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Enhancing Climate Resilience through the Solar Energy Industry for Sustainable Development in Nigeria

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Abstract: Climate change, global warming and other related environmental challenges which constitute a threat to sustainable economic growth in Nigeria have also created opportunities for youths in the solar energy industry. This study identified that the use of solar energy and a lesser reliance on fossil fuels in Nigeria which is in line with the United Nations Paris Agreement will help to reduce the excessive emission of greenhouse gases which are the major causes of global warming and climate change. Through literature review and relevant data collection, this study identified that the use of solar energy is a veritable strategy for enhancing climate resilience in Nigeria. This study concluded that there is a great need for individuals, institutions and communities to adopt the use of solar energy which is eco-friendly and has the capacity to provide green skills, green technology and green entrepreneurial opportunities for sustainable development in Nigeria.

Keywords: Green Entrepreneurship, Nigeria, Solar Energy, Sustainable Development.

Introduction

Climate change is a global phenomenon that poses significant challenges to sustainable development and the well – being of societies worldwide. As the world grapples with the urgent need to mitigate climate change and transition towards sustainable development, the role of renewable energy sources has become increasingly vital. Climate resilience is the capacity of a socio – ecological system to absorb pressures and maintain function in the face of external stresses resulting from climate change (Folke *et al.,* 2010; Anabaraonye *et. al.,* 2023)

As a developing country highly vulnerable to the impacts of climate change, Nigeria faces multiple climate related challenges (fig. 1) such as drought in the North, flooding in the South, heatwaves, desertification and reduced agricultural productivity and these threats disproportionately affect vulnerable populations and strain existing infrastructure, agriculture, water supply and health systems. Hence, there is an urgent need to enhance its climate resilience while pursuing sustainable development pathways. In this context, the solar energy industry emerges as a promising solution that can contribute to both objectives. By harnessing the abundant solar resources available in the country, Nigeria has the potential to reduce its greenhouse gas emissions, enhance energy security, create job opportunities, and foster economic growth, all while building resilience against the adverse effects of climate change.

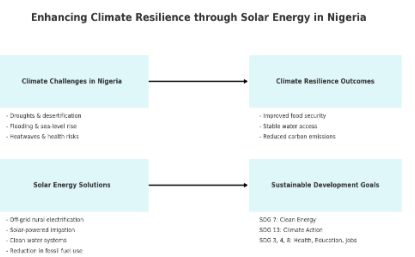

Fig 1: Conceptual diagram showing how solar energy enhances climate resilience for sustainable development in Nigeria

This paper explores the potential of solar energy industry in Nigeria to enhance climate resilience and promote sustainable development. By harnessing the power of the sun, Nigeria cannot only reduce its greenhouse gas emissions but

also build resilience against the adverse effects of climate change. This paper also delves into the various benefits of solar adoption, including its positive impacts on the environment, energy security, job creation and economic growth. It examines the challenges and opportunities associated with the solar energy industry in Nigeria and proposes strategies to enhance climate resilience through its sustainable development. By embracing solar energy, Nigeria can take a significant steps towards a greener and more resilient future.

Numerous studies have highlighted the significant potential of solar energy in Nigeria. According to the International Renewable Energy Agency (IRENA), Nigeria has one of the highest solar energy potentials in the world, with an average daily solar radiation of 4 – 6 kWh/m^2. Also the International Renewable Energy Agency (IRENA) estimates that Nigeria has a solar power potential of 13.4 GW (IRENA, 2019). This vast solar resource offers immense opportunities for the country to tap into clean renewable energy sources, reducing its dependency on fossil fuels and mitigating the harmful emissions that contribute to global warming.

According to the Nigerian Electricity Regulatory Commission (NERC), Nigeria receives an average of 5.25kwh/m^2 of solar radiation per day, making it suitable for solar power generation (NERC, 2019).

A study by Oyedepo (2012) emphasizes that solar energy can help Nigeria reduce its carbon footprint and combat air pollution, leading to improve air quality and public health.

Studies have also shown that the establishment of solar power plants can generate significant job opportunities throughout the value chain including manufacturing, installation, operation and maintenance (Olaniyan and Oyedepo 2020).

Furthermore, the adoption of solar energy in Nigeria aligns with the United Nations Sustainable Development Goals (SDGs) and the Paris Agreement targets. The SDG 7 aims to ensure access to affordable, reliable, sustainable and modern energy for all, while SDG 13

emphasizes the urgent need to take action to combat climate change and its impacts. The Paris Agreement, signed by Nigeria, commits to limiting global warming to well below 2 degrees Celsius above pre – industrial levels. The solar energy industry can play a crucial role in achieving these goals by providing clean and sustainable energy solutions.

However, despite its immense potential, the solar energy industry in Nigeria faces various challenges, including limited financing options, inadequate infrastructure and regulatory barriers. To overcome these challenges and fully leverage the benefits of solar energy, a comprehensive and multi-stakeholder approach is required. Collaboration between the government, private sector, civil society, and international partners is crucial to developing supportive policies promoting investment in solar energy projects and facilitating the transfer of technology and knowledge.

Statement of Problem

Despite Nigeria's abundant solar energy resources, the country still heavily relies on fossil fuels for electricity generation. The overdependence on non – renewable energy sources contributes to greenhouse gas emission, exacerbating climate change and hindering sustainable development. The lack of widespread adoption and integration of solar energy technologies in Nigeria's energy mix poses a significant challenge to enhancing climate resilience and achieving sustainable development goals.

Materials and Methodology

Data used for this study is derived from the literature review of published works including academic articles, journals, conference papers textbooks and internet materials. The researchers gathered much materials for the research but summarized the characteristics that centered more on "Enhancing Climate Resilience through the Solar Energy Industry for Sustainable Devel opment In Nigeria". This enabled the researchers to generate the synthesis of various researchers' views on the subject matter.

Result and Discussion

To enhance climate resilience in Nigeria

is through the development of solar energy industry. By promoting the use of solar energy, Nigeria can reduce its carbon footprint and contribute to global efforts to combat climate change. This can be possible by attaining to the following:

Solar Energy for Sustainable Development

Sustainable development balances economic growth, environmental protection and social inclusion. Solar energy supports this by offering affordable and clean energy (SDG 7), promoting climate action (SDG 13), enhancing economic productivity (SDG 8), and improving health and education outcomes through outcomes through access to reliable electricity (SDGs 3 & 4)

The Paris Agreement's role in enhancing climate resilience through solar energy in Nigeria

The United Nations Paris Agreement plays a crucial role in reducing excessive greenhouse gas emissions and addressing climate change. By committing countries to limit global warming to well below 2 degrees Celsius and pursuing efforts to limit the temperature increase to 1.5 degrees Celsius, the Paris Agreement provides a framework for global cooperation in mitigating climate change impacts.

In the context of Nigeria, the implementation of the Paris Agreement can significantly enhance climate resilience through the solar energy industry. The adoption of solar energy as a renewable and sustainable energy source can help reduce the country's reliance on fossil fuels for electricity generation, thereby reducing greenhouse gas emissions. Solar energy technologies, such as solar panels and solar farms, enable the production of clean energy without emitting carbon dioxide or other harmful pollutants.

Furthermore, the Paris Agreement includes provisions for financial and technological support to developing countries, like Nigeria, to enhance their climate resilience and transition to low-carbon economies. This support can

facilitate the deployment of solar energy infrastructure, capacity building, and technology transfer, making solar energy more accessible and affordable for Nigerians.

By embracing solar energy and implementing the commitments outlined in the Paris Agreement, Nigeria can contribute to global efforts in mitigating climate change, reducing greenhouse gas emissions, and enhancing climate resilience. This transition to solar energy can lead to sustainable development, job creation, improved energy access, and reduced environmental impact, making Nigeria more resilient to the challenges posed by climate change.

Provision of Green Skill, Green entrepreneurial opportunities, Green technology using solar energy for sustainable development in Nigeria

The use of solar energy in Nigeria can provide various green skills, green technology, and green entrepreneurial opportunities for sustainable development. Here are some ways in which solar energy can contribute to these areas:

The adoption of solar energy requires skilled professionals who can design, install, maintain, and repair solar systems. This creates opportunities for training programs and vocational education in solar energy technologies. By developing a skilled workforce in the solar energy sector, Nigeria can promote green skills development and create employment opportunities for its citizens. The solar energy industry fosters innovation in green technology. This includes advancements in solar panel efficiency, energy storage systems, smart grid integration, and solar-powered appliances. By encouraging research and development in solar technology, Nigeria can stimulate local innovation and contribute to the global transition to clean energy.

Also, solar energy presents opportunities for green entrepreneurship in Nigeria. Entrepreneurs can establish businesses that offer solar panel installation services, solar-powered product manufacturing, solar energy consulting, and maintenance services. These ventures not only create jobs but also contribute to sustainable

development by promoting clean energy solutions. Solar energy can also play a crucial role in providing electricity access to remote areas and communities without reliable grid connections. The establishment of solar-powered microgrids and off-grid solutions can enable decentralized energy generation, fostering entrepreneurial opportunities in the local energy sector. This empowers communities, improves energy access, and supports sustainable development.

Solar energy can be utilized in agricultural practices, such as solar-powered irrigation systems and solar-powered cold storage facilities. These applications enhance agricultural productivity, reduce post-harvest losses, and promote sustainable farming practices. Additionally, solar-powered water pumping systems can improve access to clean water in rural areas, supporting water management and sanitation efforts.

By embracing solar energy, Nigeria can not only transition to a sustainable and clean energy system but also create a green economy that provides employment, promotes innovation, and fosters sustainable development. The development of green skills, green technology, and green entrepreneurial opportunities through solar energy can contribute to Nigeria's overall economic growth and environmental sustainability.

Current Energy Landscape in Nigeria:

Analyzing Nigeria's current energy landscape and the heavy reliance on fossil fuels, particularly oil and gas, for power generation and economic activities. The use of this fossil fuel has an environmental consequences including greenhouse gas emissions, air pollution e.t.c. have their contribution to climate change. Nigeria's dependence on fossil fuels, has its own challenges such as price volatility, geopolitical risks, and economic vulnerability to fluctuations in global oil markets. On the other hand, there are limited access to electricity in Nigeria most especially in rural areas and in most cases these fossil fuels are used in powering their generators. Hence the potential for solar energy to bridge the energy gap and provide clean, reliable, and affordable power to remote

communities. A study by Akinbami et al., (2018) highlighted that the deployment of solar energy systems in rural areas can improve access to electricity, enhancing the quality of life and enabling socio-economic development. Solar energy can power schools, healthcare facilities and small businesses, thereby improving education, healthcare and livelihood opportunities.

The abundant solar resources in Nigeria and the potential for solar power generation are highly needed to diversify the energy mix and reduce dependence on fossil fuels. Government should analyze the existing energy policies and targets in Nigeria, including renewable energy targets, and assessing their effectiveness in promoting solar energy development and deployment. Also, identifying the investment potential in the solar energy sector, including opportunities for foreign direct investment, public-private partnerships, and incentives for solar energy projects. This will help in highlighting the potential for job creation and economic growth through the development of the solar energy industry, including opportunities in manufacturing, installation, operation, and maintenance of solar power systems.

The recent advancements in solar energy technologies, such as improvements in photovoltaic efficiency and cost reductions, and their implications for the widespread adoption of solar power in Nigeria needs to be discussed. Adequate policies and regulatory framework for promoting solar energy in Nigeria, including feed-in tariffs, net metering, tax incentives, and streamlined permitting processes. Also power sector in Nigeria needs to be reformed in order to accommodate renewable energy sources.

By assessing the current energy landscape in Nigeria and the need for diversification through solar power, policymakers, investors, and stakeholders can develop strategies and initiatives to accelerate the transition to a more sustainable and resilient energy system.

Conclusion

Enhancing climate resilience through the solar energy industry has the potential to

contribute to sustainable development in Nigeria. By reducing greenhouse gas emissions, creating jobs, improving energy security and providing reliable power during climate – related disasters, solar energy can play a crucial role in building resilience against the impacts of climate change. However, it is essential to address challenges such as high upfront costs, capacity building and regulatory frameworks to unlock the full potential of solar energy in Nigeria.

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