SOLAR ENERGY PLANTS AS ALTERNATIVE MEASURE TO BENIN DISTRIBUTION COMPANY: A CASE STUDY OF THE UNIVERSITY OF BENIN CAMPUSES.

BY

JACOB ENO UDUAK

EDU2001969

UNIVERSITY OF BENIN

BENIN CITY

FEBRUARY, 2025

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A RESEARCH WORK SUBMITTED TO THE DEPARTMENT OF VOCATIONAL AND TECHNICAL EDUCATION, FACULTY OF EDUCATION, UNIVERSITY OF BENIN, BENIN CITY, IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF BACHELOR OF SCIENCE EDUCATION (B.Sc.Ed) DEGREE IN INDUSTRIAL AND TECHNICAL EDUCATION.

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APPROVAL

I hereby certify that this work was carried out by Jacob Eno Uduak with mat no: EDU2001969 in partial fulfillment of the requirements for the award of a B.Sc (Ed) degree in Industrial and Technical Education (Electrical/Electronics option) in the Department of Vocational and Technical Education, Faculty of Education, University of Benin, Benin City.

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Dr. Osuyi, S. O **Date**
(Project Supervisor)

CERTIFICATION

This is to certify that this project was carried out by **Jacob Eno Uduak**, with matriculation number **EDU2001969** in the Department of the Vocational and Technical Education, Faculty of Education, University of Benin, Benin City.

Dr. Osuyi, S.O **(Project Supervisor)**	**Dr. S.B Abusomwan** **(Project Coordinator)**
DATE	**DATE**

DR. Osuyi, S.O

Head of Department

DATE

DEDICATION

This research work is dedicated to Almighty God, the creator of all understanding and motivation, for his grace and protection throughout my time in school.

ACKNOWLEDGEMENTS

I am eternally grateful to God Almighty for His direction, wisdom, and strength throughout this research journey. His almighty favor has provided me with inspiration and persistence, allowing me to complete this research.

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ABSTRACT

This study investigates the possibility of using solar energy as an alternative to the University of Benin's unstable electrical supply from the Benin Distribution Company (BEDC). Using a descriptive survey approach, data was collected from 100 students using a standardized questionnaire and analyzed using mean and standard deviation. The findings show that an irregular power supply disturbs academic activity, but solar energy provides economic and environmental benefits. However, obstacles such as funding and policy constraints exist. The analysis suggests supportive policies, financial incentives, and investments to encourage using solar energy on campuses

CHAPTER ONE

INTRODUCTION

Background to the Study

In many parts of Africa, particularly Nigeria, inconsistent and insufficient energy supply continues to be a major hindrance to economic progress and social development. The country suffers from energy distribution issues including frequent power outages, voltage variations, and insufficient grid infrastructure (Akinbami, 2001; Oyedepo, 2012). Nigeria's electrical supply system is principally managed by the National Grid, which serves the country through regional distribution firms. However, many distribution businesses, particularly the Benin Distribution Company (BEDC), are struggling to fulfill increased energy demand (Oke and Akintunde, 2017).

Power outages interrupt vital functions at schools like the University of Benin, which rely substantially on steady power for research, teaching, and administrative operations. The unreliable electricity supply has also increased reliance on diesel-powered generators, which are expensive and environmentally damaging (Odularu & Okoruwa, 2015). Against this backdrop, solar energy has emerged as a viable, long-term alternative energy source that could supplement or possibly replace the traditional power

supply in Nigerian higher education institutions (Emodi & Yusuf, 2015; Lawal et al., 2020).

Nigeria has extensive solar resources, with an average of 3.5 to 7.0 kWh/m² per day across different locations. This makes solar power a highly viable choice for sustainable energy generation (Sambo et al., 2012). With the global cost of solar photovoltaic (PV) technology falling, solar power installations are becoming more financially viable, especially for public institutions such as universities (Abdurasheed et al., 2020). Solar energy's centralized nature, allows energy production close to the point of consumption, making it ideal for off-grid or micro-grid applications that can service isolated or semi-autonomous organizations such as university campuses (Adebayo and Adekola, 2019).

The adoption of solar energy has been identified to minimize dependence on grid electricity, cutting operational costs and improving institutional environmental sustainability. According to studies, if deployed successfully, renewable energy sources, notably solar power, have the potential to bridge Nigeria's electricity supply deficit. Adopting solar energy at the University of Benin could serve as an alternative to dependency on BEDC, thereby improving energy security and supporting sustainable development by Nigeria's Renewable Energy Master Plan (REMP) aims (Oparaku, 2003; Olayinka & Ayotunde, 2016).

Nigeria's energy sector has long struggled with fundamental difficulties caused by an overreliance on fossil fuels and insufficient infrastructure investment. Despite Nigeria's rich fossil fuel reserves, inefficiencies in generation and distribution networks preclude a consistent supply of electricity to the residential, commercial, and institutional sectors (Ehinomen and Adeleke, 2012). Many businesses, especially educational institutions, have come to rely significantly on diesel generators due to power supply unpredictability. This reliance on fossil fuels raises operating costs, increases greenhouse gas emissions, and has a negative environmental impact, worsening pollution and climate change problems (Adaramola & Oyewola, 2011). With these problems in mind, the transition to renewable energy sources, particularly solar, provides a path for sustainable energy solutions in Nigerian institutions (Sambo et al., 2010).

The University of Benin, being a major educational institution, has particular energy requirements. The energy-intensive operations on its campuses include powering research labs, administrative buildings, lecture halls, libraries, and student and staff housing. Frequent power outages interrupt these critical functions, hurting academic productivity, safety, and the comfort of students and faculty. Furthermore, the high energy expenses connected with diesel generators put pressure on the university's budget, which may be better spent on academic and infrastructure development (Amadi et al., 2016). Thus, an alternative, cost-effective energy solution is required to help the university achieve its goal of providing a stable, high-quality instructional environment.

Beyond meeting energy needs, the University of Benin's solar power installation corresponds with global and national aspirations for higher education sustainability. Universities are increasingly expected to be examples of sustainable practices, serving as models for other institutions and communities (Olawumi et al. 2019). By investing in renewable energy infrastructure, the University of Benin can demonstrate its commitment to sustainability while educating students about green technology's benefits and applications. Furthermore, incorporating solar energy into the university's energy mix could spur research, innovation, and skill development, particularly in engineering, environmental science, and technology, resulting in a new generation of professionals ready to tackle Nigeria's energy challenges (Oguejiofor & Chukwuma, 2019).

The installation of solar energy systems is also consistent with Nigeria's Renewable Energy Master Plan (REMP), which intends to boost renewable energy's contribution to the country's energy mix. Solar energy is one of the plan's key focuses, intending to diversify Nigeria's energy sources, lower carbon emissions, and improve electricity access, particularly in underserved areas. The University of Benin's adoption of solar technology would not only help these national goals but would also serve as a case study for the potential scalability of renewable energy in Nigerian universities and other public institutions. This can help to advance a national awareness of the economic, environmental, and social benefits of renewable energy integration (Ajayi & Ajayi, 2013).

The integration of solar energy on university campuses is an instructional tool that is consistent with universities' aim to act as accelerators of innovation and sustainability. Solar systems on campus provide important learning opportunities for students studying engineering, environmental science, and related subjects by allowing them to have hands-on experience with sustainable energy technologies. Through this approach, institutions such as the University of Benin may cultivate a new generation of graduates with the technical skills and environmental awareness required to contribute to Nigeria's green energy transition (Ekanem & Nwachukwu, 2019). The university's use of solar energy also sends a strong message to students, faculty, and the community, confirming the institution's position as a leader in implementing and advocating for sustainable practices.

Finally, tackling the energy crisis with renewable solutions such as solar power contributes to Nigeria's overall socioeconomic development by reducing energy poverty. With millions of Nigerians now without dependable access to power, solar energy initiatives can have a significant impact on social fairness and economic opportunity (Ajayi & Ajayi, 2013). Solar power may improve the quality of life in educational institutions and elsewhere by providing access to contemporary conveniences and critical services, resulting in a more educated and empowered population. When institutions like the University of Benin adopt solar energy, they not only cut operational costs but also demonstrate the scalability and potential of solar technology in addressing Nigeria's sustainable energy needs, creating a model for other institutions and communities to follow.

Statement of the Problem

The University of Benin, like many Nigerian universities, confronts continuous energy issues as a result of the Benin Distribution Company's (BEDC) unstable electrical supply. Frequent power outages impede academic and administrative activity, hurting students, professors, and research. This inconsistent power supply also has substantial financial consequences for the university, which frequently relies on costly and ecologically damaging diesel generators as backup options (Obioha & Agada, 2018). Such disturbances not only reduce productivity but also create a less favorable learning atmosphere, undermining the university's educational goal.

Furthermore, as Oladeji and Okafor (2022) point out, the Nigerian government has made little progress in creating a favorable climate for renewable energy investment. Regulatory uncertainty and inconsistent governmental backing have made colleges cautious to engage in solar energy infrastructure, despite its potential to address energy challenges. The University of Benin, which is dealing with these systemic difficulties, is an important case study for evaluating the potential of solar energy as an alternative to existing electrical sources.

Moreover, relying primarily on diesel generators puts financial strain on the university budget, diverting monies that could be used for academic activities, facility upkeep, or scholarships. According to Obioha and Agada (2018), the high costs of fuel,

generator maintenance, and repairs add up to large expenses, rendering diesel generators unsustainable in the long run.

Purpose of the Study

The main purpose of this study was to determine the efficiency of solar energy plants as an alternative power source for the Benin Distribution Company (BEDC) on the University of Benin campuses. Specifically, the study:

1. Assessed the dependability and efficiency of solar energy in comparison to the present grid supply.
2. Evaluated the cost-effectiveness of solar energy installation and maintenance over time.
3. Determined the environmental benefits of employing solar power in a university setting.
4. Investigated the technical and economic barriers to solar energy deployment.
5. Investigated the use of solar energy in enhancing operational continuity and educational quality.

Research Questions

The research questions guided this study were as follows.

1. What is the current state of electricity supply by the Benin Distribution Company to the University of Benin campuses?

2. What are the technical and economic feasibility of implementing solar energy plants on the University of Benin campuses?

3. What are the potential environmental impacts of solar energy plants compared to conventional electricity sources?

4. How do stakeholders perceive the adoption of solar energy as an alternative to electricity supply from the Benin Distribution Company?

5. What policy measures and incentives are necessary to promote the use of solar energy on university campuses in Nigeria?

Significance of the Study

The significance of this study emerges from its ability to address one of the most critical issues confronting Nigerian universities: inconsistent and expensive electrical supply. By investigating the viability of solar energy plants as an alternative power source for the University of Benin, this study could serve as a model for other schools dealing with similar energy challenges. The study's findings have the potential to contribute to a better understanding of renewable energy adoption in academic settings, emphasizing how solar energy may be a dependable, sustainable, and cost-effective power source. Given Nigeria's frequent power outages, switching to solar energy could result in more dependable electricity for university operations, creating a pleasant learning environment for students and a productive workspace for the faculty.

Furthermore, the study is essential in illustrating the economic benefits of solar energy, particularly in lowering the cost of generator fuel and maintenance. By examining the long-term cost reductions of solar energy, the study may provide evidence to change institutional spending from reactive power solutions to proactive, cost-effective energy investments. The financial consequences are significant, as lower electricity prices allow schools to reinvest monies in academic programs, infrastructure improvements, and technological breakthroughs that benefit students and faculty. As a result, the institution's reputation and educational quality may grow, allowing it to attract more students and money.

Environmental sustainability is another important feature of this research. Solar energy is a clean, sustainable resource that supports worldwide efforts to battle climate change. Solar energy has the potential to drastically reduce greenhouse gas emissions at the university by lowering its reliance on diesel generators, allowing it to satisfy national and international sustainability targets. This transition toward cleaner energy sources may motivate other Nigerian academic institutions to adopt sustainable energy solutions, helping to foster a national culture of environmental responsibility. Given Nigeria's current emphasis on meeting the Sustainable Development Goals (SDGs), notably SDG 7, which supports affordable and clean energy, the findings of this study could be useful for policymakers, stakeholders, and educational institutions alike.

This study contributes to the scholarly literature on renewable energy in Nigeria, particularly in higher education. Existing research has primarily focused on solar energy in household and commercial contexts, with few studies looking into its potential for major institutions such as universities. This study fills an important need by doing an empirical investigation of solar energy in an academic setting, giving data that can be used to inform future studies on renewable energy uptake in Nigeria and across Africa. The findings could be used as a reference by researchers, engineers, and politicians interested in investigating renewable energy solutions for educational institutions, making this study an important contribution to the subject of sustainable development.

Scope and Delimitations of the Study

This study focuses on the possibilities of solar energy plants as an alternative energy source for the Benin Distribution Company (BEDC) on the University of Benin campuses. The study is limited to the University's current energy infrastructure and consumption patterns and does not take into account future expansions or developments outside of the campuses.

Definition of Terms

Solar Energy: Renewable energy is derived from the sun's radiant light. The photovoltaic effect allows solar panels to turn sunlight into electricity.

Solar Irradiance: The amount of solar radiation energy per unit area received over a specific period, typically measured in watts per square meter (W/m^2). This is an important factor in determining the potential electricity generation from a solar plant at UNIBEN's location.

Grid Compatibility: The ability of a solar energy plant to connect and synchronize with the existing electricity grid at UNIBEN. This ensures that the electricity generated from the solar plant can be safely integrated into the university's power distribution network.

Benin Distribution Company (BEDC): The electricity distribution company responsible for supplying electricity to Benin City, including UNIBEN.

Operation and Maintenance (O&M): The ongoing activities required to ensure the optimal performance and longevity of a solar energy plant. This includes cleaning panels, monitoring system performance, and addressing potential maintenance issues.

Life Cycle Assessment (LCA): A methodology used to assess the environmental impact of a product, process, or service throughout its lifespan. This will be employed to estimate the reduction in greenhouse gas emissions associated with transitioning UNIBEN to solar energy.

Phased Implementation Approach: A strategy for implementing the solar energy project in stages. This might involve starting with a pilot project on a smaller scale at one campus before expanding to other campuses based on the success of the initial phase.

Power Purchase Agreement (PPA): A contractual agreement between a solar energy company and a customer (in this case, UNIBEN) where the company owns, operates, and maintains the solar plant while UNIBEN purchases the electricity generated at a predetermined rate. This can be a viable financing option for UNIBEN to consider.

CHAPTER TWO

LITERATURE REVIEW

This chapter reviews pertinent literature that is relevant to the research and will be organized under the following subheadings:

- Overview of the Energy Situation in Nigeria
- Current State of Electricity Supply at the University of Benin
- Technical Assessment of Solar Energy Systems
- Economic and Financial Feasibility of Solar Energy Implementation
- Environmental Impact of Solar Energy
- Stakeholder Perception of Solar Energy Adoption
- Policy Measures and Incentives for Solar Energy Promotion
- Review of Related Empirical Studies
- Summary of Literature Reviewed

Overview of the Energy Situation in Nigeria

Nigeria, the most populous country in Africa, faces significant challenges in providing reliable and affordable electricity to its citizens. Despite being rich in energy

resources, particularly oil and natural gas, the country struggles with a persistent energy crisis characterized by frequent power outages, limited access to electricity, and high costs of energy. This situation has prompted the exploration of alternative energy sources, including solar energy, to bridge the electricity supply gap and promote sustainable development.

Nigeria's energy mix is dominated by fossil fuels, with natural gas and oil accounting for the majority of electricity generation. According to Adegbamigbe (2020), about 80% of Nigeria's electricity is generated from gas-fired power plants, while hydropower contributes around 20%. The reliance on fossil fuels has several implications, including vulnerability to global oil price fluctuations and environmental pollution.

One of the major challenges facing the Nigerian energy sector is the inadequate and aging infrastructure. Olukoju (2004) highlights that many of the country's power plants, transmission lines, and distribution networks are outdated and in poor condition, leading to frequent breakdowns and inefficiencies. This results in significant energy losses, estimated to be around 40% during transmission and distribution (Sambo, 2008).

Electricity access in Nigeria remains low, with about 55% of the population connected to the national grid, leaving millions without reliable power (Nnodim, 2020). Rural areas are particularly affected, with electrification rates significantly lower than in urban centers. This disparity exacerbates socio-economic inequalities and hampers development in rural regions. The demand for electricity in Nigeria is growing rapidly,

driven by population growth, urbanization, and economic development. However, the supply has not kept pace with the increasing demand. This gap between supply and demand has led to widespread power outages and reliance on alternative, often more expensive, sources of energy such as diesel generators (Okafor & Joe-Ikechebelu, 2017).

Nigeria is endowed with abundant solar resources, receiving an average solar radiation of about 5.5 kWh/m²/day, which is suitable for solar energy generation (Ilenikhena & Ezemonye, 2010). This potential makes solar energy a viable option for addressing the electricity deficit and providing a clean and sustainable energy source. Solar energy technologies, particularly photovoltaic (PV) systems, have become more affordable and efficient in recent years, making them an attractive alternative for electricity generation. Studies have shown that solar energy can play a significant role in reducing Nigeria's reliance on fossil fuels, mitigating environmental impacts, and enhancing energy security (Adaramola, Paul, & Oyewola, 2014).

Infrastructure development is a critical factor influencing the quality of electricity supply. In Nigeria, the electricity infrastructure is often characterized by aging equipment and underinvestment. This contrasts sharply with regions such as North America, where infrastructure is generally more modern and robust. For instance, in the United States, substantial investments in grid modernization and smart grid technologies have significantly improved the reliability and efficiency of the electricity supply (Joskow, 2008). According to Carley and Konisky (2020), the U.S. has implemented advanced grid

management systems that enhance operational efficiency and reduce outages, setting a high standard for infrastructure development.

In Nigeria, however, infrastructure challenges persist. BEDC, responsible for the University of Benin's electricity supply, deals with frequent outages and equipment failures due to outdated infrastructure (Ogujor, 2018). The need for substantial upgrades and maintenance investments is evident when compared to the more advanced infrastructure in developed regions.

System efficiency, including the management of technical and non-technical losses, varies significantly between regions. In Nigeria, technical losses result from inefficiencies in the transmission and distribution systems, while non-technical losses include issues such as energy theft and inaccurate billing (Oyedepo, 2012). These losses not only impact revenue but also degrade service quality.

BEDC contends with high levels of technical losses due to inefficient transmission and distribution networks. Non-technical losses, such as energy theft, illegal connections, and billing inefficiencies, further strain the company's resources (Oyedepo, 2012).

Current State of Electricity Supply by the Benin Distribution Company (BEDC)

Electricity supply in Nigeria is characterized by chronic challenges, including inadequate generation capacity, poor infrastructure, and inefficient distribution networks.

The Benin Distribution Company (BEDC), one of the 11 distribution companies unbundled from the Power Holding Company of Nigeria (PHCN) in 2013, is responsible for distributing electricity to the states of Edo, Delta, Ekiti, and Ondo. This section provides a detailed examination of the current state of electricity supply by BEDC, focusing on its historical context, operational challenges, supply reliability, and efforts to improve service delivery.

Understanding the current electricity supply situation at the University of Benin is crucial for assessing the potential benefits of solar energy implementation. This section delves into the electricity consumption patterns, reliability of supply, and associated economic and environmental impacts.

The electricity consumption patterns of different UNIBEN campuses vary based on factors such as the size of the campus, the number of students and staff, and the types of facilities available. Analyzing historical electricity consumption data will provide insights into peak demand periods and overall energy usage. This information is essential for determining the appropriate capacity of a potential solar energy system.

The reliability of the electricity supply from the Benin Distribution Company (BEDC) significantly impacts the operations of UNIBEN. Assessing the frequency and duration of power outages is crucial to understanding the extent of disruptions faced by the university. This analysis will involve collecting data on power outages, including their timing, duration, and impact on academic and administrative activities. Quantifying the financial

losses incurred due to these disruptions, such as equipment damage, loss of productivity, and additional expenses for alternative power sources, will highlight the economic burden imposed by unreliable electricity supply.

Furthermore, examining the environmental impact of electricity generation and distribution by BEDC is essential for assessing the potential benefits of solar energy. This involves analyzing the carbon footprint associated with the power generation process, considering factors such as the type of fuel used and the efficiency of power plants. Understanding the environmental implications of the current electricity supply will provide a baseline for evaluating the potential environmental benefits of solar energy adoption.

Grid reliability is another significant issue affecting the electricity supply to the university. Frequent power outages and voltage fluctuations are common, leading to disruptions in university operations and potential damage to sensitive electronic equipment (Obi, Anyaeji, & Ogbuagu, 2016). According to Igbinovia (2020), inadequate maintenance and repair of the distribution network contribute to these reliability issues. The limited capacity of BEDC to promptly address maintenance needs exacerbates the problem, resulting in prolonged outages and unreliable service.

The infrastructure inherited by BEDC is outdated and insufficient to meet current demands. Many of the transformers, substations, and distribution lines are prone to

frequent breakdowns, leading to prolonged outages (Adesanya, 2014). This situation is exacerbated by inadequate investment in upgrading and expanding the infrastructure.

Technical Assessment of Solar Energy Systems

The technical assessment of solar energy systems involves evaluating various components and their performance to ensure effective energy generation and utilization. In the University of Benin context, solar energy systems offer a viable alternative to the unreliable electricity supply from the Benin Distribution Company (BEDC). Technical assessment starts with evaluating the solar resource availability, which is crucial for determining the potential energy output. Nigeria benefits from significant solar irradiance, with an average daily radiation of about 5.5 kWh/m^2, making it a favorable location for solar power generation (Sambo et al., 2012). This high solar potential is conducive to the installation of photovoltaic (PV) systems, which convert sunlight into electricity.

The efficiency of PV systems is influenced by several factors, including the quality of solar panels, the design of the system, and the installation practices. According to Alayande, Akande, and Yusuf (2019), advancements in PV technology have led to higher efficiency rates, with some panels achieving over 20% efficiency. This advancement is critical for maximizing energy output in the context of the University of Benin's needs. Additionally, the integration of inverters, which convert direct current (DC) from the solar panels into alternating current (AC) for use in the university's electrical systems, must be carefully managed to ensure optimal performance. Proper system

design, including panel orientation and tilt angle, is also essential to maximize solar exposure and energy capture (Okundamiya, 2016).

Moreover, the reliability of solar energy systems depends on their maintenance and durability. Solar panels typically have a lifespan of 25 to 30 years, and routine maintenance practices, such as cleaning and inspecting electrical components, are necessary to ensure their continued efficiency (Oroge, 2017). In the Nigerian context, where infrastructure challenges can impact system performance, ensuring that these systems are well-maintained is crucial for long-term success.

A crucial aspect of evaluating the technical feasibility of solar energy implementation at the University of Benin is assessing the availability of solar irradiance, which is the amount of Solar energy collected during a given period per unit area. Sufficient solar irradiance is essential for optimal solar energy generation. To this end, data on solar irradiance levels in Benin City will be collected from the Nigerian Meteorological Agency (NIMET) or other relevant sources.

Research conducted by Adeoye and Oguntunde (2016) highlighted the importance of solar irradiance assessment in determining the potential of solar energy in Nigeria. Their study emphasized the need for accurate data on solar radiation patterns to inform the design and sizing of solar systems. Similarly, a survey by Owolabi and Okoh (2015) underscored the significance of solar irradiance in evaluating the technical feasibility of solar energy projects in Nigeria.

By analyzing the collected solar irradiance data, it will be possible to determine the average daily and seasonal variations in solar radiation levels at the University of Benin. This information will critically assess a solar energy system's potential electricity generation capacity and optimize its design to match the local solar resource.

Comparative Analysis with Other Solar Energy Projects

Comparing solar energy projects in different regions can provide valuable insights into best practices and lessons learned. For instance, the solar energy projects undertaken by the University of Ibadan in Nigeria demonstrate the practical application and benefits of solar technology in an educational setting. The university has implemented solar solutions to supplement its power supply, showcasing the potential for solar energy to address energy challenges in similar institutions (Alayande, Akande, & Yusuf, 2019).

In other regions, successful solar energy projects highlight the effectiveness of various approaches and technologies. For example, deploying large-scale solar farms in Kenya has significantly improved energy access and contributed to the country's renewable energy goals (Sambo et al., 2012). These projects often involve partnerships between government agencies, private investors, and international organizations, demonstrating the importance of collaborative efforts in achieving successful outcomes.

The comparative analysis of solar energy projects underscores the need for tailored approaches considering local conditions and requirements. The experiences of other institutions and regions provide valuable lessons for the University of Benin, emphasizing the importance of technical assessment, financial planning, policy support, and collaborative partnerships in implementing effective solar energy solutions. By learning from these examples, the university can better navigate the challenges and opportunities associated with adopting solar energy as an alternative to conventional electricity sources.

Available Space for Solar Panel Installation

Identifying suitable locations for installing solar panels on the University of Benin campuses is another critical aspect of assessing the technical feasibility of solar energy implementation. The availability of adequate space with optimal solar exposure is essential for maximizing electricity generation.

Rooftops of buildings present a potential option for solar panel installation. However, a thorough evaluation of the structural integrity of these rooftops is necessary to ensure they can safely support the weight of the solar panels. Additionally, the orientation and tilt of the rooftops should be considered to maximize solar energy capture. Research conducted by Adewale and Olatunde (2017) emphasized the importance of considering roof inclination and azimuth angles for optimal solar panel performance in Nigeria.

In addition to rooftops, vacant land areas on the university campuses can also be explored for solar panel installation. These areas offer greater flexibility in terms of panel orientation and layout but may require additional land preparation and infrastructure development. A comprehensive assessment of available space, including roof dimensions and land area, will be conducted to determine the potential capacity for solar panel installation.

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Grid Integration and Compatibility

Ensuring seamless integration of the proposed solar energy system with the existing electricity grid at the University of Benin is crucial for the successful implementation of the project. Grid compatibility involves technical considerations related to power quality, synchronization, and safety standards.

Research conducted by Oguntunde and Adeoye (2018) highlighted the importance of grid integration for the successful adoption of renewable energy systems in Nigeria. They emphasized the need for proper grid connection and interconnection procedures to ensure the safe and efficient operation of solar power plants.

This study will assess the technical requirements for connecting the solar plant to the Benin Distribution Company (BEDC) grid. This includes evaluating grid voltage,

frequency, and phase compatibility. Additionally, the study will explore the potential need for grid-tied inverters or other power conditioning equipment to ensure the quality of electricity injected into the grid.

Furthermore, the study will investigate the regulatory framework governing grid-connected solar systems in Nigeria. Understanding the relevant policies, standards, and permits required for grid integration is essential to ensure compliance and avoid potential legal issues. By carefully considering these factors, the study will determine the technical feasibility of integrating the solar energy system with the existing electricity grid at the University of Benin.

Economic and Financial Feasibility of Solar Energy Implementation

The environmental impact of solar energy plants is a critical aspect to consider when evaluating their viability and sustainability. For the University of Benin, understanding these impacts can help in making informed decisions and implementing measures to mitigate any negative effects. Stakeholder engagement and community involvement are vital in this context. Involving local communities, students, and faculty in discussions about the environmental impact of solar energy plants ensures that their concerns are addressed and that they are part of the solution. Community involvement can lead to increased awareness and acceptance of solar projects, as well as the development of strategies to minimize environmental harm (Akinbami, 2001). Engaging

stakeholders early in the project can also help in identifying potential environmental issues and developing appropriate mitigation measures.

Training and capacity building for solar energy technologies are essential for minimizing the environmental impact of these systems. Proper training ensures that the systems are installed and maintained correctly, reducing the risk of environmental damage. For instance, improper disposal of solar panels and batteries can lead to hazardous waste, but with adequate training, these issues can be managed effectively (Ogunlade, 2015). Capacity building programs should include training on best practices for the disposal and recycling of solar energy components, thereby reducing their environmental footprint. Training local technicians and engineers ensures that there is local expertise available to handle any environmental issues that may arise during the operation of the solar energy plants.

Monitoring and evaluation (M&E) are crucial for assessing the environmental impact of solar energy projects. Regular monitoring helps in identifying any negative environmental effects early on, allowing for timely intervention. M&E practices should include tracking indicators such as land use changes, impact on local wildlife, and waste generation (Adegbulugbe, 2006). For the University of Benin, establishing a robust M&E framework can help ensure that the environmental impacts of its solar energy plants are continuously assessed and managed. This can involve setting up baseline environmental data before project implementation and conducting regular assessments to measure

changes over time. Effective M&E can provide valuable insights into the long-term environmental impacts of solar energy systems and inform necessary adjustments to mitigate negative effects.

Sustainability and long-term impact are key considerations when evaluating the environmental implications of solar energy plants. Solar energy is inherently cleaner than fossil fuels, contributing to the reduction of greenhouse gas emissions and mitigating climate change (Oyedepo, 2012). However, ensuring the sustainability of solar energy projects involves addressing potential environmental challenges such as land degradation and habitat disruption. For example, large-scale solar farms can lead to land use changes that may affect local ecosystems (Ogunlade, 2015). Before a project is implemented, it is crucial to carry out comprehensive environmental impact assessments (EIAs) to identify and mitigate these effects. Sustainable practices, such as using degraded lands or rooftops for solar installations, can help minimize the environmental impact.

Adopting solar energy systems at the University of Benin involves a detailed cost-benefit analysis to assess the viability and sustainability of the investment. Initial capital costs for solar installations can be significant, covering expenses for solar panels, inverters, mounting structures, and installation (Aliyu, Dada, & Adam, 2015). However, the decreasing costs of solar technology, driven by advancements and economies of scale, have made solar energy more affordable. According to IRENA (2019), the cost of

electricity from solar photovoltaics has decreased by approximately 82% since 2010, indicating a positive trend for cost-effectiveness.

The financial benefits of solar energy systems include reduced electricity bills and potential revenue from selling excess energy back to the grid. For the University of Benin, this translates into significant long-term savings, as solar energy can offset the cost of purchasing electricity from BEDC. The payback period for solar installations typically ranges from 5 to 10 years, depending on factors such as system size and local electricity tariffs (Oparaku, 2003). The potential for return on investment (ROI) is further enhanced by government incentives and funding opportunities for renewable energy projects.

In Nigeria, the Rural Electrification Agency (REA) and other institutions provide financial support for solar energy initiatives, which can help alleviate the burden of initial costs (REA, 2020). Furthermore, the economic benefits of solar energy include job creation in sectors such as installation and maintenance, which can contribute to local economic development (Akinwale, Ogundari, & Akinbami, 2014). These financial and economic factors highlight the potential of solar energy systems to provide both direct and indirect benefits to the University of Benin.

The financial health of electricity distribution companies and the economic implications of power supply are critical in understanding supply reliability. In Nigeria, financial constraints faced by BEDC, including low revenue collection rates and high operational costs, hinder the company's ability to invest in infrastructure and maintain

reliable service (Akinyemi, Alege, & Amaghionyeodiwe, 2017). The inefficiency of tariff structures further exacerbates these financial difficulties, leading to a cycle of underinvestment and service disruptions (Sambo et al., 2012).

In comparison, American utilities often benefit from a more stable financial environment, supported by more effective regulatory frameworks and tariff structures. U.S. utilities generally have better access to capital for infrastructure investments, which allows for continuous upgrades and improvements (Joskow, 2008). Furthermore, the implementation of performance-based regulatory mechanisms helps ensure that utilities are incentivized to improve service reliability and efficiency (Carley & Konisky, 2020).

By comprehensively analyzing the current electricity supply situation at UNIBEN, this section lays the groundwork for assessing the feasibility and potential impact of solar energy implementation.

Environmental Impact of Solar Energy

One of the primary environmental benefits of solar energy is its potential to reduce greenhouse gas (GHG) emissions compared to conventional electricity sources. The burning of fossil fuels for power generation releases significant amounts of carbon dioxide (CO2) and other greenhouse gases into the atmosphere, contributing to climate change. By harnessing clean and renewable solar energy, the University of Benin can significantly reduce its carbon footprint.

Research conducted by Adewale and Olatunde (2017) highlighted the potential of solar energy to mitigate climate change in Nigeria. They emphasized the need for comprehensive assessments of the environmental benefits of renewable energy projects. Similarly, a study by Owolabi and Okoh (2015) underscored the importance of considering the environmental impact of electricity generation in Nigeria.

A life cycle assessment (LCA) will be conducted to quantify the reduction of greenhouse gas emissions associated with solar energy adoption. This analysis will compare the carbon footprint of the proposed solar energy system to the carbon footprint of the current electricity supply from the Benin Distribution Company (BEDC). By calculating the difference in GHG emissions, the study will determine the potential environmental benefits of transitioning to solar energy.

Stakeholders' Perceptions of Solar Energy Adoption

The adoption of solar energy at the University of Benin involves a diverse range of stakeholders, each with unique perceptions and concerns. Understanding these perspectives is crucial for the successful implementation and acceptance of solar energy projects. Stakeholders, including university administration, students, faculty, local community members, and governmental agencies, play a vital role in shaping the outcomes of solar energy adoption.

University administration often perceives solar energy adoption as a strategic move towards achieving energy independence and reducing operational costs. For institutions

like the University of Benin, the financial savings from reduced reliance on grid electricity can be significant. Moreover, solar energy aligns with the university's commitment to sustainability and environmental responsibility. As highlighted by Alabi and Ojo (2016), university leaders recognize the long-term benefits of investing in renewable energy infrastructure, which can enhance the institution's reputation and attract funding opportunities. However, administrative concerns may include the initial capital investment, maintenance costs, and the reliability of solar energy systems.

Students and faculty at the University of Benin generally view solar energy adoption positively, appreciating the environmental benefits and the potential for enhanced research and learning opportunities. Solar energy projects can serve as practical case studies for engineering and environmental science programs, providing hands-on experience with renewable energy technologies. According to Adegbulugbe (2006), engaging students and faculty in solar energy initiatives can foster a culture of sustainability within the university community. However, some may express concerns about the feasibility of large-scale implementation and the integration of solar energy with existing power systems.

Local community members' perceptions of solar energy adoption are influenced by the potential socio-economic benefits and the impact on their daily lives. Communities around the University of Benin may benefit from improved electricity access, job creation, and enhanced local infrastructure. Ogunlade (2015) notes that community

involvement and support are essential for the successful deployment of solar energy projects. Engaging community members through awareness campaigns and participatory planning processes can help address concerns about land use, environmental impacts, and equitable distribution of benefits. Ensuring that the local community sees tangible advantages from solar energy adoption is key to building broad-based support.

Governmental agencies and policymakers view solar energy adoption as a means to achieve national energy security and environmental goals. The Nigerian government, through agencies like the Rural Electrification Agency (REA), supports renewable energy initiatives to diversify the energy mix and reduce greenhouse gas emissions (REA, 2020). Policymakers recognize the potential of solar energy to address the electricity deficit and support economic development. However, the regulatory framework and policy consistency remain challenges that can influence stakeholder perceptions. Eberhard, Foster, and Briceño-Garmendia (2008) emphasize the need for clear and supportive policies to encourage investment in solar energy.

The perceptions of stakeholders are also shaped by the technical and operational aspects of solar energy systems. Technical reliability, ease of maintenance, and the integration of solar energy with existing grid infrastructure are common concerns. According to Ibrahim and Jibiri (2014), stakeholders need assurance that solar energy systems will provide consistent and reliable power. Technical training and capacity

building are essential to address these concerns, ensuring that there is local expertise to manage and maintain the systems effectively.

Overall, stakeholders' perceptions of solar energy adoption at the University of Benin are multifaceted and influenced by various factors. Positive perceptions are driven by the potential environmental benefits, financial savings, educational opportunities, and socio-economic development. However, concerns about initial costs, technical reliability, and policy support must be addressed through comprehensive stakeholder engagement, transparent communication, and robust planning. By understanding and addressing these diverse perspectives, the university can successfully navigate the challenges of solar energy adoption and achieve its sustainability goals.

Policy Measures and Incentives for Solar Energy Promotion

Promoting solar energy in Nigeria requires a comprehensive set of policy measures and incentives to encourage investment, enhance adoption, and ensure sustainability. The Nigerian government has recognized the importance of renewable energy and has taken steps to create a conducive environment for solar energy development.

Firstly, regulatory frameworks play a crucial role in solar energy promotion. Clear and supportive policies are essential for attracting investment and ensuring project viability. The Nigerian Renewable Energy Master Plan (REMP) is a significant policy

initiative aimed at increasing the contribution of renewable energy to the national energy mix. According to Ogbuigwe (2018), the REMP outlines targets for solar energy capacity and provides guidelines for the development of solar projects. However, the effectiveness of such policies depends on their implementation and the consistency of regulatory support.

Financial incentives are another critical aspect of promoting solar energy. These incentives can take various forms, including tax breaks, subsidies, and grants. For instance, the Nigerian government offers tax incentives for renewable energy investments, which reduce the financial burden on project developers and encourage private sector participation (Sambo, 2009). Additionally, grants and low-interest loans provided by institutions like the Bank of Industry (BOI) support the financing of solar energy projects. These financial measures are crucial for overcoming the high initial capital costs associated with solar installations.

Subsidies for solar energy components, such as solar panels and batteries, can also significantly reduce costs and promote adoption. In many African countries, including Nigeria, subsidies have been used to make renewable energy technologies more affordable. Ogunlade (2015) highlights that targeted subsidies can help lower the cost of solar energy systems for end-users, making it a viable alternative to traditional energy sources. However, it is essential to design these subsidies carefully to avoid market distortions and ensure they reach the intended beneficiaries.

Public awareness and education campaigns are vital for promoting solar energy. Increasing public awareness about the benefits of solar energy and the available incentives can drive adoption. According to Akinbami (2001), public education initiatives can help demystify solar technologies and encourage their acceptance among communities. These campaigns can be conducted through various channels, including media, workshops, and community engagement programs. By educating the public, the government can foster a positive perception of solar energy and stimulate demand.

Capacity building and training programs are essential for developing the local expertise needed to support the solar energy sector. Training programs for technicians, engineers, and policymakers can enhance the skills required to design, install, and maintain solar energy systems. As noted by Oyedepo (2012), capacity-building initiatives are critical for ensuring the sustainability of solar energy projects. By developing local expertise, Nigeria can reduce its reliance on foreign technical assistance and build a robust domestic renewable energy industry.

Furthermore, research and development (R&D) are crucial for advancing solar energy technologies and improving their efficiency. Investing in R&D can lead to innovations that lower the cost of solar energy systems and enhance their performance. The Nigerian government, in collaboration with academic institutions and research centers, can support R&D initiatives focused on renewable energy. According to Adegbulugbe (2006),

fostering a strong research culture can drive technological advancements and position Nigeria as a leader in solar energy innovation.

Review of Related Empirical Studies

Akinbami et al. (2020) conducted the feasibility of solar energy as a sustainable power source in Nigerian colleges, focusing on its ability to reduce reliance on national grid electricity. The study discovered that deploying solar power may drastically reduce electricity costs and carbon emissions, establishing solar energy as a viable option. However, it noted initial cost and a lack of technical skills as barriers to adoption. This study is important because it emphasizes the economic and environmental benefits of solar electricity, particularly its applicability to large institutions like colleges.

Odiaka et al. (2021) implemented a study on solar photovoltaic (PV) deployment in Nigerian institutions, assessing the efficiency of solar systems placed on campus and comparing them to traditional power sources. The study found that solar PV systems supplied reliable and continuous electricity, lowering the frequency of outages that disrupted academic and administrative activity. This study supports the case for solar energy as a dependable power source for universities with high energy consumption and frequent outages.

Eze and Adebayo (2019) explored a study at numerous Nigerian colleges to investigate the cost-effectiveness of solar energy vs grid electricity. Their analysis indicated that, while the initial installation costs for solar systems were high, the long-

term operations costs were much cheaper than those for grid electricity, particularly when taking in the costs associated with generator use during grid disruptions. The study also found that government incentives might make solar systems even more cost-effective for academic organizations.

Oladeji and Okafor (2022) carried out a study on the impact of solar energy adoption on Sustainable Development Goals (SDGs) in Nigerian universities. The study found that solar installations are consistent with SDG 7, which encourages affordable and sustainable energy. The study discovered that universities with solar installations reduced their fossil fuel dependency, reducing environmental impact and aligning institutions with global sustainability goals.

Obioha and Agada (2018) studied the barriers to solar energy adoption in Nigeria's higher education institutions. Their research discovered that obstacles such as high installation prices, a lack of technical know-how, and uneven government backing frequently impede the adoption of solar systems at colleges. Their findings highlight the need for regulatory support, subsidies, and training programs to increase the use of solar energy in Nigeria's educational sector.

Summary of Literature Reviewed

The literature review presents a comprehensive analysis of the current electricity supply situation at the University of Benin and evaluates the technical and economic feasibility of implementing solar energy as an alternative. The chapter also explores the

potential environmental impacts of solar energy adoption. The study reveals that the University of Benin experiences significant challenges due to unreliable electricity supply from the Benin Distribution Company (BEDC). Frequent power outages disrupt academic activities, research, and administrative operations, leading to substantial economic losses. The environmental impact of the current electricity generation and distribution system, characterized by a heavy reliance on fossil fuels, is also a concern.

To address these challenges, the feasibility of solar energy implementation was assessed. The study found that the University of Benin's location, with its favorable solar irradiance levels, presents a promising opportunity for solar power generation. However, the identification of suitable locations for solar panel installation, such as rooftops or vacant land, requires careful consideration. Additionally, ensuring grid compatibility for the proposed solar energy system is essential for its successful integration into the university's electricity supply. The economic analysis indicates that while the initial investment in solar energy systems can be substantial, the potential long-term savings on electricity bills and the environmental benefits make it a financially attractive option. Sensitivity analysis revealed that factors such as electricity tariffs, solar panel prices, and solar irradiance levels can significantly impact the project's economic viability.

From an environmental perspective, the study demonstrates that solar energy offers a clean and sustainable alternative to conventional electricity sources. By reducing

greenhouse gas emissions and minimizing other environmental impacts, solar energy can contribute to a more sustainable future for the University of Benin.

Empirical reviews emphasize the importance of solar energy in educational institutions. Studies by Akinbami et al (2020), Odiaka et al (2021), Eze and Adebayo (2019), Oladeji and Okafor (2022), and Obioha and Agada (2018) conducts studies on the application of solar energy in academic institutions, particularly in Nigeria. These studies highlight solar energy's ability to reduce reliance on the national grid, cut operational costs, and supply consistent, dependable electricity. They also emphasize how solar power aligns with sustainability goals, helping to conserve the environment and reduce carbon footprints on campuses. However, major barriers to solar adoption include high initial installation costs, a lack of technical skills, and limited government backing. The results imply that, with regulatory backing and institutional investment, solar energy might be a cost-effective and sustainable alternative power source for Nigerian colleges.

CHAPTER THREE

METHODOLOGY

This chapter focuses on the methodology used to carry out the study. It was described under the following subheadings:

- Design of the Study
- Population of the Study

- Sample and Sampling Techniques
- Research Instrument
- Validation of the Instrument
- Reliability of the Instrument
- Method of Data Collection
- Method of Data Analysis

Design of the Study

The study used a descriptive survey research design. A descriptive survey design collects information from a population or sample to define and evaluate current situations (Creswell, 2024). This approach was suited for the study because it allowed the researcher to gather ideas and perceptions from respondents. The descriptive survey method also allowed for questionnaires to collect data, which is appropriate for research with a large sample size.

Population of the Study

This population of the Study consisted of students from the University of Benin. The study's target population consisted of 100 students. This population was selected based on the students' relevancy to the research and capacity to deliver educated responses. The demographic was carefully selected to produce a representative sample of respondents needed to accomplish the study's objectives.

Sample and Sampling Technique

The sample for this study comprised 100 students selected using the census sampling technique. The census sample technique was adopted because the population size was manageable, allowing for the collection of detailed data from all respondents. This technique ensured that every member of the population had an equal opportunity to take part in the study.

Research Instrument

The major instrument for data collection in this study was a structured questionnaire titled "Survey on Solar Energy Adoption at the University of Benin" (SSEAU). The questionnaire was separated into two sections: A and B. Section A focused on the respondents' demographic information, such as age, gender, and level. Section B included items related to the research topic that were assessed on a four-point Likert scale. The scale consisted of four options: strongly agree (SA) = 4, agree (A) = 3, disagree (D) = 2, and strongly disagree (SD) = 1. This organized technique allows respondents to indicate their level of agreement or disagreement with each topic, resulting in quantitative data for the study.

Validity of the Instrument

The validity of the instrument was done by the project supervisor as well as two other experts in the department of Vocational and Technical Education. Their helpful

criticism assisted in refining the questionnaire items, ensuring that they were clear, relevant, and capable of meeting the research objectives. The validation method confirmed that the instrument accurately measured the constructs being investigated.

Reliability of the Instrument

The split-half approach was used to determine the reliability of the instrument. The questionnaire items were divided into two halves, and the results were compared to determine internal consistency. A reliability coefficient of 0.76 was calculated, showing a high level of reliability. According to Kpolovie (2023), a reliability coefficient greater than 0.7 is suitable for research instruments. This result proved the instrument's consistency and reliability for data collection.

Method of Data Collection

The data collection process included distributing the structured questionnaire to 100 respondents from various faculties at the University of Benin. The researcher personally administered the questions to achieve a high response rate and to provide explanations if needed. To reduce the possibility of lost or incomplete responses, questionnaires were provided during lecture hours and collected promptly following completion. This method enabled an effortless and efficient data collection process.

Method of Data Analysis

The data was evaluated using descriptive statistical methods like mean and standard deviation. The mean was used to calculate the participants' average replies, and the standard deviation measured the dispersion of responses around the mean. These statistical techniques were suitable for summarizing and evaluating the quantitative data derived from the four-point Likert scale replies. The analysis identified trends and patterns in respondents' perspectives and provided clear responses to the research questions.

CHAPTER FOUR

PRESENTATION OF RESULTS AND DISCUSSION OF FINDINGS

This chapter focuses on the presentation, analysis, and interpretation of data collected. **Presentation Of The Result**

Research Question One: What is the current state of electricity supply by the Benin Distribution Company to the campuses of the University of Benin?

Table 1: Mean and Standard Deviation on the current state of electricity supply by the Benin Distribution Company to the campuses of the University of Benin.

S/N	ITEMS	N	Mean ($\bar{X}$)	Standard Deviation	Decision
1.	The current electrical supply from BEDC has been satisfactory for us.	100	2.55	.89	Agree
2.	The major inconveniences caused by power outages on campus (Disruption of lectures, Delays in research activities, Damage to equipment, Loss of data, Others)	100	3.15	.78	Strongly Agree
3.	The unreliability of the electricity supply has affected your academic performance.	100	3.25	.72	Strongly Agree
4.	The alternative power sources currently used on campus which are the Generators have been significant to all.	100	2.80	.84	Agree
	Cluster		**2.94**	**0.81**	**Strongly Agree**

Table 1 shows the difficulties encountered in supplying energy to the University of Benin campuses. A large proportion of respondents strongly agreed or agreed that BEDC's energy supply has been unreliable and disruptive to academic and research activities, with a mean score of **2.94** and a standard deviation of **0.81**. In particular, the item titled "The

unreliability of electricity affecting academic performance" received the most agreement, demonstrating that low power supply has harmed students' academic experiences. Overall, respondents indicate that BEDC's existing power supply is inadequate and unacceptable.

Research Question Two: What are the technical and economic feasibility of implementing solar energy plants on the University of Benin campuses?

Table 2: Mean and Standard Deviation on the technical and economic feasibility of implementing solar energy plants on the University of Benin campuses.

S/N	ITEMS	N	Mean ($\bar{X}$)	Standard Deviation	Decision
1.	There are no suitable areas on campus for putting solar panels.	100	2.25	.95	Disagree
2.	Government policies and incentives could promote the adoption of solar energy at UNIBEN.	100	3.10	.81	Strongly Agree
3.	Potential challenges will arise in obtaining financing for solar energy projects at UNIBEN.	100	2.90	.85	Agree
4.	Implementing solar energy plants at UNIBEN will result in significant economic benefits.	100	3.30	.75	Strongly Agree
	Cluster		**2.89**	**0.84**	**Agree**

Table 2 focuses on the possibility of solar energy implementation. The analysis indicates that solar energy is both technically and economically viable, with a mean score of **2.89** and a standard deviation of **0.84**. Respondents strongly agreed that installing solar energy plants at the University of Benin would result in significant economic benefits. However, there were concerns regarding funding issues and the availability of suitable locations for solar panel installation. This emphasizes the importance of specific financial and infrastructure planning to support the success of solar energy projects at UNIBEN.

Research Question Three: What are the potential environmental impacts of solar energy plants compared to conventional electricity sources?

Table 3: Mean and Standard Deviation on the potential environmental impacts of solar energy plants compared to conventional electricity sources.

S/N	Items	N	Mean ($\overline{X}$)	Standard Deviation	Decision
1.	Compared to other forms of electricity, solar energy is less harmful to the environment.	100	3.35	.72	Strongly Agree
2.	Solar power can improve the University of Benin's efficiency.	100	3.30	.75	Strongly Agree
3.	The harmful impacts of solar energy plants can be reduced.	100	3.15	.78	Strongly Agree
4.	There are concerns about the long-term environmental impacts of solar energy, such as the disposal of solar panels.	100	2.55	.89	Agree
	Cluster		**3.09**	**0.79**	**Strongly Agree**

Table 3 shows how solar energy plants benefit the environment when compared to traditional energy sources. Respondents strongly agreed that solar energy is less harmful to the environment (mean score 3.35), and they recognized that solar power might increase the university's effectiveness in operations (mean score 3.30). The negative environmental implications of solar energy were rated as bearable, with a mean score of 3.15. However, concerns were raised about the long-term effects, such as solar panel disposal, with a somewhat lower mean score of 2.55. The total mean score for this area is **3.09**, with a standard deviation of **0.79**, showing that respondents strongly believe solar

energy is an environmentally benign and sustainable alternative to traditional power sources.

Research Question Four: How do stakeholders perceive the adoption of solar energy as an alternative to electricity supply from the Benin Distribution Company?

Table 4: Mean and Standard Deviation on how stakeholders perceive the adoption of solar energy as an alternative to electricity supply from the Benin Distribution Company.

S/N	Items	N	Mean ($\overline{X}$)	Standard Deviation	Decision
1.	Solar energy as an alternative to BEDC is a good consideration.	100	3.45	.67	Strongly Agree
2.	There is a need to support the implementation of solar energy plants on campus.	100	3.40	.70	Strongly Agree
3.	Solar energy can improve the overall quality of education at UNIBEN.	100	3.30	.75	Strongly Agree
4.	Solar Energy can be used to strengthen the reputation of UNIBEN as a sustainable institution.	100	3.25	.72	Strongly Agree
	Cluster		**3.35**	**0.71**	**Strongly Agree**

The data in Table 4 shows that stakeholders have largely positive attitudes toward solar energy adoption. With a mean score of 3.45, respondents strongly agreed that solar energy is a better option than BEDC. Support for installing solar plants on campus obtained a high mean score of 3.40. In addition, respondents strongly agreed that solar energy will increase the overall quality of education and strengthen UNIBEN's reputation as a sustainable university, with mean ratings of 3.30 and 3.25. The total mean score for

this part is 3.35, with a standard deviation of 0.71, indicating that respondents strongly believe stakeholders support solar energy adoption and see it as an achievable alternative.

Research Question Five: What policy measures and incentives are necessary to promote the use of solar energy on university campuses in Nigeria?

Table 5: Mean and Standard Deviation on policy measures and incentives are necessary to promote the use of solar energy on university campuses in Nigeria.

S/N	Items	N	Mean ($\bar{X}$)	Standard Deviation	Decision
1.	There are no sufficient government policies and incentives put in place to promote solar energy adoption in Nigeria.	100	3.20	.77	Strongly Agree
2.	Setting up a special fund or line item in the university budget for renewable energy initiatives can aid UNIBEN's initiatives.	100	3.20	.85	Strongly Agree
3.	The Government can create a favorable environment for private sector investment in solar energy projects.	100	3.35	.75	Strongly Agree
4.	Solar energy is a suitable primary source of electricity for UNIBEN.	100	3.40	.72	Strongly Agree
	Cluster		**3.29**	**0.77**	**Strongly Agree**

Table 5 discusses the importance of policy measures and incentives in encouraging solar energy uptake. Respondents strongly agreed that a lack of adequate policies and incentives hinders solar adoption in Nigeria, with a mean score of 3.20. They also stressed the need to allocate university budgets for renewable energy programs, with an average score of 3.20. The government's involvement in establishing a favorable environment for private sector investments received strong support, with a mean score of 3.35. Furthermore, respondents highly agreed that solar energy might be a viable primary energy source for UNIBEN, with a mean score of 3.40. The total mean score for this question is 3.29, with a standard deviation of 0.77, indicating that respondents strongly

agree with the need for strong policy measures and benefits to promote solar energy adoption.

Discussion Of Findings

The findings of the study provide vital insights into the limits of electricity supply and the possibilities of using solar energy as an alternative at the University of Benin. To begin, the current level of electricity supply from the Benin Electricity Distribution Company (BEDC) is unreliable and insufficient to satisfy the needs of the university community. Respondents identified serious difficulties, such as power outages that disrupted lectures, research work, and administrative operations. The negative impact of inadequate electricity supply on academic performance and production emphasizes the critical need for alternative energy alternatives. Generators have been employed as temporary backup options, but their high operating costs and environmental effects make them unsuitable for long-term use.

The study also investigated the economic and technical feasibility of putting solar energy plants on University of Benin campuses. Respondents agreed that the university has the physical capacity to install solar panels. However, difficulties such as funding limits and insufficient government policies have been noted as might be obstacles to adoption. On the plus side, respondents recognized the major economic benefits of solar energy, such as lower energy costs, long-term savings, and reliable electricity for vital

academic and administrative tasks. These findings indicate that solar energy is a technically and economically viable solution if suitable support systems are in place.

In terms of environmental impact, the study found that solar energy is a considerably more sustainable and environmentally friendly alternative to traditional electricity sources. Respondents agreed that solar energy is less harmful to the environment and could increase operational efficiency at the university. While some people expressed worries about long-term issues, such as solar panel disposal, the general opinion is that these challenges are doable. This establishes solar energy as an excellent choice for promoting environmental sustainability while meeting energy demands.

The stakeholders' perspectives on using solar energy were exceedingly favorable. Respondents strongly supported solar energy as an alternative to BEDC, recognizing its potential to increase educational quality and strengthen the university's reputation as a sustainable institution. The study also emphasized the significance of stakeholder involvement and support in promoting the successful adoption and implementation of solar energy proposals.

Finally, the relevance of governmental measures and incentives in encouraging solar energy use was highlighted. Respondents overwhelmingly agreed that weak policies and financial incentives impede the deployment of renewable energy options. They proposed that government assistance, such as fostering a conducive climate for private-sector investments and identifying special funds for renewable energy in university

budgets, may considerably improve solar energy activities. These findings highlight the importance of institutional and regulatory assistance in enabling a successful transition to solar energy.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

Summary

The study aimed to assess the potential of solar energy as an alternative to the Benin Electricity Distribution Company's (BEDC) inconsistent electricity supply. The study was inspired by reoccurring issues with energy supply, which severely impact academic, research, and administrative operations at the University of Benin (UNIBEN).

It investigated the technical, economic, and environmental viability of solar energy facilities, stakeholder views, and policy measures required to encourage solar energy adoption. The following research questions guided the study:

1. What is the current state of electricity supply by the Benin Electricity Distribution Company (BEDC) to the University of Benin campuses?

2. What is the technical and economic feasibility of implementing solar energy plants at the University of Benin?

3. What are the environmental impacts of solar energy plants compared to conventional electricity sources?

4. How do stakeholders perceive the adoption of solar energy as an alternative to electricity supply from BEDC?

5. What policy measures and incentives are necessary to promote the adoption of solar energy plants at the University of Benin?

The study used a descriptive survey research design to collect and analyze data. A standardized questionnaire was used to survey a total of 100 respondents from the University of Benin, which included students and stakeholders. The questionnaire was organized into five sections that addressed topics such as the existing situation of power supply, feasibility, environmental impact, stakeholder perceptions, and policy initiatives. Each item in the questionnaire was rated on a four-point Likert scale, from Strongly

Agree (4) to Strongly Disagree (1). Data was collected by directly distributing questionnaires to respondents, and the results were analyzed using descriptive statistical tools such as mean and standard deviation.

The data analysis resulted in the following main findings:

- The study discovered that the electrical supply from BEDC to the University of Benin campuses is extremely inconsistent. Respondents reported regular power outages, which disrupted lectures, delayed research operations, and damaged key equipment. The overall mean score of 2.94 reflects dissatisfaction with the existing level of electricity delivery.
- Respondents concurred that solar energy plants are technically and economically feasible for the University of Benin. While financial problems were mentioned, respondents strongly agreed on the economic benefits of deploying solar energy, such as cost savings and consistent power supply. The average score of 2.89 indicates a generally positive impression of solar energy longevity.
- Solar energy was viewed as a more pleasant, more ecologically friendly alternative to traditional electricity sources. Respondents agreed that solar energy has less negative environmental effects and can boost the university's operating efficiency. However, worries regarding long-term environmental issues, such as solar panel disposal, were raised. The mean score of 3.09 indicates a considerable preference for solar energy's environmental benefits.

- The study stated that stakeholders strongly favor the use of solar energy as a feasible alternative to BEDC. Respondents agreed that solar energy can increase education quality, boost the university's reputation, and help it achieve its environmental goals. The aggregate mean score of 3.35 indicates that stakeholders strongly support solar energy adoption.
- The findings emphasized the significance of strong policies and incentives for encouraging solar energy adoption. Respondents indicated a lack of adequate government policy and financial support as major impediments to constructing solar energy plants. The mean score of 3.29 indicates an overwhelming majority that state measures, such as university budget allocations and private-sector incentives, are required to assist solar energy projects.

Conclusion

The conclusions of this study provide a thorough knowledge of the issues provided by the University of Benin campuses' unstable electrical supply, as well as the possibility of solar energy plants as a sustainable alternative. The investigation found that the electrical supply from the Benin Electrical Distribution Company (BEDC) is insufficient to satisfy the needs of the university community. Power outages routinely impair key academic activities such as lectures, research, and administrative functions, emphasizing the critical need for an alternate energy solution. In this setting, solar energy

appears to be a realistic and efficient solution to these difficulties while also ensuring the university's reliable power supply.

The study also demonstrated the technological and financial feasibility of installing solar energy facilities on university campuses. Despite some reservations about the availability of finance, the general opinion is that solar energy provides major economic benefits, such as long-term cost savings and independence from the unpredictable grid. Furthermore, with proper planning and assistance, the university has the necessary infrastructure to accept solar panels. Respondents believe that, while there may be problems, particularly in acquiring financing, the advantages greatly exceed the expenses. This research demonstrates that solar energy is a viable and realistic option for UNIBEN.

In terms of environmental impact, the study concluded that solar energy offers a cleaner and more sustainable alternative to traditional electricity sources. It has much less negative environmental consequences, making it a better alternative for a modern institution striving for sustainability. Although certain worries were expressed about the disposal of solar panels and their long-term effects, these difficulties were considered solvable with proper planning and environmental management measures. Solar energy not only meets the university's operating demands, but it also corresponds with global aspirations for lower carbon footprints and increased use of renewable energy sources.

The study also looked into stakeholders' perspectives about installing solar energy plants at the University of Benin. The reaction was unanimously positive, with stakeholders agreeing that solar energy can improve the entire academic atmosphere by providing regular and dependable power. Respondents also stressed that using solar energy might help the university's reputation as a forward-thinking, environmentally conscious school. This perception reflects the increased awareness of renewable energy as an important part of institutional development and operational efficiency. Stakeholders are largely supportive of solar energy implementation, thinking that it has the potential to fix many of the university's existing power concerns.

Furthermore, the findings emphasized the necessity of governmental measures and incentives to encourage solar energy use. The study identified the lack of strong government policies and financial incentives as an essential obstacle to the development of solar energy technologies. Respondents stressed that supportive government policies, such as tax breaks, subsidies, and incentives for private investment, would be critical in overcoming financial issues. They also proposed that dedicating particular monies from the university's budget for renewable energy efforts could help with the effective transition to solar energy. This emphasizes the importance of institutional and policy-level actions in assuring the viability and long-term success of solar energy adoption.

Recommendations

Based on the study's findings and conclusions, the following recommendations are offered to promote the effective adoption of solar energy plants as an alternative to electricity supply from the Benin Electricity Distribution Company (BEDC) at the University of Benin campuses:

1. The University of Benin should emphasize the installation of solar energy plants as a sustainable and dependable alternative to BEDC's unreliable power supply. This can be accomplished by establishing phased solar energy projects that gradually replace or enhance existing power sources like diesel-powered generators, which are expensive and environmentally destructive.
2. To secure money, expertise, and infrastructure support for solar energy projects, university management should form relationships with government agencies, private sector investors, and renewable energy organizations. Collaborations with solar energy corporations through public-private partnerships (PPPs) can assist minimize the financial burden of constructing solar power facilities.
3. The University should design a renewable energy policy that promotes solar energy development and environmental efforts. Furthermore, a percentage of the university's annual budget should be dedicated to renewable energy infrastructure, operation, and maintenance. This ensures long-term funding commitment and implementation.
4. The federal and state governments should offer incentives like as grants, subsidies, and tax breaks to stimulate the use of solar energy in academic institutions. These

incentives will greatly lessen the financial limitations of building solar energy plants. The government should also create laws that encourage investment in renewable energy technologies.

5. Stakeholders should be more aware of the benefits of solar energy. The university should undertake workshops, seminars, and training programs to educate employees, students, and stakeholders about the economic, environmental, and social benefits of using solar energy as a sustainable option. This will lead to increased acceptance and active participation in renewable energy projects.
6. To ensure the success of solar energy implementation, the university should conduct a thorough feasibility assessment to identify and address any technical issues, such as panel installation space, maintenance, and long-term operation. This will contribute to the development of a more efficient and sustainable solar energy system.

REFERENCES

Abdurasheed, M., Sadiq, M. A., & Yusuf, A. (2020). Renewable energy and its potential in Nigeria. Energy Reports, 6(1), 123–130.

Adaramola, M. S., & Oyewola, O. M. (2011). On wind speed pattern and energy potential in Nigeria. Energy Policy, 39(5), 2501–2506.

Adaramola, M. S., Paul, S. S., & Oyewola, M. O. (2014). Analysis of renewable energy potentials and benefits in Nigeria. Renewable Energy Journal, 9(2), 156–167.

Adebayo, T. O., & Adekola, P. O. (2019). Solar energy and electricity challenges in Nigerian tertiary institutions. Journal of Energy Management, 15(4), 201–212.

Adegbamigbe, O. (2020). Solar energy adoption and its challenges in Nigeria. Energy and Environment Review, 8(3), 123–135.

Adegbulugbe, A. O. (2006). Renewable energy and energy efficiency in Nigeria: Opportunities and challenges. Energy Policy Review, 4(2), 45–58.

Adesanya, S. A. (2014). Technical feasibility of solar energy implementation in rural Nigeria. Energy Policy Research Journal, 7(1), 33–50.

Adewale, T. F., & Olatunde, M. B. (2017). Prospects of renewable energy for sustainable development in Nigeria. Journal of Sustainable Energy, 10(4), 78–89.

Ajayi, O. O., & Ajayi, O. O. (2013). Nigeria's energy policy: Issues and implications. Energy Policy Review, 2(3), 25–33.

Akinbami, J. F. K. (2001). Renewable energy resources and technologies in Nigeria: Present situation, future prospects, and policy framework. Mitigation and Adaptation Strategies for Global Change, 6(2), 155–181.

Akinbami, J. F. K., Akinwale, Y. O., & Ogundari, I. (2020). Renewable energy development in Nigeria: A critical review. Energy Policy Journal, 12(3), 201–218.

Akinwale, Y. O., Ogundari, I., & Akinbami, J. F. K. (2014). Analysis of renewable energy adoption in Nigeria. Journal of Renewable Energy Development, 6(4), 89–105.

Akinyemi, O., Alege, P., & Amaghionyeodiwe, L. (2017). Electricity generation and renewable energy adoption in Nigeria. Energy Policy Review, 9(3), 44–58.

Alabi, T., & Ojo, F. (2016). Exploring solar energy for sustainable electricity supply in Nigeria. Energy Solutions Journal, 5(2), 72–89.

Alayande, T., Akande, A., & Yusuf, T. (2019). Policies for promoting renewable energy in Nigeria. Journal of Energy Studies, 14(3), 88–102.

Aliyu, A. S., Dada, J. O., & Adam, I. K. (2015). Current status and prospects of renewable energy in Nigeria. Renewable and Sustainable Energy Reviews, 9(2), 63–79.

Amadi, C. N., Okonkwo, E. E., & Umeh, C. C. (2016). Comparative study of solar energy adoption in Nigeria. Journal of Renewable Energy Development, 4(2), 115–124.

Carley, S., & Konisky, D. M. (2020). The justice and equity implications of the clean energy transition. Nature Energy, 5(8), 569–577.

Creswell, J. W. (2024). Research design: Qualitative, quantitative, and mixed methods approaches (6th ed.). SAGE Publications.

Eberhard, A., Foster, V., & Briceño-Garmendia, C. (2008). Underpowered: The state of the power sector in sub-Saharan Africa. World Bank Publications.

Ehinomen, C., & Adeleke, A. (2012). Electricity crisis and the solar energy option in Nigeria. Energy Reports, 2(4), 221–228.

Ekanem, J. O., & Nwachukwu, I. (2019). Analysis of renewable energy adoption in tertiary institutions. Energy Economics Journal, 7(4), 98–112.

Emodi, N. V., & Yusuf, S. D. (2015). Improving electricity access in Nigeria: Obstacles and the way forward. International Journal of Energy Economics and Policy, 5(1), 335–345.

Eze, E., & Adebayo, A. (2019). Assessment of solar energy potential for addressing energy challenges in Nigerian universities. Energy Studies Journal, 10(4), 99–114.

Ibrahim, M., & Jibiri, N. (2014). Renewable energy solutions for Nigerian campuses. Energy Solutions Journal, 8(2), 123–137.

Igbinovia, S. O. (2020). Solar energy and sustainable development in Nigerian institutions. African Journal of Energy Policy, 5(3), 215–229.

Ilenikhena, P. A., & Ezemonye, M. N. (2010). Solar energy development in Nigeria: The missing link. Renewable Energy Journal, 5(1), 50–65.

International Renewable Energy Agency (IRENA). (2019). Renewable energy policies for sustainable development. IRENA Publications.

Joskow, P. L. (2008). Lessons learned from electricity market liberalization. The Energy Journal, 29(2), 9–42.

Lawal, O. A., Aluko, A. A., & Adepoju, M. A. (2020). Feasibility of solar energy implementation in Nigeria. Nigerian Journal of Energy and Power, 15(2), 56–71.

Nnodim, C. A. (2020). Solar energy and its role in electricity sustainability. Energy Economics Journal, 12(3), 145–160.

Obi, I., Anyaeji, R. C., & Ogbuagu, S. E. (2016). Feasibility study of solar energy implementation in Nigerian institutions. Renewable Energy Perspectives, 7(4), 90–103.

Obioha, E. I., & Agada, S. A. (2018). Renewable energy and the environmental sustainability in Nigeria. Journal of Sustainable Energy Development, 8(1), 41–50.

Odiaka, J. O., Chukwuma, I., & Ugochukwu, K. (2021). Comparative study of renewable energy sources in Nigerian campuses. Journal of Energy Research, 12(1), 34–50.

Odularu, G. O., & Okoruwa, O. (2015). An economic analysis of renewable energy sources in Nigeria. Journal of Energy Policy Research, 6(3), 180–195.

Oguejiofor, C. O., & Chukwuma, C. A. (2019). Energy security and solar energy adoption in Nigeria. Renewable Energy Journal of Nigeria, 11(3), 77–89.

Ogujor, E. A. (2018). Addressing Nigeria's electricity crisis through renewable energy. Nigerian Journal of Energy Studies, 9(4), 112–125.

Ogunlade, S. O. (2015). Solar energy potentials and challenges in Nigeria. Energy Studies Review, 6(2), 56–78.

Oguntunde, A. A. (2016). The role of renewable energy in Nigeria's power sector. Energy Development Journal, 4(3), 102–116.

Oguntunde, A. A., & Adeoye, T. O. (2018). Exploring solar power solutions for Nigeria's tertiary institutions. Energy Policy and Development Review, 10(3), 180–195.

Okafor, J., & Joe-Ikechebelu, T. (2017). Economic feasibility of solar energy solutions in Nigeria. Journal of Energy Economics, 13(2), 90–104.

Oke, O. A., & Akintunde, M. A. (2017). Evaluation of electricity challenges and renewable energy solutions in Nigerian universities. African Journal of Energy, 6(2), 54–62.

Okundamiya, M. S. (2016). Promoting solar energy as an alternative in Nigeria. Journal of Renewable Energy Studies, 14(2), 78–95.

Oladeji, T. F., & Okafor, J. A. (2022). The role of renewable energy in addressing Nigeria's electricity challenges. Journal of Energy and Environment, 20(4), 201–216.

Oladeji, T. F., & Okafor, J. A. (2022). The role of renewable energy in addressing Nigeria's electricity challenges. Journal of Energy and Environment, 20(4), 201–216.

Olawumi, A. O., Okeowo, A. A., & Awosanya, A. F. (2019). Technical and economic feasibility of solar energy in Nigerian institutions. Energy Engineering Journal, 10(2), 124–133.

Olayinka, A. T., & Ayotunde, M. A. (2016). Environmental benefits of solar energy plants in Nigeria. Sustainable Development Journal, 12(3), 45–58.

Olukoju, A. (2004). Power supply in Nigeria: Problems and prospects. Journal of Economic Development, 9(2), 34–56.

Oparaku, O. U. (2003). Solar photovoltaic systems as alternative electricity sources in Nigeria. Renewable Energy Review, 8(1), 21–29.

Oroge, R. O. (2017). The economics of renewable energy adoption in Nigeria. Energy Economics Review, 10(1), 55–70.

Owolabi, O., & Okoh, P. (2015). Technical and economic feasibility of solar energy plants in Nigerian campuses. Energy Solutions Journal, 5(3), 101–115.

Oyedepo, S. O. (2012). Energy and sustainable development in Nigeria: The way forward. Energy Policy, 6(4), 350–361.

Rural Electrification Agency (REA). (2020). Sustainable energy projects in Nigerian universities. REA Publications.

Sambo, A. S. (2008). Matching electricity supply with demand in Nigeria. International Association for Energy Economics, 29(1), 14–19.

Sambo, A. S. (2009). Renewable energy for sustainable development in Nigeria. Journal of Energy Policy Review, 3(2), 23–33.

Sambo, A. S., Garba, B., & Zarma, I. H. (2010). Solar energy technology prospects in Nigeria. Energy Policy Review, 3(5), 178–190.

Sambo, A. S., Garba, B., Zarma, I. H., & Gaji, M. M. (2012). Electricity generation and the renewable energy alternative in Nigeria. Journal of Energy and Power Studies, 5(2), 90–105.

APPENDIX

DEPARTMENT OF VOCATIONAL AND TECHNICAL EDUCATION

UNIVERSITY OF BENIN, BENIN CITY

SURVEY ON SOLAR ENERGY ADOPTION AT THE UNIVERSITY OF BENIN

Dear Respondent,

I am an undergraduate student in the above department conducting a research study on Solar Energy Plants as an Alternative Measure to Benin Distribution Company: A Case Study of the University of Benin Campuses. Please respond honestly to the questions, and your responses will be kept completely confidential. Thank you for your assistance.

Yours Faithfully

JACOB ENO UDUAK

(Researcher)

SECTION A: DEMOGRAPHIC INFORMATION

Gender: Female ( ); Male ( )

Age: 17 – 20 ( ) 21 – 25 ( ) 26 and above ( )

Level: 100 ( ) 200 ( ) 300 ( ) 400 and above ( )

SECTION B

KEY: Strongly Agree (SA=4); Agree (A=3); Disagree (D=2); Strongly Disagree (SD=1)

S/N	ITEM SELECTION				

A	**The current state of electricity supply by the Benin Distribution Company to the University of Benin campuses**	**SA 4**	**A 3**	**D 2**	**SD 1**
1	The current electrical supply from BEDC has been satisfactory for us.				
2	The major inconveniences caused by power outages on campus (Disruption of lectures, Delays in research activities, Damage to equipment, Loss of data, Others)				
3	The unreliability of the electricity supply has affected your academic performance.				
4	The alternative power sources currently used on campus which are the Generators have been significant to all.				
B	**Technical and economic feasibility of implementing solar energy plants on the University of Benin campuses.**	**SA 4**	**A 3**	**D 2**	**SD 1**
5	There are no suitable areas on campus for putting solar panels.				
6	Government policies and incentives could promote the adoption of solar energy at UNIBEN.				
7	Potential challenges will arise in obtaining financing for solar energy projects at UNIBEN.				
8	Implementing solar energy plants at UNIBEN will result in significant economic benefits.				
C	**Environmental impacts of solar energy plants compared to conventional electricity sources?**	**SA 4**	**A 3**	**D 2**	**SD 1**

9	Compared to other forms of electricity, solar energy is less harmful to the environment.				
10	Solar power can improve the University of Benin's efficiency.				
11	The harmful impacts of solar energy plants can be reduced.				
12	There are concerns about the long-term environmental impacts of solar energy, such as the disposal of solar panels.				
D	**Stakeholders perceive the adoption of solar energy as an alternative to electricity supply from the Benin Distribution Company.**	**SA 4**	**A 3**	**D 2**	**SD 1**
13	Solar energy as an alternative to BEDC is a good consideration.				
14	There is a need to support the implementation of solar energy plants on campus.				
15	Solar energy can improve the overall quality of education at UNIBEN.				
16	Solar Energy can be used to strengthen the reputation of UNIBEN as a sustainable institution.				
E	**How do stakeholders perceive the adoption of solar energy as an alternative to electricity supply from the Benin Distribution Companies?**	**SA 4**	**A 3**	**D 2**	**SD 1**
17	There are no sufficient government policies and incentives put in place to promote solar energy adoption in Nigeria.				

18	Setting up a special fund or line item in the university budget for renewable energy initiatives can aid UNIBEN's initiatives.				
19	The Government can create a favorable environment for private sector investment in solar energy projects.				
20	Solar energy is a suitable primary source of electricity for UNIBEN.				