

Renewable Energy as a Main Factor of Sustainable Development: The Case of African Emerging Economies

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Abstract— The amount of energy provided by the sun is almost infinite in nature, which can potentially provide an emerging economy with a sufficient capacity to meet the ambitions of enhancing both urban and rural development. The development of renewable energy technology is now widely seen as important if the world is to move towards a sustainable approach to energy generation. That is why development of renewable energy technology in emerging economies of the world is now widely seen as a huge step, if the world is to move towards a sustainable development. The use of renewable energy is now widely adopted by companies. A strategy companies have adopted is to volunteer their services or manpower to the development of communities in which they are situated, in some cases by providing communities various forms of relief efforts or more. Oil companies in Nigeria provided locals with photovoltaic systems to dissuade them from burning firewood for fuel. Several companies are looking to renewable energy as a solution to sustainable development. This paper examines the direct and indirect influence of renewable energy on sustainable competitive advantage in emerging economy, it also describes a wider context in which companies can fully make achieving sustainable development a primary policy.

Keywords— *sustainable development, corporate social responsibility, renewable energy, competitive advantage, strategy*

I. INTRODUCTION

Sustainable Development is a new growth strategy supporting new generations of companies. The term sustainable development began to gain wide acceptance in the late 1980s, after its appearance in Our Common Future, also known as The Brundtland Report. The result of an UN-convened commission created to propose “a global agenda for change” in the concept and practices of development, the Brundtland report signaled the urgency of re-thinking our ways of living and governing. To “responsibly meet humanity’s goals and aspirations” would require new ways of considering old problems as well as international co-operation and co-ordination [1]. Ever since the Brundtland Report was released, advanced countries have made several policies that protects the environment in line with the report. Renewable energy is derived from natural processes that can be replenished within a short time scale and can be derived directly or indirectly from the sun and from other

natural mechanisms. Renewable energy sources include hydropower, bioenergy, thermal, geothermal, wind, photochemical, photoelectric, tidal, wave, and solar energy. It excludes energy from fossil fuel sources (oil, coal, and natural gas) [2]. With the rising demand in clean energy without damage to the environment, the importance of renewable energy. It has been realized that the renewable energy projects could be used as tools for the management of reserves and sustainable development of desert communities. Several governments have initiated programs that aim at increasing the use of renewable energy technologies in Africa, therefore providing green power to isolated villages and combating global climate change, especially greenhouse gas emissions, to protect the environment. Companies are taking advantage of this need by investing more funds on renewable energy research and development in order to gain a competitive advantage. This paper hopes to shed more light on the direct and indirect effects on how various companies are using renewable energy gain sustainable competitive advantage in developing countries all over the world.

II. LITERATURE REVIEW

Sustainable development as the “ability to make development sustainable—to ensure that it meets the needs of the present without compromising the ability of future generations to meet their own needs [3,4,5]. As populations grow, many faster than the average 2%, the need for more and more energy is exacerbated. Enhanced lifestyle and energy demand rise together and the wealthy industrialized economies which contain 25% of the world's population consume 75% of the world's energy supply [6,7]. World population is expected to double by the middle of the 21st century, and economic development will almost certainly continue to grow. Global demand for energy services is expected to increase by as much as an order of magnitude by 2050, while primary-energy demands are expected to increase by 1.5 - 3 times [8]. Globally, the quest for sustainable development has heightened today more than ever before. There are increasing awareness and concern for sustained economic development and growth. Sustainable energy has turned into one of the most promising ways to handle the challenges of energy demand problems of numerous consumers worldwide [9]. The overall goal of

sustainable development is the long-term stability of the economy and environment; this is only achievable through the integration and acknowledgement of economic, environmental, and social concerns throughout the decision-making process. In the application of this definition of sustainable development, one issue concerns the substitutability of capital.

Humanity can make development sustainable to ensure that it meets the needs of the present without compromising the ability of future generations to meet their own needs. The concept of sustainable development does imply limits - not absolute limits but limitations imposed by the present state of technology and social organization on environmental resources and by the ability of the biosphere to absorb the effects of human activities. But technology and social organization can be both managed and improved to make way for a new era of economic growth. The Commission believes that widespread poverty is no longer inevitable. Poverty is not only an evil, but sustainable development requires meeting the basic needs of all and extending to all the opportunity to fulfil their aspirations for a better life. A world in which poverty is endemic will always be prone to ecological and other catastrophes [4].

There are several types of capital: social, natural, and man-made. The definition of weak sustainable development explains that only the aggregate level of capital matters: man-made, or manufactured, capital is an adequate alternative to natural capital. The Sustainable Development Goals (SDGs) should be the key point for different stakeholders to systematize their activities and estimate their results to guarantee social and environmental responsibility [10]. Strong sustainability, on the other hand, recognizes the unique features of natural resources that cannot be replaced by manufactured capital. Most ecologists and environmentalists are proponents of the strong sustainability definition [11,12]. Global organizations such as the United Nations, NGOs, aid organizations and even governments are increasingly sponsoring efforts to ensure sustainable development goals are realized for every individual across the board [13]. Some other most important sustainable development goals set by these bodies include:

- Eradication of poverty across the world
- Promotion of good health and well being
- Provision of Quality Education for All
- Provision of Clean Water and Sanitation
- Enabling Access to Affordable and Clean Energy

The major alternative energy resources abundant throughout the African continent are solar energy (thermal and photovoltaic), wind energy, wood and biomass, and biogas production. In making renewable energy consumption sustainable and acceptable to other socioeconomic parameters of development, the following must be considered [16]:

- Sustainability of the environment through appropriate resource management.
- Economic sustainability through infrastructure and service development that keeps affordability firmly to the front because of the disadvantaged rural populations.

- Social sustainability through ensuring that the poor benefit, and that women's incomes and concerns, legal rights for all, and children's rights are all appreciated and supported.
- Administrative sustainability through ensuring that there is administrative capacity for program implementation, and that this will be maintained or increased over time.

III. RESULTS AND DISCUSSION

Renewable energy supports other goals of sustainable development because it has the most impact on society. Every system that we use in our daily lives run on electricity. The cleaner we obtain that electricity, the better it is for our environment in general. Nigeria as a country hopes to generate more electricity to create and power industries, which will eventually lead to creation of jobs, alleviation of poverty, decent work, and economic growth, zero hunger. Generation of this electricity through renewable energy such as wind, solar photovoltaic (PV), hydropower, geothermal, and biomass, will undoubtedly have enormous impact on sustainable development. From Fig.1 above, shows interconnection of renewable energy with other Sustainable Development Goals affordable.

As we can see, using of renewable energy supports goal #7 directly, however this goal is highly interconnected with other sustainable development goals.

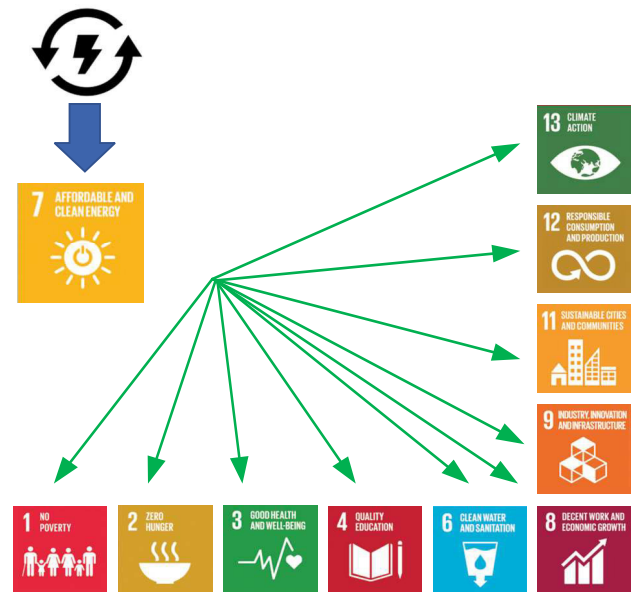


Fig.1 Interconnection of renewable energy with other Sustainable Development Goals

The creation of affordable and clean energy will impact sustainable development in various cities and communities throughout Africa, through non pollution of the environment. Coal powered plants release enormous amount of smoke and toxins into the atmosphere which destroys the environment. Investment in clean energy eventually leads to responsible Consumption and production in the country as there will be reduction in wastage in food resources by increasing recycling

of unwanted product and responsible consumption of food resources. Also, by minimizing carbon emissions at all stages of production in factories through the utilization of renewable energy in production and service facilities. Eliminating waste from procurement to all stages of the supply chain. The control and reduce any harmful emissions and pollutants. Continuous use of environmentally safe chemicals, dyes, soaps and solutions and energy efficient lighting.

Renewable energy's impact on industry, innovation and infrastructure is extremely necessary as economic growth, social development and climate action are heavily dependent on investments in infrastructure, sustainable industrial development, and technological progress. As shown below in table 1, the number of jobs created through the innovation of renewable energy and the future jobs to be created in sub-Saharan Africa.

TABLE I. RENEWABLE ENERGY JOBS CREATED AND THAT WILL BE CREATED IN SUB-SAHARAN AFRICA (THOUSANDS) [36]

Type of Renewable Energy	2017	2030 (PES*)	2050 (PES*)	2030 (TES**)	2050 (TES**)
Bioenergy	176	243	279	581	1270
Solar	44	97	135	154	583
Hydropower	71	76	64	91	111
Wind	14	25	37	30	57
Geothermal	1	2	3	3	3
Total	306	442	519	859	2023
Renewable energy jobs in energy-sector employment (%)	6.2%	9.4%	11.3%	15.7%	32.5%

*PES - Planned Energy Scenario
**TES = Transforming Energy Scenario

Production has a far greater impact on sustainability than consumption, so taken in isolation, the fact that goods can now be obtained in a digital format is a good thing for sustainability. Selling a million copies of a song via Internet downloads saves tons of plastic, tons of packaging materials and tons of fuel to get the compact discs to the shelves and the fans to the store. But, once again, we must keep in mind that sustainability is not about taking things in isolation, but instead about examining the trends and interactions that make up the whole cycle of production and consumption. In this case, it means remembering that the virtual economy has physical foundations, and that the digital product uses resources and creates waste [1].

In the face of a rapidly changing global economic landscape and increasing inequalities, sustained growth must include industrialization that makes use of clean energy without damage to the environment. Renewable energy improves sustainable development through the provision of decent work and economic growth through promotion of development-oriented policies that support productive activities, decent job creation, entrepreneurship, creativity, and innovation, and encourage the formalization and growth of micro, small and medium-sized enterprises, including through access to financial services. The more companies created

through innovative Renewable energy ideas the more financial progress it creates with decent and fulfilling jobs while not harming the environment. This will further lead to the protection of labour rights and once and for all put a stop to modern slavery and child labour. If we continue to promote job creation with clean energy as a launching pad and with expanded access to banking and financial services, we can make sure that everybody gets the benefits of entrepreneurship and innovation.

Renewable energy improves water quality by reducing pollution, eliminating dumping through recycling of waste, and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater to ensure that clean water is accessible for all. It further helps to address water scarcity, poor water quality and inadequate sanitation globally. It promotes increased investments in water management and sanitation, and international cooperation and capacity building in this respect. The substantial increase of water-use efficiency across all sectors and ensuring sustainable withdrawals and supply of freshwater to address water scarcity will substantially reduce the number of people suffering from water scarcity, protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers, and lakes. The acquisition of renewable energy knowledge and skills is needed to promote sustainable development, including, among others, through education for sustainable development and sustainable lifestyles. Adequate renewable energy education is the key that will allow many other SDGs to be achieved. When people can get quality education regarding renewable energy, they can help create and promote a sustainable environment.

Sustainable development ensures health and well-being for all, at every stage of our lives. Renewable energy policies help us live healthier. Living in a green environment helps to promote healthy living and monitoring factors that affect human health and well-being, like air quality and traffic. Renewable energy promotes clean air and that ultimately leads to good health and well-being. Sustainable development helps to promote sustainable agriculture with modern technologies and fair distribution systems, we can sustain the whole world's population and make sure that nobody will ever suffer from hunger again through proper investment in agriculture. But a problem arises with weather change in sub-Saharan Africa, that is where the need for an effective and efficient irrigation system comes in. Renewable energy is needed to pump water for irrigation to supply the farms and this largely goes to reduce hunger. Renewable energy also has a critical role to play in achieving reduction or total alleviation of poverty. The rising investment in industries because of energy generated through clean energy, increases job availability. Improved access to renewable energy also fosters food production, processing, and that goes to reduce poverty and hunger in general. Renewable energy mini grids being built in different parts of the Nigeria to power small scale businesses. For instance, using biogas to power milk refrigeration on milk farms results in better quality food, reduced food loss, and higher local incomes for the farmers, hence reducing poverty.

The use of hydropower may impact sustainable development negatively because it affects lives under water.

That is why most governments have been careful situate hydropower plants in places that it will have the least impact on aquatic lifeforms. Not all government care about this. Like the three Gorge dam being built by China rising 175meters above sea level a technological marvel, is said to be the largest dam on the planet and has been calculated by NASA to slow down the earth's time by 0.06 seconds. This hydropower plant's impact on sustainable development will be catastrophic and should the plant collapse, it will result in an ecological disaster of biblical proportion that China may never recover from.

Renewable energy is a crucial part of sustainable development, energy is the most critical resource to achieving most of the sustainable development goals. Energy plays a vital role in mitigating poverty through advancements in industrialization, education, water supply and health and fighting climate change [13]. Renewable energy offers the opportunity to displace fossil fuels and it is likely to have a major role in our future energy supply. The use of renewable energy is growing rapidly as the technology matures and so does the impact on sustainable competitive advantage in emerging economy. The growth of the renewable energy industry is dependent on the availability of appropriately trained manpower [14]. Aside from the fact that it is cheap to acquire, it provides a competitive advantage for those companies by incorporating it with corporate social responsibility. Firms in the emerging markets are striving to gain sustainable competitive advantage. Using of renewable energy can be seen as one of the main sources of competitive advantage [33]. The energy sector needs to undergo an accelerated transformation towards a zero-carbon energy system by the second half of this century. Accounting for two-thirds of the world's greenhouse gas (GHG) emissions, the energy sector presents a large opportunity to combat climate change through a shift towards renewable energy. In addition, increasing the share of renewables would lead to US\$ trillions in economic growth [15]. The health, environmental and climate benefits would save up to six times more than the additional costs associated with reconfiguring the energy sector, while creating millions of jobs in the process, and improving the health and well-being of people, in line with the Sustainable Development Goals.

Use of renewable energy is growing only modestly, but modern renewables comprise a large and expanding share. The share of renewable energy—derived from hydropower, solid and liquid biofuels, the wind, sun, biogas, geothermal and marine sources, and waste—in the world's total final energy consumption increased marginally, from 17.4 per cent in 2000 to 18.1 per cent in 2012.

Wind and solar reached record levels in the electricity mix in 2020, while sales of heat pumps, electric vehicles and energy storage grew strongly despite the COVID-19 pandemic. In the power sector, the installed capacity and penetration of variable renewable electricity sources – mainly solar PV and wind power – have grown rapidly in many countries. Several power systems reached record-high shares of instantaneous VRE in 2020 due to lower costs of these renewable technologies and to the effects of COVID-19 containment measures on electricity markets. The wider digitalization of transmission and distribution grids continued, as did growth in “behind-the-

meter” systems. In addition, electricity markets were adapted during 2020 to allow for the participation of ancillary services from wind, solar and battery storage. Flexibility services were procured increasingly from VRE power plants, flexible sources of demand and virtual power plants. Grid infrastructure constraints have become a significant bottleneck for the integration of renewables in several locations. Large transmission projects also have faced regulatory hurdles. Despite this, major projects were advanced in 2020, driven by demand for grid capacity from VRE generators [34]. However, modern renewables, which exclude solid biofuels, grew at a rate of 4 per cent a year between 2010 and 2012. The contribution of renewables to the electricity sector has been growing significantly. Modern renewables accounted for 60 per cent of all new power-generating capacity in 2014. In absolute terms, about 72 per cent of the increase in energy consumption from modern renewable sources between 2010 and 2012 came from developing regions, mostly Eastern Asia [17].

Energy resources are among the most important assets of any nation. It is a well-known fact that high rate of industrial growth is a function of the amount of energy available and the extent to which that energy is utilized. Africa's electricity consumption from 1980 to 2001 grew on the average by 3.1% per year. Africa's per capita demand for electricity declined compared to the ones achieved in North America and the Middle East; making Africa the region with the smallest per capita consumption of electricity in the world [18, 19].

In some emerging economies around the world, oil however, remains the dominant fuel source for electric energy production. In 2005, oil contributed 57% to the energy mix of Nigeria, followed by 36% of natural gas and 7% hydroelectricity [9]. Energy is an essential ingredient for the economic growth, running existing industries, establishing new ones, rapid urbanization and achieving a higher standard of living. However, while oil and gas-rich Nigeria's electricity output in 2009 was 2000 MW, South Africa produced 43,000 MW of electricity for a population size that matches one third of Nigeria's [20]. On per capita basis, Senegal, Ghana, Zambia, Algeria, Mozambique, Cameroun, and Libya were generating more electricity than Nigeria's [20]. Nigeria's consumption of electric power per capita ranked among the least of some selected countries. Moreover, Nigeria's energy development index (EDI) [21] indicates that there is a categorical size of the population who do not have access to electricity. On the other hand, South Africa has significantly higher per capita consumption rate than the region's other countries. In fact, it generates 2/3 of Africa's electricity and consumes an absolute majority of the electricity used in Africa [22].

The demand for renewable energy consumption will rise markedly in developing countries. This follows the projection that by 2050 over 90% of the world's population growth will be in developing countries. Figure 2 below shows the rate of growth in renewable generation in selected regions of the world. However, what is unknown and remains a key research question is whether economic well-being and economic freedom drives the share of renewables in total energy consumption in Africa. To address this, we commence by appreciating the current situation in Africa. The case in Africa reveals that solar and wind has not been a source of renewable

energy consumption before the millennium (i.e., 1990-1999). Instead, hydroelectric, and other sources have been the core sources of renewable energy consumption. However, beyond the millennium (i.e., 2000- 2018), growth in modern renewable energy consumption has been mainly by solar and wind. Similarly, from 2015 to 2018, solar and wind have continued to dominate the growth of modern renewable energy consumption. Promotion of modern renewable energy (such as biofuels, geothermal, wind, solar PV, hydropower, wave and tidal) has gained global support because it addresses issues that bother on greenhouse gases and uncertainties with energy crises associated with traditional sources of energy [35].

Africa is home to abundant renewable energy resources and its renewable energy power potential is substantially larger than the current and projected power consumption of the continent. Growth has been constrained, so far, by limited access to financing, underdeveloped grids and infrastructure, unstable off-taker financial arrangements and, in many countries, an uncertain policy environment. Despite this, recent advances in renewable energy technologies and accompanying cost reductions mean that the large-scale deployment of renewable energy now offers Africa a cost-effective path to sustainable and equitable growth. In many parts of Africa, decentralized renewable energy technologies offer an economical solution for electrification in remote areas as well as for grid extension [36].

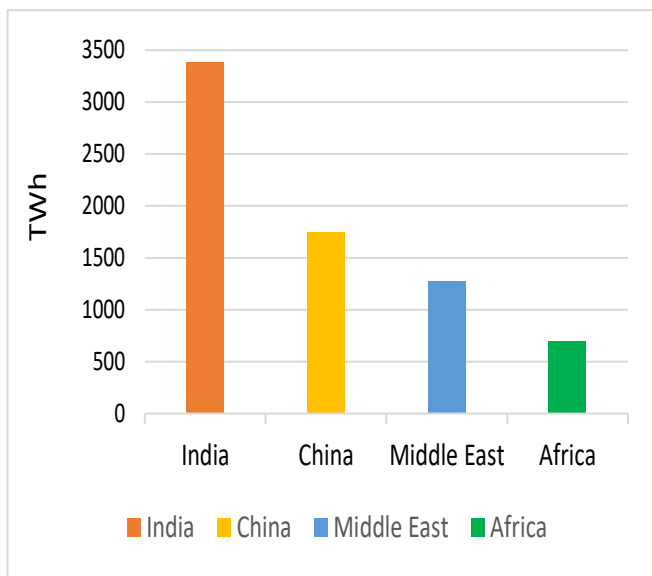


Fig. 2 Renewable generation in selected regions of the world [38]

Widespread adoption of modern renewable energy technologies, with the proper government support, can provide an excellent alternative to conventional firewood-based technologies; used predominantly by rural dwellers. More than two thirds of Nigerians live in the rural areas where the major energy resource is fuel wood, the conventional petroleum fuels being, ironically, scarce in these rural areas. The fuel wood is used for cooking, water heating, and generation of warmth during the harmattan winds (North-eastern winds that blow across the Sahara Desert, four month every year) and in rural cottage industries (such as pottery, blacksmithing, brown sugar,

etc.). Fuel wood consumption in Nigeria in the mid-1980s was put at 43 million metric tonnes per annum giving a per capita consumption of about 500 kg per annum. The use of fuel wood on this large scale without replenishment has obvious environmental side effects, the most glaring being desertification, now eating deep into Nigeria's savannah heart land at a very alarming rate. Unless something is done, and done quickly, the rich agricultural farmlands of the Northern states of Nigeria would in no distant future become shifting sand dunes [32].

Falling renewable energy prices are a game-changer, with consequences beyond electricity generation. For example, cheap renewables may pave the way for the transformation of other energy-intensive sectors, such as transport and industry. Vehicles powered by electricity generated from renewable energy sources could end up enabling the climate-friendly future of transport, both in Africa and globally. To summarize, there is mounting evidence that renewable energy technologies are viable alternatives to oil and coal as cheap, abundant fuel to power African economies. However, a low-carbon development path partly implies a transition from fossil fuel costs to upfront investments in renewables. Thus, in Africa, where capital is expensive, efforts to reduce risk and enable the huge investment required will be central to development that is consistent with the goals of the Paris Agreement [37].

Large scale introduction of biogas technology and solar cookers including the use of coal briquettes, natural gas and kerosene can reduce the share of fuel wood in the energy mix [23]. Sustainable Energy Development Strategies typically involve three major technological changes: energy savings on the demand side [24,25], efficiency improvements in the energy production [26,27], and replacement of fossil fuels by various sources of renewable energy [28,29]. Consequently, large-scale renewable energy implementation plans must include strategies of how to integrate the renewable sources in coherent energy systems influenced by energy savings and efficiency measures [30,31].

IV. CONCLUSION

In this paper the authors tried to describe renewable energy as a main factor of sustainable development by using the African emerging economies as a case study. Energy resources is undoubtedly the most important asset of any nation. It is an undisputable fact that high rate of industrial growth of a nation is a function of the amount of energy available and the extent to which that energy is utilized. Ever since the Brundtland Report was released, Africa has joined other advanced countries in making several policies that protects the environment in line with the report. With the increase in population in Nigeria, there is a rising demand in energy and power in general for home use, small scale businesses and industrial growth. The relevance of renewable energy has not been more urgent. It has been realized that the renewable energy projects could be used as tools for the management of reserves and sustainable development of desert communities in the Northern part of Nigeria. Renewable energy from sources like hydropower, bioenergy, thermal, geothermal, wind, photochemical, photoelectric, tidal, wave, and solar energy can be replenished within a short time scale.

Renewable energy arguably can be referred to as the thread that connects or supports other goals of sustainable development because it has the most impact on society. It impacts sustainable development the creation of clean and affordable energy, sustainable cities and communities, an implementable climate action through reduction in the emission of greenhouse gases by reducing air pollution, thereby enhancing healthy living and wellbeing. Also improving life of animals and humans on land because of the massive reduction in forest destruction and burning of fossils for energy. The acquisition of Renewable energy knowledge and skills helps to promote sustainable development and sustainable lifestyles. The rise in the construction of industries because of energy generated through clean energy, increases job availability, and reduces poverty through gainful employment provided by those companies. Renewable energy improves water quality by reducing pollution, eliminating dumping through recycling of waste, and minimizing release of hazardous chemicals and materials. Renewable energy is needed for irrigation systems to pump water to supply the farms in desert prone communities and this eventually goes to reduce hunger.

It is important to note that renewable energy plays the most prominent role in the sustainable development goals. So, if a nation can successfully invest in clean energy, a lot of problems will be solved and a lot of disasters will be avoided.

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