ACQUISITION OF ALTERNATIVE RENEWABLE ENERGY SKILLS THROUGH TVET PROGRAMMES FOR JOB CREATION AND ECONOMIC DEVELOPMENT

BY

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Abstract

Incessant power failure is a major challenge to the Nigeria economy as its electricity sector is majorly based on natural gas thermal power plants of which 85% of the grid-connected power plants are fossil fuel (gas) fired, while (15%) is of hydroelectric power plants. This is coupled with a degraded environment as a result of global warming due to constant use of non-renewable energy from fossil fuel. This paper examines how TVET programmes need to provide basic ARE employable skills for job creation and economy development. Two research questions were designed, formulated, and tested. The study employs a descriptive research method that involved 100 respondents, using a survey instrument that was analysed with inferential statistics of chi-square to accept or reject the hypotheses at 0.05 alpha level of significance. Findings revealed that skills needed for alternative energy can be provided for by TVET programmes in order to meet up with technological changes in the use of alternative renewable energy. The study recommended that youths and interested adults should be provided with free training skills and equipment on installation, repair and maintenance of alternative renewable energy products.

Keywords: Renewable energy, Skill acquisition, Technical education, Job creation

Introduction

Alternative energy sources are renewable with lower carbon emissions, compared to conventional energy sources. According to Skills and Occupational Needs in Renewable Energy (2011), the main renewable energy technologies are wind, solar, geothermal, hydropower and bio energy. These types of alternative energy will reduce carbon dioxide gas in the atmosphere. The global pressing needs is how to deal with reducing the rate at which carbon dioxide gas (CO_2) is been emitted to the atmosphere. There is a need to decarbonise and explore more of ARE that does not emit CO_2. Malamatenios (2016) opined that alternative renewable energy drastically cut CO2 emissions which make the development of renewable energy technologies essential. This is why energy sectors worldwide are undergoing rapid transformations towards a more sustainable and low-carbon pathway utilizing renewable resources (Africa-EU Renewable Energy Cooperation Programme, 2014).

Biomass are mainly from crops such as sweet sorghum, maize, and sugarcane, forage grasses, shrubs, animal wastes and waste arising from forestry, agriculture and municipal and industrial activities. According to estimates, the daily production of animal waste in Nigeria is about 227,500 tons, which could lead to about 6.8 million m^3 of biogas. Bio energy is an organic matter that is available on a renewable basis, including forest and mill residues, agricultural crops and associated field as well as processing residues, wood and wood waste, animal excreta, aquatic

plants, fast-growing trees and herbaceous crops, municipal and industrial wastes amongst others (Skill and Occupational Needs in Renewable Energy, 2011).

Hydropower is the current generated from large rivers and some few natural falls to power grid-generation (Renewable Energy Potentials, 2016). Windmills use turbines to convert rotational energy into electricity that can reliably flow into to a grid. Wind energy is generated from wind speeds and about 2.0 m/s is recorded at the coastal region and 4.0 m/s at heights of 30m in the far northern region of the country. The highest wind speeds is recorded in the Sokoto region, the Jos Plateau, Gembu and Kano / Funtua, while Maiduguri, Lagos and Enugu has fair wind speeds, sufficient for energy generation by wind farms. On a larger scale, wind farms are projected to provide as much as 20% of global electricity production by 2030 (Renewable Energy Potential, 2016). Solar energy is derived from solar radiation harnessing the power of our sun averaging 19.8 MJm2/day and average sunshine hours of 6hr /day. From photovoltaic (PV) cells that capture photons and convert them into electricity, to solar thermal energy (STE) that makes use of the sun's heat. Merensky-Hartinger (2017) viewed that it can be tapped from sunshine in the world all year round resulting to providing photovoltaic.

Table 1: Renewable Energy Potentials in Nigeria

Resource	Potential	Comments
Large Hydropower	11,250MW	1,900MW exploited
Small Hydropower	3,500MW	64.2MW exploited
Solar	4.0kWh/m^2/day – 6.5kWh/m^2/day	Significant potentials for solar infrastructure; both for on-grid and on-grid use
Wind	Average of 2-4m/s @ 10m hub height	Moderate wind potentials in the country.
Biomass	Municipal waste	18.5 million tons produced in 2005 and now estimated at 0.5kg/capita/day
	Fuel wood	43.4 million tons/yr of fuel wood consumption
	Agricultural residues	91.4 million tons/yr. produced
	Energy crops	28.2 million hectares of arable land; 8.5% cultivated

Source: ECN (2014), Energy Implications of Vision 20: 2020 and Beyond, Report no.: ECN/EPA/2014/01

Technical Vocational Education and Training at a glance

United Nations Education and Scientific Organization and the International Labour Organization (UNESCO & ILO, 2010), defined TVET as 'a comprehensive term referring to those aspects of the educational process involving, in addition to general education, the study of technologies and related sciences, and the acquisition of practical skills, attitudes, understanding and knowledge relating to occupations in various sectors of economic and social life' (UNESCO & ILO, 2010). In this vein, some of its goals are to provide the technical knowledge and vocational skills necessary for agricultural, commercial, and economic development; and give training and impact the necessary skills to individual for self-reliance economically as every job has its own skills that

can be transferred to the work place require for and on the job (National Policy of Education, NPE 2013).

Technical education is designed to meet the complex technological needs of modern industry, knowledge, and related industrial information for the purpose of qualifying persons for useful and gainful employment in trades and industrial pursuits. In the light of this, TVET programmes need to provide technical knowledge and vocational skills necessary for, commercial, and economic development in renewable energy, particularly at craft, advance craft and technical levels. As stated by Malamatenios (2016), TVET is in a good position to provide a good basis for working at technician level in Renewable Energy industries and this is while it is necessary to acquire the relevant skills.

Skills Acquisition

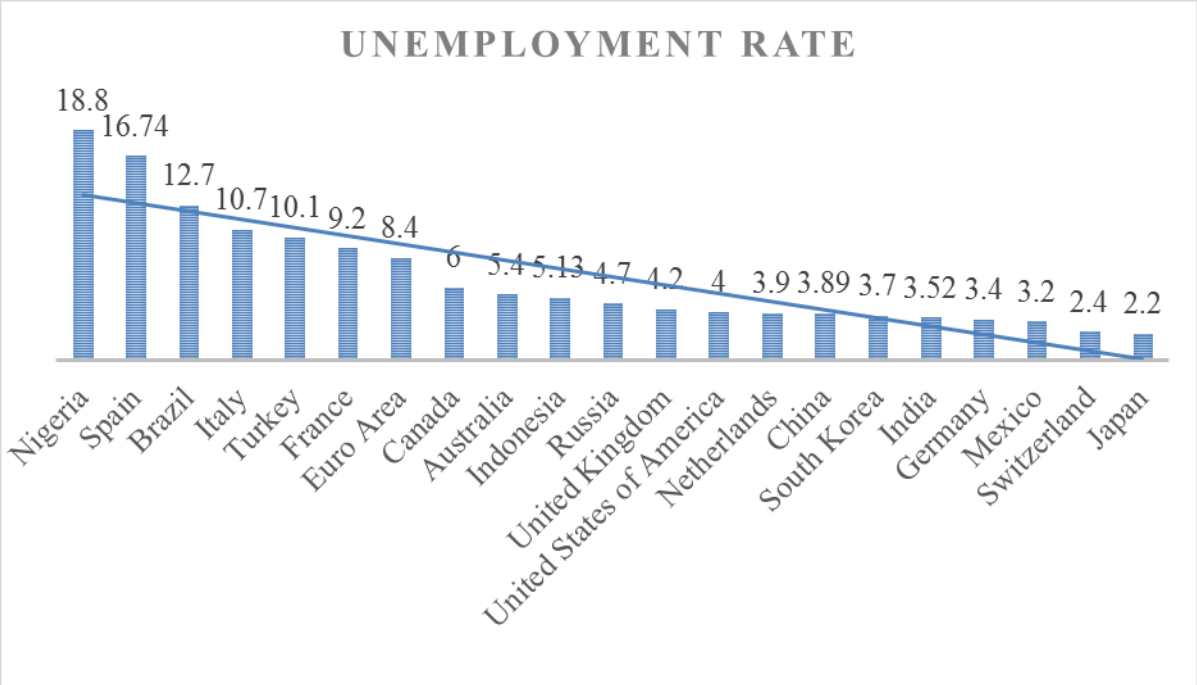
According to Ogundele (2010), acquiring skill is usually gained through training or experience that bestow on the beneficiary new knowledge on how to carry out an effective work done. When a skill is acquired in any discipline, there will be productivity that will enhance the development of the individual and the nation. Skills needed for renewable energy according to Chalwa and Singh (2018) are operational & maintenance, installation and technical construction, equipment manufacture, in order to develop, build, and operate projects. As asserted by Cattelaens & Fromme (2014), engineers, technicians will be required to cover the whole value chain from assembly of solar PV modules, to project development skills for PV system design, resource assessments, business plans. Project planning skills, technical and electrical skills will be needed to construct and assemble solar PV plants. If an installation is to be made at a household with a small demand profile from appliances such as lighting, radio and cell phone charging, a technician will need to analyze such demand. Similarly, entrepreneurial skills, including management and financial skills are required for designing and selling smaller systems.

Renewable energy has emerged as one of the most economical choices for new power generation in countries around the globe that will accelerate renewable energy deployment in developing countries to improve health and welfare, creates jobs and drives economic growth that will improve the livelihoods of over a million people through providing better access to energy (The International Renewable Energy Agency, IRENA, 2015). According to Trading Economics (2018), as reported by the World Bank, the renewable energy consumption in Nigeria was 86.64 % in 2015.

Unemployment and Job Creation

The unemployment rate measures the number of people actively looking for a job as a percentage of the labour force. In Nigeria, it increased to 18.80 percent in the third quarter of 2017 from 16.20 percent in the second quarter of 2017 (Trading Economics, 2018). The Nigerian National Petroleum Corporation Business (2016) spearheaded the launch of a bio-fuel program for Nigeria which aimed at creating a sustainable domestic industry by integrating the energy and agricultural sectors, growing a thriving home grown industry, providing jobs and economic empowerment to rural communities, reducing dependence on fossil fuels and protecting the environment while participating in the Clean Development Mechanism (CDM) programme.

ISSN 2705-2559
E-ISSN 2705-2567



Source: Trading Economics (2018). Figure 1. Graph by Ogundele (2018).

Developing renewable energy capacity can make a significant contribution to job creation. Each renewable energy project creates jobs in manufacturing, operations and maintenance, installations, production, transport and processing. Employment in the renewable energy sector increased by 5% in 2015, to 8.1 million jobs (direct and indirect), as estimated (IRENA, 2015).

Table 2: Estimated direct and indirect thousands of jobs in renewable energy worldwide, by industries

	World	China	Brazil	United States	India	Japan	Bangla desh	Germany	France	Rest of EU
Solar PV	2772	1652	4	194	103	377	127	38	21	84
Liquid bio fuels	1678	71	621	277	35	3		23	35	47
Wind power	1,081	507	41	88	48	5	0.1	149	20	162
Solar heating/ cooling	939	743	41	10	75	0.7		10	6	19
Biogas	382	209			85		9	48	4	14
Hydropower (small scale)	204	100	12	8	12		5	12	4	31
Geothermal energy	169			35		2		17	31	55

Concentrating Solar thermal Panel (CSP)	14			4				0.7		5
Total	8052	3523	918	769	416	388	141	355	170	644

Source: Renewable energy policy network for the 21st century (2016).

Research Questions

1. Do TVET graduates acquire adequate skills towards alternative energy sources?
2. What extent can alternative energy leads to job creation?

Methodology

This study adopted a descriptive survey design with a total population of 100 respondents consisting of lecturers in Kwara State College of Education (Technical), Lafiagi in the School of Technical Education and the Department of Industrial and Technology Education, Federal University of Technology, Minna which both consists of five major departments namely: Automobile, Building, Electrical/Electronic, Metalwork Technology and Woodwork Technology respectively. The instrument used for data collection was a structured questionnaire developed by the researchers. The structured questionnaire contains 8 items which seek to elicit information on acquisition of alternative renewable energy skills through TVET programmes for job creation. The Cronbach alpha analysis reliability co-efficient was used in scoring of items using the Statistical Product and Service Solutions (SPSS) 23.0. The reliability co-efficient of all the items were above 0.50 regarding them as reliable. The instrument was validated by two (2) experts in the Department of Industrial and Technology Education, Federal University of Technology, Minna. The questionnaire was administered to the respondents and retrieved by the researchers. The study employs a survey instrument that was analyzed with inferential statistics of chi-square to accept or reject the hypotheses at 0.05 alpha level of significance.

Results

Research Question 1: Do TVET graduates acquire adequate skills towards alternative energy sources?

Table 3: Chi-Square table showing adequate acquisition of skills towards alternative energy sources

S/N	Items	A	U	D	Total	Cal(X^2)	Df	Table of Value X^2	Decision
1.	Lecturers prepare college students with alternative energy skills before graduation.	04	10	86	100	289.76	7	14.1	HO_1 Rejected
2.	Lecturers have adequate ARE training equipment.	11	08	81	100				
3.	The TVET Curriculum is very strong to meet future technological changes.	00	10	90	100				
4.	The college lecturers are up to date in providing ARE Skills instructional methods.	00	09	91	100				
	Total	**15**	**37**	**348**	**400**				

The table 3 above shows that the calculated value (x^2) of 289.76 is greater than the critical value of 7 shows that, TVET graduates do not acquire adequate skills towards alternative energy sources. From the result presented, 81% respondents disagree on the availability of lecturers having adequate ARE training equipment. This is because 86 % of the respondents disagree that lecturers do prepare college graduates with alternative energy skills before graduation. It is a clear fact that when a skill is acquired in any discipline, there will be productivity that will enhance the development of the individual and the nation. Skills needed for renewable energy according to Chalwa and Singh (2018) are operational & maintenance, installation and technical construction, equipment manufacture, in order to develop, build, and operate projects. It is necessary to acquire relevant practical skills, that can be transferred to the work place for self-reliance relating to occupations in various sectors of economic and social life' (UNESCO & ILO, 2010, NPE, 2013 & Malamatenios (2016).

Research Question 2: What extent can alternative energy leads to job creation?

Table 4: Chi-Square table showing the significant relationship between alternative energy sources and job creation

S/N	Items	A	U	D	Total	Cal(X^2)	Df	Table of Value X^2	Decision
5.	Skills acquisition in ARE can lead to employment.	92	00	08	100	274 .52	7	14.1	HO_2 Rejected
6.	Wind energy can create jobs for skill personnel.	72	10	18	100				
7.	Solar PV Source of energy can provide TVET graduates with Employment	73	23	04	100				
8.	Hydropower can improve electricity generation for Job creation.	92	00	08	100				
	Total	**329**	**33**	**38**	**400**				

From Table 4 above, the hypothesis testing on the significant relationship between alternative energy and job creation shows that the calculated value (X^2) of 274.52 is greater than the critical value of 7 at 0.05 alpha levels. Thus, the null hypothesis is rejected, showing that, there is a significant relationship between alternative energy sources and job creation as more jobs can be created. From the above table, 92% of the total respondents agreed that skills acquired through ARE can lead to employment. This is because wind energy alone can create jobs for skill personnel as agreed by 72% respondents in the study. This is supported by the International Renewable Energy Agency (2015) that renewable energy creates jobs and drives economic growth to improve livelihoods of over a million people through providing better access to energy. Developing renewable energy capacity can make a significant contribution to job creation in the manufacturing of local equipment for renewable energy sources for hydropower; biomass, solar and wind. As asserted by Cattelaens & Fromme (2014), engineers, technologists and technicians will be employed to cover the whole value chain from assembly to business plans. This can increases job opportunities, income, wealth creation and poverty reduction. This view is

supported the International Renewable Energy Agency (2015) where employment in the renewable energy sector increased by 5% in 2015, to 8.1 million jobs.

Conclusion

In conclusion, unemployed youths and adults need to be equipped with employable skills in order to meet up with the increasing demand for technical manpower by various sectors of the nation's economy.

Recommendations

In respect of the essence of the 21st century innovation approach towards alternative energy and job creation, the following recommendations are made:

1. Existing TVET curricula be reviewed, upgraded and possibly develop new curricula to accommodate alternative renewable energy sources by integrating modules.
2. Youths and interested adults should be provided with free training skills and equipment on installation, repair and maintenance of alternative renewable energy products.
3. In a more advanced mode, specific TVET courses and certifications for solar installers for rooftop installations, where technicians will be needed to have roofing skills.
4. Uneducated youths should be equipped with repair skills, maintenance skills, technical skills, and procedures of operation skills.
5. Enough training facilities in the area of renewable energy are provided in this era of digitalization to colleges, in order to meet modern standard.

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