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Energy Efficiency Potential: A Tool to Mitigate Energy Poverty

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Abstract: ***Energy efficiency is the policy or strategy that helps in reducing the amount of energy required to provide products and services through the use of efficient technology, procedures or methods that reduce energy losses while achieving same or better results (energy saving). Using the various energy efficiency methods as an approach for energy excavation will help save a large amount of energy for use as it provides an adequate, sustainable, and environmentally sound supply of energy to fuel global economic growth. A strategy that emphasizes energy efficiency is the most economically and environmentally sensible way of meeting the twin objectives of providing energy for sustainable development and avoiding dangerous interference in the climate system. This paper examines the various methods and approach of estimating the potentials of energy efficiency and how this can be applied to mitigate the current energy poverty across the globe.***

Keywords: Energy, Potentials, Efficiency, Saving

1. Introduction

Energy efficiency is the policy or strategy that helps in reducing the amount of energy required to provide products and services through the use of efficient technology, procedures or methods that reduce energy losses while achieving same or better results (energy saving). In virtually every sector of the economy (industrial, transport, agriculture etc) especially in the developing nation where already energy is highly insufficient, a very large amount of energy is lost due to inefficiency in energy utilization. (14) The good news is that energy efficiency presents a historic opportunity for developed and developing countries alike to use energy more efficiently thereby pooling large amount of energy (saved energy) to further drive the economy.

The need to provide adequate, sustainable, and environmentally sound supplies of energy to fuel global economic growth has created an imperative for increased energy efficiency.(15) A strategy that emphasizes energy efficiency is the most economically and environmentally sensible way of meeting the twin objectives of providing energy for sustainable development and avoiding dangerous interference in the climate system.(4) Supplying energy for sustainable economic development is an objective shared by developed and developing countries alike, although the urgency is particularly great in the developing world, where large populations do not have access to modern energy services such as electricity and instead rely on traditional and often unsustainable energy sources such as fuel wood.(15) Demand for global energy services to support economic growth has grown by 50 percent since 1980 and is expected to grow another 50 percent by 2030. There are two options available to meet the increased demand for energy: supply more energy or improve energy end-use and supply efficiencies. Clearly, both approaches are needed. However, of the two, only energy efficiency can generate nearly immediate results with existing technology and proven policies and do so while generating strong financial returns that exceed those from investments in conventional energy supply. (12)Simply increasing conventional energy supply is not a viable option because continued reliance on the predominant energy source, fossil fuel, exacerbates energy insecurity and raises serious environmental concerns, especially related to climate change. Deploying clean energy alternatives will be needed to meet global development and environmental objectives. (14)

Emphasis on energy efficiency has hence become a better option in meeting the current global energy challenge as energy pooled from the efficient utilization of the available energy has the potential of driving sufficiently the global economy without a devastating effect on the ecosystem. This paper intends to capture a reality that is often overlooked and bring to lime light the potentials of efficient utilization of energy and to create awareness of the multiple benefits associated to efficient energy utilization.

1.1 Benefits of Energy Efficiency

Investing in energy efficiency provides different benefits to different stakeholders. This is either by directly reducing energy demand and associated costs (which can enable investment in other goods and services) or facilitating the achievement of other objectives (e.g. making indoor environments healthier or boosting industrial productivity (5) (12). Recent research acknowledges the enormous potential of energy efficiency to among others include;

- **Environmental**: Increased efficiency can lower greenhouse gas emissions and other pollutants, as well as decrease water use.
- **Economic**: Improving energy efficiency costs significantly less than investing in new generation and transmission. Energy efficiency can also boost the local economy and create downward pressure on natural gas prices and volatility.
- **Utility System Benefits**: When integrated into energy resource plans, energy efficiency can provide long-term benefits by lowering base load and peak demand and reducing the need for additional generation and transmission assets.
- **Risk Management**: Energy efficiency also diversifies utility resource portfolios and can be a hedge against uncertainty associated with fluctuating fuel prices and other risk factors.(7) (11)

Figure 1: Summary of the Benefits of Energy Efficiency

1.2 Ways of Improving Energy Efficiency

A number of measures have generally been adopted to improve energy efficiency globally. These include:

- Make mass transit more extensive, more economical and user friendly.
- Review building codes to ensure new homes and buildings are constructed to be reasonably energy efficient, perhaps having different grading levels (with payback periods estimated) so purchasers can choose how far above a threshold value, they wish to go. Standards for commercial buildings need to consider the global economy competitive issues. Innovative ideas, such as using waste water from restroom sinks, or laundry machines, to flush toilets on lower floors, need to be considered.
- Implement consumer education programs at all levels, particularly within commercial establishments that produce goods and services. For example: provide energy saving tips, and management advice and software to truck and automobile fleet owners, to fishing vessel and maritime vessel owners, and highway designers.
- Develop and disseminate practical energy conservation packages for the general population and for industry sectors such as agriculture, trucking, airline, fishing, mining, refining, warehousing. These packages should contain reasonable energy reduction targets, progress markers (milestones) and estimates of savings if achieved.
- Review traffic flow measures that cause vehicles to stop and go, or wait unnecessarily for non-existent pedestrians or intersecting traffic.
- Set advisory guidelines for industry and consumers in the use of Energy Star products.
- Get a watt-hour meter and see what each appliances, electronics, and plug-in lights costs to run. There will be some surprises!
- Reduce the number of parasitic loads in the house. If a TV or VCR or Cable TV Box is sitting in the basement, and is rarely used, put it on a power strip and shut everything off when you leave the room.
- Get an energy audit of your home or business, particularly if it is free from your power company.
- Consider energy use efficiencies on all appliances and vehicles.
- Put your hand on your water heater, or the pipes leaving it. If hot, insulate them. For one thing, it is not just a loss of energy, but in the summer, it is fighting the air conditioner.
- Leaving a room and last one out, Shut off the light! Put your computer to sleep or shut it off. If the A/C is on, be extra careful.
- Vehicles: share rides in a car pool; inflate tires properly; time for a tune-up with new sparkplugs; air filter dirty; unnecessary weight in the trunk.
- Conserve our energy through efficiency in all we do. This includes in our lighting, vehicles, appliances and home insulation, but also mundane things such as multipurpose trips when we run our errands or visit our clients. For example, replacing the few incandescent lights in every home or business that are used the most with fluorescent bulbs or LEDs will make major reductions in energy use.

1.3 Steps for Conducting a Potential Study

1. Identify the objective and the audience;- Seek to reach consensus as to which objective is most important, and consult the intended audiences to determine what data sources they trust, what issues need addressing, and what level of detail they require.
2. Select the potential type to be calculated;- Energy efficiency practitioners often distinguish between four different types of analyzed efficiency potentials i.e. technical, economical, achievable, and program.
3. Determine appropriate level of detail and assess data requirements;- The level of detail should be driven by the study objectives and influenced by considerations of cost, time, and data availability. The level of aggregation depends on the needs and objectives of the study, the available data and budget, and the uniqueness of the region. Consider primary data collection when the study objectives warrant the additional expense and complexity.
4. Select and define the methodology;- A potential analysis involves forecasting a baseline, identifying and screening efficiency measures, designing a program, and calculating total savings. Select the appropriate cost-effective test, such as total resource cost, societal cost, participant cost, ratepayer impact measure, and program administrator cost tests and consider comparing results from multiple tests as appropriate. (11)

2. Estimating Energy Efficiency

In estimating energy efficiency, the key metric of interest is the “energy saving”. This quantity (energy saving) cannot be directly measured instead, efficiency programme impacts are estimated by taking the difference between:

a) The actual energy consumption after efficiency measured are installed

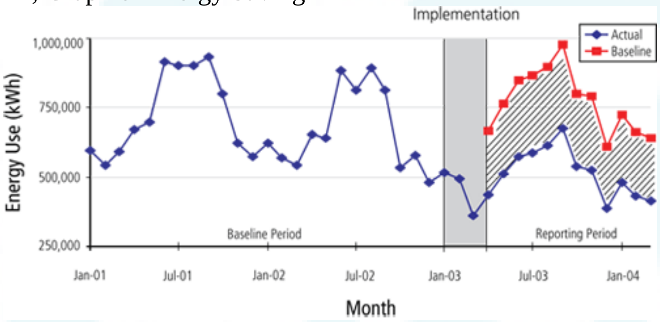
b) What energy consumption would have occurred during the same period had the efficiency measured not been installed. (i.e. the baseline).

In addition, steps are taking to adjust the baseline and/or the post – installation energy use to account for factors other than the energy efficiency measure or system that affect energy consumption (e.g. weather, building occupancy, operation hour etc.) hence, equation for energy saving is;

Energy saving = (b)(baseline energy use) — (a)(post-installation energy use) ± (c)(adjustments).

Estimating the energy saving involves forecasting a baseline, identifying and screening efficiency measures, designing a program and calculating energy savings. (11) (13)

F1; Graph of Energy Saving



Source: National Action Plan for Energy Efficiency (2007)

The shaded area represent the energy saving. It Indicate that when a proper energy efficiency technique is implemented in a system, the energy saved could in the reporting period dropped from a previous peak of 1000000(KWh) to a new peak of about 650,000(KWh) thereby saving about 350,000(KWh). (1) (8)

2.1 Methodology of Calculating Energy Efficiency Savings

Basically, two methods are used which are; (2) (10)

I. **Deemed savings approach**. To evaluate programs that target simpler efficiency measures with well–known and consistent performance characteristics, this approach is appropriate. It involves multiplying the number of installed measures by an estimated (or deemed) savings per measure, which is derived from historical evaluations. Deemed savings approaches may be complemented by on–site inspections. (1)

II. **Measured savings approach**. To evaluate larger and more complex program strategies – including those expected to result in significant savings or those with a high degree of uncertainty – a measured savings approach that follows established protocols may be appropriate. Estimates of energy (and/or demand) savings are calculated using one or more of the following techniques.

i. **Engineering Methods** i.e. using standard formulas and assumptions to calculate the energy use of the baseline and post-installation energy systems.

ii. **Statistical Analyses** i.e. using statistical models to estimate “before” and “after” scenarios, while taking into consideration changes in weather, facility occupancy, factory operating hours, and other factors that affect energy use.

iii. **Computer Simulation of System**. In this case, computer models are used to predict the change in energy use after complex, system-wide improvements in energy efficiency are implemented.

iv. **Metering and Monitoring**. In this case, baseline and post-installation energy use is directly metered and monitored, while accounting for the non-energy factors that affect energy consumption.

v. **Integrative Methods**. Integrative methods combine some or all of the preceding approaches. For example, metering and engineering methods can calibrate computer simulations of baseline and post-installation buildings that receive efficiency retrofits.

3. Application of Energy Efficiency Potentials in Mitigating Energy Crises in the World

There is a wide body of evidence demonstrating that a significant proportion of the potential for energy efficiency improvement remains untapped. The difference between the actual level of investment in energy efficiency and the higher level that would be economically beneficial from the consumer’s (i.e., the individual’s or firm’s) point of view is often referred to as the “efficiency gap” and is generally caused by market failures and barriers. (6)(9) This gap can be reduced with significant economic and environmental benefits. For example, to attain a 2.5 percent annual improvement in energy efficiency would reduce G8 energy demand by about 20 percent in 2030, thereby avoiding the consumption of 55 exajoules of primary energy in the G8 (equivalent to the output of more than 2,000 power stations), and return energy consumption to 2004 levels. While 55 exajoules is only about 25 percent of the total global demand growth projected by the IEA, reducing energy demand by that amount in only the G8 countries would offset the equivalent of 80 percent of the increased energy supply needs currently projected to be met by coal-generated power. If extended globally, this scenario would hold atmospheric CO_2 concentrations below 550 ppm. An exajoule (EJ) is slightly less than a quadrillion British thermal units (BTUs). (3) (10).

4. Conclusion

Improving energy efficiency potentials in the various sector of the economy will pull an enormous amount of energy which will be enough to solve the world energy crisis without environmental damage usually associated with energy excavation. This approach is hence a better and cheaper means of mitigating energy poverty currently experienced in most part of the world especially the developing nations were energy efficiency utilization is in its poorest state. By creating more public awareness, implementation of energy efficiency laws and policy, and by reducing market failures and barriers, “efficiency gap” will be reduced with significant economic and environmental benefits.

5. Recommendations

To mitigate the energy poverty ravaging the world, the following recommendations are hereby offered;

1. Strict adherence to energy efficiency policy should be enforced by the establishment of energy efficiency task force across the globe.
2. All energy efficiency strategy should be widely publicized to sensitize the general public thereby harvesting energy that should have been lost or wasted.

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