ELECTRIC DEMAND AND SUPPLY IN JOS METROPOLIS: IMPLICATION FOR SUSTAINABLE SOCIO-ECONOMIC ACTIVITIES.

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Abstract

The study aimed at investigating the nature of electricity power supply on the socio-economic activities in Jos Metropolis. Purposive sampling was adopted in the choice of socio-economic activities using electricity for daily operations.. The result shows the leading socio-economic activities was Hair cut/Hair dressing 17.3%), followed by Metal and Aluminum work (10.7%). About half (46.3%) of the socio-economic activities needed between 6 - 10 hours (21.1%) and ≥11 hours (25.3%) of electricity power daily for their operations. , but only 30.6% (14.2% and 15.4%) had it. The proportion of electricity power required and the supplied largely vary; where 77.3% spent on fueling Generator for alternative power. The study recommends that the Governments, Electricity Power Distributors and all stake holders should practically work towards exploiting generating alternative sources of energy from the solar and biomass for adequate electricity power supply to enhance socio-economic activities for sustainable national development.

Keywords: Socio-economic activities, Electricity power, Megawatts (MW), and Plant.

INTRODUCTION

The quest for more energy is a Global concern. In the beginning, wood was the fuel for civilization as early as 5400 BC, however, scientific and technological advancement became instrumental in leading to the discovery energy resources which reduces the use of wood, charcoal and other combustible renewable energy resource. Preceding the use of wind and water power (hydro-power), Coal was considered fuel for industrialization, while oil and gas were considered fuel for advance industrialization. Energy is the key factor in the achievement of socio-economic growth and development, without which, is a sign that something bad is happening to the economic and social change. Shortage of this energy resource could be the most important constrain of material development (Earth, 1973).

The discovery of oil and gas (natural gas) together with resent discovery of hydro-electric, geothermal, tidal and direct solar energy resources has enhance the reduction in charcoal and coal consumption. These are cleaner energy resources that are used in most countries of the world for the improvement of economic and structural development for better standard and quality of life for citizens. Tropical countries like Nigeria have in abundance solar energy potentials which are the safest and cleanest energy resources with less environmental consequences and hydroelectric power resources. There has been low level investment in research and development on the exploitation of solar energy on the hybrid system combining wind power as fairly available during the day and night with solar thermal or solar voltaic generation available during the day. The maximum solar radiation power reaching Nigeria land surface area; 924000 km^2 is about 600 mw/km^2 at noon and decline to zero at sunset. The Sahara desert with a sparsely populated land area of about 9,100,000km^2 receives the maximum of about 700 mw/km^2 is about to be the suitable power house for Africa (Sambo *et al.*, 2013).

Nigeria, for instance, is the largest economy in the sub-Saharan Africa and the 26th in the world with per capital (GNP) of $509.9 billion in 2013 which was about 80.22 trillion naira; the economy when measured by real Gross Domestic Product (GDP), grew by 6.23 percent (year –on–year) and in the third quarter of 2014, higher by 1.06 percent at points from rates recorded in the third quarter of 2013 (National Bureau of Statistics, 2014). But still, the country has a greater percentage of her population living under the poverty line. This may be attributed to limited power that incapacitated many socio-economic activities

from thriving which would have allow people occupied in active income generating activities using simple equipment that use electricity. Sambo *et al*. (2013) noted that in spite of the abundance of energy resources in Nigeria, the country is in short supply of electric power. Only about 40% of the nations' over 160 million have access to grid electricity and at the rural level where about 70% of the population live; the availability of electricity is 1.5%. The total technically exploitable hydro-power potential based on the country's river system is conservatively estimated to be about 10,000 MW, of which only 19% is currently being tapped or developed. Available statistics of electricity generation and per capita consumption in Nigeria is less than 4000MW electricity generation capacity and 0.03KW per capital consumption.

Ayodele (2001) observed that within the particular conception of socio-economic processes which underscore every economic system, economic development, globally, revolves around the issues of the character, structure, pattern and evolution of desirable inter-personal relations of production, allocation and utilization of available resources in any country. In order to optimally develop and efficiently manage such available resources, equitably allocate and effectively utilize them and subsequently put economic development firmly on course; modern operational technologies with respect to production, allocation and utilization are designed and tied strictly to the use of energy in one form or the other. Thus, the quest to rapidly and firmly put the Nigerian economy on the course of economic development is technically, a function of adequate supply and distribution of energy, particularly, electricity. In this regard, adequate supply and distribution of electricity constitute a central sustainable development pillar of wealth creation in Nigeria; it is also the nucleus operations and subsequently the 'engine of growth.

According to a recent survey of the United Nations (2013), while urbanization is growing, for the first time in history, the world's absolute number of rural inhabitants is declining and so, the provision of energy and more particularly electricity is a dominant element for economic sustainability. Karanfil and Li (2014) the reported the relationship between electricity consumption and economic Growth can be categorized into four testable causal hypotheses: (1) growth hypothesis Assumes that electricity is a necessary factor of economic growth; (2) conservation hypothesis postulates a causality running from economic growth to electricity consumption; (3) feedback hypothesis emphasizes the interdependence between electricity consumption and economic growth; (4) neutrality hypothesis assumes no causal link. In order to make proper policy suggestions, it is necessary and essential to clarify the relationship and the direction of causality between them. This was similarly affirmed by Iyke (2014) on some concluded strands that: electricity consumption causes economic growth (electricity led growth thesis); that economic growth causes electricity consumption (the growth-driven electricity consumption thesis); that there is bidirectional causality between electricity consumption and economic growth (the feedback thesis); and that there is no causal link between electricity consumption and economic growth (the neutrality thesis).

United Nations Development Programme (2005) and Akinbami and Momudu (2011) held that the provision of adequate, affordable, accessible and sustainable electricity supply has the capacity to serve either as a catalyst or a fetter on the wheel of development to the attainment of sustainable human improvement at different levels and, facilitates economic development and poverty reduction by underpinning industrial growth and enhancing productivity. This is because, the arrival of electricity supply in an area seems to kick start new economic activities and marked rise in the standard of living. The result shows correlation between supply of electricity and significant growth of commercial enterprises. In the same vein, Sambo (2008) observed that accesses to reliable energy services (electricity) enable enterprise development and are necessary for local and national economic growth. Lighting form the energy permits income generation beyond daylight hours and reduce costs, help create sustainable business/jobs and economics, and fortify the social fabric. However, only 10% of rural households and 40% of the country's total population have access to electricity and it has been estimated that this situation would require many

additional new power plants; approximately 15,000 km of transmission lines, as well as distribution facilities to ensure electricity that would enhance sustainable socio-economic and human progress (www.mbendi.com/indy/powr/af/ng/p0005.htm).

Abiodun (2014) reported that Nigeria's estimated economic growth is between 7% – 13 % with 3,8% urbanization and have the demand for electricity is projected to grow from 15, 730 MW in 2014 to 41,133MW and 88, 282 MW by year end 2015 and 2020 respectively. In March 2014, electricity supply form national grid was 4,306 MW which was far below the estimated demand of 12, 800 MW which implied only about 34% of the country's requirement was generated. The per capita electricity consumption has been adjudged to be the lowest in Africa. In order to achieve the Vision 20:2020, Nigeria will need an electricity generation capacity of about 35,000 megawatts by 2020 (Presidential Committee on Nigerian Electricity, 2006).

Megbowon and Oyebisi (2005) pointed that global, reliable electric power availability has been observed as effective and indispensable machinery for the rapid industrial and economic growth of any nation. Popoola *et al.* (2011) equally viewed that electricity power importance in the society and its necessity for national economic growth, its supply is expected to be available 24 hours a day and is expected that its utilities throughout the world must ensure they meet customer demands at a reasonable level of service reliability. For Okonkwo (2010), more than 90% of Nigerians cannot boast of 16hours of electricity supply daily where the power outages plague Nigeria's businesses, leading to relying on fossil-fuel-burning generators. However, respondents to "Power Performance"; a weekly Network Service of Radio Nigeria Programme by the Ministry of Power pointed to inadequate transformers, prepaid meters, indiscriminate and high light billings and dilapidated electricity power facilities in the country as causes of insufficient electricity distribution (Federal Ministry of Power, 2014).

Inadequate electricity supply affects virtually all level socio economic activities. This is not limited to welders, barbers, business centre, refrigerators, air conditions, technicians, tailors etc. The middle class workers are equally affected. The few that can afford to buy generators are unable to operate them because of high cost of fuel. Bejide (2010) said this trend has been the reason for many held the believe that the middle class has been wiped out in Nigeria as a result of the twisted economy and the situation is dangerous for any society. The upper class pays high prices to provide generators at home, offices and factories. This trend increased the cost of production of goods and services. Unfortunately at the end of the day, these prices are passed on to the low level workers (the end consumers). It is obvious that without the full participation of the low and middle classes, the economy of any nation cannot thrive. But, the people are deprived by electric power shortage and are forced into using alternatives that may be harmful.

To substantiate this, the NOI Polls (2013) in its series of Power Sector Polls conducted by in the second quarter of 2013 which revealed that an average of 47% of Nigerian said that electricity supply was poor or went from bad to worse. The results also indicate that about 8 in 10 of those interviewed (81%) generate their own power supply through alternative sources to compensate for irregular power supply; while a combined average of 69% have experienced increase in their spending on alternative power supply compared to a year ago. Although, a new phase in managing electricity power emerged in Nigeria with the handing over of electricity power generation and distribution to Private Operators in September 2013, the situation has not improved significantly. This is because of the inability of both the Government and the Private Operators to meet up with their promises of adequate electricity power generation and consistent distribution across the country. Prepaid meters that were promised to be available soon have been provided and the general electricity infrastructure and services seem to be below the expectation of consumers. For Abiodun (2014), the challenge of inadequate electricity supply in the country is associated with shortage of gas supply, deplorable condition of some PHCN successor generating and distribution companies, as well as high transmission/ distribution losses. The epileptic and inadequate situation of electricity to meet the required power at the various Business Districts

in Jos Metropolis is worrisome and this situation prompted questions to include: What are the socio-economic activities in Jos Metropolis? What is their electricity demands and supply (in hours) for daily operations? How do they survive in the events of unmet hours of electricity demanded? What are the determinants of the nature of electricity supply for socio-economic activities? The study attempts to address these questions through the following specific objectives; which are to:

i. identify the socio-economic activities that require electric power supply for their daily operation in Jos Metropolis.
ii. determine the available daily supply and required demand of electric power for socio-economic operations.
iii. identify factors responsible for the nature of power supply in the study area.

METHODOLOGY

A stratified sampling technique supported in delineating the study area into business districts of similar characteristics. The socio-economic activities were categorized into three; based on duration of light requirement as high, medium and low (see Table 1).

A systematic sampling method was then used to acquire information 150 (10%) owners of Business activities using questionnaires to generate data on the various socio-economic activities identified requiring electricity for daily. Descriptive statistical technique was used to summarize that data.

STUDY AREA

Jos metropolis is located between latitude 8.32^0E and 8.53^0E and longitude 8.53^0N and 9.05^0 N of the Greenwich Meridian. It has an average elevation of about 1,250 meter above sea level. The growth of the population of Jos in the early years was linked to the economic fluctuations of the tin mining industry. According to 2006 population census, Jos Metropolis has grown to about 900,000 dwellers. (National Bureau for Statistics, 2010). As the prosperity of tin mining increased, it encouraged the migration of labourers from the northern part of the country to the town. In 1926, Jos became the Provincial Headquarters of Plateau Province and is currently the capital of Plateau State. The study area has a tropical high land, cool climate characterize by two seasons; the wet and the dry seasons being controlled by the position of the Inter Tropical Convergence Zone (ITCZ) which attracted people of varying national and international backgrounds engaged in viable socioeconomic activities.

There are diverse commercial activities combined that made Jos attractive many of which are businesses providing services inform of manufacturing, mining and agro-allied industries estimated to be providing employment for a significant number of individuals in the formal and informal sector of the urban economy. It has health and educational training institutions like the NIPSS, NVIR, University of Jos, Plateau State Polytechnic, and Federal College of Forestry among others. The City enjoyed electricity distribution from the Jos Electricity Power Distribution Company (JEPDC) and NESCO. All the Telecommunication Networks have their major Offices in the study area. There are large and small scale private and public industrial enterprises booming production of capitals, goods and services. Some of them are: the Jos International Breweries, NASCO Group of Companies, Jos Steel Rolling Mill, Grand Cereals Company among others.

RESULTS

The Socio- Economic Activities Using Electric Power

The socio economic activities requiring electric power operation are presented in Table 2. It reveals that 17.3% were into hair cut/hair dressing enterprise, followed by 13.3% into computer operation/services and 10.7% Mental and Aluminum work were the major activities captured that required constant electric power for operation.

Remarkable socio-economic activities whose survival are tired to availability and supplied of electricity power identified in the study conceded with Okonkwo (2010). These activities were involved in production of goods and providing relevant services that are crucial to the daily needs for human survival that could subsequently lead to national development. For instance, Hair cut/ dressing; Computer operations or services that have to do with typing, printing, photocopying and production of vital documents for individuals and

organizations; GSM services in terms of repairs, charging batteries, commercial calls and sales; Metal/Aluminum works among others are services required in high demand by individuals to make their live better. In fact, the various socio-economic activities identified in this study reflect the fact that many people are involved in various means of livelihood with many of the managers as owners or employees. This could also imply that due to the challenges of acquiring meaningful education in Nigeria, coupled with the high rate of poverty and unemployment, graduates who constituted over one-quarter of the owners/managers or employees settled down on handwork or engage in one business or the other to make a living

Features of Electricity on Socio-Economic Activities

The results in Table 3 makes obvious that almost all (99.3%) of the socio economic activities required regular electricity to operate daily and all of them were connected with electric power for supply, including the 0.7% that has less need for it to function. Majority (59.7%) of the socio-economic activities rated the nature of electricity power supply to them as very poor, 38.3% said it was erratic and only 2 % said the supply was regular.

Daily Hours of Electricity Needed and Supplied

However, Figure 2 clearly demonstrates that 25.3% of all the socio-economic activities required an average electric power supply for 11 hours and more to operate effectively in a day; only 14.2% reported they had it with 11.1% of those who could not have it. For the socio – economic activities that required between 6 to 10 hours (21.3%) of electricity, only 16.4% said they had it and 4.7 % could not have it. The few (4.3%) that required between only 1-5 hours in a day, over quarter (14.2%) additional socio-economic activities who needed more than the hours (1 - 5 hrs) reported they had it. In additional, Table 3 shows that, in spite of the general nature of electric power supply reported to be very poor by 59.7% respondents and erratic in supply by 38.3%; the businesses used their meager income to settle monthly electricity power bill charges of less or equal to ₦2000 (30.9%) ,₦ 2,001 - ₦ 4,000 (40.3%) and ₦ 4,001 and more (28.8%). The result implied that almost all the businesses required electricity power for effective daily operation and were all connected to either Jos Electricity Power Distribution Company (JEPDC) or NESCO (a private and non PHCN successor company). Many of the socio-economic activities required steady supply of average ≥ 11 hours electricity power for or between 6 -10 hours daily to enable them provide services and/or meet their daily production targets. However the supply of the electricity power has been below the average number of hours demanded, this is consistent with Bejide (2010), Abiodun (2014) that Nigerians cannot boast of 16 hours average daily supply of electricity power and national supply of 34% is below the estimated demand. Countries like Niger and Ghana who once look up to Nigeria for supports on electricity have the utilities stably today and are boosting of supplying electricity to Nigeria!

The insufficient electricity in terms of the number of hours required for operation explains the levels of unemployment and poverty in most communities. If the urban socio-economic activities could experience this, what becomes of the rural areas where majority of them are not connected with National Electricity Grid? The socio- economic life in our communities struggled for survival where local productivity is reduced, which in turn affects the generally national productivity output, revenue turn over and adding to the levels of poverty in the society . This may be what is forcing the youths resorting to all manner of crimes for survival and being used as thugs to end a living. With this situation, the effort for achieving Millennium Development Goal (MDG) that targets reducing poverty level among communities in ensuring sustainable development may be very difficult, if this nature of electricity power supply does not improved in the nearest future .

Alternative Sources of Electricity

Figure 2 unfolds the various means socio-economic activities thrived to survive using other alternatives to electricity. The result reveals that over two-quarters (77.3%) of the socio-economic activities resort to using Generators as substitute to electricity for the hours not supplied. This was followed by 10 % who used tough / charcoal, 6.7% and 6% who went for Batteries/ Inverters and solar panel

respectively. On how much the various socio-economic activities spent on maintain their alternative sources power, Figure 3 shows that over one quarter (34.2%) reported spending between ₦2, 001- ₦4, 000 monthly, 31.5% spent ₦4, 001- ₦6,000 monthly while 19.5% used up ≥₦6,001 monthly to provide alternative power sources to enable meet up with monthly production and/or service provision targets.

The two Figure (2 and 3) implied that, in the efforts of the socio-economic activities thriving to survive, they had to source for other means of ensuring their operations continued by resorting to alternative power sources with Generator among others the highly utilized to supplement for the remaining hours required. This is in harmony with NOI Polls (2013) and Abiodun (2014) that over 80% of Nigerian population generate electricity through alternative means sources. This has made many of the socio-economic activities spent more money in the purchase of fuel and maintenance of the alternative sources than they do on bills/charges from electricity power companies (JEPDC or NESCO). The money paid for electricity power without proportionate benefits from the services, adds greater burden on the survival and sustainability of socio-economic activities and citizens to enhance national development. This is in addition to the implication on the air pollution generated by harmful substances emitted from the Generators which has long time effect on the ozone layer and human health. If this situation continues, it means that businesses will find it very challenging to thrift in communities sharing similar characteristics with Jos Metropolis. United Nations (2010) said on this situation that the proportion of the working population that is (self) employed is a good indicator of the ability of an economy to generate jobs and so a high price for energy could exacerbates severe economic downturns that are likely to have a significant negative impact on the proportion of working people living in extreme poverty. These are people self employed may not earn enough to lift themselves and their families above $2 a day poverty line.

Moreover, this situation is capable of frustrating the global efforts of achieving socio-economic sustainable development through eradicating extreme hunger and poverty, whose specific targets are to reduce by half the proportion of people living on less than $1 a day and those who suffer from hunger. Although, the study did not investigate whether some businesses fissile out of operations, however, the threat by some manufacturing companies to relocate/ relocated to other African countries from Nigeria might have been associated with the cost of powering their machines to ensure production and using other alternative power sources among others reasons reported in the study.

Factors Affecting Power Supply on Socioeconomic Activities

It is apparent from the study that the various socio-economic activities were not finding it funny with the inadequate electricity power supply. The study investigated the owners/managers of the various businesses on their opinions on the reasons for the nature of electricity power supply in the midst of high demand for effective operation. The findings in Figure 4 demonstrates obviously that 31.7% of the businesses owners/managers attributed the reasons to dilapidation of electric power facilities, 23.1% of them attribute it to the Inadequate Meters and Power Distribution, 19.3% increasing pressure on existing electricity facilities, 14.5% of the respondents reported that fraudulent attitudes of arbitrary and high billing caused it while 11.4% said electricity power providers are inefficient.

The causes of inadequate electricity power supply are multi-facet and the study has to not exhaust them. However, NOI Polls (2013) and Abiodun (2014) pointed at similar ones reported by the managers / owners of the socio-economic activities. One of the causes in recent times has been observe red to be the deplorable condition of most of the electricity generation, distribution and transmission companies. The losses and shortfalls in gas supply has been another critical challenge to the sufficient supply of electricity, These situation are actually what contributed to the low supply and consumption of electricity in Nigeria and fit it low rating in Africa, in spite of huge investment by the government and international organizations.

Recommendations

Electricity is the life wire of economic development in countries around the world. In Nigeria, most social and economic activities

rely on electricity for survival and national development. However, the nature of supply amidst high demand of electricity in the country has been very challenging, despite many promises and frantic efforts to improve the utility across the country; Plateau State inclusive. This is evident by the with a gap between the high demands and the nature of inadequate supplies of the utility for thriving residential and socio-economic activities. Based on the implication of the findings of the study, the following recommendations are made:

1. The Governments and the electric power generation, distribution and transmission companies should ensure that conditions agreed upon during the handing over of electricity power for adequate provision in the country should be pursuit so as to ensure sustainable domestic and industrial high demand operations.
2. Electricity Regulatory Agencies in Nigeria should work towards exploiting to generate energy from alternative sources from the solar and biomass for stable and adequate power supply to enhance socio-economic activities for sustainable national development. This would address the poor supply of the utility amidst high daily demand.

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APPENDIX: TABLES AND GRAPHS

Table 1: Samples drawn from the three categories of Socio-economic Activities

Categories of Electricity Use	Identified Economic Activities	Total Economic Activities Identified	Number Sampled (10%)
High	GSM Repairs/Charging/Sales	151.0	15
	Computer Operation / Services	204.0	20
	Metal and Aluminum Works	164.0	16
	Filling Station	47.0	5
	Hair Cut / Hair dressing shops	256.0	26
	Dry Cleaning Services	53.0	5
	Health Care	41.0	4
	Financial Services	42.0	4
Moderate	Poultry Farming	135.0	14
	Sales of Electrical Appliances	58.0	6
	Carpentry / Furniture Works	20.0	2
	Viewing Centre	23	2
Low	Provision Store	132.0	13
	Tailoring / Design	44.0	4
	Food/Drink/Restaurant Services	74.0	7
	Photographing	37	4
	Shoe Making	32.0	3
	TOTAL	**1513**	**150**

Table 2: Distribution of Socio-Economic Activities in Jos Metropolis

Socio-Economic Activities	Frequency	Percentage
Carpentry / Furniture Works	2	1.3
Computer Operation / Services	20	13.3
Dry Cleaning Services	5	3.3
Financial Services	4	2.7
Food / Drink Services/Restaurants	7	4.7
GSM Repairs/Charging/Sales	15	10.0
Hair Cut / Hair Dressing	26	17.3
Health Care	4	2.7
Metal and Aluminum Work	16	10.7
Photographing	4	2.7
Poultry Farming	14	9.3
Provisions Store	13	8.7
Sales of Electrical Appliances	6	4.0
Filling Station	5	3.3
Shoe Making	3	2.0
Tailoring / Design	4	2.7
Viewing Centre	2	1.3
Total	**150**	**100.0**

Table 3: Selected Features of Socio-economic Activities

Features		Frequency	Percent
Required Electricity for Operation			
	Yes	149	99.3
	No	1	0.7
	Total	150	100.0
Connected with electricity Power			
	Yes	150	100.0
Nature of Electric Power Supply			
	Regular	3	2.0
	Erratic	57	38.3
	Very Poor	89	59.7
	Total	149	100.0

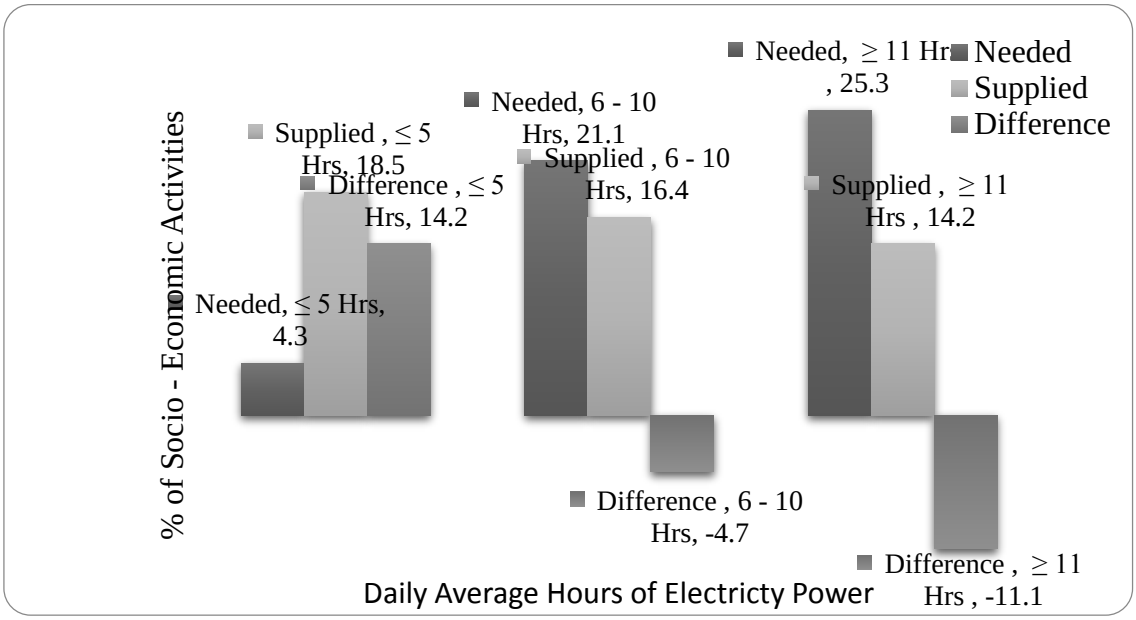

Figure 1: Average Daily Electricity power Needs and Supply for Socio-economic Activities

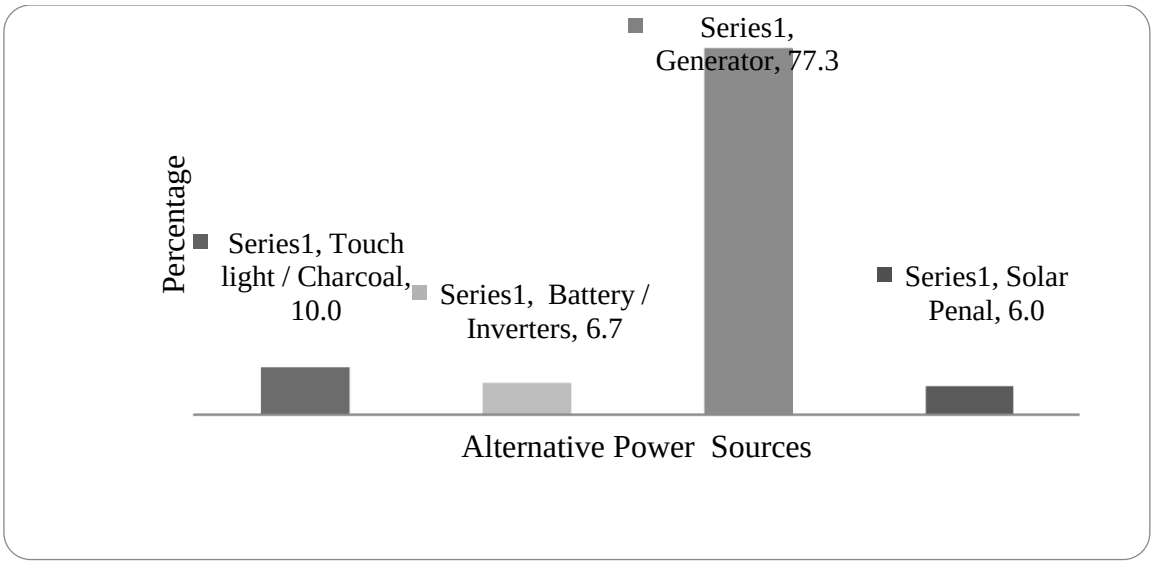

Figure 2: Alternative Sources of Electricity Power

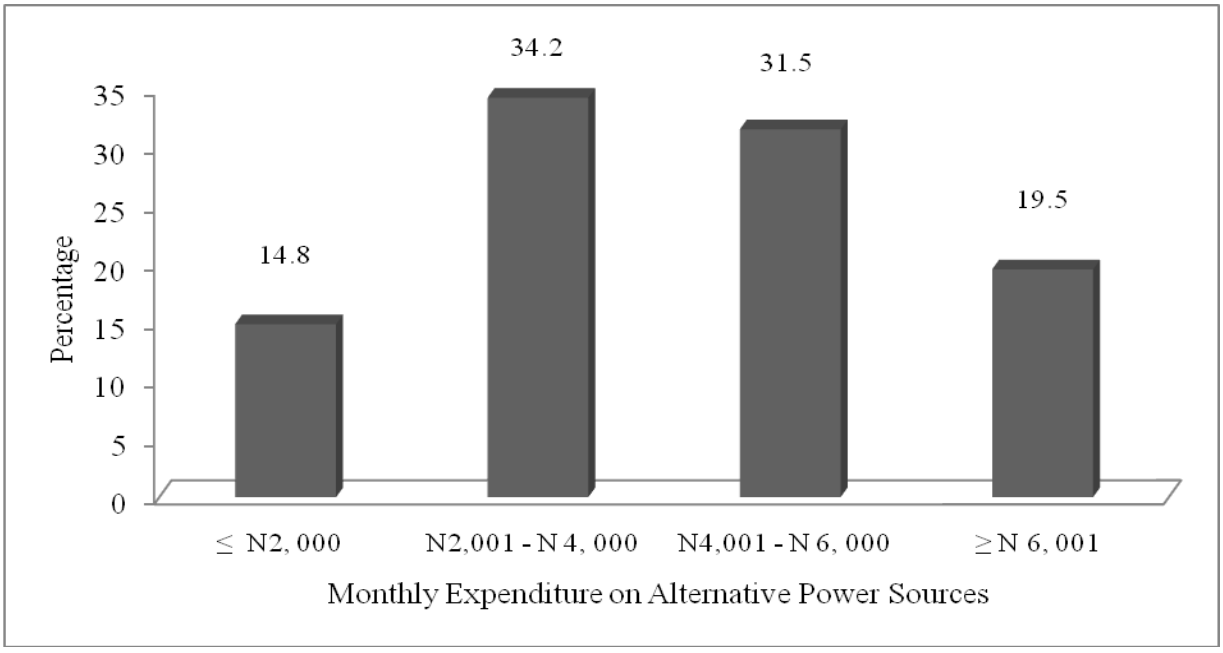

Figure 3: Expenses on Alternative Power Sources

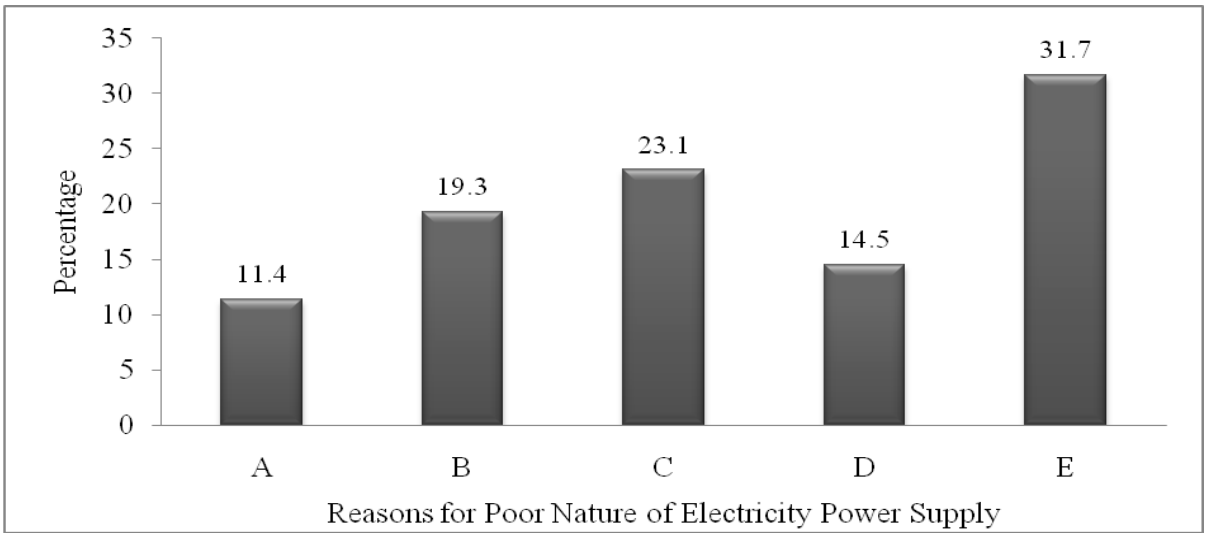

Figure 4: Factors Limiting Adequate Power Supply

Note: A= Inefficiency of the Electric power distributors, **B**= Increasing Pressure on Existing Electricity Facilities, **C**=Inadequate Meters and Power Distribution, **D**= Arbitrary and High Billing and **E**= Dilapidated Electrical Facilities.