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Skills Gap of Industrial Electricians towards Efficient Management of Electric Motors in Industries in Kaduna State, Nigeria.

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Abstract

The study was carried out to determine skills Gap of industrial electricians towards efficient management of electric motors in industries in Kaduna State, Nigeria. Three research questions guided the study while two null hypotheses were formulated and tested at 0.05 level of significance. The study adopted descriptive survey research design. The target population of the study was 669. Proportionate stratified random sampling technique was employed and a total of 233 respondents were used for the study. The instrument for data collection was a structured questionnaire which was validated by three experts. Cronbach alpha reliability method was employed to determine the internal consistency of the instrument and a reliability coefficient of 0.89 was obtained for the entire instrument. Mean statistics, standard deviation and Improvement Need Index (INI) were employed to analyse data for answering the research questions while z-test was used to test the null hypotheses. The findings of the study revealed that industrial electricians need improvement on 11 skills for efficient management of electric motors in industries. The hypothesis tested revealed that there was no significant difference in the mean responses of Lecturers of Electrical Engineering and Electrical Engineers on theskills required by industrial electricians for efficient management of electric motors in industries in Kaduna State. The hypothesis tested further revealed that there was no significant difference in the mean responses of Electrical Technologists and Electrical Technicians on theskills performed by industrial electricians for efficient management of electric motors in industries in Kaduna State. It was recommended amongst others that, industrial managers should use the established skills identified as a basis for planning and organising staff development training through workshops and seminars to improve the performance of industrial electricians towards efficient management of electric motors in industries.

Key Words: Skills Gap, Industrial Electricians, Management of Electric Motors

Introduction

Energy is a very vital and essential commodity needed for influencing and powering both socio-economic activities and serves as a catalyst for meeting the needs of biological life. When the supply of energy is insufficient to the sectors of any economy, socio-economic and quality of life of the citizenry will be adversely affected (Ibrahim & Ukwenya, 2012). Okeke, Izueke and Nzekwe (2014) observed that, Nigeria has been engulfed in energy crisis for almost two decades now, and this has largely contributed to the decline inindustrial and commercial activities in the country. Ohadi and Qi (2017) on the other hand projected that the

world energy consumption is expected to rise continually over the next two decades and therefore, the demand of energy will continue to rise on daily basis. Hence, drastic measures must be taken to ensure that the available energy is harnessed and effectively managed by competent hands to meet the rising energy demand in industries.

Energy exist in different forms amongst which iselectrical energy. The electrical energy that is generated is supplied to industries towards providing electrical power for operating equipment, running of power appliancesincluding electric motors. Electric motors are appliances that consume so much electrical energy in industries hence, the necessity to device means for electrical energy savings in the industrial sector by efficiently managing the electric motors used in industries through effective electrical energy management.

Electrical energy management is very necessary and important to every industrybecause electrical energyhas been identified as one of the major commodities that cost industries a lot of money to purchase (Saba, Tsado, Bukar & Ohize, 2016). According to Tsado (2014), substantial amount of electrical energy can be savedwhen there is proper and efficient management of appliances including electric motors. Hence, the role of efficient management of electric motors in Nigeria's industrial sector cannot be overemphasised. This signifies that there is need for industrial electricians such as technologists and technicians' skills be improved where necessary towards efficient management of electric motors because they are the personnel responsible for installation, testing, maintenance and control of electrical equipment and machines in industries. This study therefore, focused on the skills improvement needs of industrial electricians for efficient management of electric motors in industries in Kaduna State.

Statement of the problem

The challenges of electrical energy supply to industries is so alarming to the extent that most industries groan under intense pain due to overhead cost incurred in providing alternative sources of electrical power. According to Ubani (2013), the high demand for electrical energy has become a key issue facing all sectors of economies globally including the Nigeria's industrial sector. Electric motors are appliances that consumes high amount of electrical energy in industries but ironically, their operation which is supposed to be carried out with maximum efficiency tend to be poorly managed in the midst of inadequate electrical power supply, and hence, incurring unnecessary cost on industries. In order to stay afloat, most industries have resorted to the use of private generating plants with a view of augmenting the rather unreliable electricity supplied by authority, since their industrial

production activities involve the use of electricity. Despite these efforts, Aderemi, Ilori, Aderemi and Akinbami (2009) reported that many industries in Nigeria run into losses due to factors that include wastage of electrical energy which is caused by inefficiency of electric motors. This calls for efficient management of electric motors.

What is worrisome however is that despite the existence of trained electrical technologists and electrical technicians otherwise known as industrial electricians who should help the industries to manage the inadequate electrical energy, operate equipment and machines with maximum energy efficiency, losses are still being incurred, indicating that industrial electricians have areas in electrical engineering activities where they require improvement with respect to skills.Such area is efficient management skills in the operation of electric motors.It is in this regard that the researcher sought to look at the skills improvement needs of of industrial electricians towardsefficient management of electric motors in industries in Kaduna State, Nigeria.

Research Questions

The following research questions were raised to guide the study:

1. What are the skills required by industrial electricians for efficient management of electric motors in industries in Kaduna State?
2. What are the skills performed by industrial electricians for efficient management of electric motors in industries in Kaduna State?
3. What are the skills Gap of industrial electricians for efficient management of electric motors in industries in Kaduna State?

Hypotheses

The following research hypotheses were postulated and tested at 0.05 level of significance:

HO_1: There is no significant difference in the mean responses of lecturers of electrical engineering and electrical engineers on the skills required by industrial electricians for efficient management of electric motors in industries in Kaduna State.

HO_2: There is no significant difference in the mean responses of electrical technologists and electrical technicians on the skills performed by industrial electricians for efficient management of electric motors in industries in Kaduna State.

Research Methodology

The study adopted descriptive survey research design. Descriptive survey research according to Salaria (2012) is to carry out a study which includes proper analysis, interpretation, comparisons, identifying trends and relationships on a part or sample of the population so that

the result can be generalised on the entire population. The study was carried out in Kaduna State, Nigeria which covered industries across the three senatorial zones of the State. The population of the study was 669 made up of 119 electrical technologists, 255 electrical technicians across the 88 large-scale operational industries in the three senatorial zones of Kaduna State, 250 registered and practicing electrical engineers in Kaduna State and 45 lecturers of electrical engineering technology from the two polytechnics in Kaduna State. The sample for the study was 233 made up of 36 technologists, 77 technicians and 75 registered and practicing electrical engineers which were obtained through proportionate stratified random sampling. However, all the 45 lecturers of electrical engineering technology were used for the study because the number of lecturers can be managed. Data was collected using a structured questionnaire developed by the researchers. The instrument was validated by two experts who are teachers in the area of electrical energy efficiency and conservation in higher institutions and one expert who is experienced in the management of electrical energy in industries respectively.

The instrument was pilot tested in Kano State and a reliability coefficient of 0.89 was obtained for the entire instrument which was very high and therefore considered acceptable for the study. Statistical Package for Social Sciences (SPSS) version 23 was used to analyse the data. The data that was collected from respondents was analysed using mean statistics, standard deviation; Improvement Need Index (INI) and z-test. The mean statistics, standard deviation and INI were used to answer the research questions while z-test was employed to test the null hypotheses at 0.05 level of significance.

Research Question One

What are the skills required by industrial electricians for efficient management of electric motors in industries in Kaduna State?

Table 1

Mean and Standard Deviation of the Responses of Lecturers of Electrical Engineering and Electrical Engineers on the Skills Required by Industrial Electricians for Efficient Management of Electric Motors in Industries in Kaduna State.

N= 120

S/N	Item Statement on Skills Required	$\bar{X}_A$	SD_A	REMARKS
1.	Operation of high efficient electric motors with longer service life for greater energy savings potential.	3.42	0.58	AR
2.	Setting and use of automatic control devices such as motion sensors and infrared sensors in electric motors.	3.38	0.57	AR

3.	Operation protection with the aid of protective devices such as overload protection and no-load protection devices.	3.85	0.56	HR

Table 1 Continued

S/N	Item Statement on Skills Required	$\bar{X}_A$	SD_A	REMARKS
4.	Connecting suitable protective devices such as fuses and circuit breakers and the right size of cables on electric motors correctly.	3.50	0.60	HR
5.	Monitoring of electric motors for overheating, lower operating temperatures and noise levels.	3.60	0.66	HR
6.	Adjustment and replacement of slack belt or chains and cut or wounded belt on electric motors	3.31	0.62	AR
7.	Operation monitoring by observing gauges, dials or indicators to ensure electric motor is working properly.	3.74	0.57	HR
8.	Replacement of all worn-out sprocket/gear teeth on electric motors.	3.71	0.58	HR
9.	The application or use of adjustable or variable speed drives (ASDs/VSDs) in electric motors.	3.66	0.61	HR
10.	Power factor correction in the operation of electric motors.	3.80	0.65	HR
11.	Carrying out energy efficiency improvements in electric motors through systems approach by analysing both the energy supply and energy demand sides.	3.34	0.66	AR
12.	Carrying out quality control analysis and relevant test such as continuity and polarity tests on electric motors for effective performance.	3.80	0.63	HR
13.	Carrying out the right kind of maintenance using appropriate tools and equipment in electric motors properly.	3.62	0.67	HR
14.	Disassemble and assemble back electric motors to specified requirements after maintenance or repair.	3.38	0.68	AR
	Grand Total	**3.35**	**0.61**	

N = Number of respondents, $\bar{X}_A$ = Average mean, ,SD_A= Average standard deviation.HR = Highly Required, AR = Averagely Required, SR = Slightly Required and NR = Not Required.

Table 1 shows the analysis of responses of the respondents on the skills required by industrial electricians for efficient management of electric motors in industries in Kaduna State. The results revealed that items 3, 4, 5, 7, 8, 9, 10, 12 and 13 have their mean values within the ranges of highly required (3.50 - 4.00) while five items; 1, 2, 6, 11 and 14 have their mean values within the ranges of averagely required (2.50 - 3.49). The table also shows the standard deviations (SD) of all items are within the ranges of 0.57 to 0.68 and are positive and less than the normal deviate of 1.96, thereby indicating that respondents were not too far from the mean and from one another in their responses.

Research Question Two

What are the skills performed by industrial electricians for efficient management of electric motors in industries in Kaduna State?

Table 2
Mean and Standard Deviation of the Responses of Electrical Technologists and Electrical Technicians on the Skills Performed by Industrial Electricians for Efficient Management of Electric Motors in Industries in Kaduna State.
N= 113

S/N	Item Statement on Skills Performed	$\bar{X}_A$	SD_A	REMARKS
1.	Operation of high efficient electric motors with longer service life for greater energy savings potential.	3.49	0.60	AP
2	Setting and use of automatic control devices such as motion sensors and infrared sensors in electric motors.	3.34	0.57	AP
3	Operation protection with the aid of protective devices such as overload protection and no-load protection devices.	3.22	0.64	AP
4.	Connecting suitable protective devices such as fuses and circuit breakers and the right size of cables on electric motors correctly.	3.32	0.57	AP
5.	Monitoring of electric motors for overheating, lower operating temperatures and noise levels.	2.55	0.61	AP
6.	Adjustment and replacement of slack belt or chains and cut or wounded belt on electric motors	3.50	0.36	HP
7.	Operation monitoring by observing gauges, dials or indicators to ensure electric motor is working properly.	3.18	0.53	AP
8.	Replacement of all worn-out sprocket/gear teeth on electric motors.	3.56	0.66	HP
9.	The application or use of adjustable or variable speed drives (ASDs/VSDs) in electric motors.	3.24	0.68	AP
10.	Power factor correction in the operation of electric motors.	2.06	0.51	LP
11.	Carrying out energy efficiency improvements in electric motors through systems approach by analysing both the energy supply and energy demand sides.	2.33	0.35	LP
12.	Carrying out quality control analysis and relevant test such as continuity and polarity tests on electric motors for effective performance.	2.08	0.45	LP
13.	Carrying out the right kind of maintenance using appropriate tools and equipment in electric motors properly.	2.45	0.36	LP
14.	Disassemble and assemble back electric motors to specified requirements after maintenance or repair.	2.20	0.62	LP

Grand Total		**2.99**	**0.50**

N = Number of respondents, $\bar{X}_A$ = Average mean ,SD_A = Average standard deviation. HP = High Performance, AP = Average Performance, LP = Low Performance and NP = No Performance.

Table 2 shows the analysis of responses of the respondents on the skillsperformed by industrial electricians for efficient management of electric motors in industries in Kaduna State. The results revealed that items 6 and 8 falls within the ranges of high performance (3.50 – 4.00) while items 1, 2, 3, 4, 5, 7 and 9 have their mean values within the ranges of average performance (2.50 – 3.49). The result further shows that items; 10, 11, 12, 13 and 14 have their mean values within the ranges of low performance (1.50-2.49). The table equally shows that the standard deviations (SD) of all items are within the ranges of 0.36 to 0.68 and are positive and less than the normal deviate of 1.96, thereby indicating that respondent were not too far from the mean and from one another in their responses.

Research Question Three

What are the skills gap of industrial electricians for efficient management of electric motors in industries in Kaduna State?

Table 3
Performance Gap Analysis of Industrial Electricians for Efficient Management of Electric Motors in Industries in Kaduna State.

S/N	Item Statement on Performance Gap	$(\bar{X}_R-\bar{X}_P)$	REMARKS
1.	Operation of high efficient electric motors with longer service life for greater energy savings potential.	-0.07	INR
2.	Setting and use of automatic control devices such as motion sensors and infrared sensors in electric motors.	0.04	IR
3.	Operation protection with the aid of protective devices such as overload protection and no-load protection devices.	0.33	IR
4.	Connecting suitable protective devices such as fuses and circuit breakers and the right size of cables on electric motors correctly.	0.18	IR
5.	Monitoring of electric motors for overheating, lower operating temperatures and noise levels.	1.05	IR
6.	Adjustment and Replacement of slack belt or chains and cut or wounded belt on electric motors	-0.19	INR
7.	Operation monitoring by observing gauges, dials or indicators to ensure electric motor is working properly.	0.56	IR
8.	Replacement of all worn-out sprocket/gear teeth on electric motors.	-0.05	INR
9.	The application or use of adjustable or variable speed drives (ASDs/VSDs) in electric motors.	1.13	IR
10.	Power factor correction in the operation of electric motors.	2.16	IR

Table 3 Continued

S/N	Item Statement on Performance Gap	($\bar{X}_R$-$\bar{X}_P$)	REMARKS
11.	Carrying out energy efficiency improvements in electric motors through systems approach by analysing both the energy supply and energy demand sides.	1.01	IR
12.	Carrying out quality control analysis and relevant test such as continuity and polarity tests on electric motors for effective performance.	1.72	IR
13.	Carrying out the right kind of maintenance using appropriate tools and equipment in electric motors properly.	1.17	IR
14.	Disassemble and assemble back electric motors to specified requirements after maintenance or repair.	1.18	IR
	Grand Total	**0.77**	

$\bar{X}_R$ -$\bar{X}_R$ = Skills improvement need index gap.IR = Improvement Required, INR = Improvement Not Required.

Table 3 shows the analysis of responses of the respondents on theskills improvement needs of industrial electricians for efficient management of electric motors in industries in Kaduna State. The results revealed that the performance gap for items; 1, 10 and 12 indicated negative (-), meaning that the level at which each of the item was required is less than the level at which the item was performed. The table further revealed that items 2, 3, 4, 5, 7, 9, 10, 11, 12, 13 and 14 were positive (+) which indicated that industrial electricians need improvement on the items. This is because the level at which each of the item is required is greater than the level at which the item was performed.

Hypothesis One

HO_1: There is no significant difference in the mean responses of lecturers of electrical engineering and electrical engineers on the skills required by industrial electricians for efficient management of electric motors in industries in Kaduna State.

Table 4 t-Test Analysis of Mean Ratings of Lecturers of Electrical Engineering and Electrical Engineers on the Skills Required by Industrial Electricians for Efficient Management of Electric Motors in Industries in Kaduna State

	Test for Equality of Variances		t-test for Equality of Means						
								95% Confidence Interval of the Difference	
	F	Sig.	T	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Variances assumed	2.31	0.13	0.70	148	0.48	0.06	0.09	0.25	0.12
Variances not assumed			0.67	97.56	0.50	0.06	0.09	0.26	0.13

Table 4 shows the the t-test analysis of differences in the responses of lecturers of electrical engineering and electrical engineers on the skills required by industrial electricians for efficient management of electric motors in industries in Kaduna State. The table indicated that the significant criterion (sig.) of Levene's test for equality of variance was 0.131, which is greater than 0.05 (the probability value). Hence, equal variance assumed t value of 0.705 was selected in accordance with SPSS t-test interpretation, and compared with 0.05, and was found to be greater than the p-value. The hypothesis was therefore accepted. Therefore, there is no significant difference in the mean responses of lecturers of electrical engineering and electrical engineers on the skills required by industrial electricians for efficient management of electric motors in industries in Kaduna State.

Hypothesis Two

HO_2: There is no significant difference in the mean responses of electrical technologists and electrical technicians on the skills performed by industrial electricians for efficient management of electric motors in industries in Kaduna State.

Table 5 t-Test Analysis of Mean Ratings of Electrical Technologists and Electrical Technicians on the Skills Performed by Industrial Electricians for Efficient Management of Electric Motors in Industries in Kaduna State

	Test for Equality of Variances		t-test for Equality of Means						
								95% Confidence Interval of the Difference	
	F	Sig.	T	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Variances assumed	0.45	0.50	4.75	180	0.00	0.47	0.10	0.28	0.67
Variances not assumed			4.91	179.99	0.00	0.47	0.10	0.28	0.67

Table 5 shows the the t-test analysis of differences in the responses of electrical technologists and electrical technicians on the skills performed by industrial electricians for efficient management of electric motors in industries in Kaduna State. The table revealed that the significant criterion (sig.) of Levene's test for equality of variance was 0.501, which is greater than 0.05 (the probability value). Hence, equal variance assumed t value of 4.75 was compared with 0.05, this was greater than the p-value. Hence, the null-hypothesis was accepted. Therefore, there is no significant difference in the mean responses of electrical technologists and electrical technicians on the skills performed by industrial electricians for efficient management of electric motors in industries in Kaduna State.

Findings of the study

1. The study revealed that 9 skills were highly required while5 skills were averagely required by industrial electricians for efficient management of electric motors in industries.
2. The study revealed that 2 skills were highly performed, 7 skills were averagely performed while 5 skills were performed low by industrial electricians for efficient management of electric motors in industries.
3. The study revealed that industrial electricians need improvement on 11 skills and do not need improvement on 3 skills for efficient management of electric motors in industries. The skills that require improvement include; setting and use of automatic control devices such as motion sensors and infrared sensors in electric motors, the application or use of adjustable or variable speed drives (ASDs/VSDs) in electric

motors and carrying out quality control analysis and relevant test such as continuity and polarity tests on electric motors for effective performance among others.

4. There is no significant difference in the mean responses of lecturers of electrical engineering and electrical engineers on the skills required by industrial electricians for efficient management of electric motors in industries in Kaduna State.
5. There is no significant difference in the mean responses of electrical technologists and electrical technicians on the skills performed by industrial electricians for efficient management of electric motors in industries in Kaduna State.

Discussion of Findings

The findings from Table 1 revealed that industrial electricians highly required skills improvement on 9 items while 5 skills were averagely requiredfor efficient management of electric motors in industries in Kaduna State. The skills highly required include: application of adjustable or variable speed drives (ASDs or VSDs) in electric motors and carrying out the right kind of maintenance in electric motors among others. In the same vein, Table 4 revealed that there is no significant difference in the mean responses of lecturers of electrical engineering and electrical engineers on the skills required by industrial electricians for efficient management of electric motors in industries in Kaduna State. This is in line with the view of Amadike and Robinson (2017) who stated thatgraduates of technical colleges need improvement in identified skills in electrical installation and maintenance practice for employment. The findings also agree with Javieda, Rackowa, Stankallaa, Sterka and Frankea (2015) on the need for most electric power consumption by electric drives such as Variable Speed Drives (VSDs) in industries to be allocated to a few applications. When the above considerations are given prominence, substantial amount of electrical energy can be saved in the operation of electric motors in industries.

The findings from Table 2 revealed that industrial electricians had high performance on 2 skills, average performance in 7 skills and low performance in 5 skillsfor efficient management of electric motors in industries in Kaduna State. In the same vein, the study further revealed that, skills such as power factor correction in the operation of electric motors and carrying out energy efficiency improvements in electric motors through systems approach by analysing both the energy supply and energy demand sides among others fell in the low performance skills range. In the same vein, Table 5 revealed that there is no significant difference in the mean responses of electrical technologists and electrical

technicians on the skills performed by industrial electricians for efficient management of electric motors in industries in Kaduna State.

This is in line with the view of **Saba,** Adamu, Yisa, & Daniel, (2020) who revealed that checking of power factor by consumers as well as correction and improvement of power factor was rarely adopted by electrical energy consumers. The findings were also in agreement with the view of Saba, Tsado, Bukar and Ohize (2016) who identified that consumers of electricity were somehow aware of electrical energy management practices in the use of electric motors.

The findings from Table 3 revealed that industrial electricians need skills improvement on 11 items for efficient management of electric motors in industries in Kaduna State while the findings equally revealed that, skills improvement is not required on 3 items. The items that skills need to be improved upon include: setting and use of automatic control devices such as motion sensors and infrared sensors in electric motors, power factor correction in the operation of electric motors and carrying out the right kind of maintenance using appropriate tools and equipment in electric motors properly among others.

This is in agreement with Ado (2014) who posited that skills improvement needs such as carrying out weekly routine maintenance activities for all electrical equipment is highly needed. The findings are also in agreement with Mohamed and Khan (2009) who suggested that direct load control, interruptible load control and Time of Use (TOU) are the main load management techniques used on the Supply Side (SS) and that the supply side authorities normally design these techniques and implement them on demand side consumers. The scholars further emphasized the need for Power Factor Correction (PFC) and observed that many power utilities, especially in developing countries, have neither developed nor implemented Demand Side Management (DSM) for their electrical energy management. It therefore indicates that when the skills of industrial electricians are improved in the areas maintenance, power factor correction and load management techniques, substantial amount electrical energy can be saved in industries

Conclusion

Efficient management of electric motors is one of the major duties of industrial electricians in industries. Skills improvement of industrial electricians therefore is aimed at equipping the recipients with the requisite skills and competencies necessary for achieving electrical energy

efficiency and saving electrical energy thereby avoiding electrical energy wastages in industries. Hence, the identified skills improvement needs should be given considerable attention in order to provide the needed manpower that will manage the inadequate electrical energy for operation of electric motors in industries. Hence, if the skills improvement needs identified are effectively implemented, it will go a long way in reducing unnecessary cost and on the long run boosting productivity in industries.

Recommendations

The following recommendations were made for implementation based on the findings of this study;

1. Industrial managers should use the established skills identified as a basis for planning and organising staff development and training through workshops and seminars to improve the performance of industrial electricians towards efficient management of electric motors in industries.
2. Industrial electricians should also strive to improve or update their skills in the management of electrical energy in industries through attending and participation in workshops and seminars towards efficient management of electric motors in industries.
3. Industrial electricians in industries should be retrained based on areas of skills improvement needs identified in the study.

REFERENCES

Aderemi, A. O., Ilori, M. O., Aderemi, H. O., & Akinbami, J. F. K.(2009). Assessment of Electrical Energy Use Efficiency in Nigeria Food Industry. *African Journal of Food Science.3*(8), 206-216.

Ado, Y. K. (2014). Skill Improvement Needs of Electrical Teachers for the Maintenance of Electrical Laboratory Equipment in Technical Colleges in Kano State. *Unpublished M.Ed Thesis.* Department of Vocational Teacher Education, University of Nigeria Nsukka.

Amadike, O. & Robinson, R. N. (2017).Electrical Installation and Maintenance Practice for Work Skills Improvement Needs of Technical College Graduates for Employment in Rivers State. Retrieved on 10th July 2017 from http:// www.globalacademicgroup.com/journals/pristine/ELECTRICAL%20INSTALLATION%20AND%20MA.

Ibrahim, S. & Ukwenya, J. (2012).Managing Energy Resources: Case Study on Energy Consumption Pattern. *Leonardo Electronic Journal of Practices and Technologies.21*(1), 47-61

Javied, T., Rackowa, T.,Stankalla, R., Sterk, C. & Franke, J. (2015). A study on electric energy consumption of manufacturing companies in the German industry with the focus on electric drives.48th CIRP Conference on Manufacturing Systems. *ProcediaCIRP,41* (1), 318 – 322

Mohamed, A., & Khan, M. T. (2009). A Review of Electrical Energy Management Techniques: Supply and Consumer Side (Industries). *Journal of Energy in Southern Africa, 20*(3), 14-21.

Ohadi, M. M. & Qi, J. (2007). Alternative Energy Technologies: Price Effects. *Encyclopedia of Energy* Engineering and Technology, (2nd Ed). Retrieved on 30th March 2018 from https://www.bokus.com/.../encyclopedia-of-energy-engineering-and-technology-seco

Okeke, R. C., Izueke, E. M. C., & Nzekwe, F. I. (2014). Energy Security and Sustainable Development in Nigeria. *Arabian Journal of Business and Management Review, 4*(3),63-72.

Saba, T. M., Adamu, M. J., Yisa, S. N. & Daniel B. C. (2020) A Model Predicting Electrical Energy Management Practices among Residents in Niger State, Nigeria. *Journal of Information, Education, Science and Technology (JIEST). 6(3) 61-69*

Saba, T. M, Tsado J., Bukar, B. & Bello, H. (2015).Technology Approach to Electrical Energy Management in Small and Medium Enterprises in Niger State, Nigeria. *.ATBU, Journal of Science, Technology & Education*. *3*(3), 92-101.

Salaria, N. (2012). Meaning of the Term- Descriptive Survey Research Design. *International Journal of Transformation in Business Management*. 1 (6), 1-7.

Tsado, J. (2014). *National energy saving initiative and right lighting*. Paper presented at the 8th International Lighting Conference 2014, (Nov.18th- 20th) at Hotel De Bently, Utako District, Abuja.

Ubani, O. (2013). Determinants of the Dynamics of Electricity consumption in Nigeria. Organisation of the Petroleum Exporting Countries (OPEC) Energy Review, June edition, 149-161.