

# **ADEQUATE EDUCATION AND INFORMATION SHARING: KEY TO ATTAINING ACCESS TO SUSTAINABLE ENERGY**

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## **Abstract**

*Access to sustainable energy has been considered paramount in meeting all or most of the sustainable development goals. This is because of the pervading impacts of energy to human, economic and social developments. However, meeting the global demands for sustainable energy, especially for a developing country such as Nigeria, has never been easier due to poor information sharing and educational knowledge. This scenario contributes towards the difficulty in picking and choosing energy technological winners that are more sustainable from limited choices available to producers, consumers from developing countries. It also leads to the inadequate knowledge of what works and what does not work among the emerging renewable technologies. From the conventional fossil fuels to Nuclear energy up to the emerging renewable energy, no one technology is could be said to be a winner because each energy type has advantages and disadvantage. However, the lack of adequate information and educational knowledge, on both old technologies and emerging ones has affected choices of technologies. The objective of this paper is to reassess the contribution of education and adequate knowledge in promoting access to sustainable energy.*

**Key Words:** Education, Information Sharing, Sustainable Energy, and Developing Countries.

## **1. Introduction**

There are more than 1.2 billion of the world's population especially from the sub-Sahara Africa and Latin Asia, that are still denied access to sustainable and commercially driven energy sources and more than 1.8 billion of the global population still do not have access to uninterrupted cooking fuels. All these contribute

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in heightening the world's poverty level, reduced economic growth and aggravate more social unrest that threatens global peace<sup>1</sup>. The International community, Governments world over, industries and business are well aware of the alarming scenarios with regard to the negative impacts of unsustainable energy pattern. Their knowledge became more obvious due to the adverse roles of fossil fuels to the global environment. Fossil fuels are highly carbon intensive and are carriers of green house gases which contribute to global climate variability.<sup>2</sup>

Notwithstanding, fossil fuel is still desirable for its pervasive role in the transport sector, where it seems to assume some monopoly with commanding height not met either by nuclear energy or renewable energy technologies. The transition from highly fossil fuels to more sustainable energy technologies has been hampered again by lack of adequate information and education knowledge for both producers and consumers of various energy sources. These also contribute to the lack or inadequate access to the limited and available sustainable energy, hence leading to inadequate access to sustainable energy uses.

Due to this lack of adequate information and educational knowledge, both old technologies and emerging ones are competing for space, acceptability and adoption by producers and consumers as well.<sup>3</sup> The case of developing countries and countries in transition are made worse due to the lack of adequate research, education and economic power which all contribute, along with other social and political factors, to worsen their citizens' access to sustainable energy sources.

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<sup>1</sup> Seitz, J. *Global Issues :An Introduction* (Black well Publishing 2008) 15-29: on the relationship between access to energy and economic development and poverty in various continent.

<sup>2</sup> Dike, S. C. "Sustainable Environment, Economic Growth and Poverty Eradication Measures: the African Context: Why there is no meeting point ?" *4 (2) 2015 European Journal of Sustainable Development* 439,444 on the role of sustainable energy to economic development.

<sup>3</sup> The various debates on whether to do away with fossil fuels are tied to the lack of penetration of renewable energy. Similarly, the global agreement to cut down carbon recently reached in USA is hinged on the need for improved targets for renewable energy forms.

However, a broad scientific knowledge could enhance access to a more sustainable energy form suitable for a developing country. This paper will argue that adequate information and education on existing and established energy technologies, use pattern and impacts, along with informed knowledge and education about other emerging renewable and modern sustainable energy forms, would promote access to sustainable energy sources for economic, social and human development, especially in developing countries.

Furthermore, adequate education and information on existing technologies and emerging ones would reveal and expose cost, acceptability, security, environmental and trade implications of various sources, thereby enabling informed choices to be made by producers and consumers alike. This paper will further argue that informed knowledge and education will also contribute to the desirability or otherwise of policy and regulatory shifts in favour of any particular technology. However, a broad scientific knowledge could enhance access to a more sustainable energy form suitable for a developing country because adequate education and information on existing technologies and emerging ones would reveal and expose cost, acceptability, security, environmental and trade implications of various sources, thereby enabling informed choices to be made by producers and consumers alike. This paper will further argue that informed knowledge and education will also contribute in the desirability or otherwise of policy and regulatory shifts in favour of any particular technology.

Accordingly, Part one of this paper is the introduction while Part Two shall first examine the energy scenarios and transition from coal to renewable energy technology, highlighting their advantages and disadvantages. Part Three will adumbrate on the impact of education in promoting or hindering access to the more sustainable technologies. This part will limit the discussion to the impact of information sharing and educational knowledge on security of supply, energy cost implications, trade implication, environmental impacts and sustainable production and consumption pattern of energy sources. Part Four will make recommendations and conclude the paper. The author will adopt some comparative methodologies of some common energy

technologies with a view to extrapolating the impacts of adequate educational knowledge in hindering their wide- spread adoption or in bringing them to the market place.

## **2. EDUCATION/ENERGY SCENERIOS AND TRANSITION TO SUSTAINABLE ENERGY.**

The thrust of this part is to examine the roles of quality education for the attainment of the United Nations Sustainable Development Goals with particular emphasis on meeting access to sustainable energy.<sup>4</sup> By sustainable energy the author refers to energy sources whose production and consumption do not reduce or degrade both natural and human capital; or degradation of the environment, flora and fauna. The author will argue that a sound and quality education, with modern information services would promote access to sustainable energy which will in turn improve the level of sustainable development in our cities and communities.

It would be recalled that the First United Nations Millennium Development Goal (MDG) of 2000<sup>5</sup>, had the year 2015 as the primary target year and one of its goals is the attainment of universal primary education. Also, in the 2000 MDG goals, little emphasis was made on the role of energy in meeting these eight goals.<sup>6</sup> It is now a common knowledge, at least, from the reports of various MDGs' monitoring groups that meeting all the eight goals: namely (1) reducing extreme poverty,(2) achieving universal primary education,(3) ensuring gender equality, and women empowerment(4) reduction in child mortality,( 5) improvement in maternal mortality, (6) reduction on HIV/AIDS and other deadly diseases, (7)ensuring environmental sustainability and (8) promoting global partnership for development, would necessarily require meeting access to sustainable energy.

Although, reports from both international and national data, show great leap forward in the achievement recorded in all the

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<sup>4</sup> UN Millennium Development Goals and Targets is available at< <http://mdgs.un.org>> accessed 25 March, 2016.

<sup>5</sup> Ibid.

<sup>6</sup> See Goal 8 on environmental sustainability.

eight millennium goals.<sup>7</sup> However, there are still gaps in meeting fully all these goals. For instance, the International data on the attainment of some of these goals present disturbing scenarios thus:

... 8000 million people still live in extreme poverty and suffer from hunger. Over 160 million children under age five have inadequate height for their age due to insufficient food. Currently, 57 million children of primary school age are not in school. Almost half of global workers are still working in vulnerable conditions, rarely enjoying the benefits associated with decent work. About 16,000 children die each day before celebrating their fifth birthday mostly from preventable causes. The maternal mortality ratio in the developing regions is 14 times higher than in the developed regions.<sup>8</sup>

This is more worrisome in most African States as epidemics and diseases like HIV/AIDS, malaria, poverty, hunger, inadequate access to safe drinking water, poor sanitation and lack of other basic things of life are still highly prevalent in these states more than anywhere else.<sup>9</sup> The above scenarios equally point to the importance of education in meeting the Millennium Development Goals. It could be argued that the reason for including universal primary education as one of the main millennium Development criteria was to broaden the basis for enlightenment on responsible conduct, by individual, enterprises, communities which are apposite for meeting all the goals particularly, sustainable economic development. However, the author argues that

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<sup>7</sup> UN Millennium Development Goal Report 2015 <[http://www.un.org/millenniumgoals/2015\\_MDG\\_Report/pdf/MDG%202015%20rev%20\(July%201\).pdf](http://www.un.org/millenniumgoals/2015_MDG_Report/pdf/MDG%202015%20rev%20(July%201).pdf)> accessed 25 March 2016.

<sup>8</sup> Ibid.

<sup>9</sup> United Nations, MDG Progress Report, Assessing Progress in Africa Toward the Millennium Development (25 October, 2014) <<http://www.undp.org/content/undp/en/home/librarypage/mdg/mdg-reports/africa-collection.html>> accessed 25 March, 2016.

inadequate access to quality education and information sharing at the tertiary level, has hindered the achievement of some of these goals as education serves as a veritable link to the success of other Millennium Development Goals.

Furthermore, the failure to give premium or include any targets in the 2000 MDG goals for meeting sustainable energy for all, has equally hindered the achievement of most of the MDG goals.<sup>10</sup> This is due to the importance of energy to the economic and social development of a community or individual. Energy enhances wealth creation, powers industries and business, creates jobs, power our schools our laboratories, serves as fuels for our roads to convey pupils to and from schools, and is an engine of our economic development through energy trade and services.<sup>11</sup> The lack of access to sustainable and commercial energy has hindered the progress attained by some African states in meeting some of the MDG<sup>12</sup>. Consequently, poorer Africa and Asian countries are still struggling to meet the targets set for meeting the MDG by 2015.<sup>13</sup> This is evident in Goal 2 on access to universal primary education. The relationship between meeting access to energy and primary school enrolment can be better stated thus:

Household wealth remains an important determinant of a child's likelihood of attending school. For instance, 2008–2012 survey data from 63 developing countries show that children in the poorest households were four times as likely to be out of school as children in the richest households. More specifically, 21.9 per cent of primary-school-age children in the poorest quintile were out of school, compared to 5.5 per cent in the richest quintile....<sup>14</sup>

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<sup>10</sup> See Principle 19 of the United Nations Stockholm Convention on Human Environment 1972.

<sup>11</sup> African Energy Policy Research Network (AFREPREN/FWD) "UN-DESA REPORT *Final Report* Sustainable Energy Consumption in Africa" Nairobi Kenya 14th May, 2004.

<sup>12</sup> United Nations (n. 6).

<sup>13</sup> UN Millennium Development Goals Report 2015 (n. 7).

<sup>14</sup> UN Millennium Development Goals Report 2015 (n. 7).

Access to energy increases wealth and promotes economic development. It is only when a family, community or society is empowered economically that it can consider education as a primary option. Poverty and hunger are greatest challenges to environmental protection and economic development in Africa.<sup>15</sup> For the poor and the hungry would face the reality of uneconomic development and are more vulnerable to environmental risks like pollution, climate change and unsafe drinking water, dislocation of homes caused by flooding and epidemics. The poor has no adaptive capacity for resilience to environmental risks. These are major concerns of poorer nations – how to feed or provide their mostly deprived population with basic food and shelter.<sup>16</sup>

The First Millennium Development Goal is on the eradication of extreme hunger by 2015 and eight millennium Development goal is on ensuring environmental sustainability. These lofty goals are anything but achievable in some African states.<sup>17</sup> This is due to the reports from the United Nations titled “Assessing progress in Africa towards the Millennium Development Goals: Emerging Perspective from Africa on Post 2015” which gave a graphic account of the performance of the continent on human development indicators and stated that most of the indicators are off track. There is therefore a need to scale up the performance of some African states in meeting with these goals through quality education collaboration through information dissemination and modern networking services.

The author argues that a robust and ambitious target in the 2000 MDG for quality education would have made a lot of difference. This is because of the important contribution of citizens and behavioural changes to meeting the rest MDG goals particularly Goal 7 on environmental sustainability. It could be

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<sup>15</sup> See World Bank, World Development Report 1990. According to World Bank, within regions and countries, the poor live in the secular rural setting where there is no means of electricity and means of communication hence they are not well informed. Majority of the world’s poor live in sub Saharan Africa.

<sup>16</sup> Dike, “Sustainable Environment, Economic Growth and Poverty Eradication Measure. etc” (n. 2) 441.

<sup>17</sup> See United Nations (n. 6).

argued that Policy, legislation and rules may have failed in yielding the expected result for attaining the millennium development goals, hence the need for quality education as part of post MDG 2015 report.

Further, the inadequate access to disposable income, credits and loans in developing countries more than anything else, contribute to the poor level of primary school intake and indeed to the low levels of educational attainment in these poorer nations. The numbers of persons who had attained primary education globally could have been more were there greater access to sustainable energy globally. Although, there has been progress in expanding primary education enrolment since the adoption of the MDGs in 2000, however, some developing countries are still lagging behind as many children of primary education age do not attend, school, and many children who began primary school do not complete it. So far, Asia and North America had met the threshold of 97 % whereas sub-Saharan Africa is yet to reach this target.<sup>18</sup>

This author further argues that had the emphasis on the UN MDG 2000 been placed on quality education and information sharing rather than on universal primary education per se, there would have been greater impact on meeting the MDG goal by most African nations. The resulting gap created now calls for educational transformation, effective information sharing and networking through greater access to quality education at the tertiary institutions, quality teachers, adequate educational and instructional materials, modern internet services and modern social forms of communication that are more suitable beyond the primary and secondary levels. It is this form of education and information services that would increase access to sustainable energy and promote the attainment of sustainable development goals.

Thus, an enhanced access to information on the negative externalities of economic development, energy uses, production and consumption of energy at the tertiary education levels rather than the primary school level, would promote the adoption and

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<sup>18</sup> Ibid.

application of sustainable energy. Further, the author argues that better information on the cost of each energy source, negative and positive implications of various energy sources, trade pattern, environmental implications, would make more meanings to an educated and well informed society, government or people and this would promote all round sustainable development goals.

Furthermore, and in particular, the International data on the performance of the MDG 2000 showed that the lack of access to sustainable energy contributed to the inability to meet Goal 7 on environmental sustainability. According to the report, South America and Africa experienced the largest net losses of forest area in the first decade of the new millennium. There are also cases of drought in some African countries and Australia including forest fire.<sup>19</sup> In Asia however, there is a net gain of around 2.2 million hectares annually between 2000 and 2010 following a net loss in the 1990s. This gain, is mostly due to large scale up of forestation programmes in China, which offsets continued high rates of net loss in many countries in Southern and South-Eastern Asia. There is also a report of global increase in carbon dioxide emission leading to a disturbing case of global warming and its negative impacts since 2000.<sup>20</sup>

The African continent are still not been able to develop resilience to certain climate prone incidents like flooding, desertification, typhoon, acid rain and bio-diversity depletion ,use of pesticide, bush burning due to poverty ,inadequate education and information on climate change science.<sup>21</sup> This is due in part to poor information available on the causes, mitigation and adaptive mechanisms. The author argues that adequate education would enhance and uplift knowledge levels and create better understanding on these scenarios. Thus, ensuring adequate access to sustainable energy could empower individual and communities to develop adaptive responses beyond government regulations and

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<sup>19</sup> UN Millennium Development Goals Report 2015 (n. 7).

<sup>20</sup> UN Millennium Development Goal Report 2015 (n. 7).

<sup>21</sup> Collier P, Conway G and Venable T, "Climate Change in Africa" in Dieter Helm and Cameron Hepburn, *The Economics and Politics of Climate change* (Oxford University Press, London 2013) 127.

policies. It is in realisation of this fact that the post MDG presents sixteen sustainable development goals which are inextricably tied to meeting access to sustainable energy through Goal 6 on access to water- which will promote hydro energy; Goal 7 on access to sustainable energy; Goal 8 on meeting sustainable economic growth which depends on access to energy; Goal 9 on sustainable infrastructure and Goal 12 on sustainable consumption and production which would regulate energy uses, and better production and consumption pattern.<sup>22</sup>

All energy sources are useful but not all are sustainable. Most energy sources are in abundance but costly to bring to the market place. The adoption of an energy form may depend on government policy and availability of energy type. Thus, picking and choosing sustainable energy winners had depended on number of factors in the past. These factors include: the availability of energy source; government's policy, security of supply, environmental safeties, available infrastructure e.g sea lane for transportation by sea and<sup>23</sup> international politics, among other factors.<sup>24</sup>

The competition for the adoption of any energy form is predicated on two main variables namely meeting security of supply or compliance with environmental protection.<sup>25</sup> If an energy source is readily available and cheaper to bring to the market place, the government or policymakers might overlook its environmental impacts.<sup>26</sup> Although, a country might also consider the

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<sup>22</sup> UN Millennium Development Goals (n. 4).

<sup>23</sup> Carolin Liss, "The Maritime Dimension of Energy Security" in B Sovacool (ed) *Routledge Hand Book of Energy Security* (Routledge 2011)114-115.

<sup>24</sup> See the case of Russia and Ukraine where Russia cut off the supply of Gas to some European Union countries due to the problem between it and Ukraine, coupled with Russia's refusal to endorse and apply fully the provision of Energy Charter Treaty 1994, which would have made available cheaper gas to all European countries.

<sup>25</sup> Brown M A , and Dworkin M“, Environmental Dimension of Energy Security “ in B Savocool (ed) *The Routledge hand Book on Energy Security* (Routledge: London, 2011) 176 -177.

<sup>26</sup> Nigerian economy has been sustained by crude oil, a fossil fuel, since 1960 till date. However, crude oil production through gas flaring had caused serious environmental concerns in the Niger Delta oil producing region with

environmental impacts of an energy form ahead of its availability, for example, coal as an energy source and a fossil fuel is available and cheaper in the United Kingdom, but due to its adverse environmental impact, the government policy does not favour the construction of more coal plants.<sup>27</sup> Nuclear energy suffers the same faith in UK but is gaining momentum in France, USA and China.<sup>28</sup> While France is in love with more Nuclear energy and is constructing more nuclear plants for its electricity generation, UK is rethinking its continued use of nuclear for electricity generation due to poor safety records.<sup>29</sup>

Coal initially dominated electricity supply globally before the first and second world wars but due to its negative impacts on the environment, coupled with its poor health and safety records, it was then overtaken by gas. Gas could not be fully developed due to the cost of bringing it to the market place for electricity generation particularly in Europe and America, hence the search for cheaper oil.<sup>30</sup> Crude Oil was found to be versatile and cheaper with established infrastructure than gas which can only be transported by pipeline thus making crude oil one of the fastest growing fossil fuels.<sup>31</sup> However, crude oil has been found to be carriers of green house gas which contributes to global warming.<sup>32</sup>

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government paying less attention to eradicating it due to the importance of the sector to the macro-economic development of the country.

<sup>27</sup> See Department of Energy and Climate change, UK Coal Consumption 2014 UK <[www.gov.uk/government/organisations/department-of-energy-climate-change/about/s](http://www.gov.uk/government/organisations/department-of-energy-climate-change/about/s)> accessed 25, December, 2015; DECC section of the GOV.UK <[www.gov.uk/government/publications/solid-fuels-and-derived-gases-section-2-energy-trends](http://www.gov.uk/government/publications/solid-fuels-and-derived-gases-section-2-energy-trends)> accessed 25 December, 2015.

<sup>28</sup> Ibid.

<sup>29</sup> Kendra Ulrich, "Fukushima Impact Accelerating the Nuclear Industry's Decline" February 2015 K Greenpeace Japan 2015 available at <[http://www.greenpeace.org/italy/Global/italy/report/2015/nuclear/FINAL\\_Fukushima\\_\(Global\)\\_Nuke\\_Industry\\_Impacts\\_Briefing\\_Fukushima\\_Impact.pdf](http://www.greenpeace.org/italy/Global/italy/report/2015/nuclear/FINAL_Fukushima_(Global)_Nuke_Industry_Impacts_Briefing_Fukushima_Impact.pdf)> accessed 25 December, 2016.

<sup>30</sup> Yergin D, *Energy Security* (2006) 85 (2) foreign Affairs 69-74.

<sup>31</sup> Ibid.

<sup>32</sup> See Inter governmental Panel on climate change( IPCC) 2007 and 2013 reports.

According to the World Energy Outlook,

Coal is abundant and its supply secure, its future use is constrained by measures to tackle pollution and reduce CO<sub>2</sub> emissions. Global coal demand grows by 15% to 2040, but almost two-thirds of the increase occurs over the next ten years. Chinese coal demand plateaus at just over 50% of global consumption, before falling back after 2030. Demand declines in the OECD, including the United States, where coal use for electricity generation plunges by more than one-third.<sup>33</sup>

This shows that the future of coal depends on its environmental sustainability and the development of technologies for carbon capture and sequestration. This also depends on developing new skilled knowledge based on quality education and research at the tertiary levels.

In the case of Nuclear, most of the plants in some countries have reached maturity and constructions of new plants have been slow due to the past nuclear catastrophes as reported by the International Energy Agency:

Almost 200 reactors (of the 434 operational at the end of 2013) are retired in the period to 2040, with the vast majority in Europe, the United States, Russia and Japan; the challenge to replace the shortfall in generation is especially acute in Europe. Utilities need to start planning either to develop alternative capacity or to continue operating existing plants years in advance of nuclear plants reaching the end of their current licence periods.<sup>34</sup>

Sadly, nuclear energy provides base load electricity more than any other technology; it is cleaner and more sustainable than fossil

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<sup>33</sup> OECD/ International Energy Agency, "World Energy Outlook: An Energy System under Stress" 2014 [www.iea.org](http://www.iea.org) > accessed 25 March 2016.

<sup>34</sup> Ibid.

fuels. Therefore, the continuing deployment of nuclear would depend on much research and quality education that would address its negative impacts and reduce its potential for havoc.

Gas is found cleaner than oil but lack wide-spread infrastructure and network. Crude oil has for now no competition in the transport sector until electric vehicles become cheaper and renewable energy sources become more accessible in the market places. The negative externalities and environmental impact of fossil fuel are causing a rethink for the continued deployment of fossil fuels and galvanising the transition to cleaner energy sources that would promote security of supply while protecting the environment. Fossil fuels are carriers of green house gases like carbon dioxide, nitrogen oxide and sulphur; and renewable energy is still at its infancy in some countries.<sup>35</sup>

Furthermore, the cost of massive deployment of renewable energy is hindering its wide application especially in African states. However, renewable energy promises to be the magic wand that would lead to sustainable economic development and the attainment of sustainable development goals, if adequate education and information sharing are given priority by government, policy makers and civil society.

Renewable energy sources of solar, wind, hydro, biomass and geothermal energy call for adoption and development in order to promote sustainable development. Solar energy is energy from the sun and sun is readily abundant raw material. Solar energy could be accessed through Solar Photovoltaic and solar thermal. The construction cost of solar appears high but its running cost is smaller than other energy sources.<sup>36</sup> Adequate education and information about the harnessing of solar energy is required to bring it to the marketplace at affordable and safer way.

Wind energy is equally available in abundance although very intermittent in some locations and regions. Wind energy is usually not fully accepted in some European countries like the UK due to the belief of most residents that wind blade that propels the

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<sup>35</sup> Ibid .

<sup>36</sup> Boyle G *Renewable Energy: Power For Sustainable Future* (Oxford University Press 2004) 92 -101.

engine distorts the beauty and ecstasy of their environment hence the acronym – Not in My Backyard Syndrome (NIMBY).<sup>37</sup> However, in Denmark, Canada and China, wind energy is gaining much ground and the cost of construction of wind farm has been reduced due to its wide-spread adoption.<sup>38</sup> Here again, adequate education and information sharing are important to scale up the global and national uptake of wind energy.

Biomass energy which is energy from agricultural crops, waste and animal dung's is also in abundance globally. Biomass produces alcohol which is employed for the production of bio-fuel, biodiesel and biogas which are alternatives to conventional Petrol, Gas and Diesel in a country like Brazil.<sup>39</sup> However, it requires a lot of infrastructure to harness biomass and this energy sources could lead to the emission of carbon dioxide through air pollution.<sup>40</sup> The wide application of biomass energy negates food and agricultural objectives in most countries as most of the crops are food crops that are required for agricultural purposes.<sup>41</sup> Thus, biomass may not be the magic wand needed for the transition to sustainable energy.

The impact of Biodiversity, desertification, erratic rainfall, higher temperatures and water scarcity are today prevalent in countries such as Botswana, Malawi, Mozambique, Zambia and Zimbabwe thus threatening the adoption of hydro energy. Climate change risk affects the availability of water for dams and sundry purposes thus making availability of water for hydro energy irregular.<sup>42</sup> Similarly, agriculture's expansion into marginal lands,

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<sup>37</sup> Ibid.

<sup>38</sup> Global Wind Energy Council, "Navigating the Global Wind Power Market Update 2013."

<sup>39</sup> Boyle, 109-145.

<sup>40</sup> Ibid.

<sup>41</sup> Boyle, 137-141.

<sup>42</sup> IPCC, 2014: "for Policymakers". In *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* [Field, C.B., V.R. Barros, D.J. Dokken, K.J. Mach, M.D. Mastrandrea, T.E. Bilir, M. Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken, P.R.

particularly in Africa, has deforested large tracts of land, affecting water tables.<sup>43</sup> Hydro energy is already in wide application globally for electricity generation but hydro is also affected by the availability of water. Due to the competing needs of water for drinking, irrigation and other industrial development, hydro energy has suffered some setbacks in some countries.<sup>44</sup> Thus, adequate education and information sharing on the application and adoption of a particular energy technology is apposite for the attainment of sustainable development.

The transition to sustainable energy needs adequate information and education which are needed to drive these energy sources whether conventional or renewable energy sources to the market place at affordable rates. This transition would be influenced by the need for availability, affordability of any technology on one hand and environmental protection compliance on the other. Therefore, adequate education and information sharing is required to make informed choices that would satisfy these essential requirements. This could be a cost effective approach that does not require legislation and enforcement in promoting sustainable development goals. The next section would examine the role of quality education and information sharing on security of supply, on energy trade, environmental impact of energy and on sustainable production and consumption of energy.

### **3. THE IMPACT OF EDUCATION IN PROMOTING GREATER ACCESS SUSTAINABLE ENERGY**

This part will consider the relationship between education and security of supply of energy and how this link affects the attainment of sustainable energy for development.

#### **i Education/Security of supply of energy and Sustainable Development goals**

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Mastrandrea, and L.L. White (eds.]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, pp. 1-32.

<sup>43</sup> United Nations Post MG Reports on Africa 2014 (n. 9).

<sup>44</sup> Ibid.

Security of supply is the main pillar of energy security and a major concern of societies globally.<sup>45</sup> Many definitions have been proffered for the meaning of security of supply.<sup>46</sup> There are many variation of security of supply depending on the region or country as it is with energy security.<sup>47</sup> However, it has been defined as those measures enacted to secure physical access to certain penetration of each fuel or the continued generation of electricity or guaranteed certain sources of gas, or level of penetration.<sup>48</sup> For the purpose of this paper, security of supply is the assurance of supply of any energy forms which is a function of relative abundance or proven reserve and its affordability in the market place compared with other energy sources. It does not consider or anticipate the consideration of the other environmental implications of the said energy type. This author argues that adequate education is important for the development, production of energy and for making informed choices about the most sustainable energy form. Adequate education would promote technical abilities, develop capacities and ensure more skilled labour force which is currently lacking in the renewable energy sector.

For instance, African countries are blessed with abundant natural capitals like crude oil, bauxite, diamond, gold, natural gas and ore.<sup>49</sup> However 80% of African energy sources come from Biomass such as fuel wood, charcoal and animal dung.<sup>50</sup> This

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<sup>45</sup> Goldber, S “Security of supply in the context of the European Energy market Liberalization: A Brief Overview” *2011 International Business Law Journal* 443, 447.

<sup>46</sup> Benjamin K Sovacool, “Introduction, Defining and Exploring Energy Security” In B Sovacool ed *Routledge Handbook on Energy Security* (Routledge 2011) 6 on forty five different dimensions of energy security.

<sup>47</sup> Andy Stirling ‘The Diversification Dimension of Energy Security’ in B Sovacool, *The Routledge Hand Book of Energy Security* (Routledge 2011) 147.

<sup>48</sup> Hancher L and Jaasan S, “Shared Competences and Multifaceted concepts-European Legal frameworks for Security of Supply” in B Barton, C Redgwell, A Ronne and DN Zilman ( eds) *Energy Security: Managing Risk in a Dynamic Legal and Regulatory Environment* (OUP 2004) 35.

<sup>49</sup> Muss low B, ”The politics of unsustainable Development” (1999) 20( 3) *Third World Quarterly* p. 551-568.

<sup>50</sup> *Ibid* 37.

affects a forestation and carbon retrofit as wood-crops are required for the growth of biomass energy.<sup>51</sup> Therefore, achieving a higher access to energy services in Africa is a challenge to the people.<sup>52</sup> Energy use also affects such areas as water supply, education, healthcare, agricultural and land use. Energy sources in Africa come from fossil fuel (coal, oil, natural gas) and solar energy and biomass /wood energy.<sup>53</sup> Proper education and information sharing on the available natural resources, production and consumption would help promote access to sustainable energy.

## **ii Education and energy Cost scenarios and Sustainable Development Goals**

Education and information are relevant for promoting the transition to sustainable energy by creating awareness of the cost implications of energy type. With proper education, new technologies would be developed, and capacities built for the emergence of wide spread renewable energy technologies for sustainable development. The implication of wide spread adoption of renewable technologies would translate into lower prices which will promote affordability. Proper education at the tertiary level and quality research, would also enhance the development of carbon capture technology which is needed for the continued deployment of conventional fossil fuels due to its adverse environmental impacts.

## **iii Education/Trade And Access to Sustainable Energy Development**

Adequate access and information on natural resource availability, energy, uses and production would promote access to

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<sup>51</sup>Ellene Kebede, John Kagochi, Curtis M Jolly, “Energy Consumption and Economic Development in Sub-Sahara Africa” (2010)32 (1) Energy Economics 533-535.

<sup>52</sup> Abeeku\_brew –Hammond, “Energy Access in Africa: Challenges Ahead” (2011) 38 (8) Energy Policy 2293-2295.

<sup>53</sup>Africa Energy Situation, <[http://www.desertec-africa.org/index.php?option=com\\_content&view=category&layout=blog&id=2&Itemid=2](http://www.desertec-africa.org/index.php?option=com_content&view=category&layout=blog&id=2&Itemid=2)> accessed 15 May, 2015.

sustainable energy. The General Agreement on Trade in services (GAT) adopted by the World Trade Organization in 1995 clearly identifies education as a service to be liberalised and regulated by trade.<sup>54</sup> It has also been noted that the term of trade under the international law does not favour some countries in African states.<sup>55</sup> This is due to the fact that African export market is dominated by a commodity market and the importing countries will grant subsidies to western markets and producers but will not support similar subsidies to be granted to locally produced goods in Africa. There is therefore a distortion of term of trade which operate adversely against the African producers. While the Western countries would insist that subsidies should be removed from fossil fuels, knowing that most African countries depend on crude oil for their macro-economic development, the West have failed to make renewable energy technologies wide spread in African countries. The lack of penetration of renewable energy technologies in the African markets hinders the transition to sustainable energy. However, with proper education and information sharing among countries, technologies for renewable energy would be made available, hence cheaper for application.

While most countries in the West have alternative sources of exports, most African markets depend on commodity market with no available alternatives.<sup>56</sup> Therefore, in order to produce internationally accepted products and commercially driven other than commodity markets which meets the needs of their importers, genetically modified crops are produced through bio-technological mean.<sup>57</sup> This is ultimately an unsustainable practice in the long run due to their negative impacts on land and agriculture. These genetically modified chemical crops do not meet the quality and standards of those produced in Europe and other western countries

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<sup>54</sup> Jane K, Higher Education Crossing Border: A Guide to the Implications of the General Agreement on Trade in Services (GAT) for Cross Border Education (Common Wealth of Learning 2006) <<http://hdl.handle.net/11599/208/> accessed 25 December, 2015.

<sup>55</sup> See United Nations Economic Commission for Africa, "Economic Report For Africa 2015: Industrialization Through Trade" 2015 pp. 32-41.

<sup>56</sup> Ibid.

<sup>57</sup> Ibid.

hence the loss of foreign exchange and ensuing poverty of the African population. Thus, proper education and information sharing would help develop better technology that is comparable with other developed countries.

However, tariff preferences are not always linked to the development status of the exporting countries. Some result from regional trade agreements, as is the case for Latin America and North Africa.<sup>58</sup> In this situation, information on tariff preferences is apposite to and this is with a view to discovering if there are wide disparities in application among nations developed and developing alike.

#### **iv Education, Environmental Impact and Sustainable Energy**

Adequate education is necessary to unravel the environmental impacts of energy types and this will in turn promote access to sustainable energy. Current growth system is energy intensive with carbon and green house gas emission the major consequences. It is against this background that the UN Declaration on Environment and Development 1992, proposes a growth system that addresses the rich earths and environmental capital.<sup>59</sup> It is this form of growth that is regarded as sustainable development- a development which protects the right of both the present and future generation to use the earth abundant natural capital without jeopardising the interest of the contending and competing users.<sup>60</sup> It means a development which seeks to produce sustainable economic growth while ensuring future generation's ability to do the same by not exceeding the boundaries of what is acceptable by reasonable standards.'<sup>61</sup> The author argues that quality education would promote access to sustainable energy by detecting and eliminating the production and consumption of

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<sup>58</sup> UN Millennium Development Goal Report 2015 Pp32-  
[http://www.un.org/millenniumgoals/2015\\_MDG\\_Report/pdf/MDG%202015%20rev%20\(July%201\).pdf](http://www.un.org/millenniumgoals/2015_MDG_Report/pdf/MDG%202015%20rev%20(July%201).pdf)> accessed 25 December, 2016.

<sup>59</sup> See Principles 8 and 9 of Rio Declaration.

<sup>60</sup> Bell, S and Mc Gillvray, D *Environmental Law* (7<sup>th</sup> ed. OUP 2008) 27-28,56 for details of the concept of the world Commission on Environment in its report "Our common future".

<sup>61</sup> Ibid.

highly carbon constrained energy uses and which will facilitate the transition to clear energy technologies.

One of the greatest environmental risks which is linked with energy uses is climate change<sup>62</sup> While, most developed countries have acquired resilience, adaption and mitigation measures in addressing this risk, most African countries are still lagging behind due to poor education and information sharing. Consequently, due to the lack of adequate information, and dedicated education on climate change science and implications at the tertiary level, the African continent believes strongly that climate change risk is a product of industrialisation in western countries.<sup>63</sup> For this reasons, it has been a herculean task to get African states to effectively participate in measures that would reduce green house gas growth. However, land use and deforestation also contribute to emission of carbon and other green house gasses like methane, nitrous oxide, cloro-floro carbon, and hexafloro carbon, which lead to climate change risk other than energy uptake and industrialisation.

Therefore, there is need for adequate education and information sharing on the various risks associated with climate change and relevant measures in addressing these risks. Moreso, the threat of climate change and its attendant problems would-be felt more in developing countries of the world than the developed West.<sup>64</sup> The ability to adapt to these challenges now would be enhance by proper and quality education which promote cooperation among nations .Further, most of the African governments are not strengthened to participate in clean development programmes and other multilateral environmental agreements due to their nonchalant attitude to environmental sustainability principles. A proper awareness and quality information and education will change their attitude for greater involvement in the multilateral frameworks.

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<sup>62</sup> IPCC, Executive Summary for Policy Makers.

<sup>63</sup> Paul Collier, Gordon Conway and Tony Venable, Climate change in Africa In Dieter Helm And Cameron Hepburn (eds) *The Economics and Politics of Climate Change* ( OUP 2013) 125-140.

<sup>64</sup> IPCC (n. 39).

## **v Education/Sustainable Production And Consumption of Energy**

Adequate education, modern information technologies are relevant in promoting sustainable production and consumption of energy. The principle of sustainable development is synonymous with a regulated and sustainable consumption pattern.<sup>65</sup> However, the use of cars and electricity in developing African states can be anything but sustainable. Some of the third hand – abuse words-for used vehicles in Nigeria – had been used in developed western Nations like Germany and Japan for decades before been shipped to African states. Most of these vehicles have been found unserviceable and pollution laden. However, they are relatively cheap and affordable to the poor who may not afford the price of new vehicles. Similarly, petroleum operations in countries like Nigeria has been anything but sustainable due to the continuing acts of gas flaring which contribute to environmental pollution<sup>66</sup>. It is only through a proper education and enlightenment that the carbon content of these used cars in particular and the negative impacts of pollution, to the environment would be revealed. With proper education, citizens would make informed choices between sustainable energy products and unsustainable energy products.

### **5. Recommendations and Conclusions.**

Education is a key to modern development, key to wealth creation and promotes poverty reduction. Adequate education would promote access to energy which is the wheel that propels modern economic and social development<sup>67</sup>. Meeting access to sustainable energy cannot be attained unless quality research and quality education are put in place which would make sustainable energy available and affordable. However, while basic and primary education under the UNMDG, contributed a little in promoting

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<sup>65</sup> Dike, S C “Sustainable Environment, Economic Growth and Poverty Eradication Measures: the African Context. Why there is no Meeting Point?” 4 (2) 2015 *European Journal of Sustainable Development* 439-445.

<sup>66</sup> Ibid 445.

<sup>67</sup> Dike, S C *Energy Security: The case of Nigeria and Lessons from Brazil Norway and the UK* ( Pearl Publishers Portharcourt 2015) 1.

access to sustainable energy, it is yet to meet the required threshold hence the need for quality education and sound research .Although, universal primary education has been nearly attained in majority of the countries, quality education is yet to reach the threshold hence the recognition of the important role of quality education in the sustainable development goals of United Nations in the Post MDG 2015.

In order to fully realise the importance of adequate education in meeting sustainable energy which would promote sustainable development; first, a new set of targets should be set out by the United Nations for countries to comply with agreed criteria on educational research. Secondly, emphasis should be laid on quality tertiary institution with technological focus. Thirdly, science oriented education should be made compulsory in Universities and Colleges. Fourthly, education on energy sources and development should be considered a separate teaching module among universities and technical schools in order to develop budding talents and skill researchers that are needed to drive the development of conventional and renewable energy in a more sustainable way. Fifth, modern communication services and technology on various energy types, their negative and positive impacts be made available through internet and social media for the general public to be accessed at little or no cost. Sixth, more funding on tertiary education be made a global and national policy and if need be, access to education be made a fundamental right which can be enjoyable by every citizen.

In conclusion, it is our hope that if these measures are implemented by countries, greater access to sustainable energy which would promote sustainable development goals could be enhanced for increase wealth distribution, poverty reduction and for a safer and healthier global population that are well informed of the need for sustainable energy.