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Evaluation of Energy Efficiency for Sustenance of the Power Industry

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ABSTRACT:Energy efficiency if not encouraged may give birth to low energy supply to the power distribution sector, hence, wide gap between energy demand and energy supply representing energy deficiency in its entirety. Energy deficiency adversely affects every economy, the power sector through the customers' inability to pay for energy utilized; leading to high aggregate technical, commercial and collection (ATC&C) losses. Hence, energy efficiency has become a veritable cost-effective solution to close the wide gap between energy demand and supply in a growing economy, as well as, a strategy to make power supply more affordable for the customers, reduce aggregate technical, commercial and collection (ATC&C) losses and improve revenue collection by the distribution sector thereby making all the sections of the power industry to remain in business. Energy efficiency is adjudged most suitable to close the gap between demand and supply of power (electric energy), as well as, sustaining the power industry as a business entity.

KEYWORDS: Energy Efficiency, Power Industry, Distribution Company, Electricity Bills, Customers, Energy Waste.

I. INTRODUCTION

Energy efficiency can be defined as the utilization of less energy input to achieve the same level of services and at same time making electricity more affordable for the customers and improving loss reduction of the utility company. Energy efficiency is a measure of energy utilized for delivering a given service. It is obvious that all over the world energy demand is expanding but without a corresponding improvement in the supply-side to close the wide energy gap especially in the developing economies. Hence, placing the security of future energy supply at risk with high energy deficiency and poverty level.

Energy plays very significant role in the economic growth, progress, and development, as well as, poverty eradication and security of any nation. Optimal energy supply is a very important concern for all economies of the present day. Future economic growth largely depends on the long-term availability of energy from sources that are affordable, accessible, and environmentally friendly. The need to optimize energy efficiency through best practices cannot be overemphasized. This entails improvement in practices and products that reduce the energy necessary to provide services. Electricity is one industry where the suppliers actively encourage customers to make less use of their product partly because of demand-side management (DSM) policies such as energy efficiency [1].Energy is often one of the largest variable costs that industries can actively reduce. Today, many, but certainly not all, large manufacturing companies have adopted some kind of control or in short called internal energy efficiency program [2].Energy can be referred to golden thread that links economic growth, improved social equity, and environmental sustainability that makes the world to thrive [3].

Efficient energy utilization is essentially a quick and cheaper source of new energy supply since the cost of making energy available is usually greater than the cost of saving it. Energy efficiency basically involves not only the physical efficiency of the electrical equipment and facilities, but in addition the overall economic efficiency of the energy system in a nation [4].Energy efficiency can be realized by reducing energy consumed and cutting down on energy waste and at the same time making energy more affordable for the customers. Improving energy efficiency requires getting more energy from the available energy that is utilized. According to PHED[5],the use of energy saving bulbs guarantees the following:reduce your energy consumption, reduce your electricity bills, make your home energy-friendly, last longer than conventional bulbs, use less energy, save money, and increase overall availability of power on the grid.



II. REALIZATION OF ENERGY EFFICIENCY

A. Innovations in Electrical Devices: Innovation in lighting technology is another sure means of realizing energy efficiency which will eventually cause a greater output with less energy while cutting out wasted energy with the use of energy efficient appliances capable of reducing energy required while maintaining output level [6]. The use of energy-efficient bulbs in high loss areas within the distribution network can obviously reduce the amount of energy used. In addition, energy can be efficiently used by running air-condition and refrigerator for less by controlling the thermometer, closing the fridge doors after use, switching off appliances like fans, lights and televisions, etc, when not in use. One unit of electricity is used at the rate of 1 kilowatt (1KW) or 1000watts for 1 hour. This means that for 1 unit a 100watt (100W) lamp will light continuously for 10 hours and a 1000W (1KW) electric fire will give off heat for 1 hour. For example, to light a room with an incandescent bulb of 100W for 1 hour needs 100 W/h while for LED light bulb better lighting is achieved at 20W and 5W respectively; saving 80W to 95W for each hour the light is turned on.

In addition, energy efficiency can be technically enhanced by effective reduction in cooling, ventilating, heating and lighting loads. Technology or innovation certainly leads to equal or greater output with less consumption of energy thereby cutting out wasted energy. A technology such as heat pumps, can deliver greater output for less supplier energy. Customers must be encouraged to improve manufacturing equipment in relation to energy efficiency to produce the same or more with lower overheads. Improved energy efficiency can provide many economic, social and environmental benefits. The utility company must continue to find solutions, which allow customers to tap into the cost-effective energy efficiency improvements; whether it be through more efficient industrial processes, better use of heat, or simply installing energy efficient lighting.

According to PHED[7], distribution companies in Nigeria are currently facing low grid-energy supply from Transmission Company of Nigeria (TCN), and cannot meet their customers' demand, hence, leading to huge gap between demand and supply of power. In addition to the high aggregate technical, commercial and collection (ATC&C) losses in their monthly operations, these losses are mostly contributed by non-maximum demand customers who constitute about 90% of customers' population.

B. Increasing Customer Awareness: Different enlightenment campaigns to educate the customers on efficient use of energy and behavioural change towards energy-saving appliances and lighting which leads to more affordable electricity is necessary [8]. Awareness campaign on efficient energy management must be dispatched to the end users of electricity for the success of the power industry. The utility company has a duty to educate customers over time to maintain optimal performance of energy-using equipment for the mutual benefits of both sides. Most water heater thermostats are set much higher than necessary. Lowering the temperature setting on your water heater can save energy.

C. Minimum Energy Performance Standards: This is also known as standards or efficiency standards. Minimum energy performance standards are generally specified minimum energy efficiency levels that products must meet otherwise they will not be legally sold in a country. These are in the form of labels attached to the electrical appliances which display the accurate energy consumption data on the products. This display usually helps the electricity consumers to understand the level of efficiency of the equipment, as well as, make wise decision during product purchase. Efficient management of energy is also possible to implement by monitoring, measuring, analyzing, and controlling energy use through energy performance benchmarking, as well as, introduce new facility maintenance standards and communicate same to the facility occupants [9].

D. Testing and Certification: The need for a regulatory body to check, test and verify every information indicated on energy consuming appliances with regards to rating is very essential. Energy efficiency testing equipment will help to verify the information declared on the appliances rating labels. Provision of incentive prices by the regulatory body that reflect the real energy costs; the establishment of appropriate institution and regulatory frameworks; a collaboration between the public and private sectors to develop a well encompassing energy efficiency services, including access to funding; good planning, a regular strengthening and proper enforcement of regulations; quality control of equipment getting into the country and certification processes; institutional promotion of innovative measures; and extensive public awareness on energy efficiency potentials [6].

E. Smart Metering and Billing: This process makes the customers to keep track of their actual energy consumption. Monitoring of energy utilization via metering helps to identify areas of energy and financial wastes as reduction in energy consumption gives rise to reduced electricity cost. This technology allows a two-way communication between a



utility and an energy meter with an IP address; enables utilities to receive real-time data and in some cases control customer meters. Analysis using regression models with historic billing data that calculates demand and energy savings must be encouraged.

F. Retrofitting of Homes and Public Buildings: It is necessary to retrofit our homes and public buildings to reduce energy consumption. This is necessary because most of the old buildings are equipped with old and energy inefficient appliances. Retrofitting would replace energy inefficient design and appliances with more efficient ones. Improvement can be manifest through optimizing system design and operation to match actual cooling and lighting loads through commissioning and retro-commissioning geared towards increasing occupant comfort and saving energy, retrofit cooling and air conditioning systems, lighting, water heating and electronic appliances, as well as, ensuring the use of low-wattage appliances particularly low-wattage lumen lighting bulbs [9]. Progressively, a program feature that shapes the behavior of participants by pledging either in a written or verbal format to adopt an effective energy saving action must be adopted and at the same time making them to be conservative in energy utilization.

G. Provision of Energy Received and Utilization Chart: The distribution company as a matter of urgency must make available document containing energy received and energy given out to the customers as this will help both the company and the customers in their behavior towards the product. This will make both customers and the company become more energy efficient.

H. Corporate Commitment: Management staff generally needs to signal clearly to other staff that improving energy efficiency is a corporate goal that all must care about. This is best achieved by establishing clear energy efficiency improvement targets and making all staff accountable for achieving them.

I. Engagement of Energy Experts: Competent staff or outsourced or borrowed experts who will continually identify profitable energy efficient measures and strategies must be hired. In the case of different outsourcing arrangements and support from outside partners a significant difference between program success and failure can be made.

J. Efficient Project Processing Systems: Effective internal systems need to be in place and smoothly operate to allocate financing for the business of energy efficiency measures. Project development and implementation slows when an inordinate amount of time is needed for internal processing of good EE projects, when basic energy cost saving project rationale needs to be explained over and over, and same awareness is not given to electricity customers.

K. Behavior Measures: Behavior measures to improve energy efficiency offer even more potential savings. Behavior measures consists of little capital investment and hence bring exceptional financial benefit. However, benefitting from these opportunities entails dedicated education, awareness-building and training efforts, incentives to generate broad interest, and strong organization at all levels in the industry.

L. Operating within Corporate Structure and Culture: The company and the employees are two different entities. Operations are conducted and matters decided through the interplay of different departments and staff groups, each of which has different perspectives stemming from different core responsibilities. A program that provides continuous success in energy savings for the company needs successful cooperation on the energy efficiency agenda between most, if not all, of the various levels of staff.

M. Critical Peak Pricing: An energy rate structure which consists of an extra high rate for times when energy is most demanded. This may encourage customers to adjust the time of day when they use energy to reduce or downsize the system wide energy demand.

N. Energy Conservation consists of any behavior that results in the consumption of less energy. Energy efficiency comprises of the use of technology (innovation) that requires less energy to serve the same function. A compact fluorescent light bulb that makes use of less energy to produce the same amount of light as an incandescent light bulb defines energy efficiency. The decision to replace an incandescent light bulb with a compact fluorescent defines energy conservation. Energy choices by the utility company and the customers and actions can result in a significant reduction in the amount of energy utilized in each sector of the economy. As much as energy is one of the highest costs in most industries, manufacturers must always make use of energy efficient technologies and conservation measures to succeed in the business. Their demand for energy efficient equipment has driven much of the research and development of new technologies in the last decades as energy prices have been fluctuating. Other customers can,



however, have an effect on the consumption of energy in the industrial sector through the product choices made and what is done with the packaging and the products that is no longer used.

O. Purchase of Essential Items: The most effective way for electricity users to help reduce the amount of energy utilized by the industrial sector is to reduce the amount of unnecessary and unwanted products produced and to reuse or repair items in their original form whenever possible. Purchasing only those items that are necessary, as well as reusing and recycling products wherever possible, can significantly lower energy to be utilized in the industry. Reducing waste saves money, energy, and natural resources, and the environment is protected.

III. BENEFITS OF ENERGY EFFICIENCY

A. Reduced ATC&C Losses: The use of LED bulbs (energy-efficient bulbs) in high loss areas within the distribution network gives birth to reduced aggregate technical commercial and collection (ATC&C) losses, increased system reliability, and improved collection efficiency thereby making the power industry sustainable. Generally, improved collection will impact on lower collection losses and helps to lower the ATC&C.

Energy efficient strategy and technology has become very pertinent for the digital future and can therefore enable energy savings across the entire economy. As more systems are enabled with energy efficient digital technology, customers save money and energy suppliers have more energy to distribute with lesser impact on the distribution networks. The continuous application of energy efficient technology will bring about reduced aggregate technical, commercial and collection (ATC&C) losses; reduced feeder loading; deferred investment on feeder construction or relief transformer installations; increased collection efficiency at the areas of target; better community relations with the energy providing company; reduced complaints and dispute with communities; more power available to other customers; more reliable service to targeted areas and reduced regulatory exposure.

B. Reduction of Greenhouse Gas Emissions: Effective energy efficiency implementation will always drive down greenhouse gas emissions. Generally, energy demand reduction plays very significant role in the management of energy system which impacts on business operations and economy. Effective measures intended to reduce energy demand can contribute to a large extent in a more cost-effective direction capable of meeting the energy and climate goals than supply-side measures. This simply means that energy efficiency as a measure of energy demand reduction is itself a solution to energy crises that would have crippled the distribution company, as well as, keeping certain customers in perpetual denial of energy. Saving of energy will automatically reduce costs, preserve natural resources and mitigate the climate impacts associated with energy production and utilization. It is pertinent to encourage emission reductions. To deliver against our greenhouse gas emission targets over the coming decades in the most cost-effective manner, there is the dear need for energy efficiency to improve significantly across all sectors.

C. Reduced Dispute for the Power Industry: Effective use of energy-efficient bulbs especially in high loss areas will generally guarantee savings in electricity consumption making room for affordable bills for the customers, reduced complaints from electricity distribution customers and dispute with communities; lower load pressure on the distribution company network thereby enhancing system reliability; mitigation of failed network and reduction of number of blackouts; reduction in heat that would have been generated using incandescent lighting which is not human friendly; and mitigation of harmful CO₂ emission by generators into the environment [10]. Lower electricity bills and longer power supply duration would generally keep customers happy giving rise to good community relations and less customer complaints, as well as, improved customers' loyalty to the services of the electricity providing company.

D. Improvement of Grid Reliability: Reducing energy demand saves money, enhances affordability by the end users and cuts pollution, while improving grid reliability and resiliency. According to PHED[5], Jose Correia Nunes, the EU head of Cooperation maintained, investing in energy efficiency reduces demand, saves cost, enhances energy security and delivery of more services to customers, as well as, fosters economic growth. Energy efficiency products help to do more work with less energy and lower cost.

E. Offsetting of Energy Bills: Energy efficiency also promotes innovation and creates jobs in a large value chain making the economy stronger with higher per capita income which generally makes it easier for the energy users to offset their energy bills as at when due. Effective energy efficiency implementation often reduces energy bills and make energy system more sustainable.



F. More Savings for Network Expansion: Reduced energy demand provides an elongated life to equipment, less over loaded lines and power equipment, hence, less need for more investments. This strategy provides savings that can be used to put in the expansion of network where it is most critically needed, hence, growing the business and earning more revenue [8].

G. Reduced Technical Maintenance Cost: Lower cost in this regard resulting from lower load level on the network will be achieved. Lines and equipment are not overwhelmed or overstretched with load leading to intermittent and unnecessary interruptions. The life of the power equipment is not threatened with dangerous load level.

H. Economic growth: The installation of energy efficiency measures often needs local labour, and the investment has the potential to encourage employment and economic growth. This is very important to every business community in the current global economic climate. On the long-term growth scenario, lower domestic energy bills give rise to higher disposable incomes that can be spent elsewhere in the economy thereby engendering a reduction in running costs and increased productivity for the business community. Energy efficiency acts as a driving force in long term reductions in household energy bills[11].

I. Obvious Export Opportunities: Enough energy realized from waste can be exported to other regions or countries for foreign earnings. If the energy supplier develops innovative capacity in technology, materials or business models for energy efficiency it will open up the potential for increasingly significant export opportunities.

J. Less Future Investment Cost: Longer-term investment in energy efficiency innovations certainly leads to a virtuous circle where cost reductions are possible which makes it easier and less costly to invest in energy efficiency in the future. Improved energy efficiency encourages productivity, increasing growth and reducing inflation [11].

K. A Sustainable and Secure Energy System: Reduction in energy consumption will obviously improve the nation's energy security. A more energy efficient nation will have lower exposure to international energy market price rises and volatility. There can also be specific benefits to the energy system of reducing demand as it decreases the long-term need for investment in additional infrastructure that would have otherwise been required. This certainly possesses the potential to decrease the overall cost of the nation's energy generation framework in the future[11].

IV. CONCLUSION

Various strategies for the realization of energy efficiency have been defined and illustrated in clear terms. If constructively used will produce very appreciable result in terms of sustaining the power industry, as well as, satisfying the end users in the relationship. In most cases energy demand may grow in higher steps than the energy supply and therefore, the gap represents energy deficiency. Energy deficiency will have negative impact on the economy, the power sector through the customers' inability to pay for energy used; giving rise to high aggregate technical, commercial and collection (ATC&C) losses. Energy efficiency is the most suitable to close the difference between energy demand and energy supply thereby keeping the industry running in the required capacity.

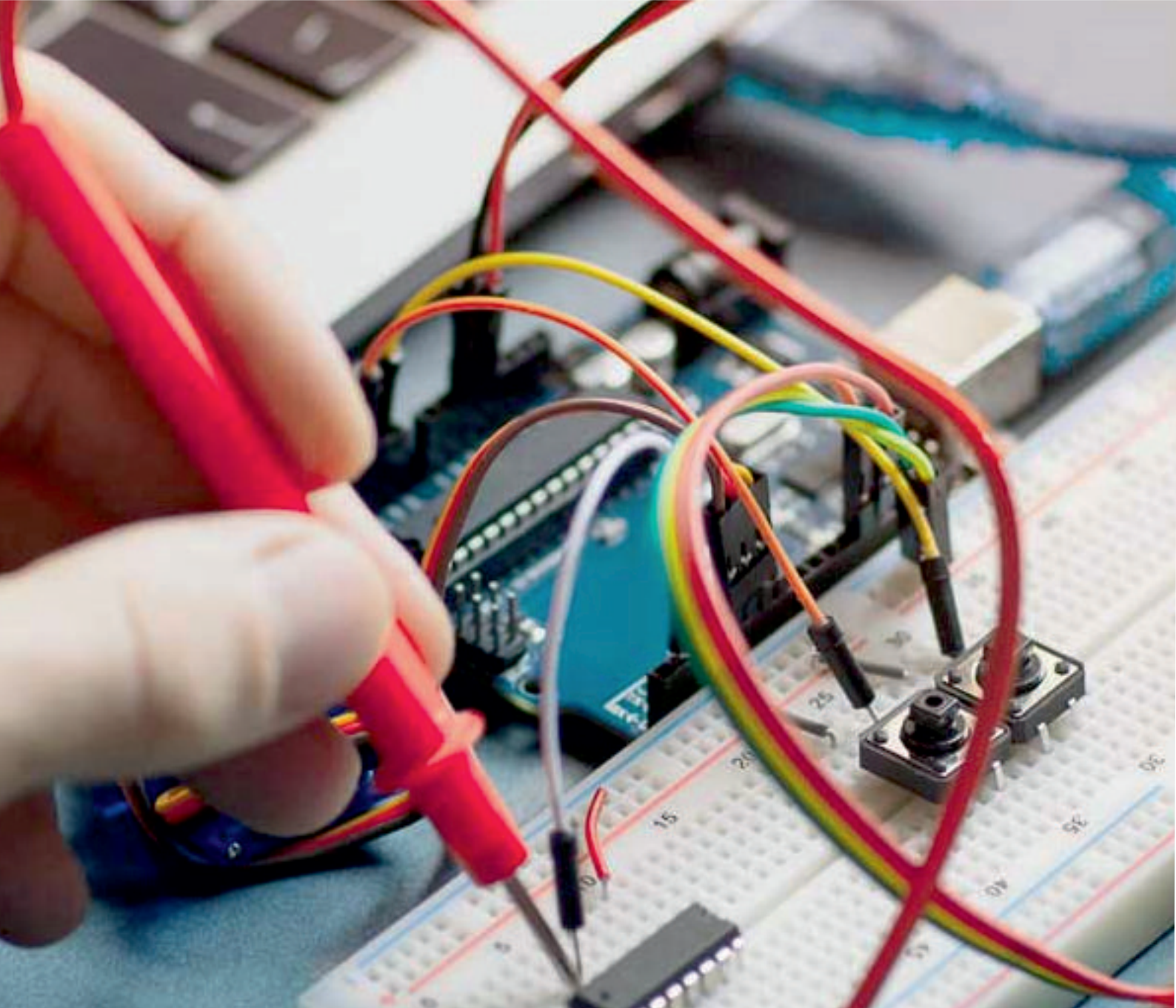
The essence of employing the strategies and technologies of energy efficiency is for the power sector to remain in business and serve the customers better without causing damage to the environment. Every technique available to reduce damage to the environment must be applied otherwise there will be no person alive to use the electricity. Energy efficiency has offered itself for both the end user of electricity and the power industry to use. The power industry must tap into this strategy to remain in business and serve the end users better in the midst of energy supply shortage and economic crises.

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