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Original Research Paper

Challenges and Opportunities in Implementing Renewable Energy

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Abstract: This research explores the possibilities of renewable energy, especially solar and wind energy, as a viable solution to Iraq's persistent energy crisis. Iraq, a nation with a historical reliance on oil and gas, is now experiencing significant power shortages and infrastructure issues due to extended conflict. This research employs a mixed-methods strategy—integrating expert interviews, public and industry surveys, along with comparative case studies from Morocco and Tunisia—to uncover both opportunities and challenges in the deployment of renewable energy systems. The results indicate a substantial potential for harnessing solar and wind energy while also emphasizing major challenges, such as insufficient infrastructure, unstable policies, and reduced investment. To address these challenges, the research highlights the importance of robust government dedication, infrastructure improvement, and increased involvement from the private sector. Moreover, cultural and economic contexts should be considered for successful implementation. The study finds that a comprehensive and inclusive national strategy is crucial for incorporating renewable energy into Iraq's energy ecosystem. Additional research is recommended to evaluate project-specific viability, policy frameworks, and the effects of global collaboration on speeding up Iraq's shift to renewable energy.

Keywords: Energy Policy, Infrastructure Barriers, Renewable Energy, Solar Power, Wind Energy.

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1. Introduction

Iraq has endured prolonged periods of conflict that have significantly damaged its infrastructure, resulting in unreliable electricity supply, transportation networks, and critical public services [1]. This widespread destruction has posed serious obstacles to the nation's economic recovery, social cohesion, and the general welfare of its population [2]. Nonetheless, the ongoing reconstruction process provides a vital opportunity to incorporate sustainable energy strategies, particularly through the adoption of renewable energy technologies, which promise long-term resilience and environmental benefits.

The country possesses considerable renewable energy potential, especially in solar and wind power, owing to its high levels of solar irradiation and favorable wind patterns in various regions [3]. Despite this endowment, Iraq has yet to fully capitalize on these resources to address its pressing energy and infrastructure deficiencies [4]. Integrating renewable energy systems into the reconstruction agenda can simultaneously alleviate energy shortages and promote sustainable economic development [5].

The global momentum toward renewable energy, bolstered by international climate accords such as the Paris Agreement, further emphasizes the urgency for Iraq to embrace green energy alternatives [6]. In the context of post-conflict rebuilding, Iraq is uniquely positioned to attract international support and investment in renewable energy infrastructure [7]. This transition not only reduces dependence on fossil fuels but also fosters economic opportunities, encourages innovation, and mitigates environmental degradation [8].

The central aim of this research is to explore how renewable energy technologies can contribute to Iraq's infrastructure reconstruction, with a focus on their practicality and advantages in expediting the post-conflict rebuilding process. This study assesses the viability of deploying solar and wind energy technologies while also identifying the technical, financial, and institutional barriers that impede their integration in post-conflict settings. Furthermore, the research proposes actionable policy and technical strategies to enhance renewable energy deployment, offering a comprehensive approach to meet Iraq's urgent energy demands and long-term sustainability ambitions.

This study offers valuable contributions to both Iraq's recovery process and the broader discourse on sustainable development by presenting a structured framework for incorporating renewable energy technologies. It addresses Iraq's critical energy challenges in alignment with international sustainability commitments, thereby improving energy security, reducing greenhouse gas emissions, and fostering long-term economic resilience. The study also delves into the socio-economic and political complexities associated with renewable energy implementation in post-conflict zones. Its findings hold relevance not only for Iraq but also for other conflict-affected countries like Syria and Yemen, which face similar reconstruction challenges. Additionally, the research enriches the academic and policy-oriented literature on renewable energy in fragile contexts, offering practical insights for policymakers and international stakeholders, while underscoring the essential role of sustainable energy in fostering resilience and socio-economic recovery in climate-vulnerable regions.

2. Literature Review

2.1. Renewable Energy Technologies

Renewable energy technologies—such as solar photovoltaic (PV) systems, wind turbines, and bioenergy—have attracted substantial global attention due to their capacity to alleviate energy deficits and address pressing environmental concerns. Solar PV is particularly advantageous in regions with high solar irradiance, offering a cost-effective and sustainable energy option for conflict-impacted rural communities. Wind energy also emerges as a viable solution in areas with strong wind resources. Additionally, bioenergy, which utilizes organic waste materials, represents a significant energy alternative in resource-constrained settings. These innovations are highly relevant for countries like Iraq, where conventional energy infrastructures have been severely compromised due to prolonged conflict [9].

Post-conflict settings such as Yemen and Afghanistan provide compelling examples of how renewable energy can facilitate the restoration of essential services. In Yemen, solar power has been widely implemented to sustain critical functions such as healthcare and water purification, demonstrating the adaptability and impact of renewable energy in fragile environments. Likewise, Afghanistan has adopted off-grid solar systems to supply energy to remote villages, thereby enhancing quality of life and supporting reconstruction activities. These cases illustrate the practical benefits of renewable energy deployment in conflict-affected zones and reinforce its importance in rebuilding initiatives [10] [11].

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One of the principal advantages of renewable energy is its decentralized nature. Unlike conventional power systems that rely on expansive centralized grids, renewable energy can be installed at smaller, localized scales to serve communities independently. This characteristic makes it especially suitable for regions with damaged or inaccessible infrastructure. In countries like Iraq, the integration of solar and wind technologies can significantly contribute to energy self-sufficiency, reduce reliance on foreign energy imports, and alleviate energy shortages that often stall recovery efforts [9].

Nonetheless, several barriers continue to obstruct the widespread implementation of renewable energy in post-conflict regions. These include limited financial resources, inadequate technical expertise, and political instability. In Yemen and Afghanistan, international cooperation has played a pivotal role in mitigating these challenges. Yet, the durability of renewable energy initiatives hinges on the development of domestic capabilities and the establishment of supportive policy environments. For Iraq, overcoming these structural impediments will be essential for the effective integration of renewable energy solutions into national recovery strategies [12].

In summary, while renewable energy technologies hold immense promise for post-conflict reconstruction, their success is contingent upon addressing complex financial, institutional, and technical challenges. The experiences of Yemen and Afghanistan offer valuable lessons for Iraq, emphasizing the need for a holistic strategy that incorporates local skill-building, international assistance, and clear regulatory frameworks. By embracing renewable energy, Iraq can meet its short-term energy demands while laying the groundwork for long-term sustainability and inclusive national development [10] [11].

2.2. Renewable Energy Potential in Iraq

Iraq possesses significant untapped potential for renewable energy, particularly in the domains of solar and wind power. The country receives an average solar irradiation of 5.5–6.5 kWh/m²/day, ranking among the highest in the Middle East. This exceptional solar exposure creates an ideal environment for large-scale deployment of solar photovoltaic (PV) systems. In addition, Iraq's western and southern regions exhibit strong and consistent wind patterns, making them suitable for wind energy development. Research indicates that these wind resources could play a crucial role in fulfilling Iraq's growing energy demands, offering a sustainable alternative to conventional fossil fuel sources [13] [14].

Geographic advantages further bolster Iraq's renewable energy prospects. The country is characterized by expansive desert areas that remain underutilized, providing ample space for the construction of solar farms optimized for high energy yields. Similarly, wind farms could be strategically located in regions with robust wind currents, such as Iraq's western plains. A 2023 study estimated that Iraq's wind capacity could reach up to 15,000 megawatts, a substantial proportion of the nation's current electricity consumption [14]. Such capacity could significantly contribute to energy diversification and reduce overdependence on oil and gas.

Despite its promising potential, Iraq faces several systemic challenges in adopting renewable energy. One of the primary obstacles is the nation's persistent reliance on fossil fuels for electricity production. The existing energy infrastructure, predominantly tailored to fossil energy systems, requires extensive modernization to accommodate renewable sources. Upgrading the grid, implementing smart technologies, and integrating energy storage solutions are essential to managing the variable output of solar and wind systems. Compounding the issue, Iraq's outdated and inadequate grid infrastructure poses further limitations to seamless renewable integration [15].

Financial constraints and political instability also impede the development of renewable energy projects. Ongoing security concerns and a fragile economic environment have discouraged both domestic and foreign investments. The renewable energy sector lacks the necessary financial incentives and a coherent regulatory framework to attract private sector participation. Although the Iraqi government has shown interest in energy diversification, initiatives remain slow-moving due to inconsistent policy direction and underdeveloped investment strategies, as highlighted by the World Bank [15].

Social and institutional challenges present additional barriers. Widespread public dependence on subsidized fossil fuels and limited awareness of renewable energy's advantages hinder public acceptance. Moreover, Iraq's institutions currently lack the technical capacity to support a robust green energy sector. Addressing these issues will require comprehensive educational programs, institutional reform, and public awareness campaigns to foster societal readiness for renewable adoption [13].

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Nevertheless, progress has begun. The Iraqi government has initiated efforts to diversify its energy portfolio, notably through the Ministry of Electricity's announcement in 2022 of plans to develop solar and wind energy projects. However, implementation has been sluggish due to persistent financial, security, and logistical hurdles. Collaboration with international partners and private investors will be critical to overcoming these barriers by leveraging external capital, technical expertise, and innovation [14].

In conclusion, while Iraq's renewable energy resources remain largely underutilized, they hold substantial promise for transforming the national energy landscape. Through targeted investments, supportive policies, and technological upgrades, Iraq can move toward a cleaner, more resilient, and sustainable energy future. Drawing on lessons from regional neighbors who have successfully integrated renewable energy, Iraq has the opportunity to overcome existing barriers through coordinated action among government institutions, international stakeholders, and the private sector [15] [16].

2.3. Relevance to Post-Conflict Reconstruction

Renewable energy plays a pivotal role in post-conflict reconstruction by contributing to both environmental sustainability and socio-economic resilience. In the aftermath of conflict, many nations face severe energy deficits that impede economic revival and hinder societal development. Transitioning to renewable sources such as solar, wind, and bioenergy allows these countries to meet critical energy demands while reducing fossil fuel dependency and advancing environmental goals. The integration of renewables can enhance energy security in conflict-affected regions, facilitate infrastructure restoration, and diminish geopolitical risks associated with energy imports [17].

Beyond supplying basic energy services, renewable energy is instrumental in addressing ecological degradation commonly found in post-conflict environments. Nations emerging from prolonged conflicts frequently grapple with issues such as deforestation, land degradation, and pollution—problems often intensified by reliance on traditional energy practices. Renewable technologies offer cleaner alternatives that help reduce carbon emissions and mitigate further environmental harm. Scholars emphasize that the adoption of renewable energy not only alleviates energy shortages but also contributes to ecosystem restoration and environmental recovery [18], thereby supporting sustainable development agendas in these fragile contexts.

Renewable energy initiatives also contribute significantly to rebuilding social cohesion in post-conflict areas. In many such regions, unreliable electricity supply can exacerbate societal divisions and obstruct the reconciliation process. Ensuring equitable access to renewable energy can foster social equity and help repair fractured communities. These projects often generate employment and skills development opportunities, which are vital for empowering marginalized populations and fostering long-term stability [19]. Thus, renewable energy contributes not only to energy resilience but also to peacebuilding and the reconstruction of social fabric.

Economically, renewable energy offers a pathway for revitalizing post-conflict economies by promoting job creation and stimulating local development. Damaged infrastructure and weak industrial bases in post-conflict countries pose significant barriers to economic recovery. However, renewable energy investments can catalyze employment in areas such as installation, maintenance, and technical support, fostering grassroots economic activity. These investments also reduce reliance on costly energy imports, enabling economic diversification and long-term energy self-sufficiency [20].

The relevance of renewable energy in post-conflict recovery is evident in countries like Iraq, Afghanistan, and Yemen, where persistent energy shortages continue to hinder development efforts. These nations are increasingly turning to renewable solutions to resolve energy deficits, stabilize their economies, and foster social resilience. Incorporating renewable energy into national reconstruction agendas presents a holistic strategy for addressing the interconnected challenges of post-conflict recovery—from rebuilding essential services to securing long-term sustainability [21]. By prioritizing clean energy investments, these countries can lay the foundation for enduring peace and prosperity.

3. Methodology

This research employs a mixed-methods approach, incorporating both surveys and interviews to thoroughly investigate the integration of renewable energy into Iraq's post-conflict infrastructure development.

A structured survey was administered to 200 participants, comprising 50 government officials, 50 renewable energy developers, and 100 local community members across key urban areas including Baghdad, Erbil, Sulaymaniyah, Basra, and Mosul. The survey was designed to gather insights into

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stakeholder perceptions of renewable energy, its anticipated impact on reconstruction, and the various perceived obstacles and opportunities associated with its implementation.

In addition to the survey, the study conducted semi-structured interviews with 10 subject-matter experts from the energy and infrastructure sectors. These experts, selected from Baghdad and Erbil, included energy policy consultants, engineers, and infrastructure professionals. The interviews sought to elicit in-depth perspectives on the technical, economic, and institutional barriers to renewable energy adoption in Iraq.

Complementing these methods, case studies were undertaken in Iraqi cities that had already initiated small-scale renewable energy initiatives—namely Erbil, Sulaymaniyah, Basra, and Najaf. These case studies aimed to evaluate the outcomes, challenges, and best practices in implementing solar and wind energy systems, offering practical insights for scaling up renewable energy deployment across the country.

Data collection was conducted throughout 2023, with surveys and interviews completed in the first half of the year. Case study research occurred during the third quarter, followed by an analytical phase concluding by the end of 2023.

The analysis combined quantitative and qualitative techniques to yield a holistic understanding of the role of renewable energy in Iraq's reconstruction efforts. Survey data were subjected to statistical analysis—both descriptive and inferential—to identify trends and correlations in stakeholder attitudes toward renewable energy technologies and their role in strengthening national energy infrastructure. Meanwhile, thematic analysis was applied to the interview transcripts, allowing for the identification of key themes related to the social, economic, and institutional dynamics that shape renewable energy integration. Through this multi-faceted methodological approach, the study offers a nuanced assessment of the enablers and constraints affecting renewable energy implementation in Iraq's post-conflict context.

4. Finding and Discussion

4.1. Findings

The following findings were identified:

1) Renewable Energy Potential in Iraq

This study found 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.

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

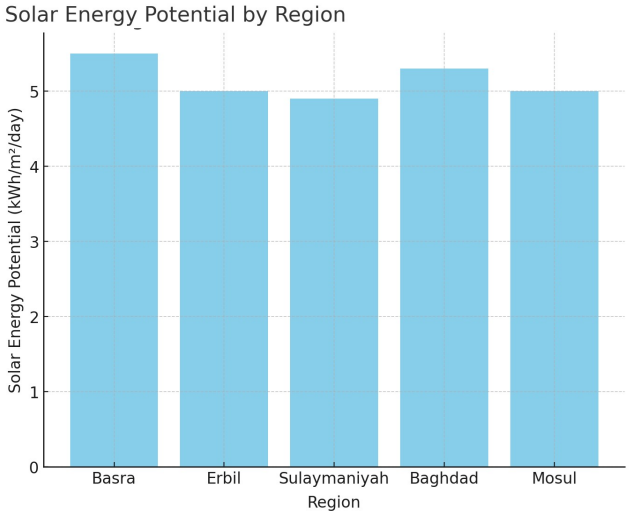

Figure 1. Solar Energy Potential by Region

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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

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.

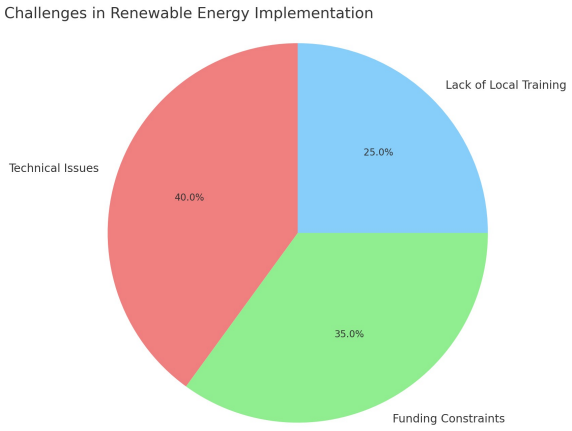

Figure 2. Challenges in Renewable Energy Implementation

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.

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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.

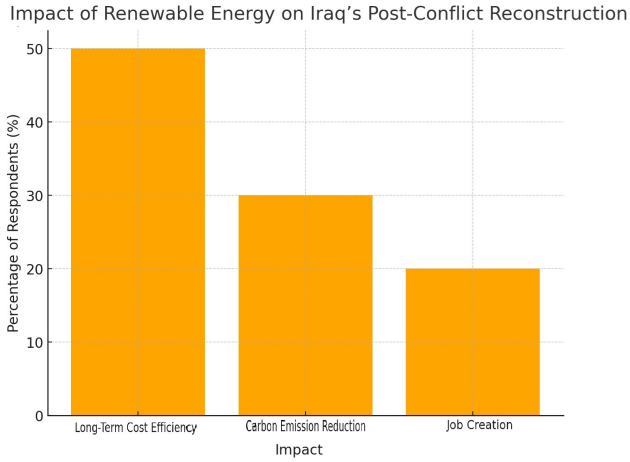

Figure 3. Impact of Renewable Energy on Iraq's Post-Conflict Reconstruction

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 research findings reveal that Iraq possesses significant potential for renewable energy development, particularly in solar and wind sectors. Key locations identified with favorable conditions include Basra, Erbil, Sulaymaniyah, and Baghdad. Basra, for instance, records a solar irradiance level of approximately 5.5 kWh/m²/day—among the highest in the nation—making it ideal for solar energy deployment. Erbil and Sulaymaniyah demonstrate promising wind energy capacities, with average wind speeds of 6.5 m/s and 5 m/s respectively. These values place Iraq alongside other high-potential renewable regions such as Morocco and Tunisia, where solar and wind energy projects have been effectively implemented.

Morocco, for example, has made considerable progress through projects like the Noor Solar Complex, representing a benchmark for large-scale solar energy initiatives. Likewise, Tunisia has articulated strategic goals to derive 30% of its electricity from renewable sources by 2030, a target that mirrors Iraq's solar potential. Despite these favorable conditions, Iraq faces substantial obstacles in realizing its renewable energy potential. Challenges such as technical deficiencies, limited financial resources, and a shortage of skilled professionals continue to impede progress. Although Iraq's solar capacity rivals leading solar regions in Morocco, its lack of advanced infrastructure and a qualified workforce poses similar constraints to those encountered in post-conflict contexts like Afghanistan.

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Furthermore, Morocco and Tunisia have succeeded in deploying renewable energy systems due to the presence of robust policy frameworks and dedicated training programs that supported workforce development and infrastructure readiness. Iraq can learn from these examples by adopting similar institutional strategies to enhance technical capabilities and expand its renewable energy infrastructure.

2) Practical Implications for Sustainable Infrastructure Development

The study underscores the substantial economic and environmental advantages that Iraq could derive from transitioning to renewable energy sources. Iraq's current dependence on fossil fuels for electricity generation imposes a heavy financial burden, particularly due to the significant share of energy that is fulfilled through fuel imports, placing considerable strain on the national budget. Shifting towards renewables, particularly solar and wind energy, offers a strategic pathway to mitigate these costs. Notably, 50% of surveyed respondents acknowledged the long-term cost-effectiveness of renewable technologies. With Basra exhibiting solar irradiance levels reaching up to 5.5 kWh/m²/day, the economic incentive for adopting solar energy is particularly compelling.

Environmental benefits also emerged as a central theme in the findings. The substitution of fossil fuels with cleaner energy alternatives is projected to significantly reduce carbon emissions, aligning Iraq with broader global climate objectives. Approximately 30% of respondents emphasized the critical role of renewables in lowering pollution levels, highlighting Iraq's current emissions problem linked to its fossil-fuel-based energy system. Case studies from countries such as Morocco, where large-scale solar deployment has demonstrated measurable environmental improvements, serve as useful models that Iraq could emulate.

Another important dimension is employment generation. According to the study, 20% of participants identified job creation as a major advantage of renewable energy development. Solar and wind projects require a skilled workforce for installation, maintenance, and operation—sectors that could provide employment opportunities in both urban and rural areas. Tunisia's solar energy sector offers a relevant example, where vocational training and workforce development initiatives have enabled thousands of new jobs. Iraq could pursue similar programs by partnering with international development organizations to build a capable and sustainable labor force within the renewable energy sector.

Finally, the findings draw attention to the critical need for electricity grid modernization. Iraq's existing grid infrastructure is outdated and ill-equipped to handle the variable output of renewable energy sources. The intermittent nature of solar and wind energy requires adaptive systems, such as smart grids, which have proven effective in countries like Morocco for stabilizing and optimizing energy distribution. Investment in grid upgrades would not only facilitate the integration of renewable energy but also reduce transmission losses and improve overall energy efficiency, thereby maximizing the benefits of Iraq's renewable energy potential.

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

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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 research affirms that renewable energy constitutes a practical and promising pathway for addressing Iraq's post-conflict infrastructure challenges. The study reveals significant renewable energy potential, particularly in solar and wind power, across multiple regions—most notably Basra with solar irradiance levels of 5.5 kWh/m²/day, and Erbil and Sulaymaniyah demonstrating favorable wind conditions. Nonetheless, the realization of this potential is hindered by persistent challenges, including technical constraints, inadequate financing, and a shortage of qualified personnel. These

findings reflect Iraq's broader struggle to transition toward a renewable energy-based economy. However, the research also suggests that these barriers are surmountable through the implementation of robust policy frameworks, targeted financial incentives, and strategic international cooperation, which would enable Iraq to effectively harness its renewable resources.

Comparative insights from nations such as Morocco and Tunisia reinforce this outlook. These countries have successfully advanced renewable energy deployment by enacting comprehensive reforms in policy, investing in workforce training, and offering economic incentives—approaches that could be adapted to Iraq's unique context. Their success illustrates that, with the right support mechanisms, post-conflict states can make considerable progress in building resilient and sustainable energy systems.

The study offers critical contributions to the discourse on renewable energy and reconstruction by highlighting Iraq's potential to reduce fossil fuel dependency, contribute to international climate commitments, and catalyze socio-economic development through green energy initiatives. It underscores the necessity for a multi-dimensional strategy that integrates policy reform, financial support, technical capacity development, and public awareness to overcome existing obstacles. Furthermore, the research provides actionable guidance for stakeholders—including policymakers, energy sector actors, and international development agencies—seeking to support Iraq and comparable post-conflict countries in transitioning to a sustainable energy future. With coordinated efforts, Iraq has the opportunity not only to meet its domestic energy demands sustainably but also to emerge as a regional leader in renewable energy transformation.

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