RENEWABLE ENERGY, EDUCATION AND APPLICATIONS PANACEA FOR DEVELOPMENT AND GROWTH IN THE SUB SAHARAN, AFRICA

Adoko Sambwa[1], T.O.K. Audu[2], Nduka Vitalis Blin[3], Joseph Ehiondor[4]
1. Asa Lambda Technology Limited, Benin City, (Nigeria)
2. University of Benin, Benin City (Nigeria)
3. Student attached for the Research, Benin City (Nigeria)
4. Osaretin Joseph (Nig.) Limited. Benin City (Nigeria)

Abstract

With the trend towards 100% transition to renewable energy, the sub-Saharan sub-region of Africa continent must stand on a tripod of renewable energy, education and applications. The authors view point is that the slow-pace of renewable energy's penetration and deployment in this sub-region is due primarily to lack of proper and coordinated teaching in specific subjects as far as renewable energy and its allied technologies are concerned. In this work, some selected authors own projects are being considered as an enabler to formulate a working educational framework to identify all necessary huddles hindering the transition to clean sources of energy in a mature and sustainable manner while the constructed equipments remain a practical model to teach and train both students and the end-users.

Key Words: Renewable Energy Deployment, Education and Applications.

1. Introduction

As the rest of the world is bent to renewable energy's world, it is evident that the sub Saharan Africa [1] has shown little effort to lift this banner and profess a new world. A world where basic needs as energy can be accessed effortlessly.

The objective of this paper is firstly, while accepting the above narration, the authors provide as solution, an easy way to learn, adapt, and possibly deploy the new technologies as enshrined in the renewable energy sector. The second objective of the paper is therefore, to present the authors 'view as the mechanism to acquire the needed knowledge. Lastly, there is need to identify some variables necessary to speedy the transformation process which may require further studies.

In summary, renewable energy's education and applications will remain the key for the growth as we attempt to create a Renewable energy world, this trend of energy evolution and revolution will be possible in the above cited sub-region if only if a broad-based technical education is sustained. The urgency is to educate a new work force as movers of the sub-regions rural communities to embrace a new energy revolution. The authors' main objective is to make practical the conviction that renewable energy's education and applications remain the most needed baggage for 100% renewable energy penetration in the sub-region's rural communities.

In the furtherance of the above, the targeted objective will be centered on the issue of energy as being manifested in the renewable energy technologies. This, will embrace all basic technologies in the preferred areas of interest. Although, it is evident that "no single technology can meet the goal of technical empowerment of the targeted professionals. The authors considered as necessary to illustrate an aggressive and ambitious programme/methodology, undertake capacity building. This development will be centered on the prevailing trend of renewable energy technologies.

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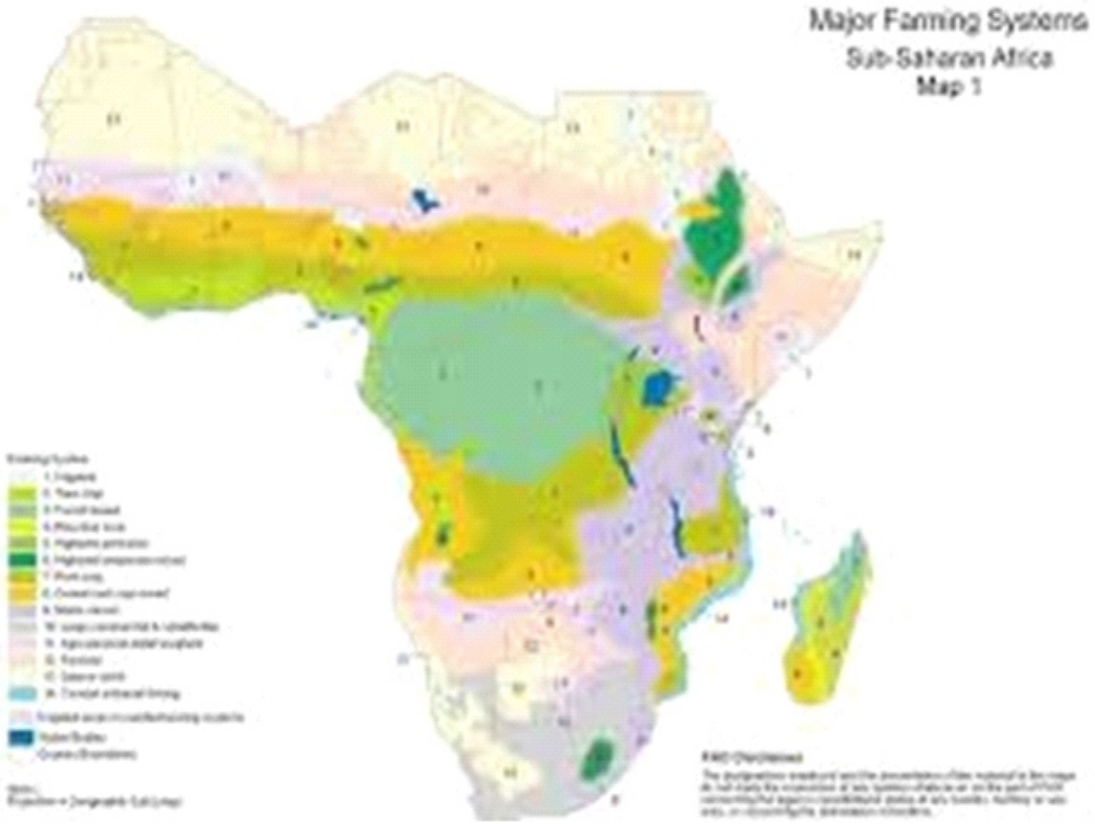

Fig (1) the Sub Saharan Africa

The sub-Saharan Africa as shown in the figure (1), is callously endowed with various and enviable renewable energy resources, viz, solar, biomass and hydro energy, widely distributed across. The overall potential as indicated by "AFREPREN2001" [2] is more than the current total energy consumption. The entire region has 1.1 Gigwatts of hydropower capacity, 9000 Megawatts of geo-thermal potential and abundant bio-mass, solar and magnificent wind potential. It is established that the renewable energy resource potential in this sub-region has not been fully exploited, hence the core mandate of this paper. However, there is prospect of the wide scale deployment and dissemination of this form of energy technologies.

There is no proper existing policy on renewable energy development. Remarkably, most renewable energy activities are being exercised from individual's desire to produce the most needed energy from renewable sources of energy. Consequently, the absence of strict monitoring of the diverse types of technologies entering the sub-region is one of the problem which needs attention.

The focus is to deploy simple and locally build technologies as an instrument to transfer the most needed knowledge rather than floating on unnecessary classroom theories which, in most times seem alien to students.

Contrarily to the view postulated by "AFREPREN 2001[3], it is the authors' view that the renewable energy technologies will continue to be driven by the desire to access this form of energy.

3. Obstacles to Renewable Energy Penetration and Deployment in the Sub Region.

It is no longer a novel that renewable energy has the potential to play all important role in providing the most needed energy. The existing obstacles for its deployment may vary across technologies and

countries. While this paper will not deal on enumerations of those obstacles or barriers, the authors in this paper have postulated a candid opinion in solving some of the barriers by providing a solid and coherent technology education as a case study.

Although, several barriers that have prevented or hindered smooth penetration of renewable energy technologies have been listed in the literatures [4]. These include cost-effectiveness, technical barriers, and market barriers such as inconsistent pricing structures, institutional and regulatory barriers. Some obstacles may be specific to a technology, while some may be specific to the sub region under this study.

Barriers were briefly discussed in the IPCC second assessment report and the IPCC third assessment. A detail discussion on barriers and measures to overcome the barriers can be found in a G E F paper by Martinot and Mcdoom[5].

From the view of the authors, many new technologies have not fulfilled their potential in this sub-region simply because the benefits that they offer, have not been fully appreciated. It is correct that some renewable energy technologies may offer significant life-cycle cost savings, but such technologies remain under-utilized due to a lack of understanding of their applicability, other technologies have not fulfilled their potential because of a lack of supporting teaching infrastructure, such as installer and service engineers, even though the technology may be fully competitive. For the sub-Saharan Africa, the process to transit to the renewable energy arena, if at all, the sub-region should be accompanied by training, education and deployment programmes so that they can compute (be integrated as a way of life).

4. Measures to Overcome Barriers

As any energy sector, renewable energy is subject to a rainbow of interacting forces of change. It may not be possible to achieve technical potentials but research and development can reduce the gap between techno-economic potential and technical potential.

In the pursue of the above, this passer will demonstrate that there is a easy way to diffuse the science behind renewable energy technologies, which may indicate that the process to achieve energy access is not only possible but it is absolutely evident. It is certain that for a transformation of the energy system to take place, new and novel technological system with powerful functions need to emerge around a range of a new energies technologies. Whereas our understanding of how new technologies systems evolve is limited.

4.1 Framing the Concept

One of the main drivers of the sub Saharan's huddles for growth is the non-access to energy and one of the main causes to such situation is the inability to understand, manipulate, and adapt to the surge of new technologies as being displayed in the renewable energy arena. This has, in turn, led to the actual efforts to develop a framework of studies where technologies can be assimilated as prime requisite to the deployment of renewable energy. Hence, technology education is the factor for renewable energy deployment in the sub region under investigation.

Technology education remains a linear process and may be achieved through a cumulative processes and stages. This, was targeted as invention-innovation diffusion paradigm . This framework follows the process of innovation, which is the generation of new knowledge and ideas.

The authors, in investigating the slow pace of development and diffusion of renewable energy technologies in sub Saharan Africa, have identified that the situation is due to lack of education base of such technologies that utilize renewable energy sources. Hence, particular focus is on a suggestion that learning about such technologies while using them may accelerate its diffusion and probably greater adoption.

The authors tried to adopt an old methodology, called "Craft Man", which was focus on making things and made them. The craft methodology was part of the growth as manifested in the industrial revolution.

During that period, situations were framed in terms of problems and solutions. It is a strategy as noted by "**Hugh Dubberly**" rooted in the craft era, in the master-apprentice relationship [6]. In this concept, student learns by emulating teachers and in adopting a *tacit learning process.*

In the craft world, were change may seem to be slow, the master apprentice system may work well using physical equipment for demonstration purposes. It was observed that the post-in-industrial world, change seems fast, equally, with the trend of open library as being showcase with Ethernet world, the apprentice under the master apprentice's proposed frame work, may be faster than the master.

Using an existing equipment as an enabler to transfer knowledge, the authors are targeting to achieve the *explicit knowledge* where if possibly distill rules from experience, codify new methods, tests and improve them, and pass them on to others [7].

There seem to be need to accelerate research, development and deployment (RD&D) of energy technologies and systems which is a crucial component for resolving key global challenges [8]. The challenges include promoting efficient use and production of energy, and ensuring energy security.
This teaching methodology framework will consider the following targets:

- Efficient end use technologies (buildings, electricity, industry).
- Fossil fuels (greenhouse-gas mitigation, supply, and transformation).
- Renewable energies and bio-fuel (technologies and development).
- Crosscutting
- Issues (information exchange, modeling, and technology transfer).

The focus is to deploy simple and locally build technology as an instrument to transfer the most needed knowledge rather than floating on unnecessary classroom theories, which in most times are alien to students. The paper made use of an existing technology shown below to illustrate the proposed learning methodology.

4.2 The Concept

In guise of illustrations, let us consider “the solar powered biodiesel rector” [9].
The schematic diagram shown below:

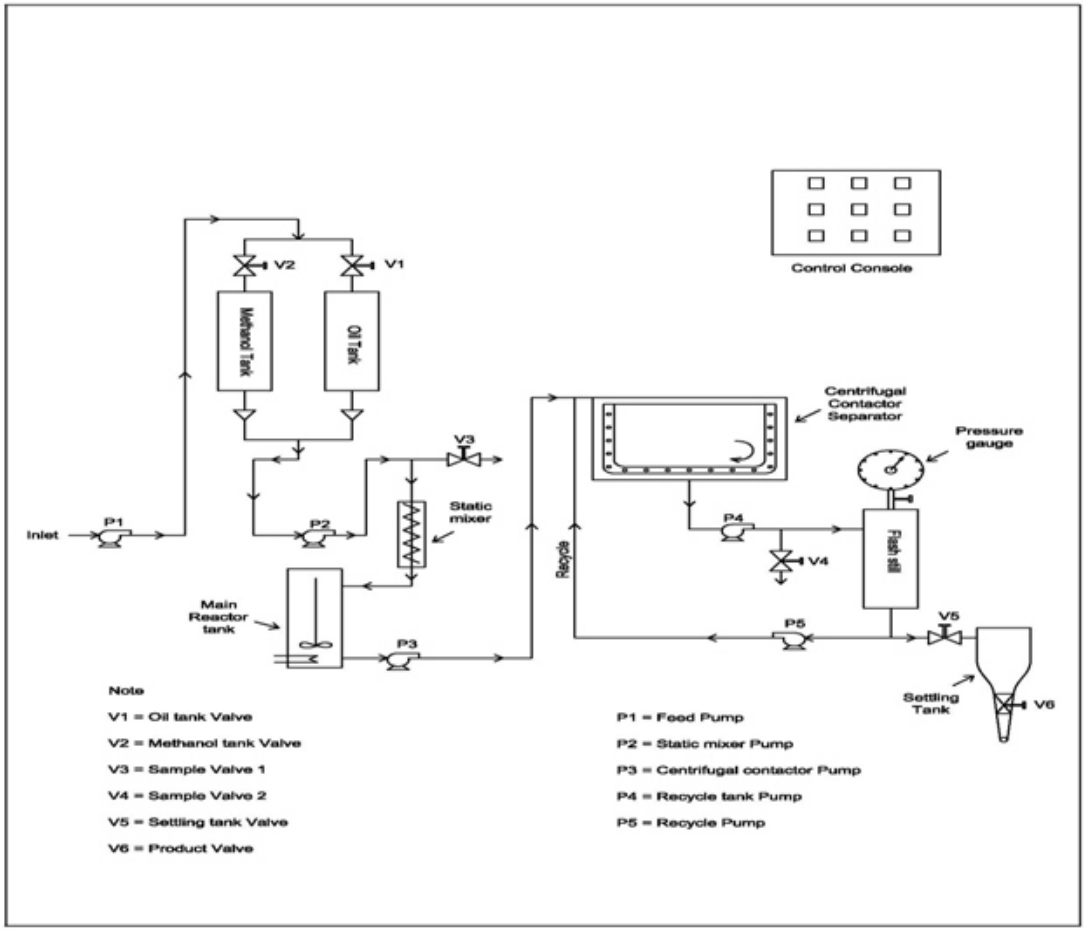

Fig. 2 The schematic of the biodiesel reactor

Fig. 3 The side view of the biodiesel reactor (with permission)

Fig. 4 The biodiesel reactor at a glance (with permission)

The solar powered biodiesel reactor as shown above, is considered an enabler to formulate a working science and technical training frame work to identify all necessary huddles hindering a smooth transfer of science and technical knowledge in a mature and sustainable manner. The constructed plant as shown above is being considered to be used to vindicate the authors' claim and possibly acknowledge some viable evidences on the impact of the proposed plant as an instrument of teaching, training , engagement, exploration, real world simulation, opportunity to expand a similar concept and possibly to strategies for a new and enviable science and technical evolution.

5. Energy Technology Demonstration

Demonstrating technologies are complementary to energy research and development activities. All together these activities constitute energy innovation, which is the process by which energy technologies are improved or developed and ultimately brought into widespread use.

Technology demonstration under the auspices of transferring knowledge and skills play an important role in helping bring technologies closer for diffusion. The process, by which any technology emerges, is improved and diffused in society, can be studied for a number of perspectives. The author's perspective will focus on how knowledge of a technology can influence its choice. It is the authors' believe that the application of technology to education has to be motivated by a desire to implement or show cased some teachers proof. Learning via technology involves with real

challenging tasks, professionalization of instructors/teachers. Creation of a culture that supports learning both in the classroom and beyond the school walls.

The authors main concern is but, the use of technology as an enabler or catalyst for pacifying knowledge transfer in ways that better support the acquisition of higher-order skills by the interested parties. Such uses of technology can have a significant impact on the deployment of renewable energy.

In this frame work, we have classified two broad categories of technology: Technology applications, and Technology uses. Technology applications are classified in the terms of how they are being used with learners.

While our goal to provide the learners with different kind of education-structured around the provision of challenging tasks that can prepare the learners for a technology-laden-world-the most relevant uses of technology are as tools. Giving learners experiences in selecting appropriate technology tools and in applying technologies such as "the solar powered biodiesel reactor". This is an authentic technology as they can be used outside the learning establishment. That is the learners use biodiesel reactor in the same way that any practicing professional processing with similar technology.

Literatures [10] have it that technologies are called authentic when the learners are using technologies for the same kinds of purposes and in the same ways that a fully trained professional would use similar equipment in the same way that any practicing professional in a job requiring to produce biodiesel.

From the authors' view, in adopting the learning process as was the practice in post Second World War as detailed above, we considered the effect of learning by doing and learning by reviewing on technical progress for a range of technologies in multiple stages of development. As in the post-world war, we find necessary to introduce with the perceived view of technical progress through technology education.

6. Conclusion

Teaching renewable energy science using existing technologies as tools will play a total role in enabling renewable technologies to deliver their potential. This work recommends a frame work for this vitally important effort, drawing extensively on studies and analysis.

In the process of knowledge transfer, the authors while adopting the old practice that grew out of the industrial revolution, they have combined with the emergence of internet world to modernize such practice to an acceptable *explicit knowledge*, one that responds to the information revolution.

Although, the authors have recognized that, for renewable energy penetration and deployment in the sub-Saharan Africa to be meaningful, redesigning a way to educate the operators and handlers in this new form of energy, much remains to be desired.

The urgency for the sub-Saharan Africa to be part of a 100% renewable energy world, keep accelerating, and the education in which the needed knowledge may be generated seems stuck. Hence

the quest to reinvent science and technical education and integrating it into an organic system through which growth and development will be seen.

This work emphatically underscores values of education as the ability to successfully integrate renewable energy technologies on a wide array of uses/technical requirements, resource options, planning processes, institutional and human capacity. The more diverse and determine this education framework, individual or group of people can draw their experience from, the more likely than in the end of the day they can be able to implement an appropriate optimized, and system-wide approach. This may be a simple remedy for those starting the processes to implement/integrate renewable energy technologies as the case of sub-Saharan Africa.

Going 100% renewables, this prospect, may remain an illusion if there is no considerable wealth of experiences and guaranty that there is always and sustainable knowledge to install and adapt technologies if need arises.

The development and deployment of renewable energy technologies are important components for not only the future of a balance global energy economy as cited by Claude Mandil [11], it is an enabler in which the penetration and deployment of this form of energy will be accelerated towards a new total renewable energy world.

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