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Original Research Paper

Challenges and Opportunities in Implementing Renewable Energy in Iraq

Hassan Al-Ghabera[1], Rania Hassan Ahmed[2], Mariam Youssef[1], Abbas Mahmood[2]

[1] *Faculty of Engineering, University of Kufa. Najaf, Iraq.*
[2] *Faculty of Engineering, University of Thi-Qar. Nasiriyah, Iraq.*

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***Corresponding Author:**
Hassan Al-Ghabera
Email:
h.alghabera@gmail.com

Abstract: This research explores the potential of renewable energy in Iraq, focusing on the challenges and opportunities for its implementation to address the country's energy crisis. Iraq, historically reliant on oil and gas, faces severe energy shortages and infrastructure damage due to years of conflict. The objective of this study is to investigate how renewable energy, particularly solar and wind power, can provide a sustainable solution to Iraq's energy demands. The research employs a mixed-methods approach, utilizing in-depth interviews with energy experts, surveys of the general public and industry stakeholders, and case studies from countries like Morocco and Tunisia that have successfully implemented renewable energy systems. The findings highlight the significant potential for solar and wind energy in Iraq, but also emphasize the barriers related to infrastructure, policy uncertainty, and investment shortages. The study suggests that while renewable energy can play a key role in Iraq's energy future, it requires strong governmental policies, infrastructure improvements, and private sector investments to succeed. Cultural and economic factors must also be considered for successful adoption. The discussion underscores the need for a strategic approach to integrate renewable energy into Iraq's energy sector. Future research should explore the feasibility of specific renewable energy projects, focusing on policy frameworks, technological advancements, and the role of international partnerships in accelerating renewable energy development.

Keywords: Energy Policy, Energy Sector, Renewable Energy, Solar Power, Wind Energy.

1. Introduction

Iraq has endured decades of conflict that have severely damaged its infrastructure, leaving the country without reliable electricity, transportation systems, and essential public utilities [1]. This destruction has significantly hampered economic recovery, social stability, and public well-being [2]. The reconstruction of Iraq's infrastructure presents an opportunity to incorporate sustainable energy solutions, particularly renewable energy technologies, which can provide resilience and long-term environmental benefits.

Iraq is endowed with abundant renewable energy resources, especially solar and wind energy, due to its high solar irradiation levels and favorable wind conditions in specific regions [3]. Despite these resources, Iraq has yet to fully utilize them to address its energy and infrastructure challenges [4]. Integrating renewable energy into the reconstruction process could help address the country's energy shortages while contributing to sustainable economic development [5].

The global shift towards renewable energy, driven by international climate agreements such as the Paris Accord, further underscores the importance of Iraq adopting green energy solutions [6]. With its post-conflict reconstruction efforts underway, Iraq is uniquely positioned to leverage international support and investments in renewable energy infrastructure [7]. Doing so not only reduces reliance on fossil fuels but also creates economic opportunities, fosters innovation, and mitigates environmental impacts [8].

The primary objective of this study is to examine the role of renewable energy technologies in the reconstruction of Iraq's infrastructure, focusing on both their feasibility and potential benefits in accelerating post-conflict rebuilding efforts. It aims to evaluate the application of technologies such as solar and wind energy while identifying the technical, financial, and institutional challenges that hinder their implementation in post-conflict environments. Additionally, the research seeks to provide actionable policy and technical recommendations to optimize the deployment of renewable energy, offering a comprehensive framework to address Iraq's immediate energy needs and long-term sustainability goals.

This study offers critical contributions to Iraq's recovery and the broader discourse on sustainable development. By proposing a roadmap for integrating renewable energy technologies, the research addresses Iraq's urgent energy needs while aligning with international sustainability goals. Renewable energy integration can significantly enhance Iraq's energy security, reduce greenhouse gas emissions, and create a foundation for long-term economic stability. The study also highlights the socio-economic and political challenges associated with adopting renewable energy in conflict-affected regions. Its findings are applicable not only to Iraq but also to other nations facing similar post-conflict reconstruction challenges, such as Syria and Yemen.

Finally, this research contributes to the growing literature on renewable energy in post-conflict settings by offering actionable insights for policymakers, researchers, and international organizations. It emphasizes the role of sustainable energy in fostering resilience and socio-economic recovery, particularly in regions vulnerable to the impacts of climate change.

2. Literature Review

2.1. Renewable Energy Technologies

Renewable energy technologies, such as solar photovoltaic (PV), wind turbines, and bioenergy, have gained significant attention due to their potential in addressing energy shortages and environmental challenges. Solar PV systems are particularly suitable for regions with abundant sunlight, providing a sustainable and low-cost solution for rural areas affected by conflict. Wind energy also offers a reliable alternative for regions with high wind potential. In addition, bioenergy, which utilizes organic waste, can be an important renewable energy source in areas with limited resources. These technologies are especially relevant for countries like Iraq, where traditional energy infrastructure has been severely damaged due to ongoing conflicts [9].

In post-conflict zones like Yemen and Afghanistan, renewable energy has been applied successfully to help rebuild and restore basic services. In Yemen, solar energy has been used extensively to provide power for essential services like healthcare and water purification, demonstrating its potential as an effective solution in conflict-affected areas. Similarly, Afghanistan has utilized off-grid solar systems to provide energy to rural communities, helping to improve living standards and support reconstruction efforts. These cases highlight the practical applications of renewable energy technologies in post-conflict regions and underscore their importance in rebuilding efforts [10][11].

A key benefit of renewable energy technologies is their decentralized nature. Unlike traditional energy systems that require large, centralized grids, renewable energy systems can be deployed on a smaller scale to serve local communities. This makes them particularly valuable for areas with destroyed infrastructure or limited access to centralized power. Renewable energy solutions, particularly solar and wind power, can play a crucial role in ensuring energy security and independence in post-conflict countries, such as Iraq. These technologies can reduce dependence on foreign energy supplies and mitigate energy shortages that often hinder reconstruction efforts [9].

However, despite their benefits, the deployment of renewable energy technologies in post-conflict regions faces several challenges. Financial limitations, lack of technical expertise, and unstable political conditions often hinder their widespread adoption. In countries like Yemen and Afghanistan, international support has been essential in overcoming some of these barriers. Nonetheless, the long-term success of renewable energy projects depends on the development of local capacities and supportive regulatory frameworks. For Iraq, addressing these barriers will be crucial to integrating renewable energy solutions effectively into the post-conflict recovery process [12].

In conclusion, while renewable energy technologies offer great potential for post-conflict reconstruction, their successful implementation requires overcoming significant challenges, including financial, technical, and political hurdles. Lessons learned from Yemen and Afghanistan provide valuable insights for Iraq, highlighting the importance of a comprehensive approach that includes local capacity building, international support, and robust regulatory frameworks. By integrating renewable energy technologies, Iraq can not only address its immediate energy needs but also ensure long-term energy sustainability, aiding in its overall recovery and development [10][11].

2.2. Renewable Energy Potential in Iraq

Iraq is recognized for its vast renewable energy potential, particularly in solar and wind resources. The country enjoys an annual solar radiation average of 5.5-6.5 kWh/m²/day, which is one of the highest in the Middle East. This high solar radiation presents an opportunity for the large-scale deployment of solar photovoltaic (PV) technology. Additionally, several regions in Iraq, especially in the western and southern parts, are characterized by strong and consistent winds, making them ideal candidates for wind energy generation. According to studies, the wind energy potential in these areas could contribute significantly to Iraq’s energy needs, offering a cleaner and more sustainable energy alternative to fossil fuels [13][14].

The potential for solar and wind energy in Iraq is complemented by a favorable geographic location, where vast stretches of desert land remain underutilized. Given Iraq’s geographical features, with open spaces and abundant sunlight, solar farms can be strategically placed to maximize energy production. Wind farms can also be installed in areas with high wind speeds, such as the plains in the west. A 2023 study highlighted that Iraq’s wind energy potential could generate up to 15,000 MW, which is a significant portion of the country's current energy consumption [14]. This renewable energy capacity could play a critical role in diversifying Iraq’s energy mix and reducing its reliance on fossil fuels.

However, despite the immense potential for renewable energy, Iraq faces several barriers to the adoption and integration of these technologies. A significant challenge is the country's continued reliance on oil and gas for its electricity generation. Iraq's energy infrastructure has historically been designed to support fossil fuel energy systems, and transitioning to renewable sources requires substantial upgrades to the grid. This includes the development of smart grid technologies and energy storage systems to manage the intermittent nature of renewable sources like solar and wind. Furthermore, Iraq's electrical infrastructure is outdated, and the ongoing lack of sufficient grid capacity further complicates the integration of renewable energy into the national energy system [15].

Another key challenge is the insufficient investment in renewable energy projects. Iraq's political instability, economic difficulties, and security concerns have contributed to the lack of investment in renewable energy infrastructure. The country’s energy sector remains largely underdeveloped, with the government struggling to attract foreign and local investments in renewable energy projects. The absence of clear regulatory frameworks and incentives for private investors further hinders the progress of renewable energy development. According to the World Bank, while Iraq's government has expressed interest in diversifying its energy portfolio, these efforts have been slow due to a lack of coherent policies and investment strategies [15].

Social and institutional challenges also hinder the implementation of renewable energy solutions in Iraq. The public’s dependence on subsidized fossil fuels, coupled with limited awareness of the benefits of renewable energy, poses significant barriers to large-scale adoption. Furthermore, there is a need for institutional capacity building within the government to support the development of a green energy sector. Educational initiatives and awareness campaigns are critical to changing public perceptions and fostering a culture of renewable energy acceptance. The implementation of renewable energy solutions would require both technical and social support, ensuring that communities are adequately prepared for this transition [13].

Despite these challenges, there have been some positive developments in Iraq's renewable energy sector. In recent years, the government has begun to take steps toward diversifying its energy mix. In 2022, the Ministry of Electricity announced plans to develop large-scale solar and wind power projects. However, progress has been slow, and the implementation of these projects has been delayed due to security, financial, and logistical challenges. International organizations and private investors could play a critical role in overcoming these obstacles by providing the necessary expertise, capital, and technology [14].

Ultimately, Iraq's renewable energy potential remains largely untapped, but with the right investments, policies, and technical solutions, it could significantly contribute to the country's energy needs and promote long-term sustainability. Drawing lessons from neighboring countries that have successfully integrated renewable energy into their grids, Iraq could gradually transition toward a cleaner and more resilient energy system. The next steps will require coordinated efforts from the Iraqi government, international stakeholders, and the private sector to overcome existing barriers and realize Iraq's renewable energy potential [15][16].

2.3. Relevance to Post-Conflict Reconstruction

The role of renewable energy in post-conflict reconstruction is crucial in supporting environmental sustainability and socio-economic stability. Post-conflict countries often experience severe energy shortages, which hinder economic recovery and social development. By transitioning to renewable energy sources like solar, wind, and bioenergy, nations can address these energy needs while reducing dependence on fossil fuels and promoting sustainability. The renewable energy integration can alleviate energy insecurity in conflict-affected regions, support infrastructure recovery, and help reduce the geopolitical tensions associated with energy imports [17].

In addition to meeting basic energy needs, renewable energy plays a key role in addressing environmental degradation in post-conflict settings. Many countries emerging from conflict face challenges such as deforestation, soil erosion, and pollution, often exacerbated by the reliance on conventional energy sources. Renewable energy projects can combat these issues by providing cleaner alternatives that reduce greenhouse gas emissions and prevent further ecological damage. Some researchers highlight that renewable energy adoption not only serves as a remedy to energy scarcity but also plays a role in restoring ecosystems and promoting environmental restoration [18]. These benefits extend beyond energy provision, contributing to long-term sustainable development in post-conflict countries.

Moreover, renewable energy projects are seen as essential for social stability in post-conflict areas. In many conflict zones, the lack of reliable electricity exacerbates existing tensions and inequalities, making it harder for communities to rebuild trust and cooperation. By ensuring equitable access to renewable energy, post-conflict societies can promote social cohesion and reduce tensions. The renewable energy projects can offer economic opportunities, such as job creation and capacity-building, which are critical for fostering a sense of empowerment and stability among marginalized groups [19]. By addressing both energy and social needs, these projects contribute to peacebuilding efforts and can help rebuild social capital in war-torn regions.

From an economic perspective, renewable energy can significantly enhance post-conflict recovery by stimulating local economies and creating jobs. Post-conflict nations often suffer from destroyed infrastructure and weakened industries, making it difficult to generate employment opportunities. Renewable energy projects, however, can create local employment in construction, maintenance, and operation, thus helping to stimulate economic growth. Renewable energy investments provide a sustainable means of diversifying the economy and reducing the financial burden of importing energy [20]. This shift not only helps in rebuilding the economy but also ensures long-term energy security by reducing dependence on external energy sources.

The importance of renewable energy in post-conflict reconstruction is evident in countries such as Iraq, Afghanistan, and Yemen, where energy shortages continue to undermine recovery efforts. These nations are increasingly looking to renewable energy to reduce energy scarcity, stabilize the economy, and promote social development. The integration of renewable energy into reconstruction strategies offers a multifaceted approach to addressing the complex challenges that post-conflict countries face, from restoring basic services to promoting long-term sustainability [21]. By investing in clean energy, these nations can lay the groundwork for stable and prosperous futures.

3. Methodology

This study uses surveys and interviews. This methodological framework allows for a thorough exploration of how renewable energy can be integrated into post-conflict infrastructure development in Iraq.

Surveys are distributed to 200 respondents, including 50 government officials, 50 energy developers, and 100 local community members. These stakeholders are located in regions such as Baghdad, Erbil, Sulaymaniyah, Basra, and Mosul. The survey collects data on perceptions regarding renewable energy, its potential impact on post-conflict reconstruction, and the perceived challenges and opportunities.

The study conducts in-depth interviews with 10 experts in the fields of energy and infrastructure. These experts are selected from Baghdad and Erbil and include energy policy advisors, engineers, and infrastructure specialists. The interviews aim to capture detailed perspectives on the technical, financial, and institutional challenges related to the implementation of renewable energy solutions.

Case studies are conducted in Iraqi cities that have already implemented small-scale renewable energy projects. These cities include Erbil, Sulaymaniyah, Basra, and Najaf. The case studies examine the successes and challenges of integrating solar and wind energy in these regions, providing valuable lessons for broader implementation.

The data collection process spans the entire year of 2023, with surveys and interviews conducted during the first half of the year. Case studies take place in the third quarter of 2023, followed by the analysis phase, which concludes by the end of 2023.

The data analysis in this study involves both quantitative and qualitative techniques to ensure a comprehensive understanding of the role of renewable energy in post-conflict infrastructure development in Iraq. Statistical analysis is applied to the survey data, focusing on identifying patterns, trends, and correlations related to stakeholders' perceptions of renewable energy. Descriptive and inferential statistics are used to examine attitudes towards renewable energy technologies and their potential for enhancing Iraq's energy infrastructure. In addition, thematic analysis is employed to analyze the qualitative data obtained from in-depth interviews. This analysis helps to uncover recurring themes and insights concerning the social, economic, and institutional factors that impact the adoption of renewable energy in Iraq's post-conflict environment. By combining these approaches, the study aims to provide a comprehensive view of the factors influencing renewable energy implementation in the reconstruction process.

4. Finding and Discussion

4.1. Findings

The following findings were identified:

1) Renewable Energy Potential in Iraq

The study identifies several regions in Iraq with the highest potential for solar and wind energy production, based on solar irradiation and wind speed data. Regions are Basra, Erbil, Sulaymaniyah, and Baghdad, highlighted as having optimal conditions for solar energy, due to their high levels of solar irradiation throughout the year. Meanwhile, Erbil and Sulaymaniyah are noted for their favorable wind conditions, which could support wind energy projects.

Table 1. Renewable Energy Potential in Different Iraqi Regions

Region	Solar Energy Potential (kWh/m²/day)	Wind Energy Potential (m/s)
Basra	5.5	3
Erbil	**5**	**6.5**
Sulaymaniyah	**4.9**	**5**
Baghdad	5.3	3.2
Mosul	5	4.1

Figure 1 illustrates the solar energy potential in different regions of Iraq.

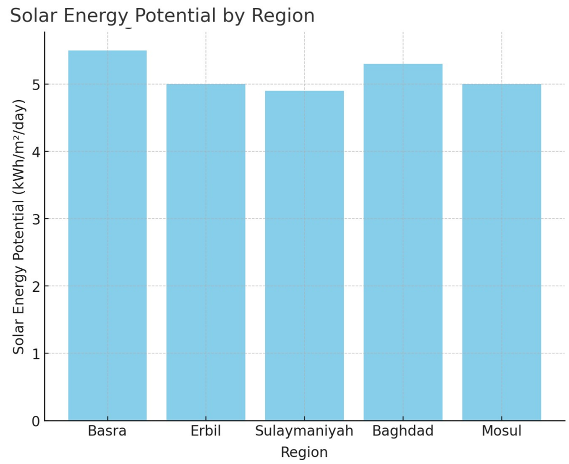

Figure 1. Solar Energy Potential by Region

2) Implementation Challenges

Several key challenges were identified in the implementation of renewable energy solutions in Iraq. The study finds that technical issues, such as inadequate infrastructure for renewable energy integration, are the primary obstacles. Funding remains a significant barrier, as both government and private sectors face budget constraints for large-scale projects. Additionally, the lack of local workforce training to operate and maintain renewable energy systems was found to be a critical issue, hindering long-term sustainability.

Table 2. Key Challenges in Renewable Energy Implementation

Challenge	Frequency (%)
Technical Issues	40
Funding Constraints	35
Lack of Local Training	25

Figure 2 shows the distribution of different challenges in renewable energy implementation in Iraq.

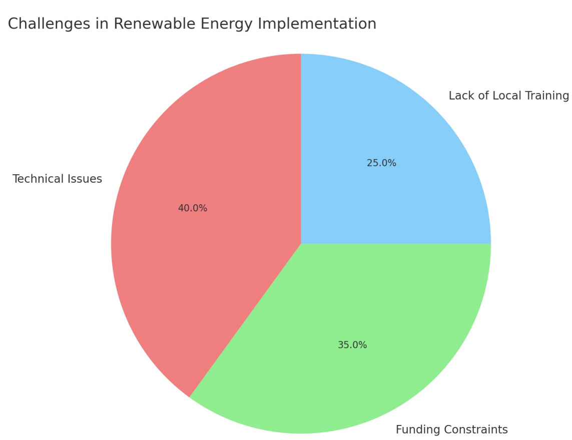

Figure 2. Challenges in Renewable Energy Implementation

3) Positive Impact of Renewable Energy Technologies

The study reveals that renewable energy technologies, particularly solar and wind power, offer several long-term benefits for Iraq's infrastructure. Cost efficiency is one of the key advantages, as renewable energy sources, once implemented, reduce the need for expensive fuel imports. Furthermore, carbon emissions are expected to decrease, contributing to Iraq's commitment to global climate goals. Additionally, the integration of renewable energy is expected to create new job opportunities, particularly in the fields of installation, operation, and maintenance of renewable energy systems.

Table 3. Positive Impacts of Renewable Energy

Impact	Percentage of Respondents (%)
Long-Term Cost Efficiency	50
Carbon Emission Reduction	30
Job Creation	20

Figure 3 depicts the positive impacts of renewable energy, as reported by survey respondents.

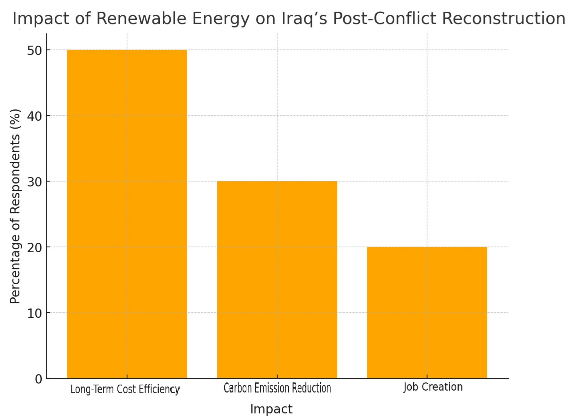

Figure 3. Impact of Renewable Energy on Iraq's Post-Conflict Reconstruction

These findings underline the significant potential for renewable energy to contribute to Iraq's post-conflict infrastructure rebuilding. While the technical, financial, and workforce challenges remain substantial, the long-term benefits of renewable energy — including cost savings, emissions reduction, and job creation — present a compelling case for its integration into Iraq's reconstruction efforts.

4.2. Discussion

The following is a discussion of these findings:

1) Comparison of Iraq's Results with Case Studies from Other Countries

The findings highlight that Iraq has substantial potential for renewable energy, particularly in solar and wind energy, with key regions identified as Basra, Erbil, Sulaymaniyah, and Baghdad having optimal conditions. For solar energy, regions like Basra have a solar energy potential of 5.5 kWh/m²/day, which is one of the highest in the country. Similarly, Erbil and Sulaymaniyah show strong wind energy potential with speeds of 6.5 m/s and 5 m/s respectively. These findings align with other regions with high renewable energy potential, such as Morocco and Tunisia, which have successfully harnessed solar and wind power.

Countries like Morocco have made significant strides with projects like the Noor Solar Complex, which serves as a model for large-scale solar energy implementation. Similarly, Tunisia has set ambitious targets to achieve 30% renewable energy by 2030, similar to Iraq's potential solar energy production. However, Iraq faces challenges in translating this potential into actual energy generation due to technical issues, insufficient funding, and lack of skilled labor, as identified in the study. While Iraq's potential solar energy (5.5 kWh/m²/day) is comparable to the best regions in Morocco, Iraq’s lack of infrastructure and skilled workforce hampers large-scale projects, similar to what Afghanistan has experienced in its post-conflict renewable energy development.

In comparison, Morocco and Tunisia have established strong policy frameworks and training programs that supported the successful deployment of renewable energy technologies. Iraq can replicate such efforts to bridge the gap in workforce skills and improve renewable energy infrastructure.

2) Practical Implications for Sustainable Infrastructure Development

The findings suggest that Iraq’s shift towards renewable energy could have significant economic and environmental benefits. Iraq’s reliance on fossil fuels for energy generation is costly, with a large portion of its energy needs met by imported fuels, a factor that strains the national budget. Transitioning to renewable energy sources like solar and wind can reduce this dependency, as evidenced by the long-term cost efficiency of renewable energy, reported by 50% of respondents. With solar energy potential as high as 5.5 kWh/m²/day in Basra, Iraq has the opportunity to lower its energy costs in the long term.

Another benefit highlighted by the findings is the potential for carbon emission reductions. As renewable energy sources replace fossil fuels, carbon emissions in Iraq would decrease, contributing to global climate goals. 30% of respondents in the study emphasized the importance of this environmental impact, noting that Iraq's reliance on fossil fuels contributes to high pollution levels. Similar initiatives in other countries, such as Morocco, have already shown the positive environmental impacts of large-scale solar energy integration, which Iraq could replicate.

The study also highlights job creation as a key benefit, with 20% of respondents pointing out the potential for new employment opportunities in the renewable energy sector. Renewable energy projects create jobs in installation, maintenance, and operation, a benefit Iraq could capitalize on. For example, Tunisia’s solar energy sector has created thousands of jobs, particularly in rural areas, by training local workers to handle the installation and maintenance of solar panels. Iraq, by creating training programs in collaboration with international agencies, could replicate Tunisia’s model and create a sustainable workforce for the renewable energy sector.

Finally, grid modernization is crucial for Iraq to fully integrate renewable energy. The study found that Iraq’s outdated grid systems are unable to efficiently handle renewable energy, particularly the intermittent nature of wind and solar energy. Smart grids have been a success in countries like Morocco, where they have enabled efficient integration of renewable energy, improving grid stability. Iraq could benefit from prioritizing investments in modernizing its grid infrastructure to accommodate renewable energy, which would lead to better energy distribution, lower transmission losses, and more efficient energy usage.

3) Policies Needed to Promote Renewable Energy Investment

The study’s findings clearly point out the barriers to renewable energy development in Iraq, particularly technical issues, funding constraints, and lack of local training. To address these, several policy recommendations can be made.

One key policy recommendation is the introduction of financial incentives to encourage both local and international investments in renewable energy. The study revealed that 35% of respondents cited funding constraints as a major challenge in renewable energy implementation. By offering subsidies, tax breaks, or low-interest loans to renewable energy projects, the Iraqi government could attract more private sector involvement, similar to the policies in Morocco and Tunisia. These countries have successfully used financial incentives to stimulate renewable energy investments, demonstrating that the private sector can play a crucial role in expanding renewable energy capacity.

Regulatory reform is also essential. Iraq currently lacks a clear policy framework for renewable energy, which hampers both domestic and foreign investment. The study indicates that 40% of respondents identified technical issues as a barrier to implementation. By creating clear renewable energy targets and setting long-term goals, such as Tunisia’s goal of 30% renewable energy by 2030, Iraq could provide a roadmap for the energy sector, giving investors the confidence to invest in renewable energy technologies.

The findings also highlighted the lack of skilled labor as a critical issue. 25% of respondents pointed out that Iraq faces a shortage of trained personnel to operate and maintain renewable energy systems. This problem can be solved through government-sponsored training programs. Iraq can collaborate with international renewable energy organizations to create specialized training programs that focus on the installation, maintenance, and operation of solar and wind systems. Morocco's experience in workforce development provides a useful model, where large-scale renewable energy projects were accompanied by extensive workforce training.

Another policy intervention would be to prioritize grid modernization. Iraq's outdated energy grid, unable to handle renewable energy effectively, is one of the primary obstacles to large-scale renewable energy integration. Smart grid investments, similar to those in Tunisia, would allow Iraq to better integrate renewable energy sources, such as solar and wind, into the national grid. This modernization would increase energy efficiency, lower transmission losses, and ensure the country can maximize its renewable energy potential.

Finally, Iraq could focus on encouraging private-public partnerships (PPPs) to share the risks and rewards of renewable energy projects. By providing guarantees, long-term contracts, and clear regulatory frameworks, the government can attract private sector participation and reduce the financial risks associated with large-scale renewable energy investments. This approach has worked well in Morocco's solar and wind projects, where public-private partnerships were instrumental in achieving large-scale renewable energy production.

The findings reveal that Iraq has a vast potential for renewable energy, particularly solar and wind, but faces several barriers to realizing this potential. The country's reliance on fossil fuels, outdated infrastructure, lack of skilled labor, and funding constraints are major obstacles that need to be addressed through comprehensive policy reforms. By introducing financial incentives, regulatory reforms, training programs, and grid modernization, Iraq can pave the way for a successful transition to renewable energy, ensuring economic stability, environmental sustainability, and job creation. The experiences of countries like Morocco and Tunisia offer valuable lessons for Iraq in overcoming these challenges and realizing its renewable energy potential.

There are few recommendation proposes based on the finding and discussion:

- Policy Recommendations
  To stimulate the growth of renewable energy in Iraq, it is essential to implement tax incentives for renewable energy developers, including subsidies or tax breaks to attract both domestic and foreign investments. The findings suggest that 35% of respondents cited funding constraints as a critical issue, and addressing this through incentives will be crucial. In addition, increased government funding should be allocated for renewable energy projects, alongside clear regulatory frameworks that set achievable long-term goals for renewable energy, such as Tunisia's target of 30% renewable energy by 2030.
- Technical Recommendations
  A major technical hurdle identified is the lack of trained personnel for maintaining and operating renewable energy systems. The study shows that 25% of respondents pointed out the shortage of skilled labor. To address this, Iraq should invest in local workforce training programs tailored to the needs of the renewable energy sector. Partnerships with international organizations, such as those seen in Morocco, could help facilitate the transfer of knowledge and expertise to Iraqi workers, ensuring a sustainable, well-trained labor force for renewable energy projects.
- Social Recommendations
  Public acceptance of renewable energy plays a critical role in its success. The study found that a significant portion of the population is unaware of the benefits of renewable energy. Therefore, comprehensive public education campaigns are needed to inform the public about the economic, environmental, and social benefits of renewable energy. These campaigns should aim to increase awareness and dispel misconceptions about renewable energy, thereby fostering greater public support. This would be essential for ensuring the successful implementation and long-term sustainability of renewable energy projects in Iraq.

5. Conclusion

This study confirms that renewable energy presents a viable solution for addressing the infrastructure challenges in post-conflict Iraq. The findings indicate that solar and wind energy have high potential across several regions, with Basra showing a solar energy potential of 5.5 $kWh/m^2/day$, and Erbil and Sulaymaniyah having promising wind energy capabilities. Despite this potential, the study identifies key barriers to successful implementation, including technical challenges, insufficient funding, and a lack of skilled labor. These issues reflect Iraq's difficulties in transitioning to a renewable energy-driven economy. However, with proper policy frameworks, financial incentives, and international collaboration, these barriers can be overcome, enabling Iraq to capitalize on its renewable energy potential. The comparative analysis with other countries such as Morocco and Tunisia further supports the conclusion that, while Iraq faces unique challenges, successful cases of renewable energy adoption in similar regions provide a clear path forward. These countries have made significant strides through policy reform, workforce development, and financial incentives, which Iraq could replicate to overcome its energy infrastructure issues.

This study provides valuable insights into the potential for renewable energy to support post-conflict reconstruction in Iraq. It highlights the significant opportunity for Iraq to reduce its dependence on fossil fuels and contribute to global climate goals while stimulating economic growth and job creation. Moreover, the study underscores the importance of integrated policy approaches, combining financial incentives, technical capacity building, and social awareness, to overcome the barriers to renewable energy development. The research offers actionable recommendations for policymakers, energy developers, and international organizations to help Iraq and similar post-conflict countries in the Middle East effectively transition to a sustainable energy future. Through these efforts, Iraq can position itself as a leader in renewable energy development in the region, making a substantial contribution to global energy sustainability.

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