NILEST JOURNAL OF SCIENCE, TECHNOLOGY, AND MANAGEMENT
(NIJOSTAM) VOLUME 1, ISSUE 1, JANUARY, 2025, pp. 1-10
eISSN: 3027-2580 www.nijostam.org

AN OVERVIEW OF ENERGY EFFICIENCY POLICIES AND INITIATIVES IN NIGERIA

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ABSTRACT

Energy efficiency refers to achieving the same level of service while using less energy, reducing unnecessary consumption, and selecting optimal equipment to enhance performance. In Nigeria, industrialisation and increasing energy demands have resulted in heightened emissions, contributing significantly to environmental degradation and climate change. The release of harmful substances during crude oil exploration and consumption underscores the urgent need for robust energy efficiency policies. This study highlights the primary energy sources driving Nigeria's economy—electricity, fuel, and process heat—and their associated negative environmental externalities. Key recommendations include the implementation of energy efficiency regulations to achieve measurable reductions in carbon emissions, spills, leaks, and fuel consumption. Addressing these challenges through policy action is critical for sustainable development.

KEYWORDS
Energy, Emissions, Environment, Efficiency Regulations

ARTICLE HISTORY:
Received: September 2024
Received: in revised: December 2024
Accepted: December 2024
Published online: January 2025

INTRODUCTION

This study examines Nigeria's energy policies with a focus on promoting efficient energy utilisation, phasing out inefficient products, enforcing mandatory labelling of electrical appliances, and institutionalising comprehensive energy management systems (ECN, 2014a). Efficient energy generation, supply, and consumption management are pivotal to national development, as poor energy management leads to economic and environmental losses. Energy Efficiency (EE) encompasses strategies that deliver more services with the same energy input or the same services with less energy input (IEA, 2014a). It involves reducing energy intensity through advanced systems, technologies, and practices (Adom, 2015; Ang et al., 2015). For a developing nation like

Nigeria, achieving energy efficiency is critical for sustainable industrialisation and economic growth.

Developing countries like Nigeria aim to achieve industrialisation and sustainable development; however, attaining development is energy intensive. Advancements in technology in recent times, such as energy generation and supply, are being carried out with more sophisticated and expensive technology, which increases the unit cost of energy (in terms of equipment costing). This high cost is more pronounced as the global cry for more environment-friendly renewable energy (RE) receives wider and increased attention, leading to costly energy services. Considering these reasons, there is a need for careful use of energy to avoid or minimise waste of energy.

The effect of industrialisation and the increase in energy generation to meet the growing demand is evidenced by the rise in emissions that are harmful to the environment (Xu & Lin, 2015; Shahbaz et al., 2014; Lin et al., 2015; Li & Lin, 2015). This results in climate change, which poses significant dangers to human existence due to emissions of harmful substances, spills, and leaks from the exploration of crude oil and its consumption (Ang et al., 2015). Carbon dioxide and methane are standard emissions from oil and gas consumption. According to Johnston (2014) has shown that increasing their levels increases the greenhouse effect, leading to global warming. This has caused faster melting of the polar ice cap, rising sea water levels and air pollution, which are physical evidence of climate change. Even though climate change is synonymous with energy generation and consumption in the form of electricity, other human activities, such as transportation and agriculture, have also been linked to the causes of climate change (Johnston, 2014). As much as energy production and consumption may be linked to climatic effects, inefficient methods of generation and consumption patterns are the major players in the climate change-related issues in Nigeria.

Nigeria is well-known for fossil fuel exploitation, with oil and gas dominating. The country is rich in energy resources and is currently the fastest developing economy in Africa (Nnanna, 2015); the energy supply and consumption in the country can be described as ‘precarious’, which poses threats to the country's sustainable development (Adom, 2015). The energy challenges in Nigeria include inadequate supply, use of inefficient methods of distribution, use of Inefficient energy devices, and high cost of energy, which has consequently caused some industries to shut down due to higher industry production costs, loss of productive person-hours, and has also caused industrial unemployment, and higher use of unclean cooking energy (wood fuel), environmental degradation, pollution, food insecurity, and energy poverty (Oyedepo, 2012a). The energy situation has also affected the gas supply to the West African Pipeline, adversely affecting countries that feed on the pipeline (Adom, 2015). Several reasons have been attributed to this energy situation, which ranges from inappropriate energy use behaviours to the use of antiquated equipment in industries and households, increased use of residential electrical appliances (Oyedepo, 2012a), the proliferation of incandescent bulbs and increased use of used (second hand) appliances that have exceeded their peak efficiency lives (Uyigue et al., 2011).

Nigeria's energy efficiency policy review is of prime importance to the country and other West African countries that depend on her for primary energy supply. The benefits of energy efficiency are overwhelming and cannot be overemphasised. It has the potential to support economic growth, enhance social development, advance environmental sustainability, ensure energy-system security and help build wealth (IEA, 2014b). Energy efficiency can be quantified in the

residential sector, improving health and well-being (IEA, 2014b). In Nigeria, a lack of awareness of the economic and social benefits of energy efficiency measures is a major contributor to the country's inability to reap the benefits of EE. (Uduma & Arciszewski, 2010). Effective energy management stems from adequate national energy policies that spell out the place of energy efficiency measures. Any country that does not have well-defined energy efficiency policies or does not implement the same (where it exists) will not only waste its energy resources but also spend so much on energy. Therefore, there is a need to review and/or upgrade policies that will ensure efficient energy generation, distribution and consumption, which also reduces the effect of greenhouse gas emissions. This paper aims to review Nigeria's energy efficiency policies to determine the achievements made so far, lessons learned from the implementation or non-implementation, and suggest action plans to ensure maximum benefit from the measures where possible. To understand and appreciate the energy efficiency policies in Nigeria, it would be necessary to briefly look at the country's energy outlook, pointing out the generation and consumption capacities.

NIGERIA ENERGY OUTLOOK

As mentioned above, Nigeria has abundant conventional energy sources such as crude oil, gas, coal and tar. Nigeria holds 37 billion barrels of proven crude oil reserves, the second (IEA, 2014a) largest in Africa behind Libya. According to the EIA (2015), Nigeria is the largest holder of natural gas in Africa and the 9th largest globally, with 180 trillion cubic feet (Tcf) of proven natural gas reserves as of January 2015. She is also among the top five LNG exporters in the world. In 2011, Nigeria accounted for 10% of gas flared globally, decreasing from 540 billion cubic feet Bcf in 2010 to 428 Bcf in 2013 (EIA, 2015).

Figure 1 illustrates Nigeria's primary energy consumption as of 2012, dominated by traditional biomass and waste (80%), followed by crude oil (13%), natural gas (6%), and renewable sources such as hydro (1%) (EIA, 2014). This heavy reliance on biomass and fossil fuels reflects the country's energy inefficiencies and limited diversification. The minimal contribution of renewables underscores the need for urgent policy interventions to shift toward cleaner and more sustainable energy sources. Expanding the share of renewables and enhancing energy efficiency in traditional sectors could significantly reduce environmental impacts and align Nigeria's energy landscape with global best practices.

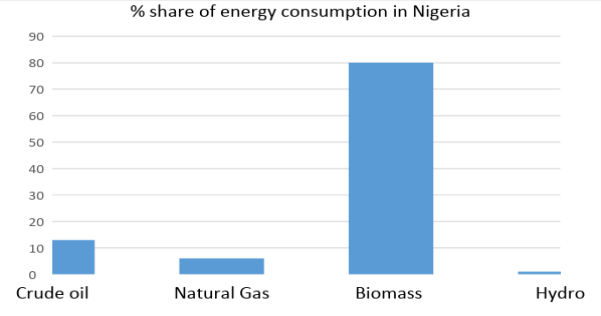

Figure 1: Share of energy consumption in Nigeria (data adapted from IEA 2014)

Despite the abundant energy resources in the country, Nigeria's power sector continues to perform poorly compared to other developing countries; only 42% of the overwhelming Nigerian population has access to electricity (Oyedepo, 2012). Electricity generation for Nigeria as of 2012 stood at 6000 MW, of which fossil fuels accounted for 4730 MW while hydro accounted for 1270 MW (Presidential Task Force on Power., 2013). As seen from the share of primary energy consumption (figure 1) and the sources of electricity generation, Nigeria depends heavily on conventional sources to drive its economy. There is no doubt that the current energy generation, distribution and

consumption pattern in the country might be responsible for the country's 6.6% share of total CO_2 emissions in Africa, making her the fourth largest emitter in Africa behind South Africa (40.06%), Egypt (17.50%) and Algeria (10.12%) (Boqiang et al., 2015). Even though 6.6% is small compared to the preceding African countries, this may be due to inefficient generation, distribution and consumption techniques or technologies that end up causing wastage. However, this can be meaningful when Nigeria's per capita energy consumption is considered.

ENERGY EFFICIENCY INITIATIVES/POLICIES IN NIGERIA

National Energy Policy (NEP)

The Energy Commission of Nigeria developed Nigeria's energy policy in 1993. The policy was reviewed in 1996 at the head of State's instance. Due to significant developments in the national economy and the restructuring of the energy sector to accommodate greater private-sector participation, the 1996 policy had to be reviewed in 2003.

The consequent policy overlays the exploitation and supply of the entire nation's energy resources, and it covers the major energy utilisation sectors such as energy efficiency, environment, energy financing and energy policy implementation. It states, "The nation shall promote the development and adoption of energy-efficient methods in energy utilisation" (ECN, 2003). In 2007, a national energy master plan (NEMP) was drafted to put government commitments of NEP's strategies into actionable programs. NEP was reviewed in 2013 to reflect national and international energy scene developments. Consequently, NEMP was also reviewed in line with the policy in 2014 (ECN, 2014b).

Vision 20:2020

Vision 20:2020 is a policy that was promulgated at the end of 2010. It outlined paths to transform the Nigerian economy and position it among the 20 leading world economies by 2020. Energy efficiency was mentioned in this policy as one of the measures to achieve the policy targets, among others. It states that "An enforcement of transmission capabilities, system redundancies, demand-side management, introduction of energy efficiency measures in industry, enlargement of the gas network for supplying gas-fired power plants" (no action word in the statement) (NPC, 2010). As can be seen from the policy statement, energy efficiency was only mentioned as a proposed general plan to achieve the vision's targets.

The National Renewable Energy and Energy Efficiency Policy (NEP)

The Federal Ministry of Power developed the National Renewable Energy and Energy Efficiency Policy (NREEEP) in 2013/2014, and it is currently waiting for approval from the Federal Executive Council. The pressures from most foreign and local investors for a separate policy document on renewable energy and energy efficiency gave rise to the draft NREEEP. The policy's primary focus is optimally utilising the nation's energy sources for sustainable development. It outlines measures for promoting renewable energy and energy efficiency and will serve as an umbrella document that consolidates related policies and strategies (GOPA Int. En. Consultants GmbH, 2014). The policy encouraged and paved the way for developing a national energy efficiency action plan and a national renewable energy action plan, which will facilitate the overall objectives of NREEEP.

The primary purpose of NREEEP on energy efficiency, as stated, is to "declare energy efficiency to be a major, low-cost, and under-utilised Nigerian energy resource offering savings

on energy bills, opportunities for more jobs, improving industrial competitiveness, and lowering air pollution" (GOPA Int. En. Consultants GmbH, 2014). The strategies and objectives of NREEEP pay particular attention to energy efficiency within the power sector, which generally highlights energy savings or consumption. The policy does not include much on the optimal energy utilisation in the industrial processes and operations where more energy could be saved. Therefore, an energy efficiency policy was needed that would be dedicated to optimal utilisation of the nation's energy resources.

Draft National Energy Efficiency Policy of Nigeria

In December 2012, Nigeria's draft national energy efficiency policy, aimed at optimising the nation's energy resources, was developed and has been under discussion since then. The Energy Commission of Nigeria created the policy with the support of UNDP/GEF (ECN, 2014a). This initiative was driven by the government's efforts to increase electricity access and the various reforms and demands from foreign and local investors, all contributing to the need for a policy promoting energy use and conservation across the country (ECN, 2014b). The policy emphasises the necessity of developing a framework that aligns with international best practices in energy efficiency.

There are on-going discussions regarding a potential name change for the policy to "Operational Framework for Energy Efficiency" to ensure consistency with the National Renewable Energy and Energy Efficiency Policy (NREEEP) (ECN, 2014a). Key policy statements outlined in the draft national energy efficiency policy include (ECN, 2014b):

- "The nation shall adopt and promote energy efficiency and conservation best practices in the exploration and utilisation of the nation's energy resources."
- "The nation shall integrate energy efficiency and conservation best practices across all sectors of the economy."
- "The nation shall establish appropriate energy pricing, metering, and billing mechanisms."
- "The nation shall incorporate energy efficiency and conservation studies into the curricula of educational institutions."

As detailed in Table 1, specific targets with timelines have been established to monitor and verify the progress of policy implementation.

Table 1 Draft Energy Efficiency Policy of Nigeria's Targets (ECN, 2014a)

S/N	Target	Timeline
1	Produce guidelines on all the key components of energy efficiency	2015
2	Enact all relevant legislation required for policy implementation	2015
3	Nigeria to attain 60% consumption of energy-efficient lighting, refrigerators, freezers and air conditioners	2016
4	Review and improve on the recommended energy efficiency practices	2016
5	Achieve replacement of 40% of old non-energy efficient appliances in Nigeria with energy-efficient appliances	2016
6	Nigeria needs to attain 100% consumption of energy-efficient lighting, refrigerators, freezers, and air conditioners.	2020
7	Achieve replacing 100% of old non-energy efficient appliances in Nigeria with energy-efficient ones.	2025
8	Sustain best energy efficiency practices beyond 2025	>2025

The targets, as contained in Table 1, guide the planning and implementation of the draft energy efficiency policy. Though the policy is well drafted, and its intentions are laudable, well-outlined targets, legislative backing, implementation, and financial resources are needed to make a meaningful assessment of its quality. Moreover, no mechanisms have yet been implemented to realise the set targets. Therefore, this policy is only on paper, not yet passed into law, and not implemented to promote energy efficiency practices (Oyedepo, 2012b).

Based on the foregoing, the energy efficiency policy is still in its infancy, and more needs to be done, particularly in regulation.

METHODOLOGY

The methodology focuses on understanding existing policies, their implementation status, challenges, and recommendations for improvement by analysing secondary data sources. A literature review was conducted to gather secondary data on Nigeria's history, development, and current state of energy efficiency policies. This includes national policy documents such as the National Energy Policy, National Renewable Energy and Energy Efficiency Policy (NREEEP), and the Energy Efficiency Regulations. Reports and publications from government agencies (e.g., the Nigerian Energy Commission, Nigerian Electricity Regulatory Commission (NERC)), research papers and academic articles discussing energy efficiency in Nigeria were made available to stakeholders.

Data Sources

Specific reports and databases analysed include the Nigerian Energy Commission's annual reports, the NERC's performance reports, and the Energy Efficiency Regulations. National energy data was sourced from the Nigeria Energy Data Portal, which provides insights into energy consumption patterns and efficiency metrics. Additionally, global benchmarks from the International Energy Agency (IEA) and other relevant international organisations were incorporated into the review to provide context and comparative insights.

Analysis Approach

Data were analysed through the study and exploration of reviews obtained from published documents, focus group discussions, surveys, and reports on stakeholder interviews. The criteria for evaluating the success or failure of energy efficiency initiatives included comparative metrics such as energy saved (kWh), emissions reduced (tons of CO2), and cost savings achieved through different energy efficiency programs.

A qualitative framework, specifically SWOT analysis (Strengths, Weaknesses, Opportunities, Threats), was employed to assess policy gaps. This allowed for a comprehensive evaluation of the mechanisms for policy implementation, the role of regulatory bodies, incentives, enforcement measures, and the outcomes of these projects, which included energy savings, cost reductions, and environmental impacts. A well-rounded analysis of Nigeria's energy efficiency initiatives' effectiveness was achieved using quantitative and qualitative approaches.

RESULTS AND DISCUSSIONS

Successes

The energy efficiency programme in Nigeria is still undergoing fundamental processes of being recognised and integrated into the Nigerian energy programmes. Even though the necessary policies to launch the full implementation are not yet in existence because they have not been signed into law, few successes can be outlined. Because campaign programmes, Workshops and conferences have been organised and are being organised by government and non-governmental

organisations (Oyedepo, 2012b) to sensitise the populace on energy efficiency programmes and benefits, it can be regarded as success to start with.

As energy consumption grows with population and living standards increase, awareness is growing about the environmental costs of energy and the need to expand access to energy more sustainably. Increased recognition of renewable energy's contribution to rural development, lower health costs (linked to air pollution), energy independence, and climate change mitigation is shifting renewable energy from the fringe to the mainstream of sustainable development. Support for renewable energy is very high among those in government, multilateral organisations, industry, and nongovernmental organisations (NGOs) pursuing energy, environment, and development agendas at local, national, and global levels. Some organisations and government agencies are executing some physical micro and macro projects. Among these include the following:

1. Promoting Energy Efficiency in Residential and Public Sector

To promote EE in residential houses, the Global Environment Facility (GEF) granted $3 million to Nigeria to implement the project in the public sector (The Mirror, 2013). Under the programme, two complete sets of light testing equipment were procured and installed to upgrade the Standard Organization of Nigeria (SON) laboratories and the National Centre for Energy Efficiency and Environment Conservation, University of Lagos. This is a welcome achievement to start with. In addition to the above, a survey of residential homes in the six geopolitical zones to ascertain the level of energy efficiency measures in the zones was carried out under the GEF grant programme, with about 1000 personnel being trained to monitor energy efficiency programmes (The Mirror, 2013).

2. ECN energy audit workshop in the textile industry, commercial and institutional buildings (NERC, 2014), development of EE regulations labelling standards for domestic appliances and luminaires, air conditioners, and household appliances.

3. Agency participation.

The Standard Organisation of Nigeria has begun a synergetic partnership with some stakeholders to implement energy efficiency measures in residential homes.

4. ECN and the Cuban government partnered with ECOWAS to distribute 1 million CFL bulbs nationwide in public and institutional residences (The Mirror, 2013).

5. The Rural Women Energy Security (RUWES) programme on the production and national distribution of a purpose-designed bio-fuel stove under the support of the Federal Ministry of Environment (GOPA Int. En. Consultants GmbH, 2014)

6. Initiation of Rural Energy Access Programme by the Federal Ministry of Environment (FMENV) to address the need to source and deploy alternative and sustainable sources for lighting purposes, which aims at reducing power consumption by using clean, energy-efficient LED bulbs and introducing household stand-alone solar kits to replace incandescent bulbs, single-wick kerosene and oil lamps as well as small diesel generators (GOPA Int. En. Consultants GmbH, 2014).

7. The energy-efficient housing scheme of the FMENV provides affordable energy-efficient housing for the Ministry staff, where bioenergy and solar are in use. It is launching 2000 EE housing units in Kaduna. Also, Julius Berger Construction Company has integrated EE in building projects, as demonstrated in some of the projects executed by the company, such as the CBN building in Lagos,

Akwa Ibom stadium, etc. (GOPA Int. En. Consultants GmbH, 2014).

8. The establishment of the Nigerian Clean Cookstoves Design and Testing Centre at Afikpo, Ebonyi State and the National Centre for Energy Research and Development UNN Enugu state by ICEED are part of the successes of the EE programme in Nigeria.

Some of the successes are also enshrined in some of the planned projects underway, such as the Abuja Green City for a low-carbon environment, Abuja Centenary City, and the establishment of the Nigeria Clean Energy Access programme, which is ready to distribute about 150 million bulbs over five years under the Clean Development Mechanism (CDM) (GOPA Int. En. Consultants GmbH, 2014).

Lessons learnt

There have been delays in foreign investments (Oyedepo, 2012a) in energy efficiency-related projects that would have had a positive economic impact in the country, mainly because of poor implementation of energy initiative policies. Similarly, the lack of energy efficiency measures in electricity generation, distribution, and consumption in the country has contributed to losses in electrical energy, thereby making Nigeria's electricity supply system epileptic and insufficient. This has resulted in the collapse and folding up of some industries and businesses that could have eased the unemployment situation in the country.

There are timeline targets towards achieving EE programmes, as shown in (Table 1); the development of the guidelines on all the key components of energy efficiency by 2015 is still in the making while the law is yet to be enacted. Because of this, other timeline targets may not be met. Even though the energy efficiency programmes in Nigeria achieved few successes, the delay in passing the draft EE policy into law can be a lesson learnt, which reveals the government's lack of political will in implementing what could benefit the country at large.

Action plans

A critical step toward establishing an energy-efficient economy in Nigeria is the swift enactment of the draft of the EE policy into law. While initial awareness initiatives have been implemented, expanding these programs is essential to reach a broader audience. Incorporating energy efficiency concepts into secondary and tertiary education curricula will help instil sustainable practices from an early stage. Additionally, Nigeria could benefit from studying the implementation strategies of successful EE programs in other sub-Saharan countries, such as South Africa and Kenya. Prioritising these actions, alongside meeting the timeline targets outlined in Table 1, will ensure measurable progress in achieving national energy efficiency goals.

CONCLUSION

Nigeria's energy efficiency policies and programmes are still undergoing fundamental processes of being recognised and integrated into the Nigerian energy programmes. However, there are significant strides in promoting energy conservation and reducing energy consumption. However, Nigeria faces the challenges of low public awareness and financial constraints. With continued efforts to strengthen policy enforcement, increase public awareness, and adopt innovative technologies, Nigeria can substantially improve energy efficiency, reduce energy consumption, and contribute to sustainable development goals.

Energy is used inefficiently in almost all sectors in Nigeria. This calls for urgent passage of EE policy into law, which will encourage/guarantee

enforcement of EE regulations and practices in Nigeria. Investments into EE projects will be encouraged from foreign and local investors with appropriate policies in place. This paper has identified and reviewed existing energy efficiency policies in Nigeria, analysed the effectiveness and implementation challenges of these policies, evaluated the impact of energy efficiency policies on energy consumption, economic growth, and environmental sustainability and provided recommendations for enhancing energy efficiency policies and their implementation in Nigeria.

Though minimal EE projects are being carried out before policy enactment, it is believed that more will be achieved if the EE policy is approved. It will enhance the physical efficiency of equipment and facilities and improve the nation's overall economic efficiency. Therefore, adopting EE measures in all sectors (household, industrial and transport) will enhance profitability, reduce greenhouse gas emissions, promote sustainable development, and improve corporate social responsibility in Nigeria. Therefore, stakeholders should encourage energy efficiency in the residential and public sectors.

The Initiation of the rural Energy Access Programme by the Federal Ministry of Environment (FMENV) to address the need to source and deploy alternative and sustainable sources for lighting purposes should be encouraged by policymakers because it is aimed at reducing power consumption by using clean, energy-efficient LED bulbs and introducing household stand-alone solar kits to replace incandescent bulbs, single-wick kerosene and oil lamps as well as small diesel generators.

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