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Building Energy Efficiency Into Energy Equation

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ABSTRACT: The increasing demand of energy in the world has causes the pollution and devastation of environment and also depletion of the resources. It imminent that cannot be avoided, however, There is agitation and confrontation from country to country which later realised that only energy efficiency practices is the means of minimizing the impact to the environment, but developing countries like Nigeria centered only on end users.These studies see how energy efficiency will be built into energy generation processes and the benefit to the environment, economic growth and development of a country.

Keywords: Energy, environment, efficiency, and generation.

I. INTRODUCTION

Energy plays important roles on the economy growth and sustainable development of every country but it's over dependence carries significant costs of its own (Atana et'al, 2013). The extraction, generation, transportation/transmission, distribution, storage and utilization carry an immense environmental burden as does its ultimate disposal of waste products. Growing concern around climate change, increasing energy demand, depletion of the conventional fuel, increasing energy prices and concern for energy security are important issues for sustainable development in today's society(Power Guide, 2009), (Bergh, 2012). However, energy efficiency has been found to be the only tool to meet up with these challenges.

The concern of energy efficiency has been circulating for decade, but recently has gained renewed broad based support. The confluence of economic, environmental and geopolitical concerns around reducing most developed nation's exposure to disruptions in the supply of energy and has moved efficiency to the fore. As a result, a number of initiatives are now underway to improve efficiency in a variety of areas, but much more can and should be done(Abb Inc., 2007).Developed countries like China, United Kingdom and United State of America have established so many efficiency programs aimed at bringing the country's energy intensity to determine the amount of energy per unit of GDP. Perhaps, help the consumers to identify energy efficient appliance like Refrigerator, Television among others. Efficiency simply means doing more with less energy, indeed the term efficiency is typically associated with how energy is consumed at the point of end use but the concept of efficiency can also be applied to how energy is produced and distributed and tendency to feed – in energy efficiency into energy equation(Abb Inc., 2007).

There is need to show appreciation for the impact that improved efficiency can have. Itis useful to examine the price we pay for inefficiency and nowhere is this more apparent than in the generation of electric power.

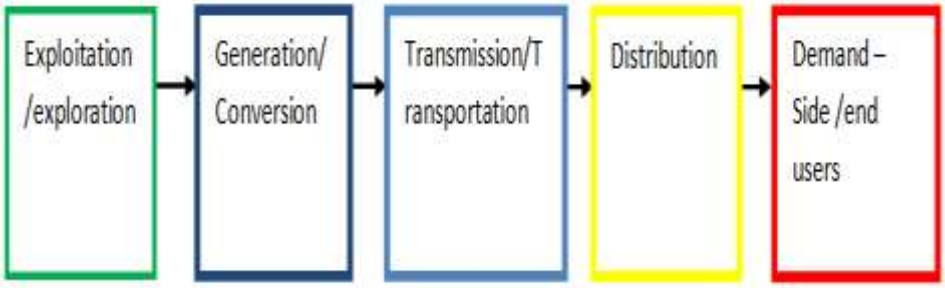
II. ENERGY AND ITS STAGES

Energy is a property of object transferable among them via fundamental interactions, which can be converted in form but not created or destroyed. Perhaps, work and heat are the two categories of processes or mechanisms through which a given amount of energy can be transferred. The second law of thermodynamics limits the amount of work that can be performed by energy that is obtained via a heating process; however, some energy is always lost as waste heat. How these losses can be minimized to achieve maximum productivityand undisrupted supply of energy is the goal of every nationto sustain sustainable economy growth and technological advancement(Feynman, 1964).The overall efficiency of energy production remains extremely low. On average, more than 90% of energy consumed is lost or wasted in the process of conversion from raw materials such as coal to the final energy service such as light(Dan Staniaszeket'al, 2012). The main problem is its effect on the environment and other ecological factors that can affect life directly or indirectly and as well as issues of Kyoto Protocol of sustainable development, and carbon emission. Therefore, energy conservation and efficiency is the only option for the day, be it in the transport, household and industrial sectors or all sectors of energy equation (Ristinen et'al, 2006)(Abb Inc., 2011).

2.1 The Stages of Energy

These are the processes through which energy is extracted or converted from its source to the meaningful ways for human consumption and these stages make up the energy equation. The chart below defined energy equation:

Chart 1: Shows Energy Production Stages.



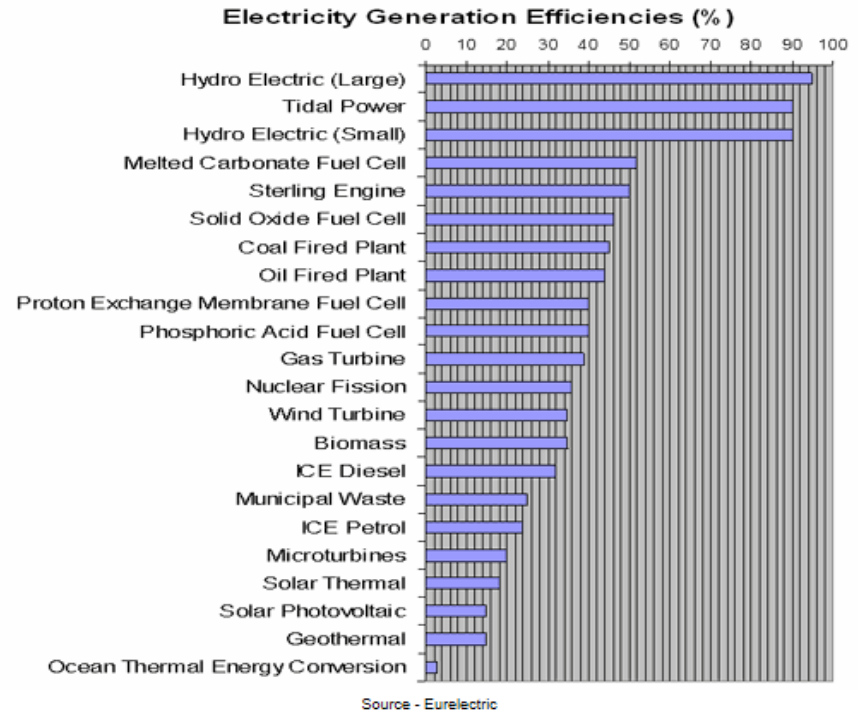
III. ENERGY EFFICIENCY IN POWER PRODUCTION

Energy efficiency is the means of achieving maximum system performancewhere less energy is use to provide the same level of energy service. However, this can be achieved primarily by the means of a more efficient technology or process rather than by changes in individual behaviour (Abb. Inc. 2011). This will look at the losses and ways to improve efficiency in power production.

Generation

The process converts the latent energy in a fuel stock (coal, gas, Uranium) into mechanical energy in a generator and ultimately electrical energy, likewise, wind and hydro power use the mechanical energy of moving masses of air or water to produce electric energy. Other devices such as solar photovoltaic cell and fuel cells use chemical reactors to generate electric energy. In all these processes the input energy is lost.

The efficiency of generation varies widely with the technology used. The traditional coal plant is only 30-35% efficiency whilst the latest technology is capable of efficiency levels above 60%. Though, the most efficient gas fire generators achieve a similar level of efficiency. Even at efficiency level, there is tremendous amount of energy wasted that account for tremendous economic and ecological problems.Perhaps there are a variety of ways to improve generator efficiency, such as combustion optimization using modern control systems.



Transmission and Distribution

Since joule heating loses are proportional to the square of the current, therefore, there is need for the power to be transmitted to have low current as possible by using higher transmission voltage and can be done by a process known as transmission(Uganda Power corp.). While Distribution is the process of delivering electric energy from the high voltage power transmission grid to specific location such as residential and commercial areas and it encompasses of the substation and feeders line of high voltage power grid(Abb Inc., 2007).

The resistance of the cables conducting the current flow between the generating plant and the end user's premises cause further efficiency losses due to the Joule heating (I^2R Losses) of the interconnecting power cables. Generally the resistance of the cables increases with distance so that loses are typically 5% for supplies to urban area close to the power source but as high as 10% to 20% for remote rural areas(Uganda power corp.). The major problem influencing efficiency is congestion and this occurs when the actual flow of electricity is restricted either by physical capacity constrained or by operational safety constrained designed to preserve grid reliability. However, this is as a result of a number of factors:

- Lack of adequate transmission investment
- An increase in bulk power transaction in competitive energy market.

Improving efficiency in the T&D system is crucial in terms of energy supply, whichrequired developed nations to adopt US Department of Energy practices, primarily aimed at setting and implementing new efficiency standard for distribution transformers. They are among the ubiquitous and the most standardised pieces of electrical equipment and for that reason make a prime target for improvements that can be propagated across large areas. The transformer has at least 4% efficiency over the current model. In the area of transmission, several measures have to be taken to improve energy efficiency thereby reducing losses in transmission and distribution, these areas are as follow: transmitting power in High Voltage Direct current, using power electronic devices known as Flexible ACTransmission Systems or FACTS to enhance transmission capacity by 20 – 40% efficiency, Gas-Insulated Substance, Superconductors and Wide Area Monitoring Systems (Abb Inc., 2007).

Demand – Side or End Users

The mind set of an average consumer on energy efficiency is always at the consumption point without giving any measure or focus on the supply side. Therefore, the energy problem in Nigeria has given room for non-governmental organization in collaboration with Energy Commission of Nigeria to organized several programs on energy efficiency and conservation and also promote the use of Compact Fluorescent Lights Bulbs (CFL) in the country, butnot much emphasis have been made on generation, transmission and distributionwhich is the hub of energy problem in the country.

It is estimated that 65% of industrial power is used in motors of various sizes, most of which run at full speed because the vast majority of industrial motors are controlled by drives that cannot alter the speed of the motors but with advancement in technology the variable speed drives also known as variable frequency drives, ramp the motor's speed up or downto meet the requirement at given moment in time and this significantly reduce power consumption as much as 80% which equally save millions of dollars per year in energy costs.

IV. BENEFITS OF IMPROVED EFFICIENCY

The importance of improving energy efficiency cannot be over emphasis due to its effect on various means of life, which eventually affect economic, environment, productivity, transportation system and other means of life. Below is some of the benefit of improved energy efficiency:

- Using less energy means paying less for energy
- Drastically reduce carbon dioxide emission to deliver the same amount of consumed energy.
- Fuel conservation and diversity is another strong selling for efficiency, and the benefit extend well beyond economic and even environmental consideration.

V. ENERGY EFFICIENCY POLICY

There is need to improve or adopt energy efficiency and conservation not only to the end users but from generation point to the demand – side.This can be achieved through formulation of policy that will monitor and allow the investors the use of improved technology and to supplement the existing ones which is more precise on the energy efficiency and conservation for residential, industrial transportation, services/commercial, agriculture, and energy efficient building. These are some of the existing energy efficiency and conservation policies (NEMP,):

- The nation shall adopt and promote energy efficiency and conservation best practices in the exploitation (exploration) and utilization of the nation's energy resources.
- The nation shall mainstream energy efficiency and conservation best practices into all sectors of the nation's economic.
- The nation shall adopt appropriate energy pricing, metering, and billing mechanisms.
- The nation shall integrate energy efficiency and conservation studies into the curricular of educational institutions (basic to tertiary level).

VI. CONCLUSION

The propagation and sanitization of energy efficiency and conservation by Energy Commission of Nigeria in collaboration with other non-governmental organizations like UNESCO and UNDP is limited to the End Users such as residential, transportation, Agriculture, Industrial etc..However, the bulk of inefficiency is in the processes of generation and distribution energy, therefore, more policy on energy efficiency and conservation should be formulated to enhance productivity and utilization.Since sustainable development and economic growth depend on the reliability of energy supply, especially electric energy, therefore, the potential impact of energy efficiency cannot be underestimated. With the advancement on technologies and methodologies presently available, efficiency stands to play large role in the energy equation.

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