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Operation save Energy: the Grid Defence Mechanism in Sub-Saharan African

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ABSTRACT: *In this paper, the indiscriminate consumption of energy by various customers/consumers has been highlighted. The paper is centered specifically on wasted energy emanating from the consumption of 60 watts incandescent bulbs by customers/consumers. By using statistical analysis, the energy consumption over a period of time was calculated and the results obtained were graphically interpreted on the Matlab 2017a environment. The obtained result indicates that the careless usage of incandescent bulbs by customers/consumers for a year constitutes a wasted energy of about 109MWhr. Further result shows that the wasted energy could have actually fed a total of 27,000 customers with a moderate energy consumption of about 3.7kWhr leading to a reduction of 2.5kVA generators in the country by 27,000. Conclusively, if the proposed method in this paper is adopted and enforced by the authority concerned then, a significant improvement can be recorded especially during this period where the system has been attributed to be highly unreliable irrespective of the huge investments pumped into the sector. There is therefore a need to save the grid especially from the consumption angle if sustainability is to be recorded in the sector.*
KEYWORDS:*Consumption, Consumers, Customers, Energy, Incandescent bulbs.*

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I INTRODUCTION

Adequate power supply is essential for a country's development, and this involves capital intensive activities demanding huge resources of both funds and capacity. In Nigeria for instance, an economy just shedding off the effects of recession and with the resultant effects of cash paucity, the need for generation, transmission and distribution of power via a more efficient means cannot be overemphasized, in order to address the power problem. One attractive prospect to the challenges of the power sector, amongst others, is the application of energy saving techniqueto improve on the system's reliability and availability.It has been estimated that 85% of the 1.2billion people who live without electricity in the world are rural dwellers [1]. In a supportive assertion, [2] affirms that 80% of persons without electricity in Africa also rural dwellers while [3] indicates that only 30% of Sub-Saharan Africa is electrified thereby leaving 645 million people without access to this amenity. It is obvious from figure 1 that there is indiscriminate use energy within this region which eventually leads to energy shortage**.**According to [4], the primary energy deposit in Nigeria for instance if successfully utilized; is capable of meeting the energy requirement of the nation however, energy shortage is predominantly experienced in the country and records have it that the power supply in the country is seasonally dependent.Presently, the power sector in Sub-Saharan Africa is unreliable [5-6] it is in a quest to solve the problem of energy shortage by consumers that made this region the largest market for generator dealers across the world yet, there is a cry for the world to "go-green" before the year 2030, how can this be achieved when the developed world have already seen this region as a good market especially when it comes to the issue of energy. To this end, if the world must go-green then, importation of generators to these regions must be terminated by all parties involved especially from the western world. According to [7],it was gathered that the sum of $5.3 billion is spent on generators on a yearly basis by 60 million Nigerians. Further study by [8],asserts that the cost of purchasing, operating and maintaining a 2.5kVA generator by an average Nigerian living in a 3-bedroom apartment can be estimated to $1,100 annually. Another study by [9]asserts that it takes $1.2million to build a 1MW power plant. If an extrapolation is done it would be seen that the $5.3 billion expended "carelessly" by 60 million Nigerians could actually build a 4, 444MW power plant and this can go a long way to reduce energy

poverty in the land. It is unarguably said that the power generated using generating sets especially in Nigeria could be more than that of the grid. Due to rapid population growth, the demand for energy keeps increasing at an alarming rate hence, there is a need therefore, to save the grid and hence providing a defence mechanism for the grid through sustainable policy and otherwise in order to reduce the attack on the grid. It is in an effort to curb energy shortage imposed by consumer/customers in figure 1 that [10] designed an energy saving mechanism that triggers a given power supply only when it is needed. Although, the paper did not state how cost effective is the proposed device however, it is a justification that there are various solutions to solve the problems of energy poverty in Africa. Similarly, [11] opines that there can be a 58% reduction on the cost incurred on yearly consumed energy if the proposed retrofitted method of the research is accepted. This paper therefore, proposes the simplest and cost effective method of saving energy from the customers/consumers angle. The onerous task of tackling energy poverty in this region can only be achieved unless there is a general consensus by the government, stakeholders, and operators of the system and more especially from the customers/consumers.

Fig 1: Indiscriminate Consumption of Energy at Different Geo-Political Zones across Nigeria

II METHODOLOGY

Energy scarcity will continue to linger in this region if consumers as shown in Figure 1 continue with their nonchalant usage of energy. It may also be argued that the customers involved are paying for the service

hence, the decision to use their electrical gadget "anyhow" lies in their hand. However, the illustration shown below shall explain why it is much better to put off all electrical gadgets when not in use.

The total power, P_T, of the devices or appliances under consideration is given by the expression below:

$$P_T = \sum P_{device} \cdot n_{device} \quad (1)$$

$$where;$$

$$P_{device} = power rating of devices$$

$$n_{device} = number of devices$$

The total energy consumption by the appliancesE_T, is computed using the expression below:

$$E_{T_n} = n * P_T * t \quad (2)$$

Assumption 1: An incandescent bulb rating of 60watts

Assumption 2: Hours of Usage is 5hrs per day

$$where;$$

$$n = number of days$$

$$t = usage period\ (hours)$$

The obtained results from (1) to (2) are summarized in Table 1.

III RESULTS AND DISCUSSION

It can be seen that is obvious that a 60W bulb depending on the hours of usage can constitute a very big problem to the grid. If 1000 consumers put on the bulb for 5 hours a day continuously for a year, the amount of energy consumed by the bulb would be approximately 109MWh.

Furthermore, reference [8]asserts that the energy consumed by an average family living in a three bedroom apartment is 3.7kWh consequently,if the energy wasted on a daily basis by 1000 customers/ consumers is divided by this value then, an approximate of 81 household can be fed with this wasted energy. Also, if an extrapolation is done for a year, then approximately 27,000 customers can also be fed from this wasted energy, and this is an implication that small sized generators of the rating 2.5kVA must have been reduced in the country by 27,000.

Table 1: Table of Energy Consumption

No of bulb(s)	Usage (Hrs)	Daily Energy (Wh)	Weekly Energy (Wh)	Monthly Energy(Wh)	Yearly Energy (Wh)
1(60W)	5	300	2100	8400	100800
10(60W)	5	3000	21000	84000	1008000
100(60W)	5	30000	210000	840000	10080000
1000(60W)	5	300000	2100000	8400000	100800000

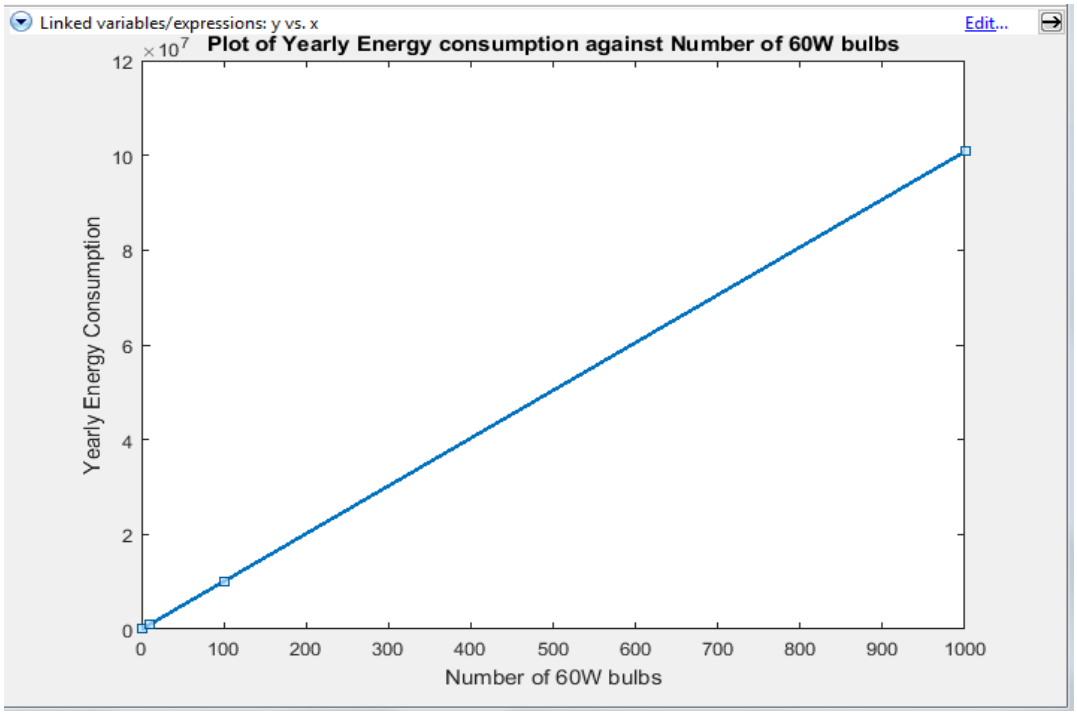

Fig 1: Plot of Yearly Energy consumption against Number of 60W bulbs.

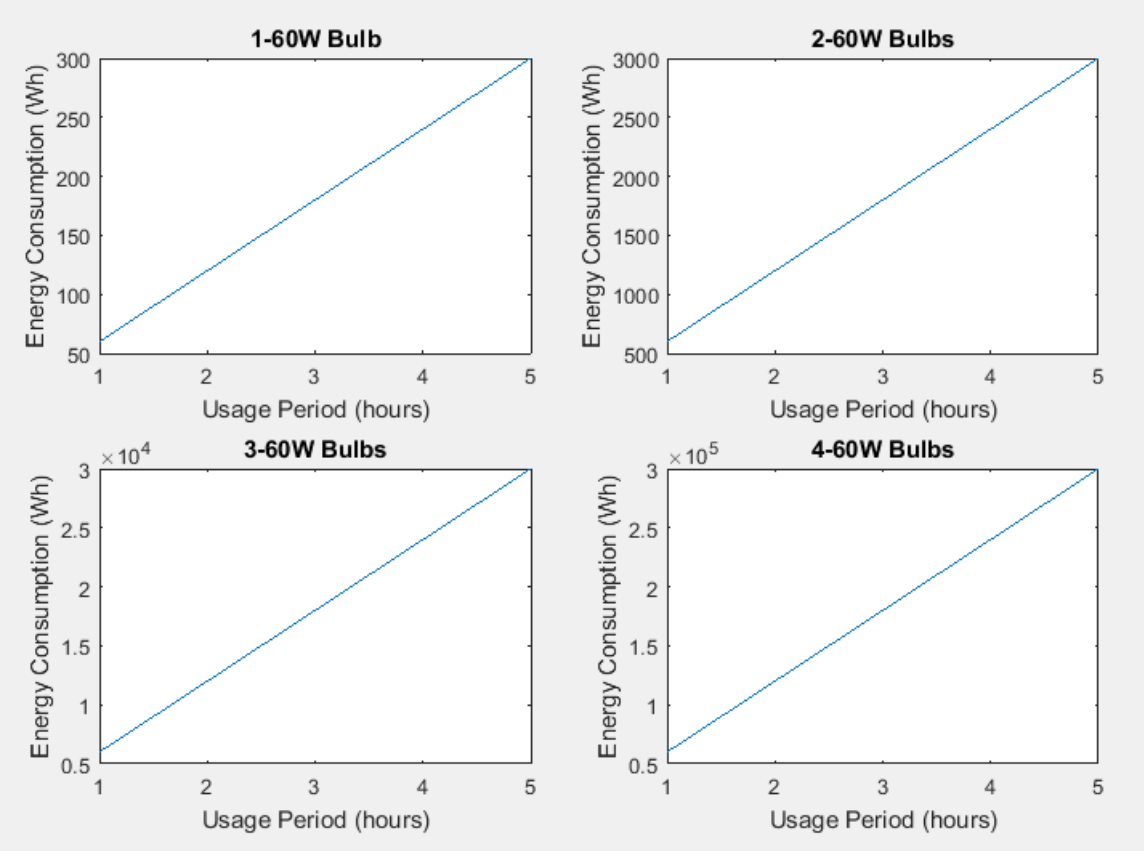

Fig 2: Daily Energy Consumption of the various number of 60W bulbs

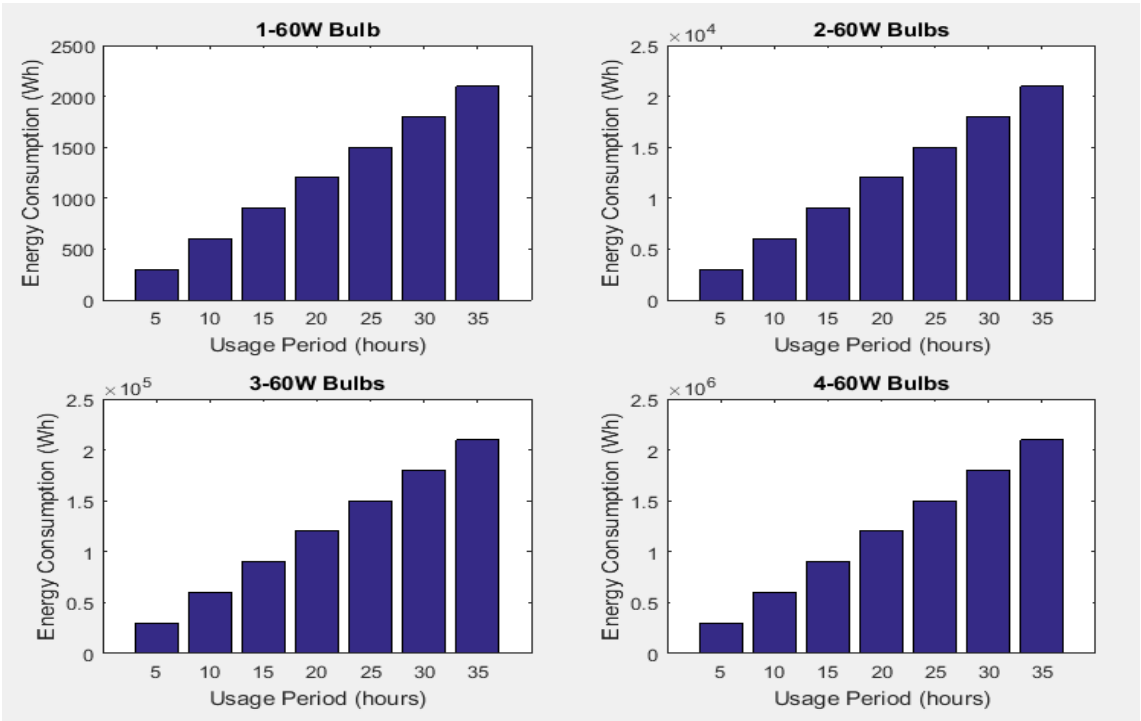

Fig 3: Weekly Energy Consumption of the various number of 60W bulbs

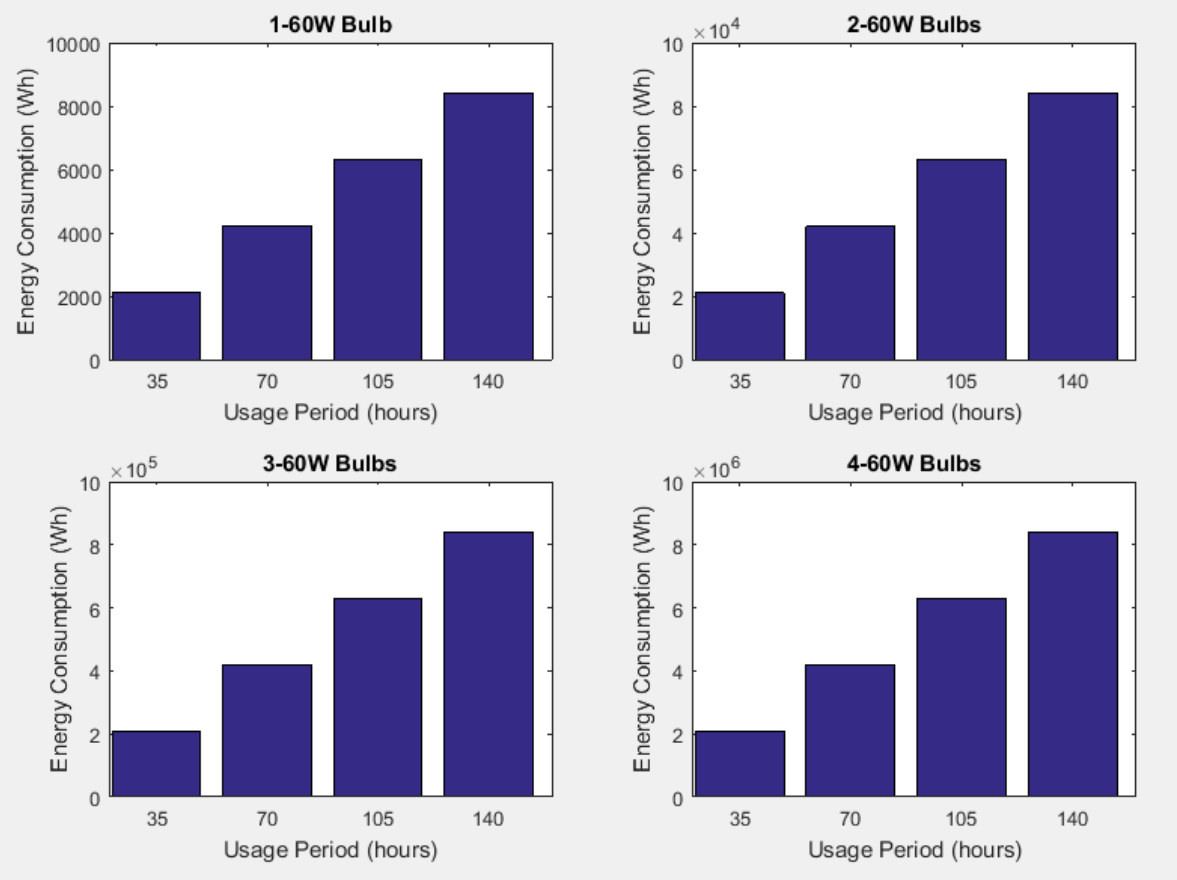

Fig 4: Monthly Energy Consumption of the various number of 60W bulbs

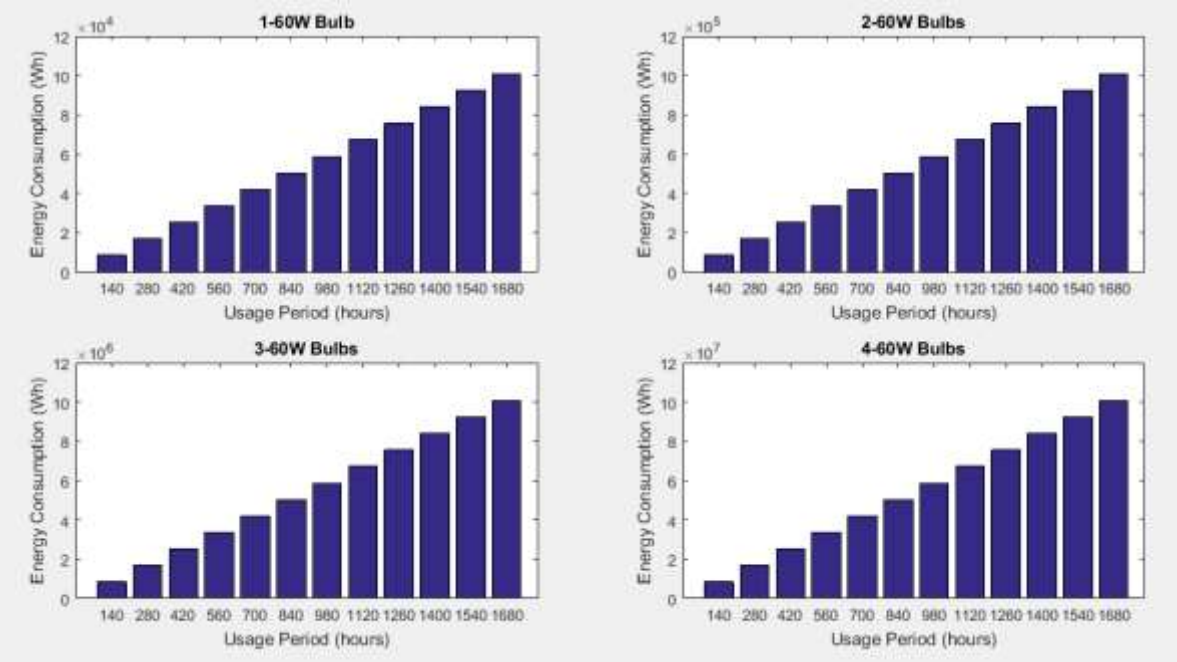

Fig 5: Yearly Energy Consumption of the various number of 60W bulbs

IV CONCLUSION

Conclusively, the paper has discussed the need to save energy in Sub-Saharan Africa and the need also for the western world to stop seeing this region as a dumping site for archaic technology. Since the authorities concerned in this region have not been able to solve this calumny, the onus therefore, lies on the hands of the consumers who are expected to assist the concerned authorities by operating all electrical gadgets only when

needed as this will go a long way to reducing energy poverty in the land and also reduce the number of generators been moved into the region. It is on this note that the following recommendations are made:

1. The use of incandescent bulbs of high power ratings should be discouraged while energy saving lamps should be encouraged although, the government of the day had to step into this by subsidizing the prices of energy saving lamp entering the region and increase the duty on incandescent bulb.
2. The western world should stop the exportation of high energy consuming devices and equipment to this region because they continue to make the grid weaker.
3. If importation of generators to this region lingers then this region will continue to see it as an alternative means of power supply however, should there be a policy to ban the importation of generators to this region then all hand will be on deck to solve the problem of energy poverty.
4. Policy should be made and enforced especially in all places of worship on the need to mandating them to use energy saving lamps in their respective places of worship.
5. Sensitization, awareness programme, campaigns, jingles etc.,is key, in order to educate the masses on the need to save energy by putting off all appliances when not in use.

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