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RESEARCH ARTICLE

Barriers and opportunities to operate photovoltaic systems in commercial buildings in Nigeria

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ABSTRACT

The rapid growth of energy consumption worldwide has increased rapidly, and has raised concerns over problems of energy supply, energy sustainability, and exhaustion of energy resources. These problems can be solved by contributing significantly to the utilization of renewable energy sources. Most developed countries are taking counter measures by implementing building energy standards in order to reduce building energy consumption by recognizing new energy policies and encouraging investment in PV system which is one of the biggest renewable energy sources and, thus, achieve sustainable energy efficient buildings. However that is not the case in a developing country like Nigeria, as there is a huge gap between the demands for electricity and demand for sustainable energy in the country. The use of PV technology in Nigeria is not new, but it still encounters many barriers for its penetration into the commercial sector. In respect to that, this research paper investigates the key challenges in the adoption of Photovoltaic systems and identifies the effective strategies of implementing PV systems in commercial buildings in Nigeria. The study focuses on identifying renewable energy sources for commercial buildings in Nigeria; examining the need for PV systems in commercial buildings in Nigeria; Identify the effects of PV systems on energy optimization in commercial buildings; review the policy context for renewable energy in Nigeria; identify the barriers in adopting photovoltaic systems in commercial buildings in Nigeria; and recommend possible ways of overcoming the barriers.

Keywords: Energy, renewable energy sources, photovoltaic system, PV barriers, building

1. INTRODUCTION

Energy is an essential requirement for all earthly operations; it is vital and of great importance to socio-economic doings of the present society which is revolved around the central point of the availability of energy. The 1973 oil disasters brought on by the Arab oil embargo, in European countries fetched an unexpected worldwide understanding to the use of renewable energy resources such as wind energy, wave energy, solar energy (photovoltaic), hydropower, biomass and bio fuels [1]. According to [2] the demand for the utilization of renewable energy resources is growing to be more desirable these days as a result of the finite nature of fossil fuel energy resources and in many cases the greenhouse gases emission which a great number of scientists clearly believe today is the cause of global warming. Effective utilizations of renewable energy resources to improve the supply of energy from fossil fuel energy resources will augment availability of energy with little or no environmental consequence.

As a reaction to international interest in the utilization of renewable energy resources, the Energy Commission of Nigeria (ECN) was founded in 1979. The Energy Commission currently has six centres open out across the country. The centres are:

1. Sokoto energy research centre (SERC) at Usman Dan Fodiyo University, Sokoto.

2. National centre for energy research and development (NCERD) at University of Nigeria, Nsukka.

3. National centre for energy and environment (NCEE), University of Benin, Benin City.

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4. National centre for energy efficiency and conservation (NCEEC), University of Lagos, Lagos.

5. National centre for hydropower research and development (NCHRD), University of Ilorin, Ilorin.

6. National centre for petroleum research and development (NCPRD), Abubakar Tafawa Balewa University, Bauchi

These energy research centers have the order to engage in energy studies and improve renewable energy technologies and likewise to make well known the benefits of the utilization of renewable energy resources in the entire country.

Nigeria as a country is endowed with substantial amounts of fossil fuel energy sources which include natural gas, petroleum, tar sands, lignite, coal, and also renewable energy resources. However, the renewable energy sources include animal waste, solar radiation, hydropower, crops residue, wind, and fuel wood. According to [1] petroleum and electricity which is produced from either burning fossil fuels or possibly hydro plants provides a huge proportion of energy services in the industrial, residential, commercial, and 3 transport sectors in Nigeria. Solar radiation basically is copiously present in Nigeria, and is most certainly one area of major concentration among the other renewable energy resources in Nigeria. According to [3] the normal solar radiation acquired in Nigeria is approximately 7.0 kWh m^{-2} day^{-1} (25.2 MJ m^{-2} day^{-1}) in the distant north while it's about 3.5 kWh m^{-2} day^{-1} (12.6MJ m^{-2} day^{-1}) in the coastal latitudes. Due to the fact that the country is located in the high solar radiation zone of the world, most of the energy institutes are helping to make huge strides in the manufacture of solar energy technologies as a means for the utilization of solar energy. The energy research centers have also been helping to make serious efforts to spread the need for the applications of these devices to be used as household commodities and also installed in commercial buildings. Some state government authorities, in cooperation with non-governmental agencies supported a couple of projects in some rural communities on solar energy. The estimate of solar energy capability in Nigeria with 5% device conversion efficiency is 5.0 x 1014 kJ of efficient energy per annum [4] this is obviously about the same as 258.62 million barrels of oil produced each year and approximately 4.2 x 10^5 GWh of electricity production per annum in the country [5].

Several Nigerians and foreigners who base in Nigeria reside in rural communities in which you may hardly find any good road, difficult terrains, electricity grids, and also no easy accessibility to fossil fuel energy resources. Efficient maximizing of solar radiation with the use of solar energy technologies to enhance energy supply from fossil fuel energy resources would definitely increase availability of energy for socio-economic activities as well as to make improvements to the normal standard livelihood of the people. With this ugly situation, there are expectations to improve the standard of energy supply in the country, employing the essential items needed in other to take advantage of solar energy (photovoltaic) which will definitely improve the standard of livelihood of the people.

2. PRIMARY ENERGY CHALLENGES IN NIGERIA

Inefficient energy utilization, ineffective and undependable energy supply system, environmental challenges, energy financing, lack of adequate technological know-how in the energy sector and poor institutional framework [6] nevertheless, before reviewing these problems there is certainly a need to consider the recent energy consumption patterns of the country.

In Nigeria the primary energy consumers could very well be categorized into three (3) major sectors particularly: commercial, residential, and industrial sector. The industrial sector in some nations around the world constitutes the major consumer of electric energy which is then pursued by the residential and commercial sector [7]. Based upon existing information, the pattern observed in Nigeria appears to be the reverse. In 2000, the total amount of electric energy consumed amounted to 29.12 PJ, where the residential sector consumed 51.65% (15.04 PJ), whereas the commercial and industrial sectors consumed 25.89% (7.54 PJ) and 22.46% (6.5 PJ) respectively of the over-all total consumed [8].

It has also been found that the commercial sector's electricity consumption has also been increasing too, although not nearly as fast as the residential sector's electrical energy rate of consumption. However, the commercial sector relates to the energy consumed by wholesale and retail trade; post and telecommunications; the operation of hotels and restaurants; real estate, renting and business activities; maintenance and repair of motor vehicles and motorcycles; the collection, purification and distribution of water, etc. The above listed commercial sectors in Nigeria consume energy amounting to about 81,537 tons of oil equivalent from 1971 to 1999 [9]. By all indications, the biggest consumer of electric energy in Nigeria is the residential sector, which is then accompanied by the commercial and the industrial sector [10]. Table 1 below shows the past trend of electricity consumption in residential, commercial, and industrial sectors of the Nigerian economy.

The decreasing trend in the total amount of electrical energy consumed between 1995 and 2000 was not attributed to the energy conservation measures and technologies [11], and also that of the industrial sector; rather, it is as a result of the continuous irregular and lack of adequate power supply in the country [7].

2.1. Energy Situation in Nigeria

Although Nigeria is a major oil producer and investor in the electricity sector, Nigeria holds a low 69th place in per capita electricity consumption globally [12]. The country has large amounts of natural resources utilized for energy generation (both conventional and renewable sources); but yet is bedeviled with unexpected and long periods of power outage, or fluctuating currents. Ibitoye and Adenikinju [13] gave an estimate that up to 60% of the populations are unconnected to the national grid.

There are presently more than 150 million people living in Nigeria, and the power sector has the capability of producing only around 3,500 MW of electricity, which is very much below all economic projections and the country's end users and business needs, regardless of the governments investment of around USD 1 billion per annum in the sector [14].

Energy use in the commercial sector in Nigerian offices is dominated by electricity supply. Cooling, lighting, hot water, and powering of appliances are all powered by electricity. It is obvious that high cost of electricity and inadequate power supply continues to be a primary concern to every sector of the Nigerian economy: especially the industrial, commercial, and domestic sectors. However, several unexpected power line cuts, which seem to have grown to be a daily regular occurrence in Nigeria, usually leads to equipment not functioning properly, which adds to the difficulty to produce goods and provide efficient services.

Due to the inconsistent and undependable supply of electricity in the country, it has forced the industrial and commercial sector into self-generation of electricity by means of purchasing of privately owned generating plant and in doing so decrease their reliance on general public source electricity power supply, and thus, adding a significant amount to their operating and capital costs. The trend of using fossil based fuel to power back-up generators in Nigeria has negative impacts on climate change, pollution, and profit for businesses.

3. RENEWABLE ENERGY SOURCES

Renewable energy is basically the energy that comes from natural sources that are constantly and sustainably replenished such as hydro energy, solar energy, geothermal energy, wind energy, and certain bio fuels [15].

Renewable energy can be used for various purposes since it can support small as well as large applications. Electricity and heat can be produced for use by using renewable energy from wind, sun and geothermal technologies. Many of these technologies contribute to renewable power generation, and amongst all renewable technologies, photovoltaic increased the fastest at a rate of 60% annually between the years 2004 – 2009 [16], which is one of the areas of renewable technologies that have received the most attention.

Solar Energy: This is basically the most successful of all sources of renewable energy taking into account all its quality. The sun radiates its energy at the speed of about 3.8 × 1023 kW per second [17]. However, a large amount of this energy is spread evenly as electromagnetic radiation which happens to be approximately 1.5 kW m^{-2} at the boundary of the atmosphere. According to [17], once the suns radiation goes across the atmosphere, a square meter of the earth's surface area could possibly receive near the amount of 1kW of solar energy, which is averaging almost 0.5 in total of the hours of daylight. Solar energy makes use of the sun rays to generate electricity. However, The energy which is produced from the sun can be used by a direct means of employing the use of photovoltaic (PV), or via an indirect means in which the energy or light from the sun is focused to heat water and afterwards used to generate electrical energy, the indirect means is referred to as 'concentrating solar power' (CSP). On the other hand, all the other renewable energy sources besides geothermal and tidal get their energy from the sun.

Hydropower: Hydropower or hydroelectricity is the application of gravitational force of flowing water or water in motion to generate electricity [18]. The hydropower is regarded as the most common and largest type of renewable energy source that is widely available in virtually most part of the world. Generally the hydropower plants are usually built and positioned in huge dams which have good gravitational forces. However, the hydroelectric is regarded as the type of renewable energy that has a much lesser level of output of the greenhouse gas 'carbon dioxide' (CO_2) because it does not generate any waste directly or indirectly. The hydro power was estimated to make up for 20% of the world's electrical energy, as well as 88% of the total amount of electrical energy generated from renewable energy sources.

Table 1. Past electricity consumption trend in the residential, commercial and industrial sectors [8]

Year	Residential sector (KWH)	Commercial sector (KWH)	Industrial sector (KWH)	Total Consumption (KWH)
1970	445,000	242,000	459,000	1,146,000
1975	1,023,000	597,700	1,098,000	2,718,700
1980	1,320,000	770,000	1,643,000	3,733,000
1985	3,189,000	750,000	2,213,000	6,152,000
1990	3,953,100	1,116,000	2,037,700	7,106,800
2000	4,940,000	2,763,000	1,029,000	8,732,000
2011	4,181,100	2,096,000	1,818,000	8,095,100

3.1. Photovoltaic (Solar) System

Photovoltaic System (PV) which is also known as solar panel systems or solar photovoltaic (PV), gets the sun's energy by means of photovoltaic cells, it produces electricity by converting the energy from the sunlight, which can be used to run appliances in buildings. The solar Photovoltaic (PV) system is a reliable technology. It provides 0.1% of the total global electricity generation and is projected by 2050 approximately

11% of global electricity will be generated by photovoltaic systems [19]. Fig 1 below shows a typical PV array mounted on a building's roof. Individual modules are attached to a racked system and wired together to form an array.

Fig 1. A typical PV Array Individual modules are attached to a racked system and wired together to form an array [10].

Over the years, the solar photovoltaic (PV) industry has enjoyed substantial growth. According to the Solar Energy Industries Association (SEIA) and GTM Research, cumulative grid-connected PV in the United States has now reached 3.1 GW — 10 times the size of the country's solar capacity in 2005. While some projections call for this segment to hit a speed bump this year, considering the uncertain effects of the U.S. Treasury 1603 tax grant program possibly expiring at the end of the year, coupled with the U.S. government's reaction to a call for import duties on Chinese manufactured PV cells and modules, most analysts anticipate the solar industry will continue on its expansion path. These systems are no longer installed exclusively by specialty solar contractors a situation that opens up on-going revenue streams for electrical contractors, who are being asked to broaden their scope of work and provide PV installation services.

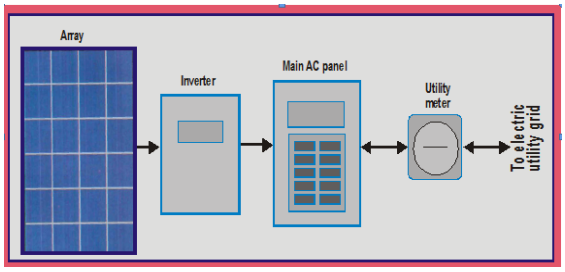

Fig 2. A grid-direct PV systems' major components [17].

In these systems, an array is connected directly to an inverter which in turn is connected directly to the electric utility grid. The arrows in the figure indicate the potential current flow within the system.

According to [20] the following are some of the benefits of using Photovoltaic (solar) electricity in building:

Cut your electricity bills: The PV gets its energy from the sunlight which is free, so electricity costs will be reduced. The more electricity the device can generate, the higher it costs on the other hand the more it could actually save.

Easy to maintain: Solar (PV) panels are quite easy to maintain as they just need to be cleaned and kept in a position where it get enough sunlight and it lasts for 25 years or more.

Reduces carbon footprint: Solar electricity is sustainable, and doesn't emit any dangerous carbon dioxide (CO_2) or various other pollutants. A standard home solar Photovoltaic system could possibly save over a tonne of CO_2 per annum which is definitely more than 30 tons over its lifetime.

3.2. The Need for Renewable Energy Technologies (PV System)

Sustainable development is starting to become an objective, to which several countries all over the world wish to have. In general, there are several ways in which sustainability has been defined, and it is usually thought about to have up to three different components: environmental, social and economic sustainability [21]. Basically sustainable development generally will involve the achievement of environmental, social and economic sustainability concurrently. However, it is indeed very challenging to achieve this balance. Although among the three components of sustainability mentioned above, energy is not one of them, it is indirectly linked to each. To be precise, in most of the economic sectors, for example: industry, commercial, residential, transportation, etc. it is actually energy resources that drives most, if not all of the world's economic activity. Moreover, energy resources either of fossil fuels or renewable, are gotten from the natural environment, same as wastes materials are gotten from energy processes either through manufacturing, transportation, storage, or domestic usage are usually discharged to the natural environment. Eventually, the services which are made available by the energy supplied are appropriate for good standards of living, and frequently encourage social stability and likewise cultural and social growth. Having looked at the related links between energy and the fundamental components of sustainable development, it is indeed obvious that the fulfilment of energy sustainability is a very important perspective on attaining sustainable development, in every country and around the world.

Though the simultaneous achievement of environmental, social and economic sustainability has indeed been so challenging, Renewable energies technologies has been recommended by many scientist as a means of combating the situation. Renewable energy as the name implies, are continually replaced by naturally occurring processes and are for that reason are limitless in supply. In addition they can also function without causing any pollution to the environment. Technologies have already been designed to take advantage of any of these energies and this sort of technologies is referred to as renewable energy technologies (RETs) or in some instances also referred to as 'clean technologies' or 'green energy'. Due to the fact that renewable energy are continuously being restored from natural resources, at the same time they also have guarantee of availability, not like fossil fuels, that happen to be traded on the international market and determined by international level of competition, in some cases might even result in wars and shortages [22]. They offer important advantages which will be stated as follows:

The rate in which they are used will not have any negative effect on their availability in future, in other words they are in-exhaustible.

- They are well distributed across the world, despite the fact that temporal variations occur. As a result, every part of the world possesses at least one or more kinds of renewable energy source.

- They don't pollute the environment, which means they are natural sustainable form of energy.
- They can be cheaply and harvested continuously and therefore a source of sustainable energy.

In contrast to the nuclear and fossil fuels plants, which are owned by the large organizations, governments, or state owned enterprises, renewable energy could possibly be constructed in small models which are thus ideal for the society management and private ownership [23]. Using this method, value from renewable energy development projects can be kept in the society. In Nigeria, this seems to have specific importance considering the fact that the power grid does not spread out to the remote parts, in addition to being very expensive to extend the electrical grid to remote parts. This offers a distinct chance to build up energy power plants close to the locations where they really are seriously required. By doing this, essential wages and income, skill and work transfer as well as manufacturing options available for small enterprises could very well be set up in rural cities.

3.3. Improving Energy Optimization with PV Technology in Nigeria

In the span of a typical building majority of the energy consumed is not from construction, but rather during the operation phase when the building is in use. The demand for energy within and around a building is put to use generally for the purposes of heating, cooking, lighting, cooling and ventilation. All of these activities are executed either crudely or perhaps through the use of electrical appliances or a mixture of both with related GHG pollutants. "Typically more than 80% of the total energy consumption takes place during the use of buildings and less than 20% during construction of the same" [24]. aspects of environmentally friendly homes and office buildings use advanced and modern-day energy efficient practices such as sensor controlled and compact fluorescent lighting, photovoltaic cell arrays, geothermal heating, high efficiency heat pumps, optimum use of fresh air and natural light, utilizing natural conditions for cooling and insulation into design so as to cut down electrical energy used in operational phase of buildings and prevent GHG emission [25]. Although in Europe, Asia and America traces of energy intelligent structures exists. Also in some African countries like South Africa and Kenya their designs are becoming green oriented. In Nigeria, according to [26] technological innovation in the case of climate change mitigation or in regards to renewable energy and energy efficiency is absolutely Zero. Other than the sparing use of photovoltaic devices for street lighting in recent times, buildings of this nature are alien to nearly all Nigerian residents. Existing innovative developments for green buildings that are energy efficient include the application of biogas produced from fermented excreta, food or crop wastes using bio digester; windmills which offers an economical and cleaner electrical energy source rather than fossil fuel; tidal turbines fastened to the seafloor; Solar panels and photovoltaic cells that transforms sunlight energy to electric energy and the utilization of ground source heat pumps which utilizes the earth energy to exchange heat within a building [27]. The application of pale colours on walls and ceilings is effective in reducing energy intended for lighting by five to ten percent; this also is applicable to all sorts of buildings with the exception of industries [28].

3.4. Barriers in adopting PV

There actually are many different factors that affect the use of PV generally and the following barriers according to the [29], has been identified and summarized as follows:

- Market Barriers
- Technical Barriers

Market Barriers

Market barriers are associated with the cost of BIPV and also the lack of awareness with regards to the added benefits of PV systems for the building sector.

- Innovations in the Building sector are usually independent
- prices for Solar panel are specified in € W^{-1}, while for architects € m^{-2} is more convenient
- the benefits of BIPV as a multi-functional building part is not known
- BIPV is still very expensive

On numerous occasions, PV systems are usually not taken into consideration in the early stages of the building design, which is as a result of the high cost of the materials. The fact remains simple, that PV systems are very expensive when compared with other formal building components which BIPV could possibly replace for example laminated glass, parapet units, roofing tiles, and of course low cost traditional bricks. However, what it is that is neither properly noticed nor taken into consideration is the fact PV systems can generate electricity. This implies that the total energy consumed in a building is going to be reduced and therefore the PV system will eventually pay back its initial investment cost.

PV systems are multifunctional building materials and, apart from the electricity generation, they are able to fulfill several other purposes for example weather protection, shading systems, heat insulation and sunlight modification providing good lighting effects.

Technical Barriers

Technical barriers are associated with the structural issues technical engineers, architects and installers experience when designing, and setting up PV systems into the building envelope.

- Missing understanding between engineers and architects/technical requirements.
- The use of PV systems makes up quite a good choice for building components to be taken into consideration by architects. They could be used to replace existing building components. However, architects today neglect this because of lack knowledge and understanding.

- Standards for PV are still lacking
- Most countries have its own regulations and requirements on qualifications or guarantees for BIPV, thereby making it challenging to enter the market.
- Producers manufacture their own standard PV systems in terms of dimensions

Every manufacturer of solar panels builds its own size, dimensions and efficiency of its modules. As a result of this the designer's tend not to integrate the use of photovoltaic panels into the buildings.

Why Photovoltaic System in Commercial Building?

Though the application of Photovoltaic system is not wide-spread in Nigeria, a quite a few sectors have started implementing photovoltaic system in projects, some commercial sectors, private firms and government sectors in Nigeria has recently embarked on applying the Photovoltaic system on a couple of projects especially in rural areas and has started working together with top manufacturers and subcontractors who have the ability to install and implement photovoltaic systems. Both private and government sectors are setting up policies and machineries for the production and installation of photovoltaic system. These sectors have also started reviewing the environmental and commercial tools available for proper production and installation of photovoltaic system, but still a huge population of Nigerians complain of poor power supply, and literature has shown that over 90% of organizations in Nigeria use diesel/petrol generators as back-up for electricity supply which is not healthy for the environment and the people. Therefore, photovoltaic system can be considered to be a justifiable issue for the study on identifying the barriers and opportunities in adoption of photovoltaic system in commercial buildings in Nigeria.

4. ANALYSIS AND FINDING

The analysis and management of all data are collected using both quantitative and qualitative methods for the research, which is usually known as triangulation; in essence a research can be carried out using different [30]. For this research all information gathered was as a result of each material analyzed, which will form the foundation from which conclusion will be drawn. A questionnaire of basically 9 questions was put up and sent to individuals working in various organizations in Nigeria electronically by mail using nine (9) contact persons located in Abuja, Lagos, and Port-Harcourt in Nigeria. A total of four hundred (400) questionnaires were sent out by email during the survey. In order to test if the questions met the objectives of the study a pilot test was conducted. However, the pilot survey accounted for fifty-four (54) of the total questionnaires sent out. A 70% response rate was gotten from the pilot survey, which was better than would have been expected. However, the response rate from the main survey was at 64%. A total of 265 questionnaires were received out of the 409 that was posted electronically. Nevertheless, this level of response does not allow a reasonable degree of confidence in the results. The table below shows the number of responses received at each stage.

Table 2. Number of questionnaires received

	Number sent	Number received	% Received
Pilot Survey	54	38	70
Main Survey	355	227	64
Total	409	265	65

Fig 3 and 4 demonstrate the level of response for both the pilot and main survey and the overall percentage contribution to the entire survey, respectively. The following section looks at the data collected from the online questionnaire survey.

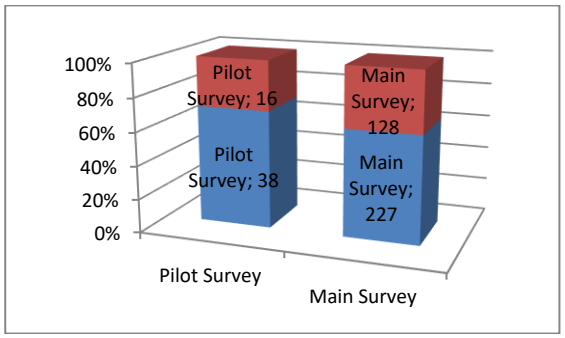

Fig 3. Response rates of pilot and main survey

4.1. Questionnaire Analysis

What alternative source of energy does your organization use?

This research question seeks to understand the type of alternative energy the respondents use besides that of the main energy provider. Fig 5 shows that 80% of the respondents rely on generator plants (Diesel/Petrol), 12% on Hydro power energy, whereas only 8% use solar energy as an alternative source of energy.

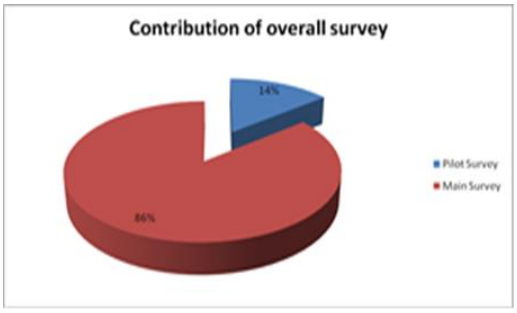

Fig 4. Percentage contributions to overall survey

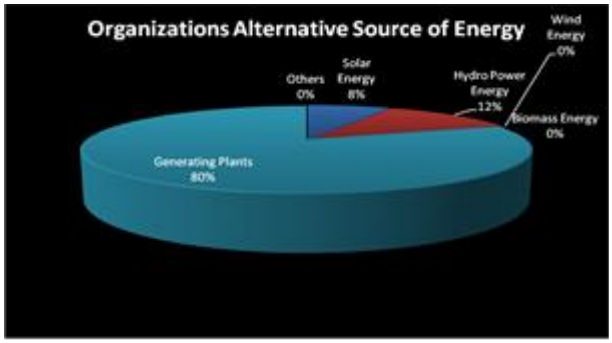

Fig 5. Organizations alternative source of energy

Please state reason why your organization is using the selected choice of alternative energy?

This research question was asked with regards to the first question in order to understand the reason behind the respondents selected choice of alternative energy. Fig 6 demonstrates the respondents' reasons for their selected alternative energy choice. However, majority of the respondents (57%) choose 'poor electricity supply' as the major reason why their organization use their selected alternative energy, This indicates that the energy sector is not meeting up to its requirement which could be as a result of inadequate technological capabilities in the energy sector. whereas, only 4% choose 'reduction of CO_2 emissions' which also indicates there is less concern for the environment.

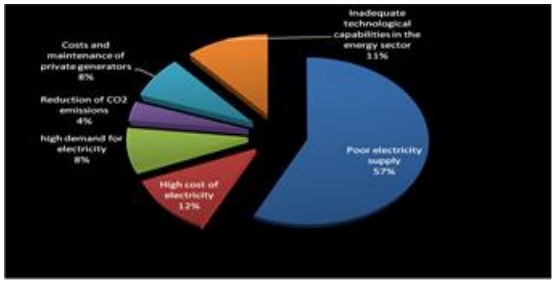

Fig 6. Reason for choice of alternative energy

Do you think that adopting the use of PV systems will improve the energy efficiency in your organization?

This question was thrown open to the respondents to get their view about improving energy efficiency in their organization and also to know if they are knowledgeable about the efficiency usage of PV systems. even so, with regards to the question asked an enormous 95% said 'Yes', and gave their reasons as solar energy is free as it is generated from the sun and the use of PV systems is very cost effective as it will help reduce the cost of energy generated from the main energy provider and also reduce CO2 in the society. Following the response from the respondents, it indicates that most organizations are aware of the benefits of installing PV systems

4.2. Questionnaires comments

The questionnaire survey was effectively carried out and properly analysed. The questionnaire was used as it was the best possible option to take a look at the population's views about the main purpose of the research study. It examines the mind-set and knowledge of the respondents about renewable energy and the use of Photovoltaic systems in buildings. It was ensured that all questions were related to the aim of the study.

5. CONCLUSIONS

Nigeria is a nation which happens to be blessed with ample conventional and non-conventional energy resources. There is certainly the need to facilitate evolvement of an energy mix which will put additional concentration on the need for the preservation of the fossil fuels in quite an effective way which will give rise to their ongoing exportation that will undoubtedly continuously create revenue to the federal and state governments for just as many years as they can. The implementation of renewable energy technologies, such as, Photovoltaic by the country with emphasis on commercial buildings could lead to great internal reduced use of petroleum products and gas. The most important advantages of photovoltaic systems comprise of its environmentally friendliness over conventional energy e.g. fossil fuels, it's easy to maintain, and it cuts down electricity bills. In the course of this study, It was found from the literature review through secondary data that the demand for electricity in Nigeria from end users is extremely high; however, the supply is not adequate and sufficient enough to meet the demand which leaves a large number of Nigerian organizations without any choice other than to be using privately owned conventional energy generating systems which was also confirmed in the analysis. The use of the conventional power generating systems is quite expensive, it's not environmentally friendly, and also it's not easy to maintain. Therefore it is encouraging to adopt the use of PV systems in buildings. However, we can conclude by identifying the various barriers that prevent organizations from adopting the use of PV systems is as a result of its high investment cost; inadequate technical know-how; lack of government financial incentives; and lack of local manufacturing capability and quality control It is recommended that there should be need for a comprehensive national renewable energy master-plan to be designed which will enable the enhancement of the solar energy policy for sustainability, and also a public campaign on the efficiency and environmental friendliness and benefits of PV systems. With regards to this, the Nigerian government needs to initiate a developed National energy policy for the country.

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