

# Challenges and Way Forward Of Renewables in Developing Energy Economy: Today and Tomorrow

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## Abstract

*With the rapid increase in population growth, the rate of utilization of fossil fuels in developing nations is becoming a severe source of danger to both humans and the environment because it emitted Greenhouse Gas emission (GHGE) and pollution to the ground. This paper aims to investigate and analyze the challenges faced by developing nations in utilizing the available abundant renewable energy present almost around the clock. These range from high initial acquisition and installation cost, non or little presence of government policies towards utilization, poor stakeholders interest in renewable energy utilization promotion or implementation of renewable energy sources, power consumer/individual awareness of its benefits both to lives and the environment, myth and belief by some heliolatry worshippers, untrained/inadequate workforce, poor or inadequate research renewable energy institutes, falsifications as well as importation of substandard products, very poor data mapping of renewable energy potentials among others. The way out of these challenges was also discussed as the significant interest it took to preserve greenhouse gas emissions and achieve the overall industrialization goal of any nation by utilizing all available clean energy sources. In turn, this will solve the problem of high unemployment and improve the overall per capita income. This will be a step in the right direction in ensuring that the gap is gradually getting bridged between the developed and the developing nations.*

**Keywords:** *Developing Nation, Greenhouse Gas Emission, Government, IEA. Renewable energy sources*

## I. INTRODUCTION

Renewable energy sources are defined as clean energy sources obtained naturally and are replenished continuously or renewed while re is(are) energy obtained from these various sources. RE sources include solar, wind hydro, tidal, geothermal, and biomass. Non-Renewable energy sources are energy sources that cannot be replenished (renewed) with the following examples; natural gas, coal, metal ores, earth minerals, oil. The world energy usage makes up of more than 75% of non-renewable energy source which has dramatically depleted the ecosystem (ozone layer) with china and United State of America (USA) as the most massive consumption of this form of energy. It is pertinent to know the level of

energy consumption and utilization in the world. Three significant institutions have so far been periodically recording and publishing energy data all over the world. These institutions include the international energy agency (IEA), the United States information administration (EIA), and the European environment agency (EEA). Recent studies have also shown that RE utilization has considerably reduced carbon emissions. Studies According to a report from International Energy Agency (IEA 2019), it is expected that Renewable Energy (RE) capacity will expand to about 50% between 2019-2024 with the fastest growth rate of hydro, solar, and wind type of RE. IEA report also investigated that 26% of the world's energy consumption is based on RE, and it is projected to attain 30% by 2024 [1-2]. About one-fourth of the electricity produced globally is from renewable energy sources as of 2017 and, it is expected to rise by 1.3% in 2017 [3-7].

Most developing nations have an abundance of RE. However, harnessing this energy for its maximum utilization still poses a huge challenge, which has affected their overall growth rate in terms of industrialization and development. Over 70% of the entire population world population is from developing countries found within the region of Latin America, Africa, and Asia. However, socio-economic activities in these zones are not too impressive, especially in sub-Sahara Africa. It staggers logical acumen that with the enormous untapped abundance of available renewable energy, especially, the government and all other stakeholders are either not interested in developing renewable energy technologies or are adamant about the whole process. Otherwise, the flow of investment and development levels would have been very high.

## II. REVIEW OF RELEVANT works of literature

Channing Arndt et al. in 2019 [7] informed that there is a gradual paradigm shift in the utilization of energy systems of renewable and non-renewable types. It was further stated that there is a decline in the cost of renewable energy generation since 2007, particularly solar and wind, with standard policies to control greenhouse emissions. In an attempt to address the challenges posed by the utilization of non-renewable energy sources by both developing and developed nations, Nicole Vandaele and Wendell Porter in 2015[8] used the United States of America (USA) as a developed nation and Kenya, Morocco as well as South Africa as a developing nation to



carry out this study. This was achieved by effectively exploring the current and future energy state affairs of these study areas. A framework was eventually developed that will guarantee 100% utilization of renewable energy per year until 2040. If this framework is implemented, the danger posed by consuming non-renewable energy sources will be a thing of the past. Evaluation of the impact of low-cost emission reductions through renewable energy (RE) and energy efficiency (EE) projects and initiatives were investigated [9]. The researchers analyzed both RE and EE projects totaling about 273. One hundred ninety-seven are RE, 62 are EE, while 14 are both RE and EE. The analyzed sample of RE projects contribute approximately 0.084Gtco<sub>2</sub>; EE projects contribute 0.113Gtco<sub>2</sub>, while RE and EE projects contribute 0.059Gtco<sub>2</sub> to the total emission reductions. It was concluded that the reduction in GHG emission resulting from all internationally supported RE and EE projects in developing countries that were implemented between 2005 and 2016 could be 0.6Gtco<sub>2</sub> per year up to 2020. M. Indra al Irsyad *et al.* in 2017[10] posited that developing nations should be cautious in adopting the various analytical tool, models, and techniques formulated by developed nations in solving their renewable energy challenges. This is because the conditions, constraints, and criteria used for the formulation in developed countries are different from developing nations. The researchers further stated some lapses upon review of some developing nations' technical papers that used these developed models and suggested potential improvement to these analytical tools of renewable energy models adopted by developing nations. Katherine Bronstein, in 2020 [11] in her investigation, identified the good, bad and ugly aspect of renewable energy utilization in developing countries and further reiterated that most of the components and technologies used in the manufacture of these facilities used for RE are highly toxic to both humans and the environment. These include Lead, Polyvinyl Fluoride, Copper by products, Tin, Lithium, Silicon Tetrachloride. The current happening with End of Line (EOL) various approaches adopted by various countries in handling the projected quantity of renewable energy waste, the role of developing agencies on management and investment of renewable energy, and how can a developing nation promote a circular economy EOL were also discussed. Dieter Holn.D.Arch in 2019 [12] established a rationale for why the government should formulate and promote policies to favor renewable energy utilization and investigated the enormous benefits inherent in the utilization of renewable energy resources. The researcher further stated that most developing nations are blessed with fossil fuels currently being utilized to their fullest but more blessed with a vast quantity of untapped renewable energy resources that need to be put to use. The researcher further posited that renewable energy productivity targets should be established, and academics, entrepreneurs, and investors should be involved either directly or indirectly, and the government should also make laws and policies favorable to all stakeholders. Assessment of Renewable Energy Sources

in Developing Countries, Challenges, and Opportunities for a Sustainable Development Agenda was carried out by Jorge Fernando and Sergio Ricardo Siani in 2016 [13]. The study compares database as well as climate change drivers of some Latin American countries with the main purpose of verifying similarities as well as differences and formulating possible strategies and government policies issues and barriers that favor renewable energy generation using the multivariate analysis approach. The following factors determined include Greenhouse gas emission, use of an alternative source of energy as well as nuclear energy sources, combustible renewables and waste, fossil fuel energy consumption, ocean health index. it was, however, concluded that the best-positioned countries with high economic performance are those countries whose policies are tightly connected to the sustainability of renewables. Nadia Singh *et al.* in 2019 [14] investigated the relationships between production/utilization of renewable energy, its economic growth, and the differential impact on both developed and developing economies using the Fully Modified Ordinary Least Square (FMOLS) regression model. This is demonstrated in a sample of 20 developed and developing countries between 1995-2016. It was found that these impacts yield better and favorable results compared to those from the developed nations. Echiegu in 2015 [15] investigated ways of Enhancing Capacity for Renewable Energy Application in Developing Countries and suggested that there should be a complete restructuring of the energy sector in some developing countries. These could range from fossil fuel utilization, review of policies that will be favorable to renewable energy utilization, making the sector more competitive, among others. Donastorg *et al.* in 2017 [16] critically reviewed ways of financing renewable energy products in developing countries with an emphasis on Risk and Return on Investment (ROI) of the business. The study compared the current funding mechanisms by the government and other stakeholders and the modern support mechanisms. This ranges from borrowing (loan from financial institutions such as banks) and equity capital. The latter involves sales of shares and has better ROI because of its high level of risk involved. Loans are applied to Renewable energy source utilization to conventional and tested established technologies, while equity is applied to recent and modern innovative technology. Amir and Morteza, in 2018 [17], accessed the potentials of solar energy in developing countries to reduce energy-related emission (Green House Gas-GHG) as well as indoor air pollution, especially in remote rural areas where grid connections are not accessible. The researcher further informed that solar PV utilization as a source of energy could reduce 69-100 million tonnes of co<sub>2</sub>, 68,000-99,000 tonnes of NO<sub>x</sub>, and 126,000-184,000 tonnes of so<sub>2</sub>. Factors militating against the widespread use of solar energy were also discussed. Dolf Gielen, in 2019 [18], established the roles of renewable energy in global energy transformations by exploring both technical and economic characteristics of the accelerated transition of energy up to 2050 using data sets of renewable energy. Developed nations such as the

Europeans have raised their target from 27% in 2014 to 32% in 2018, while India set their target at 174GW by 2020 [19,20]. It was investigated that GHGE in Europe decreased by 22% (World bank statistics: 2018).Moreso, in an attempt to stabilize and reduce GHGE using cost-effectiveness strategies, the introduction and application of Carbon Capture Utilization (CCU) favored the use of both renewables and nuclear sources with very low emissions of GHGE. Table 1.0 shows shares of the energy sources as investigated by International Energy Agency (IEA).The essence is to stabilize GHGE up to a value of 450ppm CO<sub>2</sub>. Renewable energy resources from scholarly investigations have proved to be the safest and cleanest form of energy the world over, but some countries are yet to tap into this most especially the developing nations[22].

**Table 1.0: IEA stabilization concept. Share of the energy sources. Source: IEA, World Energy Outlook 2017/2018**

	2015	Current Policies		New Policies in billion tones		Sustainable Dev.	
		2025	2040	2025	2040	2025	2040
Coal	5,357	5,711	6,813	5,383	5,441	4,350	2,281
Oil	6,336	7,003	7,957	6,791	6,991	6,191	4,509
Natural gas	4,439	5,166	6,863	5,056	6,337	4,934	4,889
Nuclear	983	1,147	1,359	1,150	1,387	1,230	4,904
Hydro	504	590	734	593	734	616	859
Biomass	1,979	2,246	2,531	2,271	2,644	1,960	2,149
Other renewables	363	684	1,354	737	1,747	926	3,046
	19,960	22,546	27,611	21,983	28,051	20,209	19,593

**III. Challenges of Renewable Energy Sources (RES) In Developing Countries**

**A. High Initial Cost of Acquisition and Installation**

The high initial acquisition cost, when compared to utilizing the conventional sources from power utility companies, has resulted in a severe setback in the use of Renewable Energy Sources (RES) as an alternative to power generation in developing countries. The cost of acquiring a renewable energy system increases as the power system capacities increases, whether mini, micro, and macro. It should be worthy of note that acquiring and installing RES for power generation is beyond the average individual's reach in terms of his/her income. One-fourth

of the world population resulting in well over 1.6 billion people lives without electricity access. Three hundred and thirty-three (333) million Africans live below the poverty line of one dollar per day, and in every minute that passes by, there is every likelihood that three Africans are likely to fall within this poverty bracket. Moreso, the cost of acquiring the least rated capacity of renewable energy is far above the minimum wage earned in most developing nations.

**B. Government Policies/Will Towards Enhancing and Promoting Development Of Renewable Energy Sources**

The electricity demand is rising at what could be at least 2.5kW per person, using Nigeria as an example of the most populous developing nation. If at a conservative figure of 180 million population, then what is required is about 450GW of electricity to service the energy demand effectively, thus the need for government policies to favor the utilization of RES. Unfortunately, there are no effective policies that favor the utilization of RES and, as such, have discouraged the investment of individuals, corporate organizations, and companies towards investing in this sector for power generation. It is also little or no severe commitment by the government towards mitigating environmental pollution via fossil fuels. There should be favorable government policies on power generation for RES that will be different from the conventional fossil fuel generating sources. These policies should favor reduction or total exemption in tax payment, tariff plan, low-interest loans, subsidies in RES utilization, custom duty waivers, tax rebate to encourage people to own solar-powered plants, government-sponsored programs on RES.

**C. Lack of Adequate User Awareness**

RES penetration is yet to reach the critical stage of mass awareness creation to enable a more significant number of the populace to buy into the concept and then see it as a must-have though it is still at its infant stage. From basic education down to nursery, primary, secondary, and tertiary institutions, there is inferior awareness of RES utilization by individuals. Profound enlightenment on discouraging the use of fossil fuels due to its negative impact on the overall ecosystem and the immediate environment in terms of pollution and health implication should be the new narrative and transferred to future generations. RES awareness should also cut across individuals, corporate organizations, companies, business owners, decision-makers, and personnel involved in the business of RES technology and its utilization, and the public.

**D. Insecurity and Fear of Unknown Affecting Foreign Investment**

Policy inconsistencies, poor governance, insecurity, kidnap, insurgency, political apathy, human rights violation, hostage-taking have negatively affected the attraction of foreign investors in developing nations. These have resulted in a huge threat to the overall development of developing nations socially, politically, economically, and infrastructurally. Foreign partners are

highly reluctant and discouraged to neither invest a penny nor even give credit supports and facilities because of the very high level of insecurity and volatility.

#### ***E. Myth and Believe Of Some Heliolatry Worshipers***

Some people still believe that the sun is the link between them and their life, and as such, the sun is seen as their God of wisdom, justice, beneficiary, and spiritual bond. This has resulted in the sun been revered and prayers and supplications rendered to it. Some heliolatry worshippers revere the sun and, as a result, see it as very wrong to tap and convert solar energy into electricity utilization. The same ideology also goes for the wind and hydro.

#### ***F. Lack of Trained Manpower In Renewable Energy***

One of the significant challenges of RES development in developing countries is the lack of skilled/trained human resources. RES technology is evolving very fast. However, skilled and trained human resources to match this pace of development is lacking. The shortage of human resources and competency level has resulted in low or no consideration of solar insolation, panel efficiency, and specific consideration of the geospatial angle of installation of the panels, among others. Further research has shown that most RES programs are not too satisfactory in their course content, such that the RES industries do not find their relevance in tackling challenges (be it practical or otherwise). This has resulted in making some of the RES industries hire skilled personnel or do in-house training through experts from developed nations. This, in turn, is very expensive for the company also to handle, but they have no choice.

#### ***G. Poor Research Facilities From Government And Private Bodies***

From International Renewable Energy Agency records (IREA), RES is expected to provide above 85% of global energy by 2050. To meet this projection, most developed countries and industries alike have all established state of the art research institute and learning centers equipped with all required skilled human resources. Germany, with the highest percentage of renewable energy utilization, is 12.72%, United Kingdom (UK) is the second with 11.92%, followed by Spain (10.17%), Italy (9.08%), and Brazil (7.35%). These countries have all reduced to a very large extent the dependency level on conventional fossil fuel sources of power generation to achieve a better ecosystem. Compared to developing countries, the high dependency on fossil fuel has still not built the renewable energy industry. There is hardly any renewable energy industry that produces the required facilities and equipment either in part or in whole built-in these developing countries not to imagine the research into some of the issues concerning RES technology.

#### ***H. Importation of Falsified and Substandard RES Products***

Falsified and substandard equipment is imported into some developing countries mostly through the

importers that have the financial strength to import but lack the pre-requisite knowledge of renewable energy technology. There have been reported cases where some renewable energy products shipped into the developing countries are fake and fail to perform as designed. This has resulted in low procurement of equipment and facility quality. More so, some importers indulged in sharp practices with manufacturing companies and smuggled them into the countries. Among these range from deliberately importing facilities whose ratings are below its stated ratings yet make consumers pay for it to compromising/bribing constituted authorities that would have checked and corrected these criminal acts. When experts install these facilities, their performance output becomes less effective. This has destroyed the gradually built confidence in renewable energy utilization in most developing nations.

#### ***I. Poor Mapping Data of RES Potentials In Comparison With the Environment***

Although most developing nations are blessed with an abundance of renewable energy potentials such as wind, solar, hydro, biomass, the utilization level is extremely poor. Most developing countries want to harness these RES because of their peculiar characteristics of cleanness and cheapness of energy and running cost though the initial cost of installation is high. However, there is a lack of available data to enable the government, policymakers, RES companies, the public, and other stakeholders to understand these potentials and their exact locations and availability fully. Some nations such as Lesotho, New Guinea, Vietnam, Nigeria, Zambia, Madagascar. have developed programs on mapping, which is still in their initial phase; it is expected to address more serious issues relating to RES mapping currently and shortly. The mapping is expected also to tackle matters such as validation of existing data and capacity building and creation and standardization of a comprehensive database, carrying out geospatial output on both solar and wind and generation of global information of wind, solar and tidal data.

### **IV. The Way Forward**

#### ***A. Job Creation***

The coronavirus epidemic has brought the global economy to a standstill. All attempts are now in place by all responsible and focus-centered governments to create as many jobs as possible. For this singular fact that renewable energy utilization is at its infant stage, it will create enormous jobs for people, and this will be a kind of stimulus and recovery package to people either on short term or long term employment basis. These could come in various stages ranging from planning, execution, construction, maintenance. It is estimated that the dwindling unemployment that has risen to one (1) in every eight (8) can be tackled effectively and efficiently.

#### ***B. Establishment of Favorable Government Policies on Renewable Energy Development***

Policies should be channeled by the government towards the limitation to global warming to a bearable

limit of 1.5°C and ensuring that good move is put in place to encourage 100 percent use of renewable energy in the country while still ensuring that fossil fuels are phased out and converted to synthetic/hydrogen fuels for the sole purpose of power generation shortly. The policies should also ensure that carbon emission is always within the world's carbon standard budget. There should be greenhouse emission reduction and maximize positive synergies among companies and establish more renewable energy agencies to promote the set RES task.

#### ***C. Raising Awareness on Renewable Energy Utilization and its Health Challenge***

This awareness of the utilization of renewable energy sources will enhance our overall healthy well-being, economy, and general atmosphere. The awareness should imbibe in Individuals the negative and adverse effects of global warming on humans and other living things (wildlife and plants alike). It should be recalled that the two most essential components that the utilization of conventional energy sources affects are air and water. If, when contaminated, it becomes very hazardous to lives. Simultaneously, the utilization of renewable energy sources will not lead to any of these contaminations.

#### ***D. Rewriting the Narrative of Some Heliolatory Worshippers***

Changing a person's personal belief and conviction on specific issues, especially when it is attached to his/her religion, is quite a herculean task that is almost impossible. However, consistent and clear focused enlightenment on the need to see the overall relevance of rewriting the narrative concerning utilization of renewable energy should be the new order as creative teachers should adapt to any form of change.

#### ***E. Grants and Credit Facilities to RE Companies to Power Rural Areas***

Electrification of rural areas through available renewable energy sources should be prioritized by the government, most especially as these areas are usually not connected to the grid network. There should be a good formulation of rural electrification policies by a government accepted by other stakeholders (such as banks, investors, marketers, industry owners), such that access to grants and credit facilities will be easy. Moreso, the government, and other relevant stakeholders should ensure that individual households should be able to afford the least home-based products that are produced from renewable energy sources.

#### ***F. Establishment of Renewable Energy Bundling Scheme by Government***

There should be policies established by the government to bundle renewable energy sources with other conventional generating sources (i.e., hybrid generation of renewables and the conventional energy source of generation). Moreso these hybrid sources should be stated such that of the 100% power generation, renewables should contribute like 30% while the conventional sources will be 70% and this will be

regulated from time to time in order to achieve the overall goal of reducing the emission of greenhouse gas and air pollution. This will increase the penetration of energy from renewable sources and ensure better capacity utilization. Also, the tariff under this bundling scheme should be reduced for renewable energy source compared to that for conventional power generating sources.

#### ***G. Introduction of renewable energy courses in all curriculum of studies starting from nursery/ primary level to higher institutions***

There should be a deliberate attempt by the government to introduce renewable energy courses into all curriculums to boost the level of awareness. This is already obtainable in developed nations, and if we must bridge the gap, developing nations should start doing it. Imagine a child from kindergarten already knows the health and environmental effect conventional energy sources will have.

### **V. Conclusion**

Renewable energy is the way to go, but it, however, has its obvious challenges ranging from the very high initial cost of acquisition and installation, government policies towards its full utilization, poor individual/customer awareness as to its relevance and enormous advantages, lack of experts as well as trained human resources in the installation and purchase of the right and appropriate equipment/facilities, poor and inadequate research/research institutes on renewable energy resources as a subject matter, falsification and importation of substandard products, insufficient mapping data. Other challenges include fear on the part of investors (private, local or foreign) because of the high-level unrest, general belief of some heliolatory worshippers who believe that tapping electricity from these various clean, renewable sources is unacceptable and punishable as these are seen as their gods. There should be a deliberate act of switching from the conventional energy utilization source for power generation that causes too much greenhouse emission to renewable energy sources.

There will be a continuous rise soon in the utilization of renewable energy sources and the gradual phasing out of non-renewable energy source utilization with the sole aim of reducing greenhouse gas and overall carbon emission.

### **Recommendation**

- a) There should be a deliberate attempt by the government through her educational agencies in developing nations to ensure an overall review of academic curriculum on RES applications from the basic, nursery, primary, secondary and tertiary institutions. This will involve incorporating basic/modern concepts of RES in their course outline at all levels.
- b) Qualified personnel should be involved and encouraged to transfer acquired knowledge to individuals, corporate organizations, companies, business owners, decision-makers, owners of a business, and personnel involved in the business of res technology and its utilization and the public.

c) The government should encourage individuals and every stakeholder via the establishment of acts, laws, and policies that will favor renewable energy utilization.

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