

LEGAL ANALYSIS OF ENERGY EFFICIENCY PRACTICES IN THE UNITED KINGDOM, UNITED STATES OF AMERICA AND DENMARK

By

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Abstract

As the world's population continues to grow, it does appear that the demand and consumption of energy experiences even a greater growth. This proposition appears to find confirmation in the observation that global energy consumption which is mainly based on fossil fuel that accounts for 88.1% consumption is likely to grow faster than increase in the population. The implication of this observation seems that whereas world population is rapidly on the increase, global energy consumption rate grows even faster or much more rapid than the rate of increase in world population. Truly, if one should take a moment to ponder over the importance of energy to mankind, one would probably come to an irresistible conclusion that there is indeed a compelling need for concerted and deliberate efforts towards sustainable energy creation. Reducing energy demand by using energy more efficiently is the most cost-effective strategy available for reducing carbon dioxide emissions. The International Energy Agency (IEA) asserts that 'energy efficiency improvements in buildings, appliances, transport, industry and power generation represent the largest and least costly savings in emissions'. Many nations agree, including the United Kingdom which claims that the starting point for addressing climate change risks is 'to reduce our overall energy use through greater energy efficiency'. The paper aimed at analyzing energy efficiency practices in the United Kingdom, United States of America and Denmark. The doctrinal research methodology was employed to achieve the aim of this paper. The finding of the paper revealed that the Nigeria the growth of renewable energy is bedeviled by many issues. This paper therefore recommended that government policies should be made to make it mandatory for public and private companies such as banks, hotels, industries to train their staff on energy management.

Introduction

Engaging the public about energy efficiency is an ongoing challenge. By itself, the term "energy efficiency" is a technical term that is abstracted from people's daily lives. Energy appears to be the lifeblood of economies around the world and global economic growth seems to be dependent on adequate, reliable and affordable supply of energy.

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However, energy availability, accessibility and utilization has remained inadequate and inefficient as evidenced by the epileptic power supply, constant queues in filling stations¹ and the folding up of industries in Nigeria to neighbouring African countries due to insufficient power supply resulting to unemployment. Hence, the need to develop renewable energy sources and promote energy efficiency practices. The issue of probes in the downstream petroleum sub-sector, and recently, the issue of privatization and deregulation of the Nigerian Oil Industry may have arisen due to some unfavourable developments in the petroleum industry in Nigeria. However, and significantly, it is of public knowledge that a major part of Nigeria's energy generation comes from oil and gas, and the transportation system is almost completely dependent on oil and gas. Oil and gas (petroleum) also accounts for a major aspect of the country's foreign exchange.² However, access to ready and affordable energy has continued to be a challenge in Nigeria. It is a matter of concern that as essential as energy is to mankind, it appears that many Nigerians are denied access to energy because either they cannot afford to pay for it or it is outright unavailable, a situation which is further exacerbated by the near absence of the culture of energy conservation and the practice of energy efficiency among the vast majority of the citizenry.

Legal Analysis of Energy Efficiency Practices in the United Kingdom, United States of America and Denmark

Energy efficiency belongs at the heart of a low-carbon economy. By reducing energy use and cutting down on waste, we can reduce energy bills, make our energy system more sustainable, and drive down greenhouse gas emissions. Too often, governments have neglected the role that energy demand reduction can play in managing our energy system. Yet measures that reduce demand can contribute in a more cost-effective way to meeting our energy and climate goals than supply-side measures. That is why energy efficiency – as a way of reducing demand – takes pride of place at the centre of the Coalition Government's policy framework.³

¹S Oyedepo, *Energy and Sustainable Development in Nigeria: The Way Forward* (Lagos: Trinity Publication 2012) 1-17.

² N P Nweze and G E Edame, 'An Empirical Investigation of Oil Revenue and Economic Growth in Nigeria' [2016] (12) *European Scientific Journal*, 12.

³E Davey, 'The Energy Efficiency Strategy: The Energy Efficiency Opportunity in the UK' <<https://www.gov.uk/government/speeches/energy-saving-opportunity-scheme-roadshow>> accessed 7 September 2021.

United Kingdom

Engaging the public about energy efficiency is an ongoing challenge. By itself, the term “energy efficiency” is a technical term that is abstracted from people’s daily lives. Therefore, the UK and Europe have expended energy in developing, educating, and marketing energy efficiency as a household benefit to people.

The UK implemented voluntary programs with the presence of a tax policy. The targets were negotiated between the government and 44 industrial sectors, with firms individually signed up within the sectors. Depending on the sectors’ choice, the targets were set as either an absolute reduction or a reduction in intensity, and either for energy use or for carbon emission. Firms and sectors achieving their targets can enjoy reduced rate of Climate Change Levy. The fulfilled reduction is much larger than the initial targets, and the overall environmental and economic benefits are larger than that from a flat-rate tax, because of an “awareness effect” arising from the focus on the potential for cost-effective improvements.⁴

The U.K has expended energy in developing, educating, and marketing “energy efficiency” as a household benefit to people. The United Kingdom experience of marketing energy efficiency at the household level illustrates lessons that may be applicable to Nigeria. The United Kingdom model of implementing efficiency at the household level relied on strong research into energy-related household behaviour, the development of models of domestic energy consumption, monitoring of demonstration projects and the promotion of good practice through the dissemination of technical guides.⁵ The Building Research Establishment (BRE) is an agency in the U.K.’s Department of Environment (DOE) and is one of the world’s most experienced building research organizations. BRE research has indicated that higher levels of insulation, better controlled ventilation are important considerations when attempting to improve energy efficiency.⁶ Energy suppliers work closely with Government and stakeholders to offer consumers opportunities to be more energy efficient. Energy efficiency is

⁴ P Ekins and B Etheridge, ‘The Environmental and Economic Impacts of the UK Climate Change Agreements’ [2006] (34)(15) *Energy Policy*, 2071-2086.; T Barker and Others, ‘Macroeconomic Effects of Efficiency Policies for Energy-Intensive Industries: The Case of the UK Climate Change Agreements, 2000–2010’ [2007] (29)(4) *Energy Economics*, 760-778.

⁵ D D Ward, ‘BRE Experience of Energy Efficiency in U.K. Housing’, Building Research Establishment, An Executive Agency of the Department of the Environment, United Kingdom.

⁶*Ibid.*

essential to help consumers reduce their energy consumption and improve the comfort of their homes. It is also central to achieving the UK's commitment to reducing its greenhouse gas emissions by at least 80% by 2050, relative to 1990 levels. Energy suppliers have an obligation to deliver energy efficient measures to householders via the Energy Companies Obligation (ECO). ECO was introduced in Great Britain at the beginning of 2013 and replaces two previous energy efficiency programmes, the Carbon Emissions Reduction Target (CERT) and the Community Energy Saving Programme (CESP).⁷

The UK introduced the Enhanced Capital Allowance Scheme for Energy Saving Technologies in 2001 to drive up the use of energy-saving technologies by businesses. The scheme provides accelerated tax relief for the purchase of equipment included on the Energy Technology List (ETL). Products listed on the ETL have to meet top-quartile HEPS, and manufacturers have to provide evidence to show that they meet agreed industry product standards. Every three years, ETL-qualifying HEPS criteria are strengthened to reflect recent product innovations and stimulate further product innovation. This scheme supports nearly 17,000 listed products from nearly 60 technologies used by industry, retail and commerce (e.g. LED lights, boilers, refrigerated display cabinets, electric motors). International and UK manufacturers use the scheme to showcase their most energy-efficient products and, to date, it has influenced £12.5 billion in UK industrial product sales. It has also reduced carbon emissions by 41 Mt CO₂ when compared with a baseline scenario in which less efficient products are used.⁸

The UK Government describes energy efficiency as fundamental to decarbonising the economy, maintaining secure energy supplies, and increasing the productivity of businesses.⁹ In addition to delivering energy and CO₂ savings, acknowledged benefits of investment include: job creation and economic growth, UK green innovation and business productivity, alleviation of fuel poverty, and reduction of health risk resulting from exposure to cold. The UK is a net importer of natural gas (the most common heating fuel), and reductions in energy consumption

⁷Energy Efficiency <<https://www.energy-uk.org.uk/our-work/retail/energy-efficiency.html>> accessed 17 September 2021.

⁸Energy UK, <<http://www.carbontrust.com/resources/faqs/services/energy-technology-list>> accessed 20 September 2021.

⁹DECC, *The Energy Efficiency Strategy: The Energy Efficiency Opportunity in the UK* (London: Department of Energy and Climate Change 2012) 13.

can also contribute to energy security by reducing demand for foreign imports. Analysis in the UK suggests that energy efficiency investments appear to be self-financing to the public exchequer when macroeconomic impacts are considered, with high value-for-money compared to other infrastructure projects.¹⁰

The UK government also introduced the Green Deal which is intended to encourage households to undertake energy assessments. It offers energy efficiency assessments, financing and the installation of energy efficiency measures through a network of Green Deal approved assessors, installers and providers. 188,234 Green Deal Assessments were lodged by the end of March 2014 (since January 2013). Approximately 693,000 measures were installed in around 580,000 properties through ECO, Cashback and Green Deal to the end of February 2014. The Green Deal is currently a GB-wide policy; however Northern Ireland continues to develop a range of domestic energy efficiency programmes to promote energy efficiency in the domestic sector.¹¹

In addition to the Green Deal, energy assessments and energy efficiency recommendations are available in the UK through the Carbon Trust. The Carbon Trust, originally set up and funded by the UK Government from 2001 to 2012 (and now a self-financing private company), promotes its Carbon Trust Standard to businesses. Obtaining the standard requires the measurement, reduction and management of emissions/energy use. Similarly, the Energy Saving Trust, which receives the majority of its funding from Government, provides advice on energy efficiency to businesses and households (through the Energy Savings Advice Service helpline), and also provides free resources to energy efficiency professionals throughout the UK.¹² In line with best practice on energy efficiency, the UK government introduced Smart Meters. Near-real time information from smart meters will help put consumers in control of their bills, leaving them better placed to use energy efficiently and reduce energy consumption. The introduction of smart meters will mean energy networks will have more granular information upon which to manage and plan current activities and assist the move towards smart grids.¹³

¹⁰Cambridge Econometrics and Verco, 'Building the Future: The Economic and Fiscal Impacts of Making Homes Energy Efficient' (Final Report for Energy Bill Revolution, London 2014) 56.

¹¹UK National Energy Efficiency Action Plan, 2014.

¹²*Ibid.*

¹³*Ibid.*

In Energy Efficiency Strategy the UK Government recognised that a lack of good quality, trusted information is one of the key barriers to energy efficiency take up. The Government has introduced a range of policies to help tackle this barrier and supports a number of training and awareness-raising initiatives. Information about existing energy efficiency mechanisms, financial and legal frameworks is widely available online via the GOV.uk website. Government also commissions research and evaluation projects to better understand how behavioural change can lead to savings in energy use for domestic consumers and SMEs. In 2013 the Government began a Heating Controls Trial to study the impact of trusted advice on managing heating controls in homes. A project with ENWORKS to better understand the barriers to energy efficiency faced by SMEs has also been commissioned. Such studies help inform our development of forward-looking, innovative policies.¹⁴

United States of America

Energy regulation in the United States is complex, broad and enforced by a variety of federal and state governmental entities. Further, it is continually evolving in response to global and national events, market shifts, political dynamics and priorities, and technological advances. As such, this chapter is intended to be an overview of the nature and scope of energy regulation and markets, with a particular emphasis on the federal regulation of electric energy and various regional bulk power markets.¹⁵

The United States has a limited set of comprehensive policies regarding promotion of energy efficiency for electric appliances and energy efficiency standards for federal buildings and properties. In addition, the federal government has various targeted grants and financing support programs as well as tax incentives for energy efficiency investments.¹⁶ A large number of states have similar types of programmes (many of which are supported in whole or in part by funds provided by the federal government) and a large number of states have energy efficiency portfolio standards, similar in concept to a renewable energy portfolio standard, that require retail electric utilities to reduce their total retail sales, peak

¹⁴UK National Energy Efficiency Action Plan, 2014.

¹⁵ M J Gergen and Others, 'United States' in D L Schwartz (ed.), *The Energy Regulation and Markets Review* (London: Law Business Research Ltd 2012) 336.

¹⁶*Ibid.*

retail sales, or both, by certain amounts by target dates. Some states combine their renewable and energy efficiency portfolio standards.

The benefits of energy efficiency are manifold - lower energy bills, improved air quality, reduced greenhouse gases, energy security, and deferred infrastructure costs. Numerous studies document the prevalence of economically attractive opportunities for energy savings.¹⁷ The failure to implement these opportunities indicates persistent market and other barriers to efficiency. Government policies are designed to target these barriers and enable the benefits of energy efficiency to be realized. In the United States, energy efficiency policies reflect the interplay of federal, state, and local jurisdictional levels. Because jurisdictional policies may have overlapping effects, a better understanding of the relative strengths and policy drivers of each can guide the development of future policy.¹⁸

In US, buildings contribute 40% of U.S. carbon emissions due to fossil fuel-based heating and electricity,¹⁹ the American Clean Energy and Security Act of 2009 currently before Congress mandates the creation of a national energy efficiency building code and a financial penalty if states and local governments do not adopt codes that meet or exceed this threshold. Although the federal government will not require states to comply with and enforce a national code, the legislation withholds federal funding and carbon-emission allowances if states and local governments do not comply. Most states have adopted codes based on model codes developed by the International Energy Conservation Code (IECC) and the American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE). The stringency of the codes adopted depends on the states' climate and regulatory environments and the relative strengths and interests of local stakeholders.²⁰

From 2002-2007, the United States Department of Agriculture (USDA) provided \$23 million annually, in grants, loans, and loan guarantees, to small farmers to make energy efficient improvements and install

¹⁷T McKinsey and Others, 'Unlocking Energy Efficiency in the U.S. Economy' <<https://www.reuters.com/article/idUSN29313195>> accessed 22 September 2021.

¹⁸McKinsey and Others (n 17).

¹⁹US Department of Energy, 'Office of Energy Efficiency and Renewable Energy' <http://www1.eere.energy.gov/buildings/appliance_standards/laws_regs.html> accessed 22 September 2021.

²⁰E Doris and Others, *Energy Efficiency Policy in the United States: Overview of Trends at Different Levels of Government* (National Renewable Energy Laboratories 2009) 22.

renewable energy technologies. In the first year, the quality and number of applications were low, prompting the USDA and energy advocates, such as the Environmental Law and Policy Center, to offer technical assistance and better marketing in subsequent years. Energy efficiency projects represented 38% of total REAP awards between 2002-2005, and resulted in approximate energy savings of 75,000 Megawatt-hours (MWh).²¹ Additional program benefits include reductions in emissions resulting from energy not used, and energy cost savings for rural Americans.²² Based on program popularity and impact, as well as the increasing focus on energy and rural development issues more broadly in the United States, USDA announced that the program would expand to \$220.9 million for 2008. Subsequently, the Food, Conservation and Energy Act of 2008 (HR 2419) allocated \$60-\$70 million annually from 2009-2012 for the programs.²³

In 1973, the Arab members of the Organization of Petroleum Exporting Countries (OPEC) imposed an oil embargo that increased energy prices and spurred efforts to conserve energy and improve energy efficiency in the United States and worldwide. In 1980, energy efficiency researchers formed the American Council for an Energy-Efficient Economy (ACEEE), whose mission is to act as a catalyst to advance energy efficiency policies, programs, technologies, investments, and behaviors in order to help achieve greater economic prosperity, energy security, and environmental protection.²⁴

On a per capita basis, U.S. energy productivity and efficiency gains have muted the growth in energy use that might be expected as Americans have become more prosperous. Despite the growth in average home size, more and bigger vehicles driven more miles, and the rapid growth in all kinds of energy-consuming devices, from air conditioners to computers to air travel, energy used per American has actually decreased over the last several decades. In 1970 Americans consumed the energy equivalent of about 2,700 gallons of gasoline per person for all uses of energy. That rate

²¹*Ibid.*

²²T Walters and Others, 'USDA Section 9006 Program: Status and Energy Benefits of Grant Awards in FY 2003-2005' <<http://www.nrel.gov/docs/fy06osti/40465>> accessed 22 September 2021.

²³Doris and Others (n 20).

²⁴American Council for an Energy-Efficient Economy, 'Appliance and Equipment Efficiency Standards: One of America's Most Effective Energy-Saving Policies' <<http://www.aceee.org/energy/applstnd.htm>> accessed 22 September 2021.

of consumption extrapolated to the US current economy would have come to the equivalent of about 5,400 gallons per person. Instead, 2010 consumption was the equivalent of 2,500 gallons per person.²⁵

Energy efficiency measures, investments, and behaviors are, however, not the only factors contributing to the increase in energy productivity over the last few decades. Other factors driving this improvement include changes in the nation's economic structure toward greater activity in less energy intensive industries, outsourcing of some heavy industries, general forces that drive technological advances that have improved energy productivity as a byproduct, demographic changes such as population migration to warmer regions with less winter heating needs, and volatile energy prices.²⁶

The 1973 oil embargo and ensuing energy crisis proved to be a game changer in the U.S. It exposed the U.S. to global vulnerability because of unstable energy supplies and, combined with other factors, ushered in a period of high inflation. During this time prices of energy and various material commodities rose greatly, which triggered fears that an era of resource scarcity with economic, political, and security stresses had begun. It was also recognized that the extraction, processing, transport, and use of energy was a major source of pollution, waste, and land disruption. Further, the growing environmental movement led to the passage of environmental laws and the establishment of the Environmental Protection Agency (EPA). This combination of events provided a prime opportunity for the consideration of a national energy policy, including energy efficiency.²⁷

Benefits of Energy Efficiency Practices in the United Kingdom

It is widely recognised that investment in energy efficiency can deliver many different social and economic impacts, beyond those most obviously considered. In the UK, energy efficiency is a core part of meeting legally binding emissions targets, increasing security of supply, and alleviating fuel poverty, reducing energy costs and creating of new jobs for the society.

²⁵Energy Information Administration, 'Annual Energy Outlook' 2012.

²⁶A Hunt and M Greenstone, 'Is There an Energy Efficiency Gap?' <http://web.mit.edu/ceep/www/publications/reprints/Reprint_239> accessed 22 September 2021.

²⁷Alliance Commission on National Energy Efficiency Policy, 'The History of Energy Productivity' <<https://www.ase.org>> accessed 23 September 2021.

Reduced Energy Costs

There are many motivations to improve energy efficiency. Using energy efficiently reduces energy costs and may result in a financial cost saving to consumers if the energy savings offset any additional costs of implementing an energy-efficient technology. As a homeowner, energy costs can make up a significant portion of your recurring monthly expenses. With energy efficient appliances and home upgrades, people are able to save more. Energy efficient appliances consume less energy throughout their service lives without sacrificing quality, and are an excellent way to save on your energy expenditures.

Energy Independence

When a country is able to produce enough of its own fuel to meet its own demands, then it is referred to as being energy independent. The UK has achieved a mixed record on energy independence since the 1970s. New technologies contribute to the economical use of energy in households, which leads to greater household independence.²⁸ Increasing the level of energy independence of households provides an opportunity for homeowners to function in the energy market. According to Stephen,²⁹ legislation is now changing with industry and consumer demand driving government decisions. As renewable energy increases its share in the world's electricity mix, battery energy storage technology will be a key enabler.

Avoidance of Climate Impacts

Energy efficiency delivers a number of environmental benefits. It notably reduces GHG emissions, both direct emissions from fossil fuel combustion or consumption, and indirect emissions reductions from electricity generation. According to Cosford,³⁰ since climate change impacts pose dangerous health problems in the short term as well as the future, calls have been made to the UK national health system to observe and integrate sustainable energy development operations such as measuring and

²⁸ I Gonçalves and Others, 'Optimizing the Management of Smart Home Energy Resources under Different Power Cost Scenarios' [2019] (242) *Appl. Energy*, 351–363.

²⁹ I Stephen, 'Energy Independence: UK Legislation and Investment Drives Change' <<https://hyperdriveinnovation.com/insights/blog/energy-independence-uk-legislation-and-investment-drives-change/>> accessed 13 September 2021.

³⁰P Cosford, 'Partners in Clime: Sustainable Development and Climate Change – What can the National Health Service do?' [2009] (123) *Public Health*, 1-5.

disclosing its carbon footprint, use energy efficient sources and technologies, be highly responsive to health condition of its employees as well as recycle waste. Proposing tools in which governments such as the UK and other interested organizations can use so as to realize zero-carbon benchmarks.

Climate Change Agreements (CCAs) was introduced by the UK government to provide energy-intensive industries with tax discounts (worth £170 million a year) in return for meeting energy efficiency targets. As such, measurement of energy use is one of the requirements of the scheme which has helped in the reduction of climate impacts.

Job Creation

In the current climate of economic austerity, the overarching priority of many policies is that they deliver against key macroeconomic indicators – jobs and growth (GDP). These are also arguments supporting the case for making energy efficiency a national infrastructure priority. The UK Energy Efficiency Strategy identifies investment in energy efficiency as key to supporting long term growth in the UK and the sector has been estimated by Government to be worth more than €25.6 billion,³¹ supporting 136,000 jobs. Evaluation of UK energy efficiency policy between 2000 and 2007 has estimated that these policies contributed additional annual economic growth (GDP) of 0.1 percent over that period, resulting in roughly 270,000 additional jobs in 2010 due to the cumulative impact of higher growth.³² Analysis on behalf of the Energy Bill Revolution¹¹ has estimated the macroeconomic growth benefits of an energy efficiency investment scenario as €3.20 in increased GDP per €1 invested.³³ Based on recommendation from Construction Skills (a government advisory body), DECC assume that for every €1.4 million investment in the delivery of domestic energy efficiency 32.6 jobs are created¹³. Due to the nature of the jobs created (assessment, installation), a large number of jobs are likely to be located close to where measures are put into homes, thereby benefitting local economies.³⁴

³¹HMRC Exchange Rates for 2015 <<https://www.gov.uk/government/publications/hmrc-exchange-rates-for-2015-monthly>> accessed 20 September 2021.

³²T Barker and Others, 'The Macro-economic Rebound Effect and the UK Economy' [2017] (35)(10) *Energy Policy* 35–46.

³³ Cambridge Econometrics and Verco, *Building the Future: The Economic and Fiscal Impacts of making Homes Energy Efficient* (London: Final Report for Energy Bill Revolution 2014)

³⁴Cambridge Econometrics and Verco (n 49).

Benefits of Energy Efficiency Practices in the United States of America

There are many reasons why homeowners should consider energy efficiency, from the clear environmental and financial benefits of cutting energy use to potential improvements in mental and physical health. In fact, energy efficiency has become one of the common features that prospective homeowners look for when purchasing a home. Whether a country's motivations for energy efficiency are economic, environmental, or personal, the benefits of energy efficiency will have something to offer for everyone. Here, are the top benefits of energy efficiency practices in the United States of America.

Reduction of Air Pollution

Air pollution is one of the world's single biggest environmental risks to human health, with one in nine deaths linked to poor indoor or outdoor air quality. The World Health Organization (WHO) estimates that 92% of the world's population lives in locations where local air pollution exceeds WHO limits. In US Energy efficiency reduces both indoor and outdoor concentrations of air pollutants. In doing so, energy efficiency drives a range of economic, environmental and health benefits associated with local air quality.³⁵

The energy system contributes vitally to economic and social progress around the world, but the associated emissions and negative side effects are costly. Scaling up the use of energy efficient appliances and lighting reduces the demand for electricity generation, and therefore reduces air pollution. Mandatory building standards and retrofits that reduce the energy consumption within buildings can also greatly reduce the need for power generation. Similarly, improvements in the efficiency of industrial sites can lead to significant reductions in emissions from fossil fuel based power generation (including at the level of industrial facilities).³⁶

Less Dependence on Fuel

Problems with fossil energy supply and use are related not only to GHG-emissions and global warming, but also to other environmental concerns such as air pollution, acid precipitation, ozone depletion, forest destruction, and emission of radioactive substances. In other words, the

³⁵Multiple Benefits of Energy Efficiency: Air Quality <<https://www.iea.org/reports/multiple-benefits-of-energy-efficiency/air-quality>> accessed 21 September 2021.

³⁶(n 35).

use and substitution of fossil fuels adds to sustainability concerns other than their depletion and replacement.³⁷

Energy efficiency brings about less dependence on fossil fuel and this could reduce carbon dioxide emissions by replacing fossil fuels in the power generation industry and transportation sector. Life-cycle CO₂ emissions for renewable energy technologies are much lower than fossil fuels. The life-cycle balance is also considered to be an important factor in the heat and transportation sectors. Based on an analysis performed by the IEA, renewable power generation enabled countries to save 1.7 Gt of CO₂ emissions in 2008 in the U.S, a figure that is more than the total power sector's CO₂ emissions in the European region (1.4 Gt).³⁸ This shows that hydropower technology constitutes the largest share for saving CO₂ emissions with 82 percent, followed by biomass and wind with 8 and 7 percent, respectively.

Achievement of Energy Independence

Regardless of which country you live in, look around and what do you see? You probably see cars and trucks on the road. What powers all these vehicles? The gas and diesel used to power cars and trucks is derived from petroleum. When a country is able to produce enough of its own fuel to meet its own demands, then it is referred to as being energy independent. Energy independence is something that large and energy-rich countries are attempting.³⁹ Energy independence is independence or autarky regarding energy resources, energy supply and energy generation by the energy industry.

While the US produces some petroleum, it isn't enough to meet the demand. To meet the demand for fuel, the US needs to import fuel from foreign countries. In 2005, 65 percent of all oil consumed in the US was imported. In 2010, this number dropped to 55 percent. And in 2015, due to an increase in oil production in the US, the percentage of foreign oil used dropped to 28 percent. In 2007, President Bush signed into law the Energy Independence and Security Act. This Act's main purpose is to move the

³⁷ M Braungart and Others, 'Cradle-to-Cradle Design: Creating Healthy Emissions – A Strategy For Eco-Effective Product and System Design' [2007] (15)(13) *Journal of Cleaner Production*, 1337-1348.

³⁸ S Ölz, 'Renewable Energy Policy Considerations for Deploying Renewables' <<https://www.iea.org/reports/renewable-energy-policy-considerations-for-deploying-renewables>> accessed 17 October 2021.

³⁹Y Amy, 'What is Energy Independence' <<https://study.com/academy/lesson/what-is-energy-independence.html>> accessed 21 September 2021.

US towards becoming energy dependent by increasing efficiency of buildings and vehicles and increasing clean renewable fuel development and production.⁴⁰

Energy efficiency and renewable energy are said to be the twin pillars of sustainable energy policy⁴¹ and are high priorities in the sustainable energy hierarchy. In many countries energy efficiency is also seen to have a national security benefit because it can be used to reduce the level of energy imports from foreign countries and may slow down the rate at which domestic energy resources are depleted. Energy efficiency has proved to be a cost-effective strategy for building economies without necessarily increasing energy consumption. For example, the state of California in the US began implementing energy-efficiency measures in the mid-1970s, including building code and appliance standards with strict efficiency requirements. During the following years, California's energy consumption has remained approximately flat on a per capita basis while national US consumption doubled.⁴² As part of its strategy, California implemented a "loading order" for new energy resources that puts energy efficiency first, renewable electricity supplies second, and new fossil-fired power plants last.⁴³ States such as Connecticut and New York have created quasi-public Green Banks to help residential and commercial building-owners finance energy efficiency upgrades that reduce emissions and cut consumers' energy costs.⁴⁴

Lovin's Rocky Mountain Institute points out that in industrial settings, "there are abundant opportunities to save 70% to 90% of the energy and cost for lighting, fan, and pump systems; 50% for electric motors; and 60% in areas such as heating, cooling, office equipment, and appliances." In general, up to 75% of the electricity used in the US today could be saved with efficiency measures that cost less than the electricity itself, the same holds true for home settings. The US Department of Energy has stated that there is potential for energy saving in the magnitude of 90 Billion kWh by increasing home energy efficiency.⁴⁵

⁴⁰*Ibid.*

⁴¹H Sophie, 'Invest in Clean Technology says IEA Report' <<https://www.scidev.net/global/news/invest-in-clean-technology-says-iea-report/>> accessed 21 September 2021.

⁴²I Overland, 'Subsidies for Fossil Fuels and Climate Change: A Comparative Perspective' [2010] (67) *International Journal of Environmental Studies*, 203–217.

⁴³P Bill and Others, *The Twin Pillars of Sustainable Energy: Synergies Between Energy Efficiency and Renewable Energy Technology and Policy* (Washington, DC, US: American Council for an Energy-Efficient Economy 2007) 89.

⁴⁴Z Ozzie, *Green Illusions* (London: UNP 2012) 180–181.

⁴⁵K Hallie, 'Working Paper: State Green Banks for Clean Energy' <<https://Energyinnovation.org.>> accessed 21 September 2021.

Denmark

In Denmark energy efficiency has been in focus since the mid-1970s. Many of the existing energy efficiency policies were launched before year 2000 and despite the fact that most have been adjusted on an ongoing basis each of the policies have characteristics reaching back to the year of their launch.⁴⁶ Energy efficiency can be a cheap way to achieve environmental benefits and reduced dependence on imported fossil fuels. In many cases, energy efficiency projects may be realised at low cost and the increased investment cost is more than offset by the reduced energy expenses. The cost of the policies to promote energy efficiency may however be considerable. If the policies are not designed carefully and revised at regular intervals the cost of the policy portfolio may exceed the socio-economic value of the resulting efficiency improvements.⁴⁷

In Denmark, a total of approximately 86 million € is spent every year on measures to promote energy efficiency – in round figures 40 million € for the activities of the energy companies (paid by all energy users), 32 million € for energy labelling of buildings (paid by those acquiring the label), and 14 million € for the Danish Electricity Saving Trust (collected by a special tariff on electricity for households and the public sector).⁴⁸ An evaluation of the entire policy portfolio was carried out as part of the Danish energy policy agreements of June 2005 and February 2008, the intention being to create a basis for updating and strengthening the Danish energy efficiency efforts.

The agreement of 2005 states that an evaluation of the entire energy efficiency policy portfolio must be carried out before end 2008 and put forward for discussion among governing parties no later than February 2009. The aim of the evaluation was to assess whether current energy efficiency policies are sufficient and their organisation effective relative to the agreed targets for the Danish energy policy.

From 2006 the grid companies for electricity in Denmark, natural gas, and district heating were obliged to realise energy efficiency activities. The new obligations constitute a development based on years of utility energy efficiency activities, example, electricity utilities have been working

⁴⁶ A Larsen and Others, 'The Effect of Energy Audits in Danish Industry - Evaluation of a DSM Programme' [2006] (14)(2) *Energy Studies Review*, 15.

⁴⁷ *Ibid.*

⁴⁸ S O Aggerholm, 'Energy Frames for the Buildings of the Future – Theme Day on Reduction of the Energy Consumption in Buildings' <<https://www.researchgate.net/publication/271200709>> accessed 21 February 2022.

actively with energy efficiency since 1990. The commercial oil companies entered the system on voluntary basis. The obligations are given to the grid companies, but in practice most of the activities are carried out by commercial daughter companies, and often combined with other activities, example, selling electricity to industrial companies.⁴⁹

The Danish implementation of the energy labelling scheme for buildings requires that all buildings are labelled before they are sold. The labelling report consists of a label (A to G) with individual recommendation on how to reduce the energy consumption.⁵⁰ However, the labelling is obligatory but is not enforced and without specification of possible sanctions.

Denmark, just as it is in the UK, implemented voluntary programs with the presence of a tax policy. In Denmark, individual firms can choose to make agreements with the Danish Energy Agency, usually lasting three years, to invest in energy-saving projects identified by energy audit report and to improve energy-management activities; in return, they enjoy a lower CO2 tax rate.⁵¹ The agreements are found to yield a significant reduction in energy demand of the participating firms empirically;⁵² they are considered effective in preventing free-riders, but the search costs and the administrative costs are considered high and the diffusion of knowledge between firms limited.⁵³ In general, completely voluntary programs are considered relatively weak and ineffective due to the lack of existing or threatened regulatory structure and strong political will.⁵⁴

Denmark, in re-evaluating its programming in energy efficiency, opted to rectify the situation through the development of energy consultants. The Danish consultant's capacity was further increased until the consultant acted as an intermediary between home owners and municipalities and the consultant was also responsible for part of the grant administration.

⁴⁹ Aggerholm (n 48).

⁵⁰ V H Kjærbye, *Does Energy Labelling on Residential Housing Result in Energy Savings?* (Danish Institute of Governmental Research 2008) 13.

⁵¹ T B Bjørner and H H Jensen, 'Energy Taxes, Voluntary Agreements and Investment Subsidies - A Micro-panel Analysis of the Effect on Danish Industrial Companies' Energy Demand' [2002] (24)(3) *Resource and Energy Economics*, 229-249; K Johannsen, 'Combining Voluntary Agreements and Taxes—An Evaluation of the Danish Agreement Scheme on Energy Efficiency in Industry' [2002] (10)(2) *Journal of Cleaner Production*, 129-141.

⁵² *Ibid.*

⁵³ Johannsen (n 51).

⁵⁴ K Segerson, 'Voluntary Approaches to Environmental Protection and Resource Management' [2013] (5)(1) *Annual Review of Resource Economics*, 1.

This model of energy consultant and the responsibilities ended in 1981, having been implemented in 1975.⁵⁵

In Denmark, grants are provided for energy efficiency measures in connection with converting production processes from fossil fuels to renewable energy. The scheme is aimed at all types of enterprise, including SMEs.⁵⁶ Resulting from the agreement with the Danish Energy Agency on energy-efficient initiatives, nurseries have over the last years had the possibility to obtain subsidies for implementing energy-efficient technology, example, special energy-saving screens and insulation elements, which has prompted greenhouse gardeners to implement new technologies.

Benefits of Energy Efficiency Practices in Denmark

Utility system benefits

Utility system benefits relate to the energy system through reduced costs in providing energy services to end-users. Energy efficiency obligations in Denmark and other end-use energy efficiency programmes can defer the need for investment in transmission and distribution systems and reduce congestion on existing lines, which reduces line losses and the corresponding need for additional generation to serve consumer demand. A good example is reduced line losses resulting from load reduction within the electricity grid.⁵⁷

Societal benefits

Societal benefits are the benefits that accrue more broadly to society rather than to a specific energy system. Good examples include carbon emission reductions and air quality improvements. Health benefits related to these are significant societal impacts, thus they are among the main motivators for undertaking energy efficiency improvements. Particularly where homes are under-heated, energy efficiency improvements allow the occupants to increase indoor temperatures at no additional cost. In addition, draught proofing reduces draughts in the buildings making it more comfortable to live in even if indoor temperatures are not changed.⁵⁸

⁵⁵ *Ibid.*

⁵⁶ Danish Energy Agency, 'Energy Efficiency Trends and Policies in Denmark' <www.odysseumure.eu> accessed 21 February, 2022.

⁵⁷ J Rosenow and E Bayer, 'Costs and benefits of Energy Efficiency Obligations: A Review of European Programmes' [2018] (107) *Energy Policy*, 53-62.

⁵⁸ Rosenow and Bayer (n 57).

Participant benefits

Participant benefits are direct benefits to the participating individual households and businesses that install energy efficiency improvements. In 2015, Denmark's recorded total final energy savings per year was 291 ktoe which is equivalent to a 4.2% reduction of final energy consumption per year in all sectors.⁵⁹ The energy cost savings are commonly discussed as the main participant benefit but participants often also benefit from increased comfort and increased values of their properties/assets. According to Fuerst and others,⁶⁰ properties with a higher efficiency rating achieve higher sales prices compared to other properties.

Energy efficiency obligations schemes in Denmark offer a flexible, adaptable, and cost-efficient instrument to achieve high quantities of energy savings with high accuracy. The European Union (EU) recommends such a scheme in their Energy Efficiency Directive (EED) and more and more EU countries introduce similar schemes, which potentially even allows for cross-border trades.

Conclusion

From the energy outlook of Nigeria, it is very clear that the energy demand is very high and is increasing geometrically while the supply remains inadequate, insecure, and irregular and is decreasing with time; the mix has hitherto been dominated by fossil resources which are fast being depleted apart from being environmentally non-friendly. The energy supply mix must thus be diversified through installing an appropriate infrastructure and creating full awareness to promote and develop the abundant renewable energy resources present in the country as well as to enhance the security of supply. There is clear evidence that Nigeria is blessed with abundant resources of fossil fuels as well as renewable energy resources. The major challenge is an inefficient usage of energy in the country. As a result, there is an urgent need to encourage the evolution of an energy mix that will emphasize the conservation of petroleum resources in such a manner enabling their continued exportation for foreign earnings for as many years as possible.

Improved energy efficiency is an important way to reduce energy use, and thereby CO₂ emissions, and to overcome the climate change problem. Energy efficiency undertakes major functions on sustainable liberation of

⁵⁹*Ibid.*

⁶⁰F Fuerst and Others, 'Does Energy Efficiency Matter to Home-buyers? An Investigation of EPC Ratings and Transaction Prices in England' [2015] (1)*Energy Economics*, 145-156.

institutions and countries. It has become very important to substitute fossil fuels with renewable sources of energy as they have been linked to significant reduction in carbon emissions, mitigate climate change as well as solve many challenges associated with energy poverty. However, it must be emphasized that exploitation of non-exhaustible sources of energy is only sustainable if they are consumed in ways that do not cause damage to existing environments. Thus, weak energy policies as well as inefficient energy technology contribute to unsustainability even when renewable sources of energy have been adopted.

In Nigeria, as in many developing countries, providing energy to rural and urban areas has proved to be a great challenge. While the world works towards the use of cleaner energy, our priority should be to use the energy we generate more efficiently. Energy efficiency practices have the potential to promote economic development and can lead to job creation and saving of personal income. Half of the energy used in Nigeria can be saved if efficiently utilized. The major problem has been that energy policy in Nigeria has undermined the importance and gains of energy efficiency to the environment and economic growth. In the midst of the usual energy crisis in Nigeria, energy efficiency practices will play a crucial role in ensuring access to energy. Energy efficiency is not only cheaper than all other options; it also leads to growth of the economy, by reducing energy bills, it frees up money that can be spent elsewhere in the economy.

It is evident that, there is huge market for energy efficiency products available for developers and promoters in Nigeria. However, the market is flooded with substandard products, as a result, consumers and promoters have little or no confidence in the initiative unlike in the developed countries like the UK and US. Though, majority of Nigerians especially the youth are conversant with the term 'energy efficiency', not many are familiar with or aware of the actual implication in terms of practice and its benefits. Thus, it is vital for Nigeria to draw lessons from the UK and US in order to develop policy instrument that will strengthen regulatory measures and promote energy efficiency in the country.

In order to ensure the sustainability of energy supply and subsequently the sustainable economic development of the country, the government has to intensify the further implementation of renewable energy and energy efficiency programs. As observed in quite a number of successful

countries promoting renewable energy, such as USA and the United Kingdom, a strong and long-term commitment from the government is crucial in implementing any kind of policies which will lead to the development of renewable energies, in particular, and a sustainable development, in general.

Recommendations

The following recommendations have been made by this paper:

- i) Although the Nigerian government has instituted the energy commission of Nigeria to ensure energy efficiency practices in the country and to help rebrand Nigerians from energy wasters to energy savers, yet a comprehensive framework of energy efficiency practices has not been unfolded. To address this issue, it is recommended that government policies should be made to make it mandatory for public and private companies such as banks, hotels, industries to train their staff on energy management. Such policies should also encourage the reduction in the importation, manufacturing and use of incandescent bulbs in Nigeria. Agencies responsible for standardizing goods imported into the country should be equipped to combat the influx of substandard energy efficiency products and second-hand products into the Nigerian market.
- ii) Nigeria as a large oil and gas economy poses an uneven playing field for renewable energy resources. There is substantial flow of resources and policy attention to the fossil fuel sector. This makes it difficult for renewable energy to gain a foot-hold in Nigeria, especially because of the many factors hindering renewable energy growth. Such factors include the lack of awareness of the implication and benefits of renewable energy, lack of financial and fiscal incentives, lack of capacity and standard quality control and so on. Thus, there is need for the Nigerian government to promote policy of diversifying the energy supply so as to include alternative or renewable resources and technologies into the nation's energy supply mix. Identifying the barriers hindering renewable energy growth in the country would help policy makers to make positive decisions to plan and adapt more appropriate initiatives while considering the financial, political and social perception especially the low level of awareness to ensure successful implementation. Such policy should also encourage and initiate regular information

and awareness programmes for the general public, especially young people in the promotion and potentials of renewable energy resources throughout the country. The policy should integrate financial and fiscal incentives to individuals and private organizations willing to invest in the promotion, deployment, and development of renewable energy initiatives.

- iii) Energy efficiency belongs at the heart of a low-carbon economy. By reducing energy use and cutting down on waste, we can reduce energy bills, make our energy system more sustainable, and drive down greenhouse gas emissions. All these, is been made possible in other jurisdictions like the United Kingdom and the United States of America through several policies and schemes initiated by the government of these nations and enforced by agencies with the authority to implement such policies. Thus, it is imperative that the Nigerian government and policy makers not only make the policies which is usually just in paper; but to ensure the appropriate energy controlling authority makes sure that energy is efficiently practiced by households and organisations throughout the nation.
- iv) The US and UK policies on energy efficiency practices is something to be admired. Thus, it is recommended that the Nigerian government and policy makers learn from these two jurisdictions. This the government should do by requiring that information about energy savings be displayed on certain products and providing other necessary incentives for individuals and organisations. The effective design and implementation of energy efficiency policy in Nigeria would contribute to improving the reliability of electricity supply and thus, would complement government's effort on improving supply-side capacities. Effective energy efficiency policy measures also play significant roles in attaining national climate goals and achieving commitments to binding international environmental conventions. International investors consult a country's energy policies as a guide to clean development investment opportunities.