1) transmission company (www.power.ng, 2016), all aimed at providing reliable and affordable electricity to the consumers, there is serious need for accurate models of electric power load forecasting for the operation and planning of the Nigerian power system. Power system planning is done to ensure adequate and reliable power supply which now is the ultimate in Nigeria to meet the estimated load demand of 12000MW (www.power.ng, 2016) in near and distance future. More so, electricity usage is no more primarily for house lighting but for other serious services that are very instrumental to economic growth of Nations. Planning therefore is very necessary and must be done at minimum cost possible while maintaining satisfactory and reliable supply. This will also help in meeting the target load demand of 12,800MW in Nigeria Power sector (Obi, 2016) by the year 2020. The privatization of

generation company (GENCOs) and distribution company (DISCOs) of Nigerian power sector has triggered total structural and organizational changes in the Nigerian power industry (Papaefstratiou, 2019)) with the restructuring process taking place at the GENCO's and DISCO's level, the power industry is being positioned for better services to the Nigerian populace. This includes a plan to boost system generation capacity to meet the prevailing and forecast demand which will not be effective without economic dispatch model. Amongst these laid down plans, the DISCOs are still running on losses even after years of privatization and the problem of rejection of allotted power by Discos are now in vogue. According to (Papaefstratiou, 2019)), the 11 DISCOs across the country are reeling under huge debts, following poor revenue collection emanating from lines losses and the fact that most electricity consumers are willing to use power but never willing to pay. Effective load shifting between transmission substations at all levels across extensive retail networks during periods of abnormal peak load demand requires accurate short-term forecasts (Taylor, 2008). While becoming an important instrument of economic change, the growth of power generation activity itself is totally dependent upon the overall economic system. However, for any shortfall in the availability of electric power there is a corresponding inhibiting effect on the economic growth (Obi et al, 2016), whereas excess power generation is a drain in the limited available resource which could be gainfully used in other sectors of the economy. It is, therefore, essential to dynamically model load demand for efficient power dispatch in most urban cities in Nigeria in order to enhance optimal generation and economic distribution. Additional, in electrical power systems, dynamically modeled load demand for efficient power dispatch based on hourly load demand and energy requirements studies are strong tools needed in the decision making of unit commitment for optimal generation and economic dispatch because electricity generation, transmission, as well as distribution are of a great financial liability to any Nation. In developing countries like Nigeria, provision of electric power consumes a large part in the country's annual budget (Ikarach and Adegoke, 2015). Accurate dynamically modeled load demand for efficient power dispatch and adequate knowledge of average hourly load demand of any given environment provides system dispatchers with timely information to plan and operate the system economically and reliably.

1.1 Rejection Of Power By Distribution Company (DISCOS)

On account of the inability by the distribution companies to strengthen their networks to evacuate electricity, power generation was limited to an average of 3,847.8MW in the first 104 days of 2018 (Alike, 2019). This practice of power rejection by Discos started sometime in 2017 precisely between August 27 and September 3, 2017 when the Discos rejected a total of 22,277.53 MW of power produced by power generation companies for distribution (Omoragbon, 2019) while the transmission company was willing to transmit. This practice has caused a lot of harm to Nigerian economy and will continue to if not checked. Some of the likely consequences are worsen epileptic power supply, economic loss to Nigeria, Uncontrolled load shedding, bad news for jobs, investment, rise in food prices, (<https://www.fin24.com/economy/eskom/load-shedding-bad-news-for-jobs-investment-food-prices-201902112>). On account of the inability by distribution companies to strengthen their network to evacuate electricity, power generation was limited to an average of 3,847 MW (Alike, 2019). A close look at table 1 shows the amount of rejected power by discos within only four (4) days.

Table 1: Power Rejected in only Four days by Discos

S/N	Distribution Company	Quantity of Power Rejected	% of Power Rejected of Total rejected power
1	Abuja DISCO	480.99 MW	6.32%
2	Benin DISCO	867.43 MW	11.39%
3	Enugu DISCO	809.00 MW	10.62%
4	Eko DISCO	762.43 MW	10.01%
5	Ibadan DISCO	814.92 MW	10.70%
6	Ikeja DISCO	1062.58 MW	13.95%
7	Jos DISCO	465.30 MW	6.11%
8	Kaduna DISCO	752.45 MW	9.88%
9	Kano DISCO	918.87 MW	12.07%
10	Port Harcourt DISCO	528.97 MW	6.95%
11	Yola DISCO	152.05 MW	2.00%

Source: TCN report on rejection of power by DISCOs – www.Thisdaylive.com on 20/09/19

Table 1.1: EEDC Cash Collection Analysis for 2014

S/N	MONTH	ENERGY RECEIVED (KWH)	ENERGY BILLED (KWH)	REVENUE BILLED (N)	CASH COLLECTED (N)	BILLING EFFICIENCY	COLLECTION EFFICIENCY	TOTAL EFFICIENCY
1	Jan.	219,016,030	187,330,665	1,758,196,542.31	1,142,662,983.40	64.99	85.53	55.59
2	Feb.	201,895,300	187,024,781	1,687,461,091.27	1,234,476,013.94	73.16	92.63	67.77
3	March	193,524,510	177,957,136	1,424,075,126.59	1,092,777,722.14	76.74	91.96	70.56
4	April	212,561,330	194,709,737	1,530,484,787.68	1,155,350,771.53	75.49	91.60	69.15
5	May	174,529,440	163,256,839	1,487,703,091.80	1,158,004,784.94	77.84	93.54	72.81
6	June	187,864,590	174,914,612	1,598,378,749.21	1,176,040,934.55	73.58	93.11	68.51
7	July	192,525,180	176,542,940	1,947,870,590.56	1,290,408,404.50	66.25	91.70	60.75
8	Aug.	191,440,580	174,714,587	1,947,349,852.76	1,285,487,551.41	66.01	91.26	60.24
9	Sept.	187,110,020	171,713,543	1,909,811,435.95	1,319,993,301.12	69.12	91.77	63.43
10	Oct.	203,974,260	182,145,883	2,048,099,933.22	1,345,447,902.96	65.69	89.30	58.66
11	Nov.	230,208,480	206,238,575	2,129,558,288.01	1,400,269,898.82	65.75	89.59	58.91
12	Dec.	212,526,270	194,966,257	2,022,730,176.47	1,178,730,176.47	58.27	91.74	53.46
	TOTAL	2,407,175,990	2,191,515,555	21,491,719,666	14,779,650,446	68.77	91.04	62.61

From Table 1.1, it is evident that EEDC recorded significant poor revenue collection.

132KV INPUT VIA ALAOJI

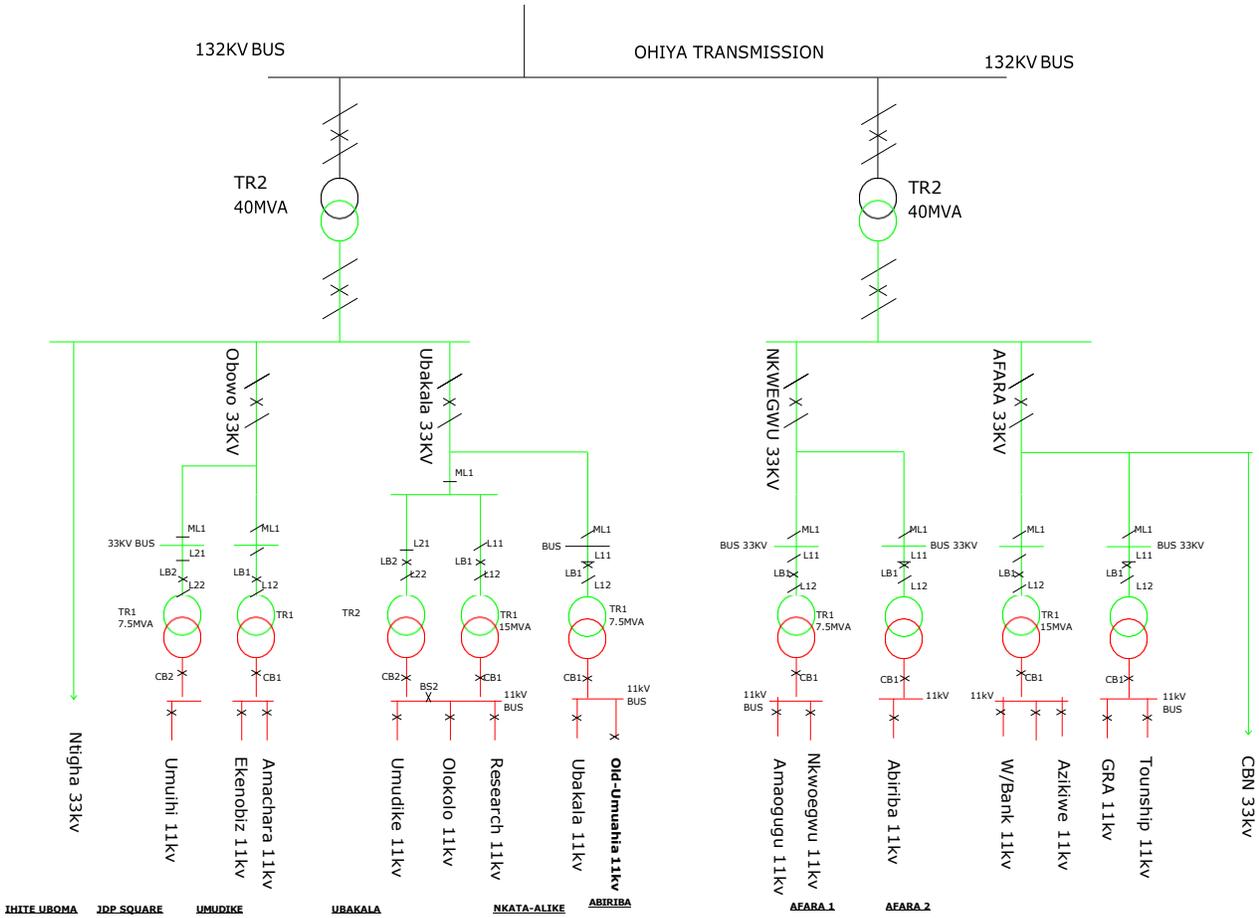


Fig. 1.1: EEDC power distribution network for Umuahia fed via Alaoji 132KV transmission line.

Fig.1.1 shows EEDC power distribution network for Umuahia fed via Alaoji 132KV transmission line. The voltage is stepped down at Ohiya transmission station to 33KV and further distributed to the various EEDC load centers in Umuahia. Ohiya transmission line has two transformers which supplies power to the various substations which are Afara 1 and 2, Ubakala, Nkata-Alike, Umudike and JDP of a step down voltage of 11kv, but directly feeds the CBN substation of 33kv, before they are then being distributed to the various feeders as shown in fig 1.1.

2.0 LITERATURE REVIEW

Large power system comprises of several power stations, load centers, interconnected to form a single grid. The operation of such grid can be controlled from a centralized control center is called load dispatch. Economic load dispatch is the process of allocating the required load demand between the available generators in power system, while satisfying all units and system equality and inequality constraints. The optimal system operation in general involves the consideration of economy of operation, system security, emission of certain fossil-fuel plants, optimal releases of water at hydro generation etc. Some of the related works on load demand efficiency are detailed herein, such as Vijo *et al* (2016) in his analysis of efficient load scheduling method for power management employed the traditional load shedding method, which was used to disconnect unnecessary and extra loads While Irimiya *et al* in 2014 employed the method of Analysis of Variance (ANOVA) on the assessment of energy use pattern in residential building of Kano and Kaduna. In 2014, Zubair and Olarewa made research on the production index of electricity generation and consumption in Nigeria. Their methodology was the simple aggregate method. Abaravicius *et al*, (2006) in his analysis of demand of load in residential houses employed load curve, daily load curve, load factor and superposition factor. Ekpo *et al* (2011) conducted a research on the dynamic of electricity demand and consumption in Nigeria over a period of 1970-2005, which indicates that, in the long run, electricity consumption is positively and significantly influenced by per capital income, population, industry drives, but insignificant with electricity price. While Babatunde and Shuaibu in 2015 presented a paper “The demand for domestic electricity in Nigeria: A bound testing approach.” This paper examines the residential demand for electricity in Nigeria as a function of real gross domestic product per capita and the price of electricity, the price of substitute and population between 1970 and 2006. Also Samuel *et al* in 2014 conducted a medium term load forecasting of Covenant University, using the regression analysis method. Three models based on linear, compound growth and cubic methods of regression analysis were developed. The sample load data collected between January 2012 and January 2013 was used for analysis.

2.1 Supplementary Page Cost function

The total cost incurred to produce electrical energy is the total of the cost of individual generator (Aravindhbabu, 2002). Thus, the cost function is given by;

$$C = \sum_{i=1}^N C_i(P_{gi}) \quad (1)$$

From equation (1), there exist some system constraints (i) Equality constraints (ii) Inequality constraints. The equation equally shows that the cost function is not affected by reactive power demand. The main attention is now on the real power balance which requires that the controlled generation variable P_{G1} obeys the constraints' equation.

Active Power Constraints: $P_{min} \leq P \leq P_{max}$

Reactive Power Constraint: $Q_{min} \leq Q \leq Q_{max}$

In designing the model, certain factors are considered;

(i) Load factor is simply the ratio of the average load during a specific period of time to the maximum load occurring during that period.

$$\text{Load Factor} = \frac{\text{Average load}}{\text{max.demand}} = \frac{\text{Average load} \times 24}{\text{Max.demand} \times 24} \quad (2)$$

$$\frac{\text{Area (in KWh) under daily load curve}}{\text{Area of rectangle in which the load curve is contained}} \quad (3)$$

(ii) The exploitation time provides information about the shape of the customer's load demand curve.

$$\text{Exploitation Time(h)} = \frac{\text{Electricity Consumption}}{\text{Load}_{\text{max}}} \quad (4)$$

(iii) The coincidence factor is the ratio of the coincident load maximum value to the maximum value of partial load demand (Abaravicius, 2006).

In the analysis also loads are normally classified into different types; residential, commercial, industrial, municipal and agricultural. Data collected from the distribution company, the respective feeders, calculations on the different types of loads were collated using two distinct methods (i) Interpolation (ii) Mann-Whitney test to transform the variables into format suitable for analysis after which average load equations are used to analyze the data and the results interpreted using excel software. The test statistics for the Mann-Whitney test U is computed based on a comparison of the sums of ranks of separate samples in the pooled set. The test statistics is given by;

$$U_x = n_x n_y + \frac{n_x(n_x+1)}{2} - \sum R_x \quad (5)$$

$$U_y = n_x n_y + \frac{n_y(n_y+1)}{2} - \sum R_y \quad (6)$$

Where U equals the smaller U_y U_x and $\sum R_x$ is the sum of X scores. $\sum R_y$ is the sum of Y scores. X and Y in this context refer to load reading of two different days. Also, for large samples the sampling distribution of U approximates a normal distribution with mean and standard deviation as follows:

$$\sigma_U = \sqrt{\frac{n_x n_y (n_x + 1)}{12}} \quad (7)$$

$$\mu_U = \frac{(n_x n_y)}{2} \quad (8)$$

2.2 Average hourly load demand: Load demand value has been identified to be a function of time therefore, only the average hourly load demand of the various EEDC Injection Substations in Umuahia Metropolis shall be considered in this study. However, the average loads occurring in any power station in a given period (day, month or year) is known as Average Load and it is defined as a function of the area under the daily load curve divided by the period in hours. It is expressed mathematically as follows:

$$\text{DailyAverageLoad} = \frac{\text{Area(KWh)under daily load curve}}{24\text{hours}} \quad (9)$$

$$\text{Monthly Average Load} = \frac{\text{Area (KWh) under monthly load curve}}{\text{Number of hours in a month}} \quad (10)$$

$$\text{Yearly Average Load} = \frac{\text{Area (KWh) under yearly load curve}}{\text{Number of hours in a year (8760 hours)}} \quad (11)$$

2.3 Evaluated Data Representation and Interpretation: Data collected are useless to the user, unless the data are analyzed, interpreted and represented in the form readily understandable by the user and even by a non-user, where the data appears. It can also involve representing the data pictorially as in bar chart, pie chart etc. (Okoro, 2008).

3.0 Load Dispatch Model for Umuahia Metropolis

The flowchart shows the Model employed to dispatch power economically in Umuahia Metropolis. This model starts by knowing the maximum load of the sixteen feeders, the feeders are labeled as **Good**, **Fair** and **Poor** base on the consumers tariff compliance level, this means that the feeder label **Good** has its consumers more compliant to the tariff, followed by the **Fair** which is average and the **Poor** which indicates the feeder whose compliance is list in terms of the tariff. The next step in the model is to ascertain the energy allocated for Umuahia Metropolis at a particular time. This power allocated equals the maximum power demand by all, feeder are closed and power is supplied, else load shed is carried out based on the percentage tariff compliance level of the feeder. The Model further queries the allocated power (greater or equals) all good. All Good feeders are closed, that is, power is supplied to feeders with percentage of tariff compliance first (G), else the Good feeders are closed with the percentage level of tariff compliance. The phase of the query in the model is to ascertain if $P_d - G = +ve$, if $P_d - G = +ve$ then close 'F' feeders first, followed by 'P' feeders with respect to $P_d - G$ but if No, close 'G' feeders with respect to percentage level. With this Model, the economic load dispatch on the distribution level is fulfilled in Umuahia Metropolis, making sure those consumers who compliances more to the tariff charges are first serve with limited power allocated in Umuahia.

Total Average Load Demand of Umuahia Metrpolis in Graphical Format

A graph showing the daily average load demand of all the feeders combined

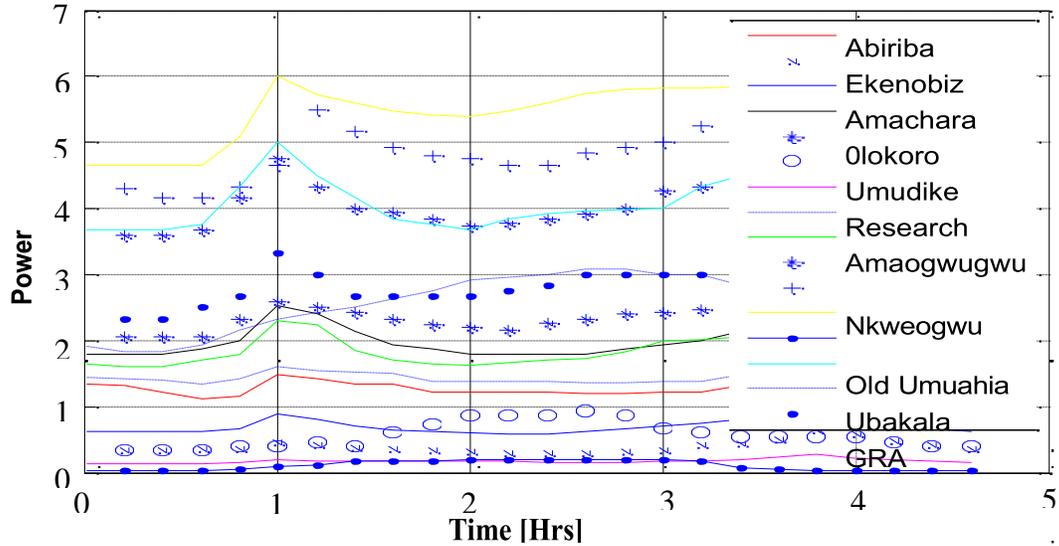


Fig. 4.1: Total average hourly load demand curve in Umuahia metropolis

FLOWCHART

Percentage Average Hourly Load Demand in Umuahia Metropolis in Pie Chart Format

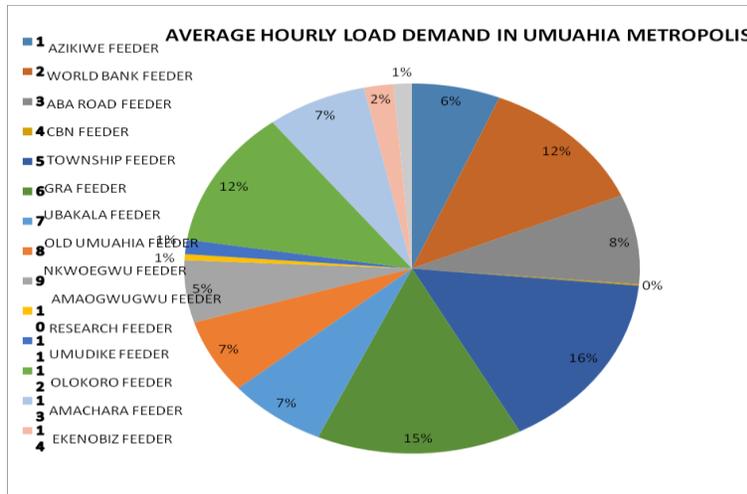


Fig. 4.2: The Figure above shows a statistical representation of the cumulative individual percentage average hourly load in Umuahia metropolis.

Economic Load Dispatch Simulation Results

Table 4.2: Economic load dispatch simulation results for zero (0) load allocation for Umuahia Metropolis

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1		ENERGY ALLOCATION, Pe:		0										
2														
3	SUBSTATION	INSTALLED CAPACITY (MVA)	FEEDER	MAXIMUM DEMAND	TARIFF COMPLIANCE LEVEL	PERCENTAGE	STATUS							
4	AFARA 1	15	Azikiwe	2.5	GOOD	70%	OFF							
5			World Bank	5	FAIR	50%	OFF							
6			Aba Road	4	GOOD	70%	OFF							
7			CBN	0.12	GOOD	100%	OFF							
8	AFARA 2	15	Township	6.5	GOOD	70%	OFF							
9			GRA	5.6	GOOD	80%	OFF							
10	UBAKALA	7.5	Ubakala	3	POOR	35%	OFF							
11			Old-Umuahia	2.5	FAIR	55%	OFF							
12	NKATA ALIKE	15	Nkwoegwu	4	POOR	40%	OFF							
13	JDP SQUARE	15	Amaogwugu	1	FAIR	50%	OFF							
14			Ekenobiz	0.5	FAIR	50%	OFF							
15	UMUDIKE	15	Umudike	5	POOR	35%	OFF							
16			Olokoro	3	FAIR	50%	OFF							
17			Research	0.23	GOOD	80%	OFF							
18	ABRIBA	15	Abriba	3	POOR	40%	OFF							
19	TOTAL			45.95										
20	DIFFERENCE BETWEEN Pmax - Pe			45.95										
21														

Table 4.2 shows when there is no load allocation to Umuahia Metropolis. It is evident from table 4.2 that, with no load allocation, the model puts all the feeders ‘OFF’ which indicates to supply, pending when there is load allocation to Umuahia metropolis.

Table 4.3: Economic load dispatch simulation results for 6MW load allocation for Umuahia metropolis

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	
		ENERGY ALLOCATION, Pe:		6											
		SUBSTATION	INSTALLED CAPACITY (MVA)	FEEDER	TARIFF COMPLIANCE LEVEL	PERCENTAGE	STATUS								
		AFARA 1	15	Azikiwe	3.08	GOOD	70%	OFF							
					World Bank	5.33	FAIR	50%	OFF						
					Aba Road	4	GOOD	70%	OFF						
					CBN	0.2	GOOD	100%	ON						
		AFARA 2	15	Township	6.8	GOOD	70%	OFF							
					GRA	6.33	GOOD	80%	OFF						
		UBAKALA	7.5	Ubakala	3.17	POOR	35%	OFF							
					Old-Umuahia	2.83	FAIR	55%	OFF						
		NKATA ALIKE	15	Nkwoegwu	2	POOR	40%	OFF							
					Amaogugu	0.28	FAIR	50%	OFF						
		JDP SQUARE	15	Amachara	0.97	FAIR	50%	OFF							
					Ekenobiz	0.65	FAIR	50%	OFF						
		UMUDIKE	15	Umudike	5.33	POOR	35%	OFF							
					Olokoru	3	FAIR	50%	OFF						
			15	Research	0.93	GOOD	80%	ON							
		ABRIBA	15	Abriba	1.93	POOR	40%	OFF							
		TOTAL			46.83										
		DIFFERENCE BETWEEN Pmax - Pe			40.83										

It is evident from table 4.3 that, 6 MW load allocation is given to Umuahia Metropolis which amounts to 12.81% of Umuahia metropolis maximum load demand. This is required to energize all feeders with ‘Good’ (100-80) % tariff compliance level. The feeders that will go ‘ON’ for the limited loads allocated are; CBN and Research feeders.

Table 4.4: Economic load dispatch simulation results for 30MW load allocation for Umuahia Metropolis

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	
1		ENERGY ALLOCATION, Pe:		30											
2															
3		SUBSTATION	INSTALLED CAPACITY (MVA)	FEEDER	TARIFF COMPLIANCE LEVEL	PERCENTAGE	STATUS								
4		AFARA 1	15	Azikiwe	3.08	GOOD	70%	ON							
5					World Bank	5.33	FAIR	50%	OFF						
6					Aba Road	4	GOOD	70%	ON						
7					CBN	0.2	GOOD	100%	ON						
8		AFARA 2	15	Township	6.8	GOOD	70%	ON							
9					GRA	6.33	GOOD	80%	ON						
10		UBAKALA	7.5	Ubakala	3.17	POOR	35%	OFF							
11					Old-Umuahia	2.83	FAIR	55%	ON						
12		NKATA ALIKE	15	Nkwoegwu	2	POOR	40%	OFF							
13					Amaogugu	0.28	FAIR	50%	ON						
14		JDP SQUARE	15	Amachara	0.97	FAIR	50%	ON							
15					Ekenobiz	0.65	FAIR	50%	ON						
16		UMUDIKE	15	Umudike	5.33	POOR	35%	OFF							
17					Olokororo	3	FAIR	50%	ON						
18					Research	0.93	GOOD	80%	ON						
19		ABRIBA	15	Abriba	1.93	POOR	40%	OFF							
20		TOTAL			46.83										
21		DIFFERENCE BETWEEN Pmax - Pe			16.83										

It is evident from table 4.5 that, 30 MW load allocation is given to Umuahia Metropolis which amounts to 64.06% of Umuahia metropolis maximum load demand. This is required to energize all feeders with ‘Good’ and ‘Fair’ tariff compliance level. The feeders that will go ‘ON’ for the limited loads allocated are; Azikiwe, Aba Road, CBN, Township, GRA, Old-Umuahia, Amaogugu, Amachara, Ekenobiz, Olokororo and Research feeders.

Table 4.5: Economic load dispatch simulation results for 50MW load allocation for Umuahia Metropolis

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	
1		ENERGY ALLOCATION, Pe:		50											
2															
3		SUBSTATION	INSTALLED CAPACITY (MVA)	FEEDER	MAXIMUM DEMAND	TARIFF COMPLIANCE LEVEL	PERCENTAGE	STATUS							
4		AFARA 1	15	Azikiwe	2.5	GOOD	70%	ON							
5						World Bank	5	FAIR	50%	ON					
6						Aba Road	4	GOOD	70%	ON					
7						CBN	0.12	GOOD	100%	ON					
8		AFARA 2	15	Township	6.5	GOOD	70%	ON							
9						GRA	5.6	GOOD	80%	ON					
10		UBAKALA	7.5	Ubakala	3	POOR	35%	ON							
11						Old-Umuahia	2.5	FAIR	55%	ON					
12		NKATA ALIKE	15	Nkwoegwu	4	POOR	40%	ON							
13						Amaogugu	1	FAIR	50%	ON					
14		JDP SQUARE	15	Ekenobiz	0.5	FAIR	50%	ON							
15						Umudike	5	POOR	35%	ON					
16		UMUDIKE	15	Olokororo	3	FAIR	50%	ON							
17						Research	0.23	GOOD	80%	ON					
18		ABRIBA	15	Abriba	3	POOR	40%	ON							
19		TOTAL			45.95										
20		DIFFERENCE BETWEEN Pmax - Pe			-4.05										

It is evident from table 4.6 that, 46.83 MW load allocation is given to Umuahia Metropolis which amounts to 100% of Umuahia metropolis maximum load demand. This is required to energize all feeders i.e. feeders with ‘Good’, ‘Fair’ and ‘Poor’ tariff compliance level. In this case, all the feeders will go ‘ON’ for full load allocation.

However, if the above results are carefully implemented, it will afford EEDC the opportunity to serve their economically viable customers better and will also motivate other non-economic viable customers to improve. Thus, EEDC’s general revenue collection will increase, since the main aim of every business owner is primarily to increase productivity and maximize profit (Optimization).

4.0 CONCLUSION

This work gives the overview of economic load dispatch problem and solution methodologies. Implementation is done using MATLAB programming and MS Excel, results are given in tabular form, Convectional method like statistical method, tables, graphs converge rapidly.

This study has been able to establish a comprehensive hourly load demand and economically viable areas, in other words, tariff compliant consumers of Umuahia metropolis. The study shows that Umuahia is mostly occupied by domestic/residential load consumers with a total of 61.6%, followed by Commercial load consumer with a total of 36.9%, followed by Industrial load consumer with a total of 1.5%. This deduction is made based on the comparison with the typical load curves of figures 2.4, 2.6 and 2.18 . However, the details of this research proved that Afara2 Injection Substation has the highest daily average load demand with its two outgoing feeders; Township and GRA occupying 16% and 15%. Township feeder has a daily average load 5.517 MW with an hourly load of 132.147 MWH and GRA feeder has a daily average load 4.945 MW with an hourly load of 118.683MWH. While CBN of Afara1 has the lowest daily average load demand of 0.107MW with an hourly load of 2.5582MWH in the Metropolis. The model if implemented will afford EEDC and other Distribution Companies the opportunity to serve more economically areas first, while increasing in productivity and maximizing profit.

5.0 RECOMMENDATIONS

In view of the above results in section 4, and in consideration of the bill settlement of our people and above all the current hardship in the country, it is economically wise that dispatchers dispatch power to tariff complaint consumers. Tariff complaint means where the distribution company gets almost 90% of their tariff paid piously. Due to nonpayment of electricity bills by Nigerians with particular reference to Umuahia, the distribution company (EEDC) prefers allocating or dispatching the little available power allocated to them by Transmission feeders to only industrial feeders rather than the commercial feeders. Again due to the poor generation very evident in Nigeria nowadays (www.power.ng) it is economically wise for the distribution company (EEDC) to dispatch only available power to reasonable and tariff compliant consumers like the Research Feeder. It is therefore recommended that dispatch of power in Umuahia be based on:

- Availability of power at power station.

- Economic viable areas and tariff compliant consumers.
- Feeder capacity with respect to available power at Ohia power station.

REFERENCES

- Abaravicius, J., Sernhed, K. and Pyrko, J. (2006), “*Load Demand in Residential Houses*”, Lund University Efficiency in Building, pp 106.
- Babatunde, M., Adetunji and Shauibu, M. I. (2011) “*The Demand for Residential Electricity in Nigeria*”, Pakistan Journal of Applied Economics, Applied Economics Research Centre, vol. 21, pages 1-13.
- Ekpo, U., Chukwu, C. and Effiong, E. (2011), “*The dynamic of electricity demand and consumption in Nigeria*”, Current Research Journal of Economic Theory, Vol. 3(2), pp 43-52.
- Talor, J. W. (2008) “*An evaluation of methods for very short-term load forecasting using minute-by-minute British data*” International Journal of Forecasting. Volume 24, Issue 4, October–December 2008, Pages 645-658
- <https://www.pwc.com/ng/en/assets/pdf/solving-liquidity-crunch-nigerian-power.pdf>
- <https://apgc.org.ng/tackling-power-rejection-by-discos/> (Monitored: 2nd May, 2016)
- Ikaraocha, O. and Adegoke, O.M , (2015) “*Multi –factorial short term Load forecasting for Enugu load enter using Artificial Neural Network concept*”, The Pacific journal of Science and Technology, Volume 16,No.1, pp 38-49.
- Iloh, J.P and Obi, P. I, (2016) “*Analysis of Nigeria’s power Generation Statistics from June to December 2015*”, International Journal of Innovative Engineering, Technology and Science, Vol 1,No 1, pp 95-101.
- Irymiya, Y, Humphery, I. A and Aondover, I. (2014), “*Assessment of energy use pattern in residential building of Kano and Kaduna*” American Journal of Engineering Research (AJER), Vol. 4, pp. 65-71.
- Okoro, O. I, (2008) “*Introduction to Matlab Simulink*” John Jacob’s classic publishers Ltd,Second Edition.pp 77-85.
- Papaefstratiou, D. (2019) “*The Nigerian power market experiment: a critical appraisal of the PHCN privatization*” DLA Piper.
- Samuel, I., Chihurumanya, F. and Adeyinka, F. and Awelewa, A. (2009), “*Medium Term Load Forecasting of Covenant University*”, Journal of Energy Technical and Policy, Vol. 4, pp 15-17
- Vijo, M. J. and Krishan, K. (2016) “*Efficient Load Scheduling Method for Power Management*” International Journal of Scientific and Technology Research, Vol. 5, pp 99- 101.
- Zubair, M. and Olanrewaju, S. (2014), “*Production Index of Electricity Generation and Consumption in Nigeria*”, International Journal of Engineering and Science, pp 11-17.