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Investment decision analysis on sustainable renewable energy policy: Literature review

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Abstract: This paper discusses sustainable renewable energy policies. The method used in this paper is a descriptive method that collects data from various sources literature studies and previous research. The results of the literature review show that the development of renewable energy in the European Union has three clusters dividing the share of renewable energy and the degree of dependency on energy imports based on the country. In Pakistan, the government has been designing a renewable energy policy since 2006 to supply sustainable energy to all consumers. In Nigeria, the electricity crisis and the need to reduce greenhouse gases spurred the development of renewable energy. Denmark has moved to wind power sources by increasing the share of renewable energy in the domestic electricity supply. The government encourages local ownership in the renewable energy sector, and many neighborhoods are connected to district heating systems that use renewable energy such as biomass. Increased investment in renewable energy technology will aid in addressing global energy concerns and hastening the transition to a low-carbon economy.

Abstrak: Tulisan ini membahas kebijakan energi terbarukan yang berkelanjutan. Metode yang digunakan dalam penulisan ini adalah metode deskriptif yang mengumpulkan data dari berbagai sumber studi literatur dan penelitian terdahulu. Hasil tinjauan pustaka menunjukkan bahwa pengembangan energi terbarukan di Uni Eropa memiliki tiga klaster yang membagi pangsa energi terbarukan dan tingkat ketergantungan impor energi berdasarkan negaranya. Di Pakistan, pemerintah telah merancang kebijakan energi terbarukan sejak tahun 2006 untuk memasok energi berkelanjutan bagi seluruh konsumen. Di Nigeria, krisis listrik dan kebutuhan untuk mengurangi gas rumah kaca mendorong pengembangan energi terbarukan. Denmark telah beralih ke sumber energi terbarukan tanaga angin untuk meningkatkan pasokan listrik domestik. Pemerintah mendorong kepemilikan lokal di sektor energi terbarukan, dan banyak lingkungan yang terhubung dengan sistem pemanas distrik yang menggunakan energi terbarukan seperti biomassa. Peningkatan investasi pada teknologi energi terbarukan akan membantu mengatasi permasalahan energi global dan mempercepat transisi menuju perekonomian rendah karbon.

Introduction

In recent decades, the need for clean, sustainable, and environmentally friendly energy has become increasingly urgent. Global climate change, increasing air pollution, and limited traditional fossil resources have pushed the international community to turn to renewable energy sources (Liu et al., 2023). The issue of the phenomenon of global warming is an urgent problem in all countries. The consequences of global warming not only have an impact on changes in environmental structure, but can also have an impact on disrupting the stability of social, economic, and global political systems, and the environment (Scheffran & Battaglini, 2011). Therefore, a renewable energy policy is needed to deal with this issue. Renewable energy policy is an important tool to encourage widespread use of renewable energy. Renewable energies, such as solar, wind, hydro, geothermal, and biomass, are derived from natural resources that can be sustainably renewable (Kang et al., 2023). Renewable energy policies aim to reduce dependence on non-renewable fossil fuels, as well as reduce greenhouse gas (GHG) emissions, which cause climate change. The reduction of greenhouse gas emissions was identified in the Kyoto Protocol on 11 December 2011. In short, the Kyoto Protocol operates the United Nations Framework Convention on Climate Change by making it mandatory. Industrialized countries and developed economies must transition to limiting and reducing greenhouse gas emissions. adhere to agreed personal goals (Z. Liang et al., 2023). The agreement itself only obligates countries to adopt climate protection policies and measures and report on them regularly. The Kyoto Protocol is based on the principles and provisions of the Convention and follows a structure based on its annexes. It only binds and imposes more burdens on developed countries, recognizing their responsibilities, based on the principle of shared responsibility but according to their respective capabilities, albeit with differences. It is responsible for most of the increase in global greenhouse gas emissions. atmosphere. The Kyoto Protocol sets binding emission reduction targets for 37 developed and transition countries and the European Union. Taken together, these targets will reduce emissions by an average of 5% compared to 1990 levels over the five periods 2008-2012.

One of the main objectives of the renewable energy policy is to significantly increase the use of renewable energy in the national energy matrix (Strawa et al., 2020). To achieve this, the government and related institutions adopt various policies, such as fiscal incentives, subsidies, government-supported electricity tariffs, and reducing bureaucracy in the development of renewable energy projects. Fiscal incentives, for example, could be in the form of tax exemptions or investment incentives for the development of renewable energy projects. Subsidies can also be provided to reduce production costs and make renewable energy more competitive with conventional energy sources (Bu et al., 2023). In addition, the government-

supported electricity tariff setting ensures that renewable energy producers receive a fair price and are attractive for investment.

In many countries, renewable energy technologies make up only a small portion of the primary energy supply, despite public support for such technologies through incentives, taxes, and other public spending. Of the world. One reason for this limitation is that the transition to a low-carbon economy requires significant investment. Until now, private capital has played only a subordinate role. Raising private capital to support renewable energy projects is difficult, especially in the current economic climate, as investors are reluctant to invest in promising new technologies. Offers uncertain short-term returns. The majority of tech venture capital (VC) firms choose to invest in low-risk, low-return technology and avoid risky green investments. This means technology companies fail for a variety of reasons (Xu et al., 2023).

Only the right policies can stimulate technology. Indeed, except for stand-alone systems for remote off-grid applications, where renewables are sometimes the only option, most renewable energy markets rely heavily on direct subsidies. energy tax or electricity price (H. Liang & You, 2023). However, most incentives to invest in renewable energy have mixed results. This can be partially explained by the fact that recommendation engines underutilize the determinants of the investment decision-making process and are not adapted to the broader socioeconomic context. It does. The insufficient effectiveness of these measures and the divergent views of investors towards renewable energy indicate that these organizations still have a limited understanding of financing energy technology firms. suggesting. renewable quantity. means (Fang et al., 2023).

Renewable energy sources, as technology and infrastructure increase, can be easily identified and investigated without causing serious accidents or dangerous situations affecting life on Earth, and as a result, It is an option that should be seriously considered by governments, as it enables cheap energy production (M. Pacesila, et al. 2016). According to prior research, a sustainable supply of renewable energy is a vital aspect of any society's long-term economic success (Aized, 2017). According to European Union research, renewable energy policies help European countries to establish a competitive, dependable, and sustainable energy industry, as well as contribute to tackling society's most important energy problems and difficulties (M. Pacesila et al. 2016). Another research is being undertaken in Nigeria. This country has an abundance of renewable energy resources that are underutilized (Aliyu et al., 2015).

The purpose of this paper review is to provide a comprehensive understanding of the latest developments in the field of renewable energy and identify existing challenges and opportunities and their relationship to investment decisions.

Method

This article was written by providing an overview of renewable energy policies and investments and adapting them to later literature, identifying literature sources that are relevant to the topic being studied, and then establishing clear inclusion and exclusion criteria to select articles or literature sources to include in the review. The papers are evaluated, and the key results are highlighted, as well as the consequences for theory and practice, as well as the limits of this article.

Results

Development of Renewable Energy in the European Union

The growth of renewable energy in the European Union is divided into three groups, with Sweden occupying an interesting position along with other countries in the first group. Despite having a large share of renewable energy production (50.97%), 28.7% still depends on imported energy. On the other hand, the low share of renewable energy (25.97% of total energy production) has allowed Denmark to reduce its energy dependency and even export 3.40% of its energy production. Produced domestically. Denmark is the only EU member state to achieve such results. National polarization based on the share of renewable energy in total energy production is a key feature of the second group (Kang et al., 2023). Austria, Latvia, and Finland have higher shares (32.09% to 35.76%) than other countries in the cluster with significantly lower renewable energy shares. Lithuania and Portugal account for more than 20% of total energy production from renewable sources, well ahead of other EU countries in the third group. Smaller nations such as Malta and Luxembourg, however, are at a disadvantage concerning renewable energy share (up to 3.13%) and their absolute energy dependency (around 100%).

Development of Renewable Energy in Pakistan

Pakistan is one of the developing countries that is currently facing a severe energy shortage. Current and previous governments have established numerous energy programs to fulfill energy demand but have been unable to close the demand-supply gap; there was a 5000 MW electricity supply shortage during the summer of 2016. In 2006, a renewable energy development program was established to supply sustainable energy to all users, especially those in rural and isolated areas who do not yet have access to electricity or natural gas (Sakti et al., 2023). In 2011, the policy was extended for implementation and is currently in effect. This program is founded on energy security and self-sufficiency, social fairness, and economic rewards. The purpose of this study is to explore and find strategies to ensure future energy supply utilizing LEAP by analyzing Pakistan's renewable energy strategy. In assessing the truth of the energy plan, the government develops several scenarios consisting of nuclear, optimization, green Pakistan, and business-as-usual. In conclusion, a green Pakistan scenario using renewable energy technologies, with little operating costs

and externalities, is the highly demanded option in the future (Devlin et al., 2023). Pakistan is one of the developing countries which is currently facing a severe energy shortage. Current and past state governments have devised various energy policies to meet energy demand. Nevertheless, they are unable to meet the demand-supply gap; there was a shortfall of around 5000 MW of electricity supply during the summer of 2016. A renewable energy development policy, compiled in 2006, is designated for supplying sustainable energy, mainly to rural and remote houses with little or no electricity and natural gas. This policy was implemented in 2011 and is currently applied.

Development of Renewable Energy in Nigeria

The current electricity crisis and the need to reduce greenhouse gas emissions must be the key actions in Nigeria to achieve sustainable energy. This project demonstrates the current state of sustainable energy technologies that are important in Nigeria in promoting a sustainable energy plan for electricity generation. Zheng et al. (2023) mentioned that the country has potential for renewable energy and is currently considering planned renewable energy projects. Relevant policies and laws will be highlighted and market-oriented policies will be discussed. Furthermore, the paper examines the growth of renewable energy sources in Sub-Saharan Africa by examining the renewable electricity status in South Africa, Cameroon (the fourth largest), Ghana, and Senegal. The importance of sustainable energy in Nigeria's energy mix is clear and widely recognized. Studies on renewable energy indicate that most of the country is potentially generating electricity using renewable energy, with two forms of renewable energy technology at minimum. Nevertheless, compared to developed and developing countries, the development of renewable energy in Nigeria is slower. They are the only minorities who use wind as a source of power to generate electricity. Nevertheless, Nigeria’s first wind farm which has been installed and commissioned is expected to encourage wind power technology investments in Nigeria. Solar power gadgets are the most demanded product around the world, particularly in the energy market. If the feed-in-tariff policy is implemented, the solar power plants in Nigeria will undergo an increment in the installed capacity. However, the power grid must be prepared for the integration of renewable energy using available technology. It is encouraging that the country's SHP development has received increased support from the United Nations Industrial Development Organization (UNIDO), the regional center for sustainable agriculture in Africa. There is still potential for renewable energy for power generation, but more efforts are needed to increase the use of sustainable energy in the country. To promote and support renewable energy deployment in Nigeria, several steps, such as private partnership agreements, investments in research and development, incentives provided by the government through government Books, and legislation supporting many regulations, have been implemented. To enhance renewable energy development incentives, new laws and policies that are market-based must be

introduced. This is done through various renewable energy instruments such as procurement mechanisms, incentives for pilot projects, and deregulation. Appropriate market policies can lead to significant domestic growth in renewable energy development and utilization. Renewable energy for on-grid and off-grid power plants must be continuously socialized and promoted by strengthening research and development capacity, training workers, introducing an operation and maintenance culture, and manufacturing local renewable energy equipment. To overcome the current power crisis and lead the country to economic prosperity, the current renewable energy power system and integrated renewable energy solutions based on distributed generation using renewable energy technologies should be developed into renewable energy. should be pursued on a base (Mansour & Zaky, 2023).

Renewable Energy Developments in Denmark

Self-sufficiency in total energy production continues to decline, reaching 89% in 2015 when oil, natural gas, and renewable energy production are included. Although oil and gas self-sufficiency is projected to decline significantly over the next two decades, these trends are spurring Denmark to continue its transition to other energy sources in the coming decades. As a result, the share of renewable energy (mainly wind energy) in the country's total electricity supply increased from almost 0% to 42% in 1985. The share of renewable energy in total energy consumption increased from 2.7% in 1980 to 26%. in 2014. In the heat sector, local heat currently accounts for about 50% of the total heat demand or 50% of the total heat demand. It comes from renewable energy. energy sources, especially biomass. Overall, green energy technologies accounted for almost 7% of total Danish exports in 2016, or around €5.7 billion. In 2017, Denmark had 4,910 wind turbines with an installed capacity of 5,229 MW. Of this, an estimated 20% (1,082 MW) is locally owned by local cooperatives (549 MW), farmers and local landowners (484 MW). Financing programs for wind energy in general are constantly being developed and adapted specifically to support local ownership. Already in the 1920s, some small municipal thermal power plants began using waste heat for ambient heating. The district heating network was established in 1957 and mainly involves district heating companies in large cities. Cogeneration plants were established between 1992 and 2005, replacing the current generation electric heating systems with natural gas or biomass. In 2016, about 64% of all households were connected to district heating, which was generated by 430 heat generators and CHP units and distributed by 407 district heating distribution companies. Of the distribution companies, 341 are owned by consumers and 47 by municipalities (Garthe et al., 2023).

Investment Decision on Renewable Energy Policy

Until the early 2000s, investment in renewable energy technologies remained negligible, and non-government spending accounted for a negligible share. Since

then, clean energy investments have grown significantly, reaching nearly US$150 billion in 2007, and a CAGR of 30% from 2002 to 2009. After the global financial crisis of 2008-2009, investment in clean energy increased again and recently reached US$145 billion. This growth continued in 2010, with the five most active countries (China, Germany, USA, Italy, and Brazil) investing nearly US$150 billion in renewable energy. Despite these measures, renewable energy advocates argue that current renewable energy investments are insufficient to meet the Kyoto Protocol's carbon reduction targets. The contribution of renewable energy technologies to the world's energy supply is still small. In 2007, 3% of the world's electricity came from non-renewable water sources. The share of non-hydro renewables increased slightly between 1990 and 2007 (around 2% in OECD countries and around 1% in non-OECD countries). By 2030, investments will increase to $500 billion to meet the Kyoto Protocol's CO2 reduction target. Supporters of RE, including those in Nigeria, Pakistan, Denmark, and especially Europe, claim that adopting expedited ET technology will need significant adjustments to current practices to meet the Kyoto Protocol's emission reduction goal. Additionally, it will call for certain policies that, by removing obstacles and focusing on all the factors that influence investment choices, may encourage RE investment in a far more efficient manner.

To achieve a sustainable energy transformation, investment decision analysis plays an important role in helping stakeholders understand the risks and benefits of investing in renewable energy. By considering all of these aspects, investment decisions can be made more wisely and have a long-term positive impact on the company and society.

Identification of Challenges and Opportunities for the Development of Sustainable Renewable Energy

The challenges in the development of renewable energy in this paper are:

1. High dependence on fossil resources. Although there is awareness of the importance of renewable energy, supporting infrastructure and policies are still not strong enough to replace established sources of fossil energy (Daneshvar et al., 2023).
2. Cost Initial investment in developing a renewable energy project is often expensive. The new technology and infrastructure required to produce renewable energy still require high costs, thereby discouraging investors from participating in this sector (Magazzino et al., 2023).
3. Investments in renewable energy projects are often fraught with risks and uncertain returns on investment. New technologies and policy changes can affect the financial performance of projects, thereby reducing the interest of investors in injecting capital into this sector.
4. Renewable energy development requires adequate infrastructure, such as a strong electricity transmission and distribution network. However, this infrastructure is

still limited in some areas, especially in rural or remote areas, thereby hindering the overall development of renewable energy (Coppitters & Contino, 2023).

The opportunities for a renewable energy policy are:

1. Policies and regulations that support renewable energy development can create attractive investment opportunities. Fiscal incentives, subsidies, and Government-subsidized electricity tariffs can make renewable energy investments more profitable and attractive to investors.
2. The demand for clean and sustainable energy is growing with global awareness of the need to reduce greenhouse gas emissions and the negative impacts of fossil resource use. With growing demand, there are many market opportunities to invest in renewable energy.
3. There is great potential for technological innovation in the renewable energy sector. The development of new, more efficient, and cost-effective technologies for generating renewable energy can open up promising investment opportunities (Fang et al., 2023).
4. Investing in renewable energy can be part of a diversified investment portfolio. Renewable energy can be an attractive option for investors to find sustainable investment options and generate long-term returns.

Discussion

This paper discusses the need for clean, sustainable, and environmentally friendly renewable energy and the importance of renewable energy policies in addressing environmental issues and global climate change (Deng et al., 2023). The contribution of this research is to comprehensively understand the latest developments in the renewable energy sector, identify existing challenges and opportunities, and link them to investment decisions. In the context of the European Union, this document divides renewable energy development into three clusters. Sweden produces a significant amount of renewable energy, yet it still needs to import energy. Despite having a lower percentage of renewable energy, Denmark has been able to terminate its reliance on imported energy and even export electricity. Austria, Finland, and Latvia, along with other nations in the second cluster, have a larger proportion of renewable energy. Meanwhile, Lithuania and Portugal also have a significant share of renewable energy. However, smaller countries such as Malta and Luxembourg have high energy dependence and a low share of renewable energy. In Pakistan, this paper identifies a severe energy shortage and government efforts to develop renewable energy policies to meet energy demand. This study suggests that a "Green Pakistan" scenario using renewable energy technologies is the most suitable option for securing energy supply in the future. Meanwhile, in Nigeria, this paper highlights the importance of renewable energy to overcome the electricity crisis and reduce greenhouse gas emissions. Even though Nigeria has excellent

renewable energy potential, the development of renewable energy in the country is still slow. The utilization of wind energy for the production of electricity is likewise still in its infancy.

The novelty or contribution of this paper lies in presenting the latest data and information regarding the development of renewable energy in the European Union, Pakistan, and Nigeria. In addition, this paper also highlights the challenges faced in mobilizing private capital for investment in renewable energy. This information can be the basis for formulating policies and strategies that are more effective in addressing renewable energy issues and achieving the goal of using renewable energy more broadly.

Conclusion

The need for clean, sustainable, and environmentally friendly energy is increasingly urgent in the current era. Global climate change, air pollution, and limited fossil resources are forcing people to switch to renewable energy sources. Renewable energy policy is an important instrument to promote the use of renewable energy. The policy seeks to decrease reliance on fossil fuels and mitigate greenhouse gas emissions that are responsible for climate change. Renewable energy has great potential, but its development and utilization are still limited. Lack of investment in renewable energy technologies is one of the main reasons. Private finance is still hesitant to invest in new technologies because they carry unpredictable risks and short-term returns.

Fiscal policies and incentives, such as government-supported tax breaks, subsidies, and electricity tariffs, can be a stimulus for investment in renewable energy. This mechanism can reduce production costs and make renewable energy more competitive with conventional energy sources. However, the effectiveness of renewable energy policies in attracting investment remains limited. A proposed instrument should consider all factors of an investment decision and be appropriate to the broader socioeconomic context to which it applies.

In some countries, such as the European Union, the development of renewable energy is increasing the share of renewable energy in the national energy matrix. Countries such as Sweden, Denmark, and Austria have made great strides in the use of renewable energy. On the other hand, developing countries such as Pakistan and Nigeria have great potential for renewable energy development. However, the development of renewable energy in these countries remains limited and requires large-scale investments to realize this potential

To increase investment in renewable energy, we need supportive policies, attractive fiscal incentives, and increased awareness and understanding of the long-term benefits of renewable energy. Increased investment in renewable energy technology will contribute to addressing global energy concerns and hastening the transition to a low-carbon economy.

References

Aliyu, A. S., Dada, J. O., & Adam, I. K. (2015). Current status and future prospects of renewable energy in Nigeria. *Renewable and Sustainable Energy Reviews*, *48*, 336–346. https://doi.org/10.1016/j.rser.2015.03.098

Bu, J., Chang, S., Li, J., Yang, S., Ma, W., Liu, Z., An, S., Wang, Y., Li, Z., & Zhang, J. (2023). Highly selective electrocatalytic alkynol semi-hydrogenation for continuous production of alkenols. *Nature Communications*, *14*(1), 1–9. https://doi.org/10.1038/s41467-023-37251-z

Coppitters, D., & Contino, F. (2023). Optimizing upside variability and antifragility in renewable energy system design. *Scientific Reports*, *13*(1), 1–17. https://doi.org/10.1038/s41598-023-36379-8

Daneshvar, M., Mohammadi-Ivatloo, B., & Zare, K. (2023). An innovative transactive energy architecture for community microgrids in modern multi-carrier energy networks: a Chicago case study. *Scientific Reports*, *13*(1), 1–18. https://doi.org/10.1038/s41598-023-28563-7

Deng, Z., He, X., Chai, Y., & Wang, T. K. (2023). An Investment Decision Model for Underground Urban Utility Tunnel Based on MIVES and Real Option Theory from a Sustainable Perspective. *Sustainability (Switzerland)*, *15*(9). https://doi.org/10.3390/su15097711

Devlin, A., Kossen, J., Goldie-Jones, H., & Yang, A. (2023). Global green hydrogen-based steel opportunities surrounding high quality renewable energy and iron ore deposits. *Nature Communications*, *14*(1). https://doi.org/10.1038/s41467-023-38123-2

Fang, H., Wu, S., Ayvali, T., Zheng, J., Fellowes, J., Ho, P. L., Leung, K. C., Large, A., Held, G., Kato, R., Suenaga, K., Reyes, Y. I. A., Thang, H. V., Chen, H. Y. T., & Tsang, S. C. E. (2023). Dispersed surface Ru ensembles on MgO(111) for catalytic ammonia decomposition. *Nature Communications*, *14*(1). https://doi.org/10.1038/s41467-023-36339-w

Garthe, S., Schwemmer, H., Peschko, V., Markones, N., Müller, S., Schwemmer, P., & Mercker, M. (2023). Large-scale effects of offshore wind farms on seabirds of high conservation concern. *Scientific Reports*, *13*(1), 1–13. https://doi.org/10.1038/s41598-023-31601-z

Kang, X., Yang, F., Zhang, Z., Liu, H., Ge, S., Hu, S., Li, S., Luo, Y., Yu, Q., Liu, Z., Wang, Q., Ren, W., Sun, C., Cheng, H. M., & Liu, B. (2023). A corrosion-resistant RuMoNi catalyst for efficient and long-lasting seawater oxidation and anion exchange membrane electrolyzer. *Nature Communications*, *14*(1). https://doi.org/10.1038/s41467-023-39386-5

Liang, H., & You, F. (2023). Reshoring silicon photovoltaics manufacturing contributes to decarbonization and climate change mitigation. *Nature Communications*, *14*(1), 1–19. https://doi.org/10.1038/s41467-023-36827-z

Liang, Z., Tian, F., Yang, G., & Wang, C. (2023). Enabling long-cycling aqueous sodium-ion batteries via Mn dissolution inhibition using sodium ferrocyanide electrolyte additive. *Nature Communications*, *14*(1), 1–11. https://doi.org/10.1038/s41467-023-39385-6

Liu, J., Zhang, H., Xu, Y., Meng, H., & Zeng, A. P. (2023). Turn air-captured CO2 with methanol into amino acid and pyruvate in an ATP/NAD(P)H-free chemoenzymatic system. *Nature Communications*, *14*(1). https://doi.org/10.1038/s41467-023-38490-w

Magazzino, C., Mele, M., Drago, C., Kuşkaya, S., Pozzi, C., & Monarca, U. (2023). The trilemma among CO2 emissions, energy use, and economic growth in Russia. *Scientific Reports*, *13*(1), 1–18. https://doi.org/10.1038/s41598-023-37251-5

Mansour, A. S., & Zaky, M. S. (2023). A new extended single-switch high gain DC–DC boost converter for renewable energy applications. *Scientific Reports*, *13*(1), 1–22. https://doi.org/10.1038/s41598-022-26660-7

Sakti, A. D., Rohayani, P., Izzah, N. A., Toya, N. A., Hadi, P. O., Octavianti, T., Harjupa, W., Caraka, R. E., Kim, Y., Avtar, R., Puttanapong, N., Lin, C. H., & Wikantika, K. (2023). Spatial integration framework of solar, wind, and hydropower energy potential in Southeast Asia. *Scientific Reports*, *13*(1), 1–18. https://doi.org/10.1038/s41598-022-25570-y

Scheffran, J., & Battaglini, A. (2011). Climate and conflicts: the security risks of global warming. *Regional Environmental Change*, *11*, 27–39. https://doi.org/10.1007/s10113-010-0175-8

Xu, Z., Qi, J., Wang, S., Liu, X., Li, M., Mann, S., & Huang, X. (2023). Algal cell bionics as a step towards photosynthesis-independent hydrogen production. *Nature Communications*, *14*(1), 1–11. https://doi.org/10.1038/s41467-023-37608-4

Zheng, X., Liu, Z., Sun, J., Luo, R., Xu, K., Si, M., Kang, J., Yuan, Y., Liu, S., Ahmad, T., Jiang, T., Chen, N., Wang, M., Xu, Y., Chuai, M., Zhu, Z., Peng, Q., Meng, Y., Zhang, K., … Chen, W. (2023). Constructing robust heterostructured interface for anode-free zinc batteries with ultrahigh capacities. *Nature Communications*, *14*(1). https://doi.org/10.1038/s41467-022-35630-6

Appendix: Journal Review

No	Author	Research Title	Research variable	Research methods	Research result
1.	Pacesila M., Stefan Gabriel Burcea A, Sofia Elena Colesca	Analysis of renewable energies in European Union	Renewable Energies	Applied the k-means clustering method based on the data obtained from Eurostat. By using the Statistical Package (SPSS) for the Social Sciences	The application of k-means clustering algorithm using SPSS package generated three groups of countries: (Fig. 2): • 1st group: Sweden, Denmark, Romania, Estonia and Czech Republic. These countries have registered energy dependence rates less than 30%. • 2nd group: Austria, Latvia, Finland, Slovenia, France, Germany, Croatia, Bulgaria, Greece, Poland, Slovakia, Hungary, Netherlands, United Kingdom. These countries have registered energy dependence rates between 30% and 70%. • 3rd group: Portugal, Lithuania, Italy, Spain, Ireland, Belgium, Cyprus, Malta, Luxembourg. These countries have registered energy dependence rates higher than 70%.
2.	Tausef Aized, Muhammad Syahid, Amanat Ali Bhatti, Muhammad Saleem, Gabriel Anandarajah (2017)	Energy security and renewable energy policy analysis of Pakistan	Energy security, renewable energy policy	This study focuses on an integrated energy approach;	One hundred years of potential global warming due to electricity generation increased from 22.2 million tonnes of energy CO2 equivalent in 2012 to 55.2 million tons of CO2 energy equivalent to 2030. This increased potential is a potential threat to food and water security for the community Pakistan. Therefore, there is an urgent need to upgrade The use of renewable energy is not only for electricity generation but also for transportation and other social services. This study shows that the current energy mix is an expensive option and it will definitely be increase the cost of externalities along with the potential for global warming tall one. Therefore, the energy mix in the future must be based on the greater share of the renewable resources it has minimum fuel costs and externalities and damage impacts less environment.

3.	Abubakar Sadiq Aliyu, Joseph O. Dada, Ibrahim Khalil Adam	Current status and future prospects of renewable energy in Nigeria	Future Prospects of Renewable Energy	Conduct a comprehensive assessment and make comparisons	Appropriate market driven policies will lead to a significant growth in RE development and utilization in the country. The RE for both on-grid and off-grid electricity generation needs to be continuously promoted and encouraged through the strengthening of research and development capability, training of manpower, operation and maintenance culture and local manufacturing of RE equipment. An integrated power solution based on the current centralized power systems and decentralized electricity generation using RE technologies needs to be rigorously pursued in order to overcome the present electricity crisis, thereby moving the country towards economic prosperity. The suggested methods for promoting the utilization of RE in Nigeria are equally applicable to other sub-Sahara African countries. The major factors militating against the RE deployment in most of these countries are lack of government clear policies on RE and the economy of RE technologies.
4	Henk-Jan Kooij, Jenny Palm, Marieke Oteman, Sietske Veenman, Karl Sperling, Dick Magnusson, Frede Hvelplund.	Between grassroots and treetops: Community power and institutional dependence in the renewable energy sector in Denmark, Sweden and the Netherlands	Community power, institutional dependence in the renewable energy sector	Analyze the possibilities of GIs to emerge and act within three dimensions: the material-economic, the actor-institutional and discursive dimension.	We conclude that conditional factors lie within the material economic dimension in terms of the biophysical conditions, the structure of the economy, energy dependency and the energy market. Within the actor-institutional dimension, we conclude that the presence or absence of fossil fuel incumbents, such as regional utilities, strongly influence the possibilities of GIs. Within the discursive dimension, openness for alternative discourses proved to be enabling for GI-activities, as well as democratized knowledge production. In addition to these conditions of possibility, GIs can also act despite dominant institutions, albeit limited. Finally, GIs need a strong network with knowledge institutes, technology developers and political parties in order to achieve institutional change that enables Gis to flourish. Without institutional space, GIs remain subjected to the dominant power-relations, and cannot exert much influence upon the energy system.

5	Andrea Masini, Emanuela Menichetti	Investment Decision in the Renewable Energy Sector: An analysis of non-financial drivers	Renewable energies, Behavioral finance, Investment diversification,	Empirical analysis, Portfolio, Survey research	Our results shed new light on the role of institutional and behavioral factors in determining the share of renewable energy technologies in energy portfolios, and have important implications for both investors and policy makers: they suggest that RE technologies still suffer from a series of biased perceptions and preconceptions that favor status quo energy production models over innovative alternatives.