

**SUSTAINABLE ENERGY DEVELOPMENT:
EMERGING ISSUES, CONSTRAINTS AND
CHALLENGES OF UNIVERSAL RURAL
ELECTRIFICATION IN NIGERIA**



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Synopsis

Sustainable energy development can be understood as a holistic approach to minimizing the negative environmental impact of production and consumption of energy resources used for producing energy services and a practical implementation strategy for achieving sustainable development. The United Nations declared the year 2012 as the international year for Sustainable Energy (SE4ALL) with three basic objectives: universal access to modern energy services; doubling the share of renewables in the energy mix; and doubling the rate of improvement in energy efficiency.

The objective of this study is to examine the issues, challenges and strategic options for achieving universal rural electricity in Nigeria within the framework of SE4ALL. The study identified income; institutional arrangements; investment challenges; mobilization of financial resources; electricity pricing; technological and economic risks; and human resource requirements as major emerging issues and challenges in the provision of universal rural electricity in Nigeria.

The study concludes by suggesting various action plans for sustainable rural electricity access including policy and institutional framework; technology transfer; educational and skill development; investment and finance; environmental strategies and governance; and social and gender responsibility strategies.

1. Introduction

Energy is central to sustainable development and poverty reduction (Toman et al, 2003). It affects all aspects of development – social, economic and environmental – including livelihoods, access to water, agricultural production, education and poverty – related issues. None of the Millennium Development Goals (MDGs) can be met without major improvement in the quality and quantity of energy services available to development countries (UN, 2001).

An energy system is made up of an energy supply sector and energy end-use technologies. The object of the energy system is to deliver to consumers the benefits that energy offers. The term *energy services* is used to describe these benefits, which in households include illumination, cooked food, comfortable indoor temperatures, refrigeration, and transportation. Energy services are also required for virtually every commercial and industrial activity. For instance, heating and cooling are needed for many industrial processes, motive power is needed for agriculture, and electricity is needed for telecommunications and electronics (Srivastave et al, 2012).

The structure and size of the energy system are driven by the demand for energy services. Energy services, in turn, are determined by driving forces, including economic structure and activity; demographics; Technology base; natural resource endowment and access; lifestyles; national policies; laws, institutions and regulations. The structure and level of demand for energy services, together with the performance of end-use technologies, largely determine the magnitude of final energy demand. The final energy demand mix, the structure and efficiency of energy supply (resource extraction, conversion, transmission, and distribution), domestic resource availability, supply security, and national energy considerations then determine primary energy use (ECN, 2002; Ibitoye et al, 2007).

The linkage between energy, economy and environment makes the integration of policies affecting the three sector imperative. Hence to provide energy systems that are simultaneously affordable, stable and environmentally sensitive is the universal aspiration. Energy must be accessible and affordable, contribute to the well – being of the people and the environment, and enhance economic growth now and the future (Adenikinju, 2005). This is the major objective of a sustainable energy system.

In furtherance to the challenges of sustainable energy development, the UN Secretary General launched the global initiative – Sustainable Energy for All (SE4ALL), following the declaration of 2012 as the international Year for Sustainable energy. The SE4ALL is expected to provide access to energy as a necessary precondition to achieving many development goals that extend far beyond the energy sector, such as eradicating poverty, increasing food production, providing clean water, improving public health, enhancing education, creating economic opportunities and empowering women (Kaberuka, 2012).

The objective of this study is an exploratory assessment of the Federal Government of Nigerian (FGN) towards the provision of universal access to modern energy services in the rural areas in Nigeria, in line with universal SE4ALL programme. The study highlights the current issues and challenges being confronted by the FGN and proposes an action plan towards the successful implementation of this programme in Nigeria. The paper is divided into five sections. The first section is the introduction; section 2 reviews the concept of sustainable energy development and discusses extensively the SE4ALL programme and the importance of the programme to the overall development of the country. Section 3 discusses the emerging issues, constraints and challenges in the provision of universal energy services and section 4 provides an action plan for implementation. Section 5 concludes.

2. The Sustainable Energy for ALL (SE4ALL) Programme

Sustainable energy development can be understood as a holistic approach to minimizing the negative environmental impact of production and consumption of energy resources used for producing energy services in society, and can be considered as a major practical implementation strategy for achieving sustainable development (Sambo, 2009). The objective of the concept is to promote the development of energy resources and provision of energy services within the carrying capacity of the ecosystem and the decoupling of economic growth from environmental degradation. Thus, to be considered sustainable, energy systems must not overload the carrying capacity of ecosystems; nor should the use of finite resources compromise the ability of future generations to meet their energy service requirements. Efficient use of resources, clean conversion processes, and the timely development of inexhaustible supply options —such as renewable forms or nuclear energy based on breeding or fusion — are therefore the principal strategies for sustainable energy development (UNCTAD, 2007; World Bank, 2011). Figure 1 shows the interrelations between sustainability dimensions of the energy system.

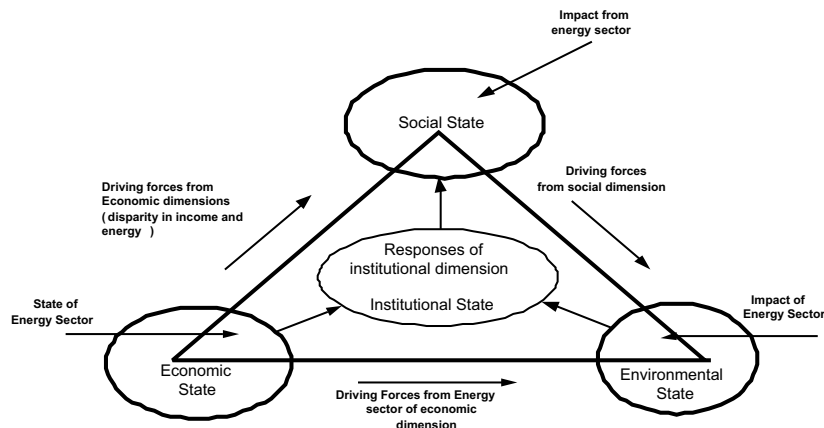


Figure 1: Interrelations between the sustainability dimensions of the energy system

The UN secretary General launched the SE4ALL global initiative to catalyze all stakeholders – governments, private sector and civil society groups to take concrete action towards three critical objectives to be achieved by 2030. These objectives (figure 2) are: universal access to modern energy services; doubling the share of renewables in the energy mix and doubling the rate of improvement in energy efficiency (UN, 2012).

Universal access to modern energy services would facilitate a giant leap in human wellbeing and economic development, enhancing the life of the poor in countless ways. Electricity extends the day, enabling children to study after dark and for working hours to be extended. Modern cook stoves, which is expected to replace cook stoves and open fires saves women and children from daily exposure to smoke that damage their health and from the time – consuming drudgery and danger of travelling long distances to gather woods. Refrigeration allows local clinics to keep needed medicine on hand (UNCTAD, 2007; WHO, 2006). Access to energy provides consumers with the means to generate income and improve productivity, which in turn creates wealth and new wealth. Thus, expanding access to modern energy services can yield significant economic returns, especially when integrated with efforts to promote the efficient use of limited energy resources and the harnessing of locally available renewable energy sources.

Doubling the share of renewable energy and the rate of energy improvement globally would fundamentally change the energy landscape throughout the world. It would reduce energy demand by roughly 30% and greenhouse gas emissions by roughly 60% compared to a business – as – usual trajectory and would contribute to stabilizing climate change at a temperature increase of 2°C or less. In this transformed energy system, more reliance on local renewable energy sources and emphasis on energy efficiency would increase the diversity of supply, and have the potential to energize the world economy through a wave of innovation and job creation (ECN, 2005).

The three core objectives of SE4ALL are built around a complementary vision of universal access to renewable, efficient, secure and low – cost energy with benefits at the household, village, and community, national and global scales. Achieving the SE4ALL efficiency objective would mean that the same goods and services we consume today

could be produced using only 70% as much energy as we currently do. This can happen through a combination of changes that are technological (e.g. increasing the fuel efficiency of vehicles), structural (e.g. telecommunication to cut down on travel), and Behavioural (e.g. living closer to work to reduce the length of commutes). Progress is needed in all of these areas to achieve the overall efficiency objectives. Bringing about each of these types of changes requires sector – specific and cross – sector efforts (Kaberuka, 2012).

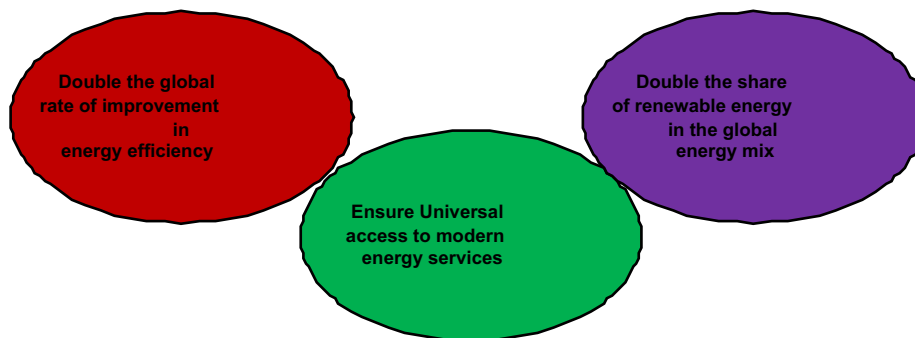


Figure 2: SE4ALL 2030 goals

The successful implementation of the three core objectives of SE4ALL by 2030 according to the UN secretary general will be based on strong partnerships, the encouragements of common action and forging of lasting commitment among all the stakeholders groups across many relevant sectors of the economy. The stakeholders are National governments; the private sector and civil society organizations.

To make the core objectives of the SE4ALL achievable, the core objectives have been disaggregated into eleven (11) action areas (Figure 3). The 11 action areas have been further grouped into two categories – sectorial action areas and enabling action areas (Figure 4). From Figure 4, it is seen that the seven sectorial action areas address both power generation (40% of total primary energy demand in 2009) and the three principal sectors of energy consumption; industry and agriculture; transport and building, each of which accounts for roughly a third of total energy consumption. The International Energy Agency (IEA) projects that each of these sectors will account for a similar share of total primary energy demand in 2030 (IEA, 2012).



Figure 3: SAE4ALL from Vision to Initiatives

The four enabling action areas include cross – cutting mechanisms that support effective sectorial Action Areas and address existing obstacles and catalyze rapid scaling at the country, regional and local levels. The four enabling action areas are: Energy planning and policies at all levels; Business model and technology innovation; Finance and risk management and capacity building and knowledge sharing.

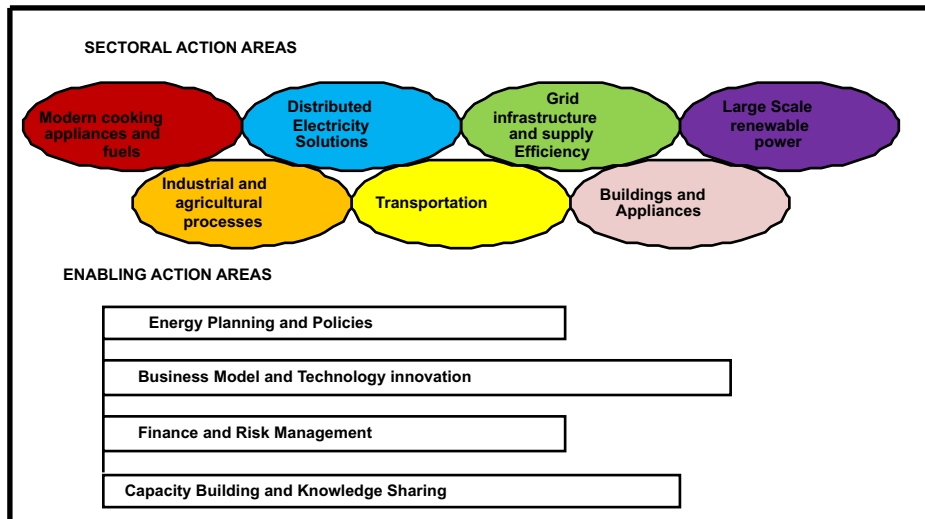


Figure 4: SAE4ALL Action Areas

There are three compelling reasons to support Nigeria domesticating SE4All, the new global energy initiative. These reasons are:

1. Adopting the SE4All planning framework would help policy makers and other stakeholders in the industry to address decisively, the electricity dimension of Nigeria's paradox of energy poverty amidst plenty.
2. The SE4All initiative would help provide a framework for dealing with the various forms of energy-related environmental degradation that continue to have devastating economic, social, political and environmental impact on local communities and the economy.
3. With the highly expensive flooding experiences in Nigeria in the past two years, in terms of human and property losses, SE4All offers a pro-active policy framework for pursuing sustainable energy and development strategies underpinned by mainstreaming climate change into the development process in the context of a dynamic transition to a new energy paradigm driven by clean and low carbon energy.

Nigeria's effort to domesticate the SE4All initiative with focus on achieving its first objective of universal rural electricity access (the more limited scope of this study) raises three fundamental and practical policy questions: “what to do”, “what not to do”, and “how best to do what should be done” for the transformation of Nigeria's abundant non-renewable and renewable energy resources anchored on clean and low carbon energy technologies to achieve universal energy and electricity access in the drive for economic and social advancement.

The primary goal of this study is to answer these and related questions with focus on the design and implementation of best practices for the emergence and sustenance of efficient and effective universal rural electricity outcomes. The study seeks to provide valuable insights on the issues, challenges and strategic options for achieving universal rural electricity in Nigeria in the context SE4All. Against the backdrop of Nigeria's protracted electricity crisis and the emerging issues and challenges that confront expanded and ultimately universal electricity access, the study offers key suggestions for achieving the goal of universal rural electricity.

3. Emerging Issues and Challenges

Prior to discussing the strategic options and the way forward in achieving SE4All's fundamental objective of universal rural electricity in Nigeria, it is useful to examine the major emerging issues and challenges arising from the assessment of the domestic and international context of the problem.

First, Nigeria is both income and energy/electricity poor despite her vast energy and other natural resources. Also of significance is the fact that rural electricity access is among the lowest in the world (Iwayemi, 1999). The low ranking by global energy and development standards reveals some dimensions of development divide gap that Nigeria must overcome to be among the top 20 economies in the world in the next two decades.

Second is the institutional arrangement for achieving universal rural electricity access given the abysmal failure of public provision of electricity service in the country (Iwayemi, 1990). Meeting the challenges of providing adequate, reliable and widely accessible energy service involves more than getting the generating and transmission and distribution numbers (mega-watt and kilovolt) and other technical issues, and even, the investment figures right. Equally of significance as a key success factor is closing the current gaps in policy, institutional, legal, regulatory, and market environment (Modi et al, 2005; Iwayemi, 1997).

Third is the investment challenge, which has several dimensions: size, source and security of investment and input supply, human resource requirements, investor/producer incentives, including market-responsive electricity tariff level and structure, regulatory framework and macroeconomic environment. Given the current high level of suppressed electricity demand, the current decay in the supply system and the need to raise electricity consumption per capita from the current extremely low level and achieve universal rural electricity, the estimated \$300 billion required in the next few decades in generating, transmission and distribution capacity expansion to deliver reliable and adequate electricity to end users is huge by historical standard. Overcoming this key challenge is central to sustainable and universal rural electricity access (World Bank, 2003 & 2009).

Fourth and related to the previous issue is the mobilization of the financial resources to support transforming the vast endowment of energy resources to achieve universal rural electricity access. Besides, mobilizing the large financial requirement must be situated in the context of the global capital market competitiveness and country risk assessments.

However, while the financial requirement is high by historical standards, the right institutional framework, policy consistency, appropriate incentive structure and security of investment and input should guarantee the required financial inflows (Zerriffi, 2007).

Fifth is the pricing of electricity from both conventional and non-conventional sources. There has been a tendency for Independent Power Producers (IPP) to lock in high tariff into their power purchase agreement (PPA) for unnecessarily long periods notwithstanding production from more efficient plants in the future (Caven, 1998). The key principle should be energy pricing that guarantees attractive rate of return to investors adjusted for industry risk and security of investment. The feed-in tariff of MYTO2 has addressed this important issue by providing the price incentive investors and operators.

Sixth is how to share the economic, political, technological and environmental risks associated with the investment required to sustain a reliable and adequate modern energy supply systems that support universal rural electricity access. Optimal sharing of these risks among the three principal actors in the electricity market, namely, consumers, investor/producers and the government is essential to efficient allocation of resources in the industry and sustainable rural electricity future in Nigeria (Omoigui, 2000).

Seventh is the human resource requirement of robust and reliable electricity supply system which is fundamental to sustainable electricity future in Nigeria. The demand on local and foreign skilled workers will be immense. However, having the appropriate reward structure is essential given the globalized, regional and national demand for electrical, mechanical, computer engineering and other skills needed to support a vibrant industry at the centre of Nigeria's rural energy and electricity access map.

4. Action Plan for Sustainable Rural Electricity Access

The way forward in achieving sustainable universal rural electricity access in Nigeria includes but is not limited to the action plan outlined below.

4.1. Policy, Legal, Regulatory and Institutional Framework

- a) Establish and maintain an enabling policy, legal, regulatory, and institutional frameworks that provide level playing incentives that will maximize investment by stimulating private sector investment and public-private partnership.
- b) Since several ministries, department and agencies are often involved in the rural electricity development, focus must be placed on interagency collaborative and cooperative mechanisms. These include installing databases to strengthen information flow and the working committees responsible for integrated rural energy planning.
- c) National Planning Commission should be the agency coordinating the collaboration among the three tiers of government, industry, civil society, development partners and local communities to ensure successful energy service outcomes.

4.2. Technology Transfer

- a) Develop a renewable and low carbon energy registry and database that track key technology players; and track technology developments in the industry.
- b) Establish Clean Energy Research and Development partnership with local tertiary institutions and Research Centres.
- c) Enhance collaboration between industries and training institutions to develop technical skills. Collaboration could take the form of apprenticeship schemes, employment opportunities, on the job training, workshops etc.

4.3. Education and Skills Development

- a) Support and promote the development of skills and competitive competencies necessary for the country's entrepreneurs and other stakeholders to participate in the delivery of goods and services required for SE4All
- b) Identify the training skills required for the sector and plan for their development through both formal and industrial training to include training for both core skills and ancillary skills.
- c) Promote public-private-local community partnerships in training and capacity building in clean energy technology and management.

4.4. Investment and Finance

- a) Provide information on opportunities for investment in rural electricity infrastructure.
- b) Promote private sector participation and investment in rural electricity infrastructure.
- c) Review existing investment codes and frameworks to make it attractive for the major global player to set-up clean energy technology industries locally. This will involve updating the regulatory environment and improving the business environment, and taxes, tariffs, duties and other incentives.

4.5. Environmental Strategy and Governance

- a) Implement environmental policies as affects the electricity industry development.
- b) Design energy strategies and measures to support environmental sustainability.
- c) Invest in environmental planning and management and incident reporting
- d) Clearly delineate environmental liabilities and responsibilities
- e) Facilitate public/private/local community partnerships in environmental stewardship.

4.6. Social and Gender Responsibility Strategy

- a) Identify and implement appropriate responses to the human resources and skills development needs of local population

- b) Set up a framework of community investment that will support rural electricity access in the context of local economic growth and development.
- c) Establish a framework underpinned by public and private sector partnerships and support to address women economic empowerment with focus on rural electricity access.

5. Conclusions and Recommendations

Achieving SE4All's primary goal of universal rural electricity access in Nigeria will involve putting in place a sustainable electric energy supply system that achieves rapid economic growth, greater social equity and environmental sustainability with due recognition of the interests of both current and future generations. However, given the multi-dimensional nature of Nigeria's energy and economic challenges, overcoming the current challenges to universal access to reliable, affordable and adequate electricity in the rural areas will require pushing the energy boundary radically beyond the historical experience especially in the area of decentralized and cleaner energy technologies. Clearly, the achievement of universal rural electricity access will depend on the design and implementation of appropriate policy strategies and action plan. The broader and more desirable sustainable development orientation driven by eliminating energy poverty will require two key paradigm shifts. One is adoption of more decisive and strategic development policy directions and implementation strategies. The other is radical institutional change and innovative partnerships and collaboration between the public, private, development partners, NGOs and local communities.

Summing up, poor access to modern energy services, especially electricity has constituted a major constraint to the effective exploitation of economic opportunities, and consequently sustained economic growth, higher living standards and sustainable development. Since improved energy access is widely recognized as a key factor in achieving MDGs and sustainable human development, it is imperative that adequate, reliable and universal rural access to electricity deserves greater policy focus and urgency. Indeed, a major energy paradigm shift is required to achieve the objectives of SE4All in Nigeria on a sustainable basis.

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