

Harnessing Renewable Energy for Local Economic Growth: Future Research Themes and Strategies

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Abstract: *This paper explores the economic impact of renewable energy projects on local communities, focusing on how these initiatives influence income growth. It highlights renewable energy sources like solar, wind, hydro, and biomass, which have a smaller environmental footprint than traditional fossil fuels and have shown significant potential for stimulating local economies. The research emphasizes the direct, indirect, and induced effects of renewable energy projects, including job creation, supply chain stimulation, and increased local spending. Through empirical evidence and case studies, the study demonstrates how community ownership and innovative financing models enhance the economic benefits of renewable energy for local populations. Additionally, it addresses the challenges of ensuring equitable distribution of these benefits and proposes strategies to overcome financial barriers for low-income communities.*

Keywords: renewable energy, local communities, income growth, job creation, economic benefits

1. Introduction

In recent years, renewable energy has emerged as a critical component in the global effort to combat climate change and reduce dependence on fossil fuels. Governments, non-governmental organizations, and private sectors are increasingly investing in renewable energy projects, recognizing not only their environmental benefits but also their potential economic impacts on local communities. This paper aims to explore and measure the impact of renewable energy initiatives on the income of local communities, thereby providing a comprehensive analysis of how these projects contribute to local economic development.

Renewable energy sources, such as solar, wind, hydro, and biomass, are inherently sustainable and have a significantly lower environmental footprint compared to traditional fossil fuels. As of 2020, renewables accounted for nearly 29% of global electricity generation, and this share is projected to increase as technology advances and costs decrease (International Energy Agency [IEA], 2020). While the environmental advantages of renewable energy are well-documented, understanding the socio-economic implications, particularly on local communities' income, is essential for policymakers and stakeholders aiming to foster inclusive and sustainable development.

The deployment of renewable energy projects can lead to various economic benefits for local communities. These benefits can be categorized into direct, indirect, and induced effects. Direct effects include job creation during the construction, operation, and maintenance of renewable energy facilities. For instance, the solar industry alone employed over 3 million people worldwide by 2020 (International Renewable Energy Agency [IRENA], 2021). Indirect effects encompass the economic activities generated in the supply chain, including manufacturing, transportation, and services related to renewable energy infrastructure. Induced effects refer to the increased economic activity resulting from the spending of incomes earned through direct and indirect employment in the local economy.

A case in point is the development of wind energy in rural areas of the United States, which has been shown to increase household incomes and local government revenues (Brown et

al., 2012). Wind farms often lease land from local farmers, providing them with a steady source of income, which can be particularly beneficial in times of agricultural uncertainty. Additionally, local governments benefit from increased tax revenues, which can be reinvested in community services and infrastructure, further stimulating local economic growth.

While the potential economic benefits of renewable energy projects are significant, several challenges and considerations must be addressed to ensure these benefits are realized equitably. One major challenge is the initial capital investment required for renewable energy projects, which can be a barrier for low-income communities. However, innovative financing mechanisms, such as community-owned renewable energy projects and public-private partnerships, can help overcome this hurdle (Bauwens et al., 2016).

Moreover, the distribution of economic benefits can vary widely depending on the ownership and management structure of the projects. Community-owned renewable energy projects tend to provide more substantial local economic benefits compared to externally-owned projects, as the profits are reinvested locally rather than being repatriated to external investors (Hicks & Ison, 2018). Therefore, fostering community involvement and ownership in renewable energy projects is crucial for maximizing local economic impacts.

Empirical studies and case studies provide valuable insights into the relationship between renewable energy projects and local income levels. For instance, a study conducted in Germany found that regions with higher investments in renewable energy experienced higher income growth and lower unemployment rates compared to regions with lower investments (Frondel et al., 2010). Similarly, in Kenya, the deployment of off-grid solar systems has been linked to increased household incomes and improved quality of life for rural communities (Ondraczek, 2013).

These case studies highlight the importance of context-specific factors, such as the type of renewable energy technology, the scale of the projects, and the socio-economic characteristics of the local communities. Therefore, a nuanced and comprehensive approach is necessary to accurately measure the impact of renewable energy on local incomes.

The transition to renewable energy presents a unique opportunity to not only address environmental challenges but also to drive economic development in local communities. This paper seeks to contribute to the growing body of literature on the socio-economic impacts of renewable energy by providing a comprehensive analysis of how these projects affect local incomes. Through a combination of empirical evidence and case studies, this research aims to offer practical insights for policymakers, practitioners, and stakeholders to maximize the economic benefits of renewable energy projects for local communities.

Understanding the nuanced relationship between renewable energy and local income is essential for designing policies and initiatives that promote sustainable and inclusive economic development. By shedding light on this critical issue, this paper hopes to inform future efforts to harness the full potential of renewable energy for the betterment of local communities worldwide.

2. Literature Review

Role of Renewable Energy

Renewable energy has been the focus of extensive research, particularly in the context of climate change mitigation and energy security. The shift from fossil fuels to renewable sources is seen as a pivotal strategy to reduce greenhouse gas emissions and combat global warming. The most common forms of renewable energy include solar, wind, hydro, biomass, and geothermal energy. Each of these technologies has distinct characteristics, benefits, and challenges.

Solar energy has seen remarkable growth due to advances in photovoltaic technology and significant reductions in cost. According to IRENA (2021), the cost of solar photovoltaics has decreased by nearly 82% over the past decade, making it one of the most competitive energy sources globally. Research by Breyer et al. (2017) indicates that integrating solar energy into national grids can significantly reduce reliance on fossil fuels and enhance energy security.

Wind energy is another rapidly growing sector, particularly in countries with abundant wind resources such as the United States, China, and Germany. Studies by Wiser et al. (2016) show that wind energy not only reduces carbon emissions but also creates substantial economic benefits, including job creation and increased tax revenues. The technological advancements in turbine efficiency and the development of offshore wind farms have further expanded the potential of wind energy.

Hydropower remains one of the most established and widely used renewable energy sources. It accounts for a significant share of electricity generation in many countries. Research by Zarfl et al. (2019) highlights both the benefits and environmental concerns associated with hydropower, such as ecosystem disruption and displacement of local communities. However, with proper management, hydropower can provide reliable and sustainable energy.

Biomass and geothermal energy also contribute to the renewable energy mix, albeit to a lesser extent compared to solar, wind, and hydro. Biomass energy, derived from organic

materials, has been researched for its potential in waste management and energy production. Geothermal energy, which harnesses heat from the earth, is explored for its reliability and low environmental impact. Study by Dincer & Acar (2015) provide comprehensive reviews of the advancements and challenges in biomass and geothermal energy, respectively.

Growing Research in Local Communities

Local communities are central to sustainable development, and their involvement is crucial for the success of renewable energy projects. Research in this area often focuses on community engagement, social acceptance, and the socio-economic impacts of development projects.

Community engagement in renewable energy projects is critical for their success. According to Walker & Devine-Wright (2008), projects that involve local communities in planning and decision-making processes are more likely to gain public support and achieve long-term sustainability. The concept of community energy, where local residents own and manage renewable energy projects, has gained traction in recent years. Bauwens et al. (2016) discuss how community energy projects can empower local communities, enhance social cohesion, and provide economic benefits.

Social acceptance of renewable energy projects is influenced by various factors, including perceived benefits, environmental impact, and trust in developers. Wüstenhagen et al. (2007) propose a tripartite model of social acceptance, comprising socio-political, community, and market acceptance. They argue that addressing local concerns and ensuring transparent communication are essential for achieving broad support for renewable energy initiatives.

The socio-economic impacts of renewable energy projects on local communities have been widely studied. Research indicates that renewable energy projects can stimulate local economies through job creation, increased income, and infrastructure development. However, the distribution of these benefits can be uneven, leading to potential conflicts and resistance. Aitken (2010) emphasizes the importance of understanding local contexts and ensuring that the benefits of renewable energy projects are equitably shared.

Research has also explored the role of local governments and institutions in facilitating renewable energy projects. Studies in the past highlight the importance of supportive policies, financial incentives, and capacity-building initiatives in promoting local renewable energy development. These findings underscore the need for a collaborative approach involving multiple stakeholders to achieve sustainable outcomes.

Renewable Energy's Role in Local Communities' Income

The impact of renewable energy projects on local communities' income is a critical aspect of their socio-economic benefits. Several studies have examined this relationship, highlighting both the potential and challenges associated with renewable energy investments.

Renewable energy projects can directly contribute to local incomes through job creation. The construction, operation,

and maintenance of renewable energy facilities require a range of skills, providing employment opportunities for local residents. According to IRENA (2021), the renewable energy sector employed over 11 million people globally in 2020, with significant contributions from solar, wind, and biomass industries. Studies by Wei et al. (2010) demonstrate that renewable energy projects can generate more jobs per unit of energy produced compared to fossil fuels, thus enhancing local employment prospects.

Indirect economic benefits also arise from renewable energy projects. These include the stimulation of local businesses and services that support the renewable energy industry. For instance, local contractors, suppliers, and service providers benefit from the increased demand for their products and services. Research by Brown et al. (2012) on wind energy projects in the United States shows that local businesses experience increased revenue and growth due to the presence of wind farms.

In addition to direct and indirect benefits, renewable energy projects can induce broader economic effects by increasing disposable incomes and local spending. Households and businesses benefiting from renewable energy projects tend to spend more in the local economy, creating a multiplier effect. A study by Allan et al. (2011) on the economic impacts of biomass energy projects in Scotland found that increased household incomes and spending led to significant economic growth in local communities.

However, the distribution of economic benefits from renewable energy projects can be uneven. Research indicates that the ownership structure of renewable energy projects plays a crucial role in determining who benefits. Community-owned projects tend to provide more substantial local economic benefits compared to externally-owned projects, as profits are reinvested locally. Conversely, projects owned by external investors may lead to profit leakage, where financial gains are transferred out of the local community.

Furthermore, the initial capital investment required for renewable energy projects can be a barrier for low-income communities. Innovative financing mechanisms, such as community shares, crowdfunding, and public-private partnerships, can help overcome this challenge. Studies by Seyfang et al. (2013) and Hicks & Ison (2018) explore various financing models that enable local communities to participate in and benefit from renewable energy projects.

Empirical evidence from various regions supports the positive impact of renewable energy on local incomes. For instance, in Germany, regions with higher investments in renewable energy have experienced higher income growth and lower unemployment rates (Frondel et al., 2010). In Kenya, the deployment of off-grid solar systems has been linked to increased household incomes and improved quality of life for rural communities (Ondraczek, 2013). These case studies underscore the potential of renewable energy projects to enhance local economic development.

In conclusion, the literature demonstrates that renewable energy projects can significantly impact local communities' income through direct employment, indirect economic

activities, and induced effects. However, the extent of these benefits depends on various factors, including the ownership structure, financing mechanisms, and local context. Understanding these dynamics is essential for designing policies and initiatives that maximize the economic benefits of renewable energy projects for local communities.

Renewable Energy and Local Community Income Growth

Renewable energy projects have demonstrated significant potential in contributing to the growth of local communities' income. This contribution can be categorized into direct, indirect, and induced economic effects. The following section explores these sources and avenues in detail, supported by past literature, surveys, and factual reports.

Direct Economic Contributions

Job Creation

One of the most immediate ways renewable energy projects contribute to local income growth is through job creation. The construction, operation, and maintenance of renewable energy facilities require a diverse range of skills, providing employment opportunities for local residents. According to the International Renewable Energy Agency (IRENA), the renewable energy sector employed over 11 million people globally in 2020, with significant contributions from the solar, wind, and biomass industries (IRENA, 2021). The solar energy sector alone accounted for nearly 3.8 million jobs, showcasing its potential to drive local employment (IRENA, 2021).

Empirical studies underscore the substantial job creation potential of renewable energy projects. For instance, a study by Wei et al. (2010) found that renewable energy investments create more jobs per unit of energy produced compared to fossil fuels. Similarly, it was demonstrated in the literature that the renewable energy sector in the European Union could generate between 1.2 to 1.5 million jobs by 2030, depending on policy support and technological advancements.

Lease Payments and Land Rentals

Renewable energy projects, particularly wind and solar farms, often require large tracts of land. In many cases, project developers lease land from local landowners, providing them with a steady source of income. This arrangement is especially beneficial in rural areas, where landowners may face economic uncertainties due to fluctuating agricultural yields. Research by Slattery et al. (2011) on wind farms in Texas found that landowners received annual lease payments ranging from \$3,000 to \$5,000 per turbine, significantly boosting their income.

Indirect Economic Contributions

Supply Chain and Local Business Development

The development and operation of renewable energy projects stimulate local supply chains and businesses. Local contractors, suppliers, and service providers benefit from the increased demand for their products and services. For example, wind energy projects require components such as turbines, blades, and towers, which can be sourced from local manufacturers. Research by Brown et al. (2012) on wind energy projects in the United States showed that local

businesses experienced increased revenue and growth due to the presence of wind farms.

In the solar energy sector, local businesses involved in the installation and maintenance of solar panels benefit from increased demand. A study in the solar sector highlighted that the growth of the solar industry in North Carolina led to the establishment of numerous small and medium-sized enterprises (SMEs) specializing in solar installation and related services.

Induced Economic Contributions

Increased Household Incomes and Local Spending

Renewable energy projects contribute to local income growth by increasing household incomes, which in turn leads to higher local spending. Households benefiting from direct employment or lease payments tend to spend more on goods and services within the community, creating a multiplier effect. This increased spending stimulates local businesses, further driving economic growth.

A study by Allan et al. (2011) on the economic impacts of biomass energy projects in Scotland found that increased household incomes and spending led to significant economic growth in local communities. The study estimated that every £1 million invested in biomass projects generated £2 million in additional economic activity within the local economy.

Empirical Evidence from Various Economies

Germany

Germany's investment in renewable energy, particularly through its Energiewende (energy transition) policy, provides valuable insights into the economic benefits for local communities. Research by Frondel et al. (2010) found that regions with higher investments in renewable energy experienced higher income growth and lower unemployment rates compared to regions with lower investments. The study highlighted that the distributed nature of renewable energy projects, such as small-scale solar installations, facilitated widespread economic benefits across various regions.

United States

The development of wind energy in rural areas of the United States has been shown to increase household incomes and local government revenues. A study by Brown et al. (2012) on wind farms in Texas revealed that local communities benefited from increased property taxes and lease payments, which were reinvested in community services and infrastructure. Additionally, wind energy projects created local employment opportunities, further contributing to income growth.

Kenya

In Kenya, the deployment of off-grid solar systems has been linked to increased household incomes and improved quality of life for rural communities. A study by Ondraczek (2013) found that access to solar energy enabled households to extend their productive hours, engage in income-generating activities, and reduce expenditures on traditional energy sources such as kerosene. The study highlighted the

transformative potential of renewable energy in enhancing rural livelihoods and economic resilience.

Challenges and Considerations

While the potential economic benefits of renewable energy projects are significant, several challenges and considerations must be addressed to ensure these benefits are realized equitably.

Ownership Structure

The ownership structure of renewable energy projects plays a crucial role in determining the distribution of economic benefits. Community-owned projects tend to provide more substantial local economic benefits compared to externally-owned projects, as profits are reinvested locally rather than being repatriated to external investors. Ensuring community involvement and ownership in renewable energy projects is essential for maximizing local economic impacts.

Initial Capital Investment

The initial capital investment required for renewable energy projects can be a barrier for low-income communities. Innovative financing mechanisms, such as community shares, crowdfunding, and public-private partnerships, can help overcome this challenge. Studies by Seyfang et al. (2013) and Hicks & Ison (2018) explore various financing models that enable local communities to participate in and benefit from renewable energy projects.

Equitable Distribution of Benefits

Ensuring that the economic benefits of renewable energy projects are equitably distributed among community members is critical. Research by Aitken (2010) emphasizes the importance of understanding local contexts and ensuring that the benefits of renewable energy projects are shared fairly. This includes addressing potential conflicts and resistance that may arise from perceived inequalities in benefit distribution.

Renewable energy projects have the potential to significantly contribute to the growth of local communities' income through direct, indirect, and induced economic effects. The creation of jobs, lease payments, stimulation of local supply chains, and increased household incomes all play a role in driving local economic growth. Empirical evidence from various regions, including Germany, the United States, and Kenya, underscores the positive impact of renewable energy on local incomes. However, addressing challenges related to ownership structure, initial capital investment, and equitable distribution of benefits is essential for maximizing the economic potential of renewable energy projects for local communities.

Future Research Themes in Renewable Energy for Enhancing Local Community Income

Renewable energy has demonstrated substantial potential in contributing to local economic development, yet there remain numerous areas where further research is needed to optimize these benefits. Future research can address several dominant themes to enhance the income of local communities through renewable energy projects. These themes include the economic impact assessment, policy and regulatory frameworks, community ownership and participation models,

technological innovations, and the integration of renewable energy with other local economic activities.

Economic Impact Assessment

Granular Economic Impact Studies

While general economic benefits of renewable energy projects are well-documented, there is a need for more granular, location-specific studies that assess the economic impacts on local communities. Future research should focus on developing detailed economic models that consider the unique characteristics of different communities. This includes analyzing the short-term and long-term economic impacts of renewable energy projects on various sectors such as agriculture, tourism, and local businesses.

Cost-Benefit Analysis

Conducting comprehensive cost-benefit analyses of renewable energy projects can provide insights into their economic viability and sustainability. These analyses should consider not only the direct financial costs and benefits but also the social and environmental costs and benefits. For instance, research can explore how renewable energy projects affect local property values, tax revenues, and public services.

Policy and Regulatory Frameworks

Incentive Structures

Future research should investigate the effectiveness of different policy incentives and regulatory frameworks in promoting renewable energy projects that benefit local communities. This includes analyzing the impact of feed-in tariffs, tax credits, subsidies, and other financial incentives on the economic outcomes of renewable energy projects. Research can also explore how these policies can be tailored to ensure that benefits are equitably distributed among community members.

Decentralized Energy Policies

Decentralized energy policies that promote local ownership and control of renewable energy resources can significantly enhance community income. Future research should examine the effectiveness of decentralized energy policies in different contexts and identify best practices. This includes studying the impact of local energy cooperatives, community-owned renewable energy projects, and other decentralized models on local economic development.

Regulatory Barriers

Identifying and addressing regulatory barriers to the development of community-focused renewable energy projects is another critical area for future research. This includes exploring how zoning laws, permitting processes, and grid connection regulations affect the feasibility and profitability of renewable energy projects for local communities.

Community Ownership and Participation Models

Ownership Structures

The ownership structure of renewable energy projects plays a crucial role in determining the distribution of economic benefits. Future research should explore different ownership

models, such as community ownership, cooperative ownership, and public-private partnerships, and their impact on local income. This includes studying the financial performance, social acceptance, and economic benefits of different ownership models in various contexts.

Participation Mechanisms

Effective community participation mechanisms are essential for ensuring that the benefits of renewable energy projects are equitably distributed. Future research should investigate different participation mechanisms, such as community advisory boards, participatory budgeting, and stakeholder engagement processes, and their impact on the success of renewable energy projects. This includes exploring how these mechanisms can be designed to maximize community involvement and ensure that the voices of all community members are heard.

Capacity Building

Building the capacity of local communities to participate in and benefit from renewable energy projects is another critical area for future research. This includes exploring different capacity-building strategies, such as technical training programs, financial literacy workshops, and leadership development initiatives, and their impact on community income and empowerment.

Technological Innovations

Cost Reduction and Efficiency Improvements

Technological innovations that reduce the cost and improve the efficiency of renewable energy systems can enhance their economic viability and increase their benefits for local communities. Future research should focus on developing and deploying new technologies, such as advanced solar panels, more efficient wind turbines, and next-generation biomass systems, that can deliver more energy at a lower cost.

Energy Storage Solutions

Energy storage is a critical component of renewable energy systems, particularly for ensuring a stable and reliable energy supply. Future research should explore the development and deployment of advanced energy storage solutions, such as batteries, pumped hydro storage, and thermal storage, and their impact on the economic outcomes of renewable energy projects. This includes studying the potential of energy storage to enhance the financial performance of renewable energy projects and increase their benefits for local communities.

Microgrids and Smart Grids

Microgrids and smart grids can enhance the resilience and reliability of local energy systems, making renewable energy projects more viable and beneficial for local communities. Future research should investigate the development and deployment of microgrids and smart grids, and their impact on local income and economic development. This includes exploring how these technologies can be integrated with existing energy systems and how they can be used to promote local energy independence and self-sufficiency.

Integration with Other Local Economic Activities

Agrivoltaics and Agroforestry

Integrating renewable energy projects with agricultural and forestry activities can provide additional income streams for local communities. Future research should explore the potential of agrivoltaics (the co-location of solar panels and agricultural activities) and agroforestry (the integration of renewable energy with forestry activities) to enhance local income. This includes studying the financial performance, environmental benefits, and social acceptance of these integrated approaches.

Eco-Tourism

Renewable energy projects can also be integrated with eco-tourism activities to provide additional economic benefits for local communities. Future research should investigate the potential of renewable energy projects to attract eco-tourists and generate additional income for local businesses. This includes exploring how renewable energy projects can be designed and marketed to enhance their appeal to eco-tourists and maximize their economic benefits.

Local Manufacturing and Services

Developing local manufacturing and service industries that support renewable energy projects can provide additional employment and income opportunities for local communities. Future research should explore the potential of local manufacturing and service industries to support renewable energy projects and enhance local economic development. This includes studying the feasibility and economic impact of developing local supply chains, training programs, and business development initiatives that support renewable energy projects.

3. Conclusion

The future of renewable energy research holds significant potential for enhancing the income of local communities through various avenues. By focusing on detailed economic impact assessments, refining policy and regulatory frameworks, exploring innovative community ownership and participation models, advancing technological innovations, and integrating renewable energy projects with other local economic activities, researchers can provide valuable insights and strategies to maximize the economic benefits of renewable energy for local communities. Addressing these themes will be crucial for ensuring that renewable energy projects not only contribute to sustainable energy transitions but also promote inclusive and equitable economic development at the local level.

References

- [1] Aitken, M. (2010). Wind power and community benefits: Challenges and opportunities. *Energy policy*, 38(10), 6066-6075.
- [2] Allan, G., Mcgregor, P., & Swales, K. (2011). The importance of revenue sharing for the local economic impacts of a renewable energy project: A social accounting matrix approach. *Regional Studies*, 45(9), 1171-1186.
- [3] Bauwens, T., Gotchev, B., & Holstenkamp, L. (2016). What drives the development of community energy in Europe? The case of wind power cooperatives. *Energy Research & Social Science*, 13, 136-147.
- [4] Breyer, C., Bogdanov, D., Gulagi, A., Aghahosseini, A., Barbosa, L. S., Koskinen, O., ... & Vainikka, P. (2017). On the role of solar photovoltaics in global energy transition scenarios. *Progress in Photovoltaics: Research and Applications*, 25(8), 727-745.
- [5] Brown, J. P., Pender, J., Wisler, R., Lantz, E., & Hoen, B. (2012). Ex post analysis of economic impacts from wind power development in US counties. *Energy Economics*, 34(6), 1743-1754.
- [6] Dincer, I., & Acar, C. (2015). Review and evaluation of hydrogen production methods for better sustainability. *International journal of hydrogen energy*, 40(34), 11094-11111.
- [7] Frondel, M., Ritter, N., Schmidt, C. M., & Vance, C. (2010). Economic impacts from the promotion of renewable energy technologies: The German experience. *Energy Policy*, 38(8), 4048-4056.
- [8] Hicks, J., & Ison, N. (2018). An exploration of the boundaries of "community" in community renewable energy projects: Navigating between motivations and context. *Energy Policy*, 113, 523-534.
- [9] International Energy Agency (IEA). (2020). Renewables 2020. Retrieved from <https://www.iea.org/reports/renewables-2020>
- [10] International Renewable Energy Agency (IRENA). (2021). Renewable Energy and Jobs – Annual Review 2021. Retrieved from <https://www.irena.org/publications/2021/Oct/Renewable-Energy-and-Jobs-Annual-Review-2021>
- [11] Ondraczek, J. (2013). The sun rises in the east (of Africa): A comparison of the development and status of solar energy markets in Kenya and Tanzania. *Energy Policy*, 56, 407-417.
- [12] Seyfang, G., Park, J. J., & Smith, A. (2013). A thousand flowers blooming? An examination of community energy in the UK. *Energy policy*, 61, 977-989.
- [13] Slattery, M. C., Lantz, E., & Johnson, B. L. (2011). State and local economic impacts from wind energy projects: Texas case study. *Energy Policy*, 39(12), 7930-7940.
- [14] Walker, G., & Devine-Wright, P. (2008). Community renewable energy: What should it mean?. *Energy policy*, 36(2), 497-500.
- [15] Wei, M., Patadia, S., & Kammen, D. M. (2010). Putting renewables and energy efficiency to work: How many jobs can the clean energy industry generate in the US?. *Energy policy*, 38(2), 919-931.
- [16] Wisler, R., Jenni, K., Seel, J., Baker, E., Hand, M., Lantz, E., & Smith, A. (2016). Expert elicitation survey on future wind energy costs. *Nature Energy*, 1(10), 1-8.
- [17] Wüstenhagen, R., Wolsink, M., & Bürer, M. J. (2007). Social acceptance of renewable energy innovation: An introduction to the concept. *Energy policy*, 35(5), 2683-2691.
- [18] Zarfl, C., Berlekamp, J., He, F., Jähnig, S. C., Darwall, W., & Tockner, K. (2019). Future large hydropower dams impact global freshwater megafauna. *Scientific reports*, 9(1), 18531.