

Original Research Paper

## A Comparative Analysis of Renewable Energy Policies and its Impact on Economic Growth: A Review

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**Abstract:** Renewable energy has been identified as a critical component of global efforts to address climate change, enhance energy security, and foster sustainable economic growth. As a result, many countries have implemented renewable energy policies to promote the development and deployment of renewable energy technologies. However, the impact of these policies on economic growth remains a subject of debate. This article provides a comparative analysis of renewable energy policies and their impact on economic growth. The study employs a systematic review of the literature and utilizes qualitative and quantitative methods to compare renewable energy policies and their economic impacts across different countries. The findings suggest that the impact of renewable energy policies on economic growth varies across countries and is influenced by factors such as policy design, institutional context, and economic structure. This research article finally, examined the challenges associated with implementing renewable energy policies, analyzed the implications of the findings for policymakers and further gave some potential solutions that will help the policymakers and future researchers.

**Keywords:** Carbon Emissions, Economic Growth, Policy, Renewable Energy.



## 1. Introduction

The world is experiencing an increasing demand for energy due to population growth, industrialization, and urbanization. This demand is met primarily by fossil fuels, which have adverse environmental impacts, including greenhouse gas emissions, air pollution, and resource depletion. The use of renewable energy sources such as wind, solar, geothermal, and hydropower has been identified as a solution to address these challenges. Renewable energy offers several benefits, including reducing greenhouse gas emissions, enhancing energy security, creating jobs, and fostering sustainable economic growth [1]-[7]. The transition to renewable energy sources is becoming increasingly important as we seek to reduce our dependence on fossil fuels and mitigate the impacts of climate change. Renewable energy policies have the potential to create jobs and stimulate economic growth, as demonstrated by the experiences of countries such as Germany. However, there are also challenges associated with implementing renewable energy policies, particularly in low-income countries with limited resources. Governments must be willing to invest in renewable energy infrastructure and provide support for the adoption of clean energy sources if we are to successfully transition to a sustainable energy future.

## 2. Literature Review

Renewable energy policies have the potential to promote economic growth and reduce carbon emissions, but their effectiveness varies by country. The United States, Germany, and China have implemented several renewable energy policies, and studies have shown that these policies have led to significant job creation and economic growth in the renewable energy sector. However, there are also challenges associated with implementing renewable energy policies, and policymakers must consider potential solutions to address these challenges [8].

Renewable energy policies have become increasingly important as countries seek to reduce their carbon emissions and mitigate the impact of climate change. In addition to environmental benefits, renewable energy policies can also stimulate economic growth by creating new jobs and promoting technological innovation. However, the effectiveness of renewable energy policies in promoting economic growth varies by country. This article compares renewable energy policies and their impact on economic growth in the United States, Germany, and China [8][9].

A review of several studies related to this research idea has examined the impact of renewable energy policies on economic growth in the world as itemized below: A study by [10] analyzed the economic impacts of renewable energy policies in six countries, including China, Germany, India, Japan, United Kingdom, and the United States. The study found that renewable energy policies have a positive impact on economic growth in all six mentioned countries, but the magnitude of the impact varies. For example, in Germany, renewable energy policies have contributed to a significant increase in renewable energy investment and job creation, while in the United States, the impact has been less significant due to policy instability and political opposition. From this, it can be concluded that renewable energy policy and the impacts of non-renewable energy vary per country due to the possibility of available resources to maintain renewable energy completely [8].

A study by [11] analyzed the relationship between renewable energy policies and economic growth in 66 countries. The study found that renewable energy policies have a positive impact on economic growth, but the impact varies depending on the policy design and the institutional context. For example, policies that provide long-term and short-term practices are not the same.

According to a study done by [9] Germany's renewable energy policies have had a positive impact on economic growth due to some favourable conditions that enhance economic growth. The study found that the renewable energy sector in Germany has created over 300,000 jobs and contributed over 20 billion euros to the country's GDP. In addition, the study found that Germany's renewable energy policies have encouraged investment in the renewable energy sector, leading to technological advancements and cost reductions.

The International Renewable Energy Agency (IRENA) 2019 examined the impact of renewable energy policies on job creation. The study found that the renewable energy sector employs over 11 million people globally, with the potential to create millions more jobs in the coming years. The study also found that renewable energy policies can have a positive impact on job creation, particularly in rural areas and in developing countries [12].

A study by [13] examined the impact of renewable energy policies on economic growth in the European Union (EU) countries. The study found that renewable energy policies have a positive impact on economic growth, but the impact varies depending on the economic structure of the country. For example, countries with a higher share of manufacturing industries benefit more from renewable

energy policies than countries with a higher share of service industries. The study further employs a thematic analysis of the literature to identify common themes and patterns in the impact of renewable energy policies on economic growth across different countries. The study also utilizes descriptive statistics to compare the magnitude of the impact of renewable energy policies on economic growth across countries.

The author in [14], researched Renewable Energy Power Generation and Conversion from 2015 to 2023e. From this research, it was concluded that Solar photovoltaic is the invoking and trending renewable energy source as it has been the leading market from 2019 to 2023. It summarized that Solar Photovoltaic is the leading in terms of renewable energy power generation/conversion followed by wind turbines. It also showed that china is the most invested country in renewable energy followed by the European union. Perovskites PV has shown an exceptional performance which makes it the third generation of solar cell technology with the highest energy conversion as a result of its good fabrication/material characteristics such as excellent absorption coefficient, exceptional carrier mobility, high dielectric constant and tunable bandgap. Figure 1 shows the Renewable Sources of Energy and their Generated Power conversion.

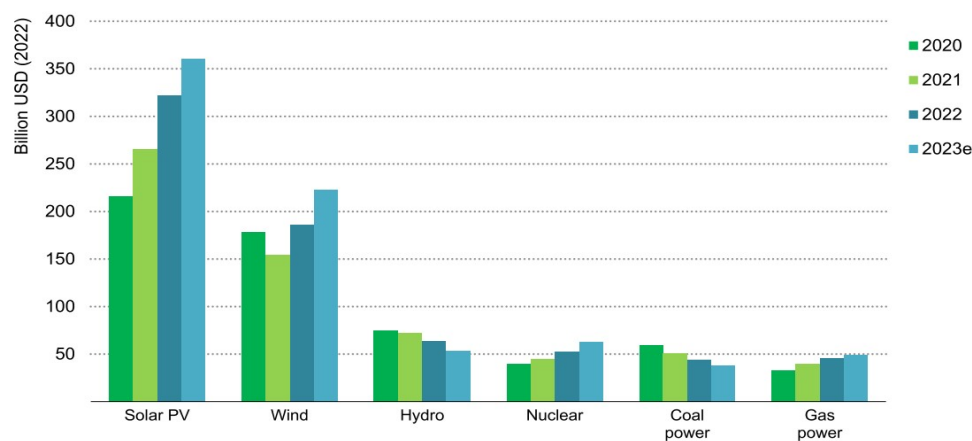


Figure 1. Renewable Sources of Energy and their Generated Power from 2020-2023 [14]

A Systematic Review of renewable energy trends was carried out by [15] which seriously dealt with the energy trends and policies leveled by the government to encourage the use of clean and safe energy. This paper in [15] shows the rapid growth and innovation in the solar energy sector as many households, businesses, and countries embrace photovoltaic sources of energy as the cleanest source of renewable energy. The researcher finally concluded that the trends of renewable energy have shifted to solar photovoltaics and wind as the most effective sources of renewable energy that can reduce dependence on fossil fuels, improve energy security and finally support the transition to a more sustainable clean and cheap energy in future [15].

## 2.1. Renewable Energy Policies

Energy policies in few countries:

1. Renewable Energy Policies in the United States: The United States has implemented several renewable energy policies, including the production tax credit (PTC) and the investment tax credit (ITC). These policies provide financial incentives for the development of renewable energy sources such as wind and solar power. According to a study by the National Renewable Energy Laboratory (NREL) 2019), the PTC and ITC have led to significant job creation and economic growth in the renewable energy sector. This implies that the policy favors and encourages renewable energy researchers and enhancers, as well as creates jobs for the citizens which invariably increases the Economic growth of the US.
2. Renewable Energy Policies in Germany: Germany has implemented several policies to promote renewable energy, including feed-in tariffs (FITs) and net metering. FITs provide financial incentives for the development of renewable energy sources, while net metering allows individuals and businesses to sell excess energy back to the grid. According to a study

by [9], renewable energy policies have led to significant job creation and economic growth in the renewable energy sector in Germany.

3. **Renewable Energy Policies in China:** China has implemented several policies to promote renewable energy, including feed-in tariffs and tax incentives to encourage renewable energy development in the country. According to a study by the National Renewable Energy Laboratory (NREL) 2019, China's renewable energy policies have led to significant job creation and economic growth in the renewable energy sector [16]. However, there are also concerns about the effectiveness of these policies in promoting the use of renewable energy sources and researchers.

## **2.2. Challenges Associated with Implementing Renewable Energy Policies and its Potential Solutions**

Renewable energy policies have the potential to create jobs and stimulate economic growth, there are also several challenges associated with their implementation of renewable energy policies such as the initial cost to implement renewable energy infrastructure. Renewable energy sources such as solar, wind and biogas require a significant upfront investment (capital), which becomes a very big problem/barrier for some low-income countries to adopt due to a lack of sustainable capital. Furthermore, the variability of renewable energy sources which made it solely depends on the weather conditions is also a very big challenge. For example, Solar and wind sources of renewable energy are dependent on weather conditions and can be intermittent, which can make it difficult to integrate them into existing energy grids. This can be particularly challenging for countries with ageing energy infrastructure, which may not be designed to handle variable sources of energy [17][18][19][20][21].

Furthermore, renewable energy policies have the potential to promote economic growth, but there are also several challenges associated with their implementation. Hence, one of the major challenges is the high cost of renewable energy technologies compared to traditional energy sources. Another challenge is the variability of renewable energy sources, which can make them less reliable for meeting energy demands. To address these challenges, policymakers can consider implementing policies that provide financial incentives for energy storage, research and development of new technologies. The findings suggest that the impact of renewable energy policies on economic growth varies across countries and is influenced by factors such as policy design, institutional context, and economic structure.

## **3. Methodology**

This research work comparatively analyzed the energy policy, energy usage and its effect on the economic growth of a country. This was done by reviewing 20 related published articles on renewable energy policy and economic growth. This review mainly focused on the major impacts of renewable energy policy and its impact on national economic growth which was achieved by online information obtained from the renewable energy database and physical data obtained from the University of Nigeria, Nsukka Energy center.

## **4. Finding and Discussion**

This study identified the three major patterns of the impact of renewable energy policies on economic growth across different countries. The finding of the study is as follow:

1. The magnitude of the impact varies depending on the policy design and the institutional context. For example, policies that provide long-term incentives and stable regulatory frameworks are more effective in promoting renewable energy investment and economic growth.
2. The impact of renewable energy policies on economic growth varies depending on the economic structure of the country. Countries with a higher share of manufacturing industries benefit more from renewable energy policies than countries with a higher share of service industries. This is because renewable energy technologies require significant capital investment and manufacturing capacity, which can stimulate economic growth in manufacturing sectors.
3. The impact of renewable energy policies on economic growth is influenced by the institutional context of the country. Countries with strong institutions, including stable political systems, transparent regulatory frameworks, and well-developed financial markets, tend to benefit more from renewable energy policies than countries with weak institutions. This is because strong institutions can reduce the risks and uncertainties associated with renewable energy investment and foster a favourable investment climate.

## 5. Conclusion

It was observed from this review research that renewable energy policies can have both positive and negative impacts on the economic growth of a country. This renewable energy impact varies across countries and is influenced by factors such as policy design, institutional context, and economic structure. Policymakers should take these factors into account when designing and implementing renewable energy policies to maximize their economic benefits. The study also highlights the need for future research to explore the impact of renewable energy policies on other economic indicators, such as employment, trade, and innovation. This research article exposes the renewable energy policymakers of various countries to know the pros and cons of incorporating favourable renewable energy policies in their laws as renewable energy enhances countries' economic growth.

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