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Article

Overcoming Barriers to Energy Transition in the MENA Region: New Institutional Dynamics

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Abstract: The transition to sustainable energy systems in the Middle East and North Africa (MENA) region addresses critical challenges of environmental protection, energy security, and socio-economic resilience. Using neo-institutional theory, this paper examines the intricate relationship between formal and informal institutions and their significant impact on the region's energy transition. Despite the MENA region's abundant renewable energy resources, numerous institutional barriers, such as governance inefficiencies, regulatory inconsistencies, and entrenched socio-cultural norms, significantly hinder this transition. Through a review of existing literature, this study presents a comprehensive analytical framework designed to overcome these barriers, with a focus on the Just and Sustainable Energy Transition model. This strategic model emphasizes equity, sustainability, and inclusive governance as pillars for reform. The study offers detailed recommendations for institutional change and underscores the importance of collaborative efforts among governments, industry stakeholders, and international partners to unlock the MENA region's renewable energy potential, advance global sustainability goals, and ensure a more secure and resilient energy future.

Keywords: renewable energy; energy transition dynamics; institutional barriers; new institutional economics; energy policy; MENA region

1. Introduction

The quest for a sustainable energy future has become paramount in an era of escalating energy demand that intersects with the imperatives of environmental protection and economic resilience. Located at the center of global energy dynamics, the Middle East and North Africa (MENA) region presents a nuanced amalgam of challenges and opportunities that are central to the transition to renewable energy systems. This narrative underscores a profound realization: the transition to sustainable energy solutions goes beyond mere technology adoption and requires a holistic reorientation of human efforts, policy frameworks, and institutional architectures toward sustainability. This study aims to explore the multifaceted nature of this transition, with a particular focus on the unique position of the MENA region and the central role of institutional dynamics in charting the path to a renewable energy future.

The concept of energy transition inherently extends beyond the visible facets of renewable energy, such as wind turbines, solar panels, and electric vehicles, to denote a deeper, systemic shift that requires a comprehensive reorientation of societal activities, legal frameworks, and organizational policies toward sustainability. Supported by empirical evidence, transition theory posits that the path to a sustainable energy paradigm depends on fostering an environment conducive to both environmental and economic innovation, supported by a robust and adaptable legal and institutional infrastructure [1–5].

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Despite its considerable natural resource wealth and strategic importance in the global energy market, the MENA region faces significant institutional barriers that impede its transition efforts. Pervasive dependence on oil and natural gas not only poses sustainability challenges, but also increases the region's vulnerability to global energy market volatility. The region's vast renewable energy potential remains largely untapped, hampered by institutional inertia, governance challenges, and an investment climate that is insufficient to fully realize this potential [6–8].

The academic discourse on the impact of institutional frameworks on energy transitions remains nascent and fragmented. A critical review of the existing literature reveals divergences in the methodologies and variables used to assess the impact of institutional quality on renewable energy adoption, leading to different conclusions and highlighting the need for a more unified analytical approach [5,9–24]. This study seeks to fill this gap by examining the MENA-specific institutional barriers to energy transitions and elucidating the institutional dimensions that are central to an in-depth analysis of their facilitative or obstructive role.

The imperative to shift to more sustainable and secure energy sources is underscored by the International Energy Agency's [25] projection of a 53% increase in global energy consumption by 2030, coupled with continued over-reliance on fossil fuels, which currently account for over 80% of global energy supply [26]. The last decade has seen significant progress in this direction, with renewable energy sources, particularly solar and wind, making an increasingly significant contribution to the global energy matrix.

The MENA region, home to more than half of the world's oil reserves and one-third of its natural gas reserves, is at a critical juncture. Historically, the abundance and low cost of fossil fuels in the region has stifled the motivation to pursue renewable energy alternatives. However, soaring domestic energy demand and the severe economic and environmental consequences of continued reliance on fossil fuels make a strong case for a strategic pivot to renewable energy. This shift is not only an environmental mandate, but also a strategic economic reorientation. It promises significant savings in oil import costs for the region and offers a lucrative opportunity to redirect crude oil into higher-value exports, thereby maximizing economic gains from the region's resource wealth [27].

With its significant potential for harnessing solar and wind energy, the MENA region is poised to become a key player in reshaping economic models traditionally dominated by fossil fuel dependence. The transition to renewable energy offers a viable and competitive alternative that can significantly reduce the region's carbon footprint and enhance energy security, marking a critical step toward global sustainability and energy independence.

This paper examines the evolving institutional dynamics that are central to shaping the energy transition in the MENA region. It examines the obstacles to the energy transition and analyzes the responses of MENA countries to these obstacles. By highlighting appropriate institutional strategies, the study sheds light on the critical institutional factors that need to be addressed to achieve a sustainable energy future. It provides insights into overcoming the institutional hurdles of energy transition in the MENA region and outlines a path for harnessing the region's renewable energy potential to advance broader sustainability goals. It also presents the Just and Sustainable Energy Transition (JSET) model as a comprehensive strategy for managing energy transition in the MENA region. This model offers new perspectives for addressing the institutional challenges of energy transition in the MENA region and provides a blueprint for unleashing the region's renewable energy potential to meet global sustainability goals. Integrating principles of equity, sustainability, and inclusive governance, the JSET model serves as an overarching framework for addressing the complexities of energy transition, ensuring that the MENA region's transition to a sustainable energy future is characterized by cooperation, innovation, and an unwavering commitment to equity and sustainability.

The paper is organized as follows: Section 2 provides a theoretical framework for studying the dynamics of energy transition. Section 3 outlines the methodology, using a neo-institutional perspective to study energy transition in the MENA region. In Section 4, the neo-institutional analysis identifies both barriers and enablers to energy transition, thereby enhancing our understanding of institutional implications. Section 5 provides strategic recommendations aimed at overcoming these

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barriers to facilitate a just and sustainable energy transition. Finally, Section 6 summarizes key findings and discusses their broader implications for advancing sustainable energy transition in the MENA region and beyond.

2. Theoretical Framework

2.1. Dynamics of the Energy Transition in the MENA Region

The MENA region is at a pivotal juncture, transitioning from its long-standing reliance on abundant fossil fuel reserves to a more diversified and sustainable energy mix that includes renewable sources. This transformative journey is being guided by a complex mix of institutional, economic, and infrastructural factors that are laying the groundwork for the region's future energy landscape. At the heart of the MENA energy story are vast reserves of oil and natural gas, which have been the linchpin of economic growth and a cornerstone of geopolitical influence. However, this dependence has created environmental challenges and exposed the region's economies to the volatility of global energy markets, as highlighted by Mills [6] and Albaker et al. [8]. Despite the inherent challenges, including political instability and the economic impact of declining fossil fuel dependence, as noted by Terrapon-Pfaff et al. [7], there is growing agreement on the need to diversify energy resources and mitigate carbon emissions. Such efforts aim to reconcile environmental sustainability with energy security, as emphasized by Mills [6] and Albaker et al. [8], with the success of these efforts depending on overcoming the barriers associated with investment in renewable energy technologies and infrastructure. In addition, the role of institutional quality and the impact of economic globalization in promoting sustainable energy initiatives is increasingly recognized. Studies by Alariqi et al. [18] and Saadaoui and Chtourou [23] underscore the central role of governance in driving sustainable energy progress, while Dahmani et al. [28,29] address the complex interplay between GHG emissions, economic growth, and the pursuit of sustainable development, advocating for targeted policies and technological innovations. Furthermore, Krzymowski [30] emphasizes the critical importance of international cooperation in facilitating green economic transitions, highlighting the essential role of global partnerships in energy transition strategies. Similarly, Haines et al. [31] argue for the integration of democratic practices into energy governance, suggesting that addressing technological, financial, and socio-political dimensions is critical to ensuring an equitable energy transition. This comprehensive approach represents a collective movement to redefine the energy paradigm in the MENA region and align it with global sustainability goals and energy security imperatives.

Harnessing the geographic and climatic advantages of the MENA region for solar and wind energy is critical for reducing carbon emissions, enhancing energy security, and promoting economic diversification. However, unlocking this renewable energy potential requires overcoming institutional barriers, including regulatory hurdles, disjointed policy environments, and financing challenges for green energy initiatives, as noted by Terrapon-Pfaff et al. [7] and Albaker et al. [8]. Moreover, the role of institutional dynamics is paramount in the energy transition in the MENA region. The quality of governance, the regulatory framework, and the investment climate are identified as critical elements influencing the successful transition to renewable energy sources. Challenges such as political instability, governance inefficiencies, and an evolving investment landscape underscore the urgent need for comprehensive reforms. These reforms aim to create an enabling environment for renewable energy development by implementing clear regulatory guidelines, incentivizing renewable energy initiatives, and developing strategies to engage the private sector, as emphasized by Terrapon-Pfaff et al. [7] and Boulanouar and Essid [32].

2.2. Critical Review of Traditional Analytical Methods

A critical review of neoclassical economics in the context of energy policy and transitions highlights its limitations in comprehensively addressing the complex challenges associated with these transitions. Focusing primarily on market efficiency and resource allocation through price mechanisms, neoclassical economics often overlooks key issues such as market failures,

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environmental externalities, and the overarching goal of sustainability. Its basic assumptions of rational actors and perfect information fall short of capturing the nuances that are essential for designing effective energy policies [33–35].

A major critique of neoclassical economics is its inadequate attention to the institutional frameworks that profoundly influence energy markets. By marginalizing legal, social, and political contexts, it fails to recognize their substantial impact on market behavior and outcomes. The model's simplistic view of technological innovation as an external factor and its neglect of the complex interactions among market forces, innovation, and regulatory policy that are critical to advancing energy transitions further underscore its limitations [36–38]. Additionally, its emphasis on equilibrium and market efficiency does not accurately reflect the real-world scenarios of path dependencies and systemic inertia found in traditional energy systems. This observation underscores the need for a more comprehensive approach to sustainable energy transitions that includes changes in consumer behavior, regulatory landscapes, and infrastructure investments within a broader economic and institutional context [39].

Recognizing these shortcomings, there is a growing consensus that the policy toolkit needs to broaden to include institutional and ecological economics. This perspective views renewable energy and efficiency not just as commodities, but as fundamental elements of a sustainable economy, and advocates policies that promote resilience, adaptability, and long-term environmental sustainability. Moving beyond the narrow confines of neoclassical economics requires a holistic understanding of energy systems that integrates technological, societal, and environmental aspects, thereby promoting policies that support sustainable and equitable energy transitions [40,41]. Traditional analytical methods also often overlook the importance of governance structures, policy environments, and regulatory frameworks that are critical to the successful deployment of renewable energy technologies. They also often ignore the complexities posed by entrenched interests, political instability, and regulatory inertia-factors that are particularly relevant in the MENA region and that critically shape the contours of the energy transition [1,7].

Moving beyond the narrow economic focus of traditional methods, neo-institutional theory offers an expansive lens for understanding energy transitions. It emphasizes the importance of formal institutions, such as regulatory policies, alongside informal institutions, such as cultural norms and societal values, thus providing a comprehensive framework for analyzing the myriad barriers and opportunities that characterize energy transitions [37,38,42]. This approach emphasizes governance mechanisms, regulatory quality, and institutional integrity, revealing how institutional dynamics can either facilitate or impede the investment climate, stakeholder engagement, and widespread adoption of renewable energy technologies. Thus, neo-institutional theory provides insightful perspectives on the institutional facilitators and barriers within the energy transition in the MENA region [3,14].

The contrast between neo-institutional theory and conventional analytical models underscores the need to broaden the analytical horizon beyond the economic and technological dimensions to delve into the institutional background. This broadened analytical perspective encourages a thorough examination of the complex interplay between institutions and energy systems. It argues for the indispensability of institutional reforms and adaptive governance strategies as crucial pathways to overcome the hurdles of sustainable energy transitions in the MENA region [2,4].

2.3. Neo-Institutional Theory: Broadening the Analytical Lens

Neo-institutional theory elucidates the complex dynamics of energy transitions in the MENA region, emphasizing the seminal role of both formal and informal institutions in shaping energy policies and practices. This approach draws on the seminal work of scholars such as DiMaggio and Powell [43], North [37], Ostrom [38], Powell [44], Williamson [42], Oliver [45], and Scott [46], whose contributions deepen our understanding of the institutional underpinnings of energy policy development and implementation.

DiMaggio and Powell's [43] concept of institutional isomorphism provides insights into the alignment of organizational practices through coercive, mimetic, and normative pressures. This

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framework is critical to understanding patterns of renewable energy technology adoption in the MENA region, suggesting that institutional forces shape national sustainable energy strategies. North's [37] exploration of the role of institutions in economic history illuminates the influence of path dependencies on energy transitions, showing how they can either facilitate progress or erect barriers. Similarly, Ostrom's [38] analysis of commons governance underscores the importance of local governance structures and community-led initiatives in the effective management of renewable resources, pointing to the grassroots potential for sustainable energy solutions. Williamson's [42] examination of transaction costs and governance structures provides a valuable perspective for assessing the effectiveness of policy instruments in the energy sector. Scott's [46] analysis of institutional pillars-regulatory, normative, and cultural-cognitive-further enriches this discourse by analyzing the dimensions that influence energy policy. Taken together, this literature highlights the complex role of institutions in shaping the energy landscape and argues for a broadened analytical focus that goes beyond economic and technical considerations to include aspects of governance quality, societal values, and institutional capacity.

Applying neo-institutional theory to energy transitions in the MENA region reveals the nuanced interplay between formal institutions, such as government policies and international treaties, and informal institutions, such as cultural norms and societal expectations. This theoretical prism facilitates a deeper understanding of the barriers and enablers inherent in the region's energy transition. For example, it helps analyze how regulatory frameworks and governance practices can support or hinder the rapid adoption of renewable technologies. Furthermore, the theory highlights the critical role of societal acceptance and cultural adaptation in the successful implementation of renewable energy projects, and advocates for increased community engagement and awareness initiatives to mitigate resistance and foster an enabling environment for energy transition efforts.

2.4. Governance Structures, Informal Institutions and Energy Transition

Drawing on the foundational insights of North [37] and Ostrom [38], who emphasize the central role of both formal institutions, such as laws and regulations, and informal norms, such as cultural practices and behaviors, in influencing economic performance and guiding energy policy trajectories, as well as Williamson's [42] analysis of transaction costs and governance structures, a nuanced perspective on energy policy formation in the MENA region unfolds. This collective wisdom reveals the indispensable role of formal institutional frameworks in driving renewable energy initiatives, as exemplified by Morocco's renewable energy legislative reforms. These reforms, which have catalyzed investments and driven flagship projects such as the Noor Ouarzazate Solar Complex [47,48], underscore the need for a supportive legal and regulatory environment to drive renewable energy deployment [49,50]. They also highlight the intricate linkages between regulatory clarity, institutional integrity, and market dynamics that are essential for the development of the energy sector in the MENA region. Moreover, the influence of informal institutions, which encompass cultural norms, social values, and unwritten rules, is critical in shaping public attitudes toward renewable energy and ensuring the effective implementation of related policies [51,52]. These institutions serve as both barriers and enablers to energy market integration, where societal acceptance of renewable technologies depends heavily on perceptions of sustainability, environmental awareness, and trust in government action. In places where environmental stewardship is deeply embedded in the culture, renewable energy projects tend to enjoy greater public support and active participation, underscoring the importance of harmonizing renewable energy policies with prevailing cultural norms and societal values to enhance policy effectiveness and sustainability, as discussed by Shayan et al. [53] and demonstrated by Khaldi and Sunikka-Blank [54]. Such harmonization not only facilitates the implementation of renewable energy projects, but also contributes significantly to their community acceptance and success, illustrating the profound interplay between informal institutions and renewable energy adoption.

The interplay between formal and informal institutions is critical to the successful governance of renewable energy deployment. Aligning formal regulations with societal norms and values fosters an enabling environment for renewable energy projects by increasing public trust, fostering

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community engagement, and instilling a sense of ownership among local populations, thereby increasing the prospects of project success [55,56]. Moreover, decentralized governance models and local governance mechanisms play a pivotal role in the adoption of renewable energy, empowering communities, enhancing stakeholder participation, and customizing projects to specific local needs and conditions [57]. The Tunisian initiative to use local governance structures to promote solar energy in rural areas illustrates how decentralization can support renewable energy adoption [23,58], benefiting from local knowledge, community participation, and alignment with local development priorities, underscoring the effectiveness of decentralized energy governance [54].

Empirical research and case studies, such as those by Purkus et al. [59] and Nie et al. [60], highlight the importance of well-defined property rights and the establishment of effective regulatory bodies to reduce transaction costs and spur innovation. The Australian Renewable Energy Agency (ARENA), highlighted by Byrnes et al. [61], is an example of how independent regulatory bodies can significantly facilitate energy transitions. Furthermore, Razzaq et al. [62] underscore the critical link between sound governance and achieving sustainable development goals in the energy sector, advocating for policies that are economically viable, socially equitable, institutionally strong, and aligned with overarching sustainability goals. In addition, Al-Sarihi and Cherni's [63] examination of Oman's political economy framework reveals tactics to delay renewable energy deployment in order to protect oil revenues, demonstrating the complex relationship between political economy and renewable energy transition initiatives.

3. Methodology

3.1. Neo-Institutional Analytical Framework for Energy Transition

In developing a neo-institutional analytical framework for assessing energy transitions in the MENA region, it is imperative to combine the theoretical insights of neo-institutional economics (NIE) with the specific institutional dynamics of the region. This structured methodology aims to identify both barriers and facilitators to energy transition, with the goal of providing actionable insights to address these challenges.

Central to this framework, as detailed in Table 1, are key constructs derived from the NIE that are critical to dissecting the complexities of energy transitions. These constructs include the institutional environment, governance structures, institutional change and adaptability, and the central role of social capital and collective action. Each construct is critical for charting pathways and evaluating the effectiveness of transitions in the energy sector.

Table 1. Neo-Institutional Framework for the Analysis of Energy Transition in the MENA Region.

Construct	Associated factor for comparative analysis	Construct/Factor description
Institutional environment		Includes both formal (laws, regulations, policies) and informal (cultural norms, traditions) institutions that shape the energy landscape. It examines how these elements influence economic performance and the trajectory of energy policy.
	Regulatory frameworks and policy incentives	Evaluates legal and policy mechanisms that support or hinder the adoption of renewable energy, including investment incentives, innovation, and private sector participation.
Governance structures		Describes the systems and mechanisms through which institutions manage energy sector operations, focusing on reducing transaction costs and facilitating effective transactions.

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	Governance efficacy and efficiency	Assesses the ability of governance structures to manage resources efficiently, reduce transaction costs, and adapt to changing energy landscapes.
Institutional change and adaptability		Examines how institutions in the MENA region are responding to internal changes and external pressures, including global energy trends and sustainability goals.
	Institutional flexibility and innovation	Examines the capacity for institutional change in response to technological advances and environmental challenges, highlighting the role of innovation in energy policies and practices.
Social capital and collective action		Assesses the impact of social relationships and collaborative efforts in advancing renewable energy projects and policies, emphasizing community engagement in the energy transition.
	Stakeholder engagement and collaborative governance	Considers the extent to which different stakeholders (government, private sector, civil society) are involved in energy governance and the effectiveness of collaborative approaches to energy challenges.
	Cultural and social norms	Prevailing lifestyles, traditions, and interrelationships that act as drivers or inhibitors of energy transitions.

The institutional environment combines formal institutions-laws, regulations, policies-with informal institutions-cultural norms, traditions, practices-to provide a comprehensive view of the context in which energy transitions unfold. Drawing on the work of North [37], this construct facilitates an examination of how these factors influence economic performance and guide the trajectories of development and energy policy.

Governance structures, which play a central role in determining how institutions manage energy sector operations, are examined. Following Williamson [42], this segment of the framework examines transaction costs associated with different governance models and their ability to reduce uncertainty and facilitate smoother transactions, highlighting the impact of governance decisions on sustainable energy progress.

Building on North's [37] insights, the dynamics of institutional change and adaptability explores the adaptive mechanisms of institutions in response to internal shifts and external demands, such as global energy trends and regional sustainability ambitions. This exploration sheds light on institutional flexibility to align with broader goals.

Finally, Ostrom's [38] examination of collective action in managing common resources assesses the influence of social capital and community participation in advancing renewable energy initiatives, highlighting the critical role of community engagement in realizing sustainable energy outcomes.

By weaving these constructs into the empirical analysis of the MENA region, the neo-institutional framework not only facilitates a thorough examination of the institutional landscape influencing energy transitions, but also identifies strategies to strengthen institutional support mechanisms essential for a rapid and sustainable transition to renewable energy. This methodology aims to extract valuable insights and recommendations to guide policy and practice, and ultimately support the region's journey towards a more sustainable and energy secure future.

3.2. Data Collection Methods and Analytical Procedures

The methodology of this study is designed to explore the institutional dynamics governing energy transitions in the MENA region, using a comparative case study approach to illuminate the

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intricate interplay of policy frameworks, institutional structures, and socioeconomic factors in different national contexts. This approach is uniquely suited to unravel the nuanced mechanisms influencing energy transitions in different political and economic contexts.

Algeria, Egypt, Jordan, Lebanon, Morocco, and Tunisia were strategically selected to encapsulate the diverse energy landscape of the MENA region. This selection reflects the economic spectrum of the region, from Algeria's oil-dependent economy to Morocco and Tunisia's diversified economic base. This variance in economic development and resource endowments provides a rich terrain to explore how economic factors and resource availability shape national energy transition strategies. In addition, the inclusion of countries with different political and institutional frameworks enriches the analysis with different governance models, which is crucial for assessing the impact of governance structures on the pathways and pace of energy transitions.

The selection of countries also reflects different stages of energy transition progress, from Morocco's advanced renewable energy initiatives to Algeria and Egypt's nascent efforts. This diversity offers insights into effective strategies and common barriers, providing a foundation for policy development that could be applied across the MENA landscape and beyond. These countries share critical energy challenges such as energy security, sustainable development imperatives, and compliance with international environmental agreements such as the Paris Agreement. Analyzing their transition efforts sheds light on the linkages between global environmental commitments, national energy strategies, and local socioeconomic contexts.

Including Jordan and Lebanon adds an important layer of analysis, considering how geopolitical tensions and refugee crises affect energy policy and system resilience. This perspective highlights the importance of considering external shocks in energy policy design and underscores the need to promote robust, adaptive energy systems.

Using a literature-based analysis, the study sifts through existing research, policy documents, reports, and case studies from a neo-institutional perspective to uncover the institutional barriers and enablers of energy transition in the MENA region. The selection of sources spans academic journals, government and international policies, and relevant case studies, ensuring a thorough and multifaceted exploration of the institutional dynamics at play.

4. New Institutional Analysis of Energy Transition in the MENA Region

4.1. Institutional Influences on Energy Policies and Practices

The trajectory of energy transition in the MENA region is shaped by a complex interplay of institutional factors. These range from formal aspects, such as legal and regulatory frameworks, to informal dimensions, such as cultural norms and practices, which together significantly influence the evolution and effectiveness of energy policies and market dynamics across this diverse landscape.

The different stages of economic development in the MENA region, from the oil-dependent economy of Algeria to the more diversified economies of Morocco and Tunisia, play a key role in shaping the implementation and outcomes of energy transition policies. The economic diversity, analyzed in conjunction with the different political and institutional frameworks of these countries, provides a rich basis for comparative analysis. Such an examination reveals the profound impact of governance structures and institutional quality on the pace and direction of energy transitions, highlighting the detailed interplay that characterizes these processes [1,2].

The contrasting progress of energy transitions observed across the region, with Morocco's advanced renewable energy deployment juxtaposed with the nascent stages in Algeria and Egypt, underscores the dynamic nature of energy transitions in different policy and regulatory environments. This variance sheds light on effective strategies and common barriers, thereby contributing to the formulation of comprehensive policy frameworks applicable across the MENA region [3,4]. Moreover, the common challenges faced by these countries, including energy security concerns, the need for sustainable economic development, and commitments under the Paris Agreement to curb greenhouse gas emissions, underscore the critical importance of energy transition initiatives. These efforts highlight the intricate relationship between global environmental

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commitments, national energy strategies, and the local socioeconomic fabric, underscoring the need for policies that are carefully tailored to address the unique challenges and capitalize on the opportunities available in each country [5].

4.2. Applying the New Institutional Framework to Country-specific Contexts

Adapting the neo-institutional framework to the unique contexts of the MENA region reveals the intricate institutional dynamics that are critical to managing energy transitions. Using constructs such as the institutional environment, governance structures, institutional change and adaptability, and social capital and collective action, this approach offers comparative insights into the challenges and opportunities within these transitions.

In Algeria, the early establishment of renewable energy institutions such as the Solar Energy Institute in 1962 and later the Center for the Development of Renewable Energies (CDER) and the National Agency for the Promotion and Rationalization of Energy Uses (APRUE) underscores a longstanding commitment to energy diversification. Despite this history and the ambitious 2030 renewable energy targets highlighted by Himri et al. [64], Algeria faces significant institutional and policy barriers, including persistent fossil fuel subsidies and fragmented energy strategies, that hinder the widespread adoption of renewable technologies.

The application of a neo-institutional lens reveals Algeria's entrenched barriers to renewable energy adoption. Bouraiou et al.'s [65] critique, which highlights the need for an integrated institutional framework, is consistent with Matallah et al.'s [66] observations on the counterproductive effects of fossil fuel subsidies. Moreover, Sakhraoui et al.'s [67] advocacy for a holistic approach to energy transition that emphasizes regulatory stability and governance reform illustrates the complexity of fostering an effective renewable energy policy framework.

An analysis through the prism of neo-institutional economics recognizes not only Algeria's pioneering efforts in renewable energy, but also the need to overcome prevailing hurdles. Discussions by Benamirouche et al. [68] and Hadjer et al. [69] on energy security and the broader economic implications of energy transitions highlight the multifaceted challenges that must be addressed to ensure a sustainable and economically viable energy future.

This exploration, anchored in the neo-institutional framework, underscores the central role of Algeria's institutional framework in shaping its energy transition trajectory. Despite the significant potential and foundational efforts towards renewable energy, progress is hampered by current policy and governance shortcomings. To fully realize Algeria's renewable energy potential, a strategic overhaul is imperative, including the removal of fossil fuel subsidies and the development of a coherent energy strategy that will pave the way for Algeria's sustainable energy future.

Egypt's journey to adopt renewable energy, set against the ambitious backdrop of reducing dependence on fossil fuels, is navigating a landscape characterized by complex institutional and regulatory frameworks. The critical interplay between formal institutions - such as laws, regulations, and policies - and informal institutions, including cultural norms and practices, plays a central role in shaping the trajectory of Egypt's renewable energy initiatives. Challenges, particularly bureaucratic complexity as highlighted by ElSayed et al. [70,71], exacerbate transaction costs and foster uncertainties that can deter investment. Addressing these challenges requires the establishment of streamlined governance structures that can adapt to the evolving global energy landscape, as underscored by the findings of Nakhla et al. [72], Hawila et al. [73], Tawfik et al. [74], and the strategic proposals of IRENA [75], which advocate improving the efficiency of the sector through centralization.

Technological innovation plays a central role in Egypt's energy transition strategy, with concerted efforts focused on harnessing solar photovoltaics and hydrogen energy to forge a sustainable energy model by 2050 [70,71,76]. The exploration of decentralized energy solutions, as discussed by Abouaiana [24] and Abouaiana and Battisti [77], underscores the significant potential for rural energy communities to contribute to energy independence and sustainability, thereby increasing resilience and broadening participation in the energy transition. This emphasis on adaptive energy planning to accommodate emerging technologies and dynamic demand patterns

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[78,79], along with advocacy for hybrid energy systems, offers reliable solutions to meet diverse energy needs.

A multifaceted approach that includes regulatory reforms, promoting technological innovation, and fostering social capital is essential to overcoming barriers to renewable energy adoption in Egypt. By synthesizing lessons learned from baseline studies and aligning them with broader sustainable development and environmental goals, Egypt seeks to effectively manage its transition to sustainable energy sources. This effort draws on the principles of neo-institutional theory to strengthen institutional adaptability and foster public engagement.

In Jordan, the implementation of significant energy sector reforms, exemplified by the establishment of the Jordan Renewable Energy and Energy Efficiency Fund (JREEEF), signals the country's unwavering commitment to fostering an enabling environment for sustainable energy development. This initiative, as highlighted by the contributions of Jaber et al. [80], Burns [81], Alkhalidi et al. [82], and Alrwashdeh [83], is strategically designed to minimize transaction costs and optimize the allocation of resources to renewable energy projects, thereby demonstrating the effectiveness of governance in facilitating the energy transition.

The application of a neo-institutional analytical framework to the Jordanian context reveals a comprehensive integration of formal and informal institutional elements aimed at promoting renewable energy projects. In particular, the JREEEF initiative exemplifies Jordan's commitment to refining regulatory processes and leveraging social capital to strengthen support for its energy transition efforts. By engaging a wide range of stakeholders, from local communities to international partners, Jordan is building a multifaceted support system dedicated to renewable energy investment and development.

Despite facing challenges such as the privatization of the electricity sector and the need for improved local governance, Jordan's strategic initiatives, including the exploration of green hydrogen production in Aqaba [84] and the consideration of socio-cultural dimensions within energy policy frameworks, underscore the complexity of the renewable energy transition. Through the prism of the neo-institutional framework, Jordan's initiatives, particularly the JREEEF and regulatory reforms, exemplify the nuanced interplay between formal regulatory measures and the mobilization of social capital, setting a precedent for achieving sustainable energy outcomes. This balanced approach, reinforced by the inclusive inclusion of diverse stakeholders and emphasis on societal engagement, provides actionable insights for realizing sustainable energy outcomes, as evidenced by the contributions of Jaber et al. [80], Burns [81], Alkhalidi et al. [82], Jaradat et al. [84], Danielson et al. [85], and Khalid and Razem [86], thereby illustrating the effectiveness of governance in facilitating Jordan's energy transition.

Lebanon's energy sector, managed by the Ministry of Energy and Water and the Lebanese Center for Energy Conservation (LCEC), faces several significant challenges, including aging infrastructure, dependence on oil imports, and the struggle to meet escalating electricity demand. These issues are further complicated by political instability, which imposes significant transaction costs and hinders vital international cooperation for energy reform efforts, as highlighted by Haddad [87] and Shehabi and Al-Masri [88]. Research by Ahmad et al. [89] and Daher et al. [90] delves into the endemic corruption and inefficiencies that plague Lebanon's electricity supply, advocating for systemic reforms through the water-energy-food nexus approach and proposing decentralized solutions as a way forward. This underscores the critical need for Lebanon to establish an independent regulator to promote investment in renewable energy sources and ensure a coherent strategic approach to the overall development of the sector.

Using a neo-institutional analytical framework to examine Lebanon's energy transition highlights the complex interplay between formal and informal institutions in an environment characterized by political instability and entrenched governance challenges, as detailed by Kumar et al. [91]. This approach reveals that the systemic inefficiencies and poor performance of the sector are deeply rooted in Lebanon's institutional context, and go beyond simple technical or economic issues.

The absence of a coherent institutional framework, as noted by El-Fadel et al. [92] and Perakis et al. [92], and further complicated by Kumar et al. [91], is a significant hurdle that obscures the clarity

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and incentives needed to promote renewable energy. The persistent monopoly of Electricity Du Liban (EDL), rooted in outdated laws and unenforced reforms, underscores the urgent need for a comprehensive overhaul of the legal and institutional framework to align with the sector's progress [94].

From a neo-institutional perspective, the importance of governance structures and their associated transaction costs becomes clear. For Lebanon, bureaucratic inefficiencies and regulatory uncertainties increase transaction costs and discourage the development and implementation of renewable energy projects. This situation calls for a focused strategy on institutional change and adaptability. In addition, the importance of social capital and community engagement highlighted by Ostrom [38] becomes particularly relevant. Community-driven energy projects that make use of local resources, expertise, and networks propose a grassroots approach to energy transition that not only aims to reduce dependence on imported fuels, but also builds community resilience and promotes social cohesion in a country deeply divided along political and sectarian lines.

Although there are significant obstacles, there is an opportunity for significant progress in renewable energy with appropriate government support for green technologies and a structured regulatory framework [95]. The Ministry of Energy and Water's focus on building robust infrastructure, strengthening institutions, and commitment to reform provides a path to overcome internal opposition and the challenges of political instability.

Morocco's journey towards a sustainable energy future is a beacon of success within the MENA region, driven by a cohesive institutional environment and robust governance structures. The strategic fusion of policy innovation, commitment to sustainability goals, and the deployment of targeted incentives has catalyzed the growth of the renewable energy sector, demonstrating the pivotal role of effective governance in reducing transaction costs and promoting the deployment of renewable technologies, as detailed by Cantoni and Rignall [50] and Okpanachi et al. [48].

Central to Morocco's achievements has been the skillful use of social capital, characterized by the adoption of innovative governance models that leverage collective action and stakeholder support. This collaborative ethos has been key to overcoming the typical hurdles of renewable energy transitions, including stakeholder resistance and financial constraints. Institutions such as the Moroccan Agency for Sustainable Energy (MASEN) and the Research Institute for Solar Energy and New Energies (IRESEN), highlighted in the works of Cantoni and Rignall [50] and Okpanachi et al. [48], epitomize Morocco's commitment to fostering a sustainable energy landscape.

Applying a neo-institutional framework reveals the intricate interplay between formal institutions, such as laws and policies, and informal institutions, such as cultural norms, in shaping Morocco's approach to renewable energy. The precise allocation of roles among key stakeholders, including the Ministry of Energy, Mines, Water and Environment (MEMEE) and the National Electricity Office (ONE), has been instrumental in attracting investment and ensuring a smooth transition to sustainable energy practices.

Notwithstanding these successes, Morocco faces challenges, including barriers to coordination and the need for a more comprehensive focus on energy efficiency. Addressing these issues will require a broad strategic approach that integrates comprehensive energy efficiency initiatives, as advocated by Steinbacher [96]. The country's political stability following the F20M protests, highlighted by Becheikh [47], as well as a legal and policy framework conducive to attracting investment, underscores the need for a coherent policy framework for renewable energy ventures to flourish. Furthermore, enhancing public participation in the decision-making process, as recommended by Haddad et al. [97] and addressing lobbying and corruption are imperative for establishing a transparent, equitable, and democratically engaged energy policy framework. Insights from Slimani et al. [99], Chentouf and Allouch [98], and the discussion of energy colonialism by Sánchez Contreras et al. [100] underscore the importance of managing the renewable energy transition in a way that ensures inclusivity and equity. In addition, Morocco's integration of international cooperation and policy alignment, as explored by Plank et al. [101] and Fragkos [102], combined with its emphasis on technological innovation and environmental sustainability, as highlighted by Mahdavi and Vera [103], Ourya and Abderafi [104], Ourya et al. [105], and Ouazzani

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et al. [106], are critical to sustaining Morocco's renewable energy leadership in the MENA region. This comprehensive approach, which transcends institutional barriers and promotes democratic engagement, is essential for securing a sustainable energy future for Morocco and setting a precedent for the region.

Tunisia's energy transition trajectory underscores both the potential and the challenges of transitioning to more sustainable energy sources. Analysis through a neo-institutional framework, drawing on Alimi and Azar [107] and Attig-Bahar et al. [108], highlights the critical need for an institutional landscape that can effectively manage policy inconsistencies and governance inefficiencies.

This framework highlights the critical role of both formal institutions, such as regulatory frameworks and policies, and informal institutions, including societal norms and cultural values. Together, these elements influence the operational boundaries and public support for renewable energy initiatives in Tunisia.

The role of key government institutions such as the National Energy Management Agency (ANME), alongside initiatives such as the National Energy Management Fund (FNME) and the Energy Transition Fund (FTE), is crucial. However, Li et al. [58], Rocher and Verdeil [109], Dridi [110], and Fragkos and Zisarou [111] note a notable lack of coordination and clarity within these structures, pointing to the need for more cohesive and adaptive governance mechanisms.

The importance of social capital and collective action is further highlighted, reflecting Tunisia's strategic efforts to engage a wide range of stakeholders in the development of its renewable energy policy. This inclusive approach is crucial for overcoming institutional barriers and enhancing the country's capacity to effectively exploit its renewable energy potential. Moreover, the analysis underscores the importance of institutional adaptability in response to both internal changes and external pressures, including global energy trends and regional sustainability goals, as highlighted by Saadaoui and Chtourou [23] and IRENA [112]. Challenges such as internal discord and broader issues of political and institutional stability are recognized as important factors affecting energy transitions, as discussed by Dridi [110], Souissi [113], and Moretti et al. [114].

By applying a neo-institutional lens, this analysis provides a nuanced understanding of the complex interplay between Tunisia's formal and informal institutions and their impact on the energy transition process. This approach underscores the importance of a detailed examination of the institutional dynamics shaping Tunisia's path to a more sustainable energy future within the broader context of the MENA energy landscape.

4.3. Institutional Barriers to Energy Transition in the MENA Region

The application of the neo-institutional framework to energy transition dynamics in the MENA region reveals a number of institutional barriers that significantly impede progress. Based on analyses in different national contexts, the framework highlights the complex interplay between formal and informal institutional structures that influence energy transition initiatives.

Critical among the formal institutions are the legal and policy frameworks that act as barriers to renewable energy development. Tunisia's challenges with policy inconsistencies and governance inefficiencies [107,108,110] highlight the need for a coherent institutional framework to effectively guide energy transition strategies. The absence of clear and stable policies and regulations can deter investment, delay project implementation, and ultimately limit the expansion of the renewable energy sector.

Governance structures within MENA countries have a significant impact on the efficiency of energy transitions. Lebanon's predicament, characterized by political instability and bureaucratic inertia [91,92], illustrates how inadequate governance can impede the energy sector's adaptation and integration of new technologies. Such governance issues can create a disconnect between the goals of energy policies and their practical implementation, slowing down the energy transition process.

The challenge of institutional change and adaptability is a significant barrier across the MENA region in the midst of a changing global energy landscape. A reluctance to change governance structures and policies to accommodate new technologies, market shifts, and environmental

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commitments can limit progress and innovation. This issue is particularly pronounced in environments where entrenched bureaucratic systems and vested interests resist change, limiting the region's flexibility in moving toward renewable energy solutions.

In addition, a lack of social capital and community engagement are significant barriers. In environments where institutional trust is low and mechanisms for stakeholder participation are limited, mobilizing community support for energy projects becomes a challenge. The lack of inclusive and participatory processes can lead to resistance from local communities and stakeholders, adding complexity to the implementation of energy transition initiatives.

5. Strategic Recommendations and Vision for a Just and Sustainable Energy Transition

5.1. Leveraging Lessons for Institutional Reform

The sustainable energy transition in the MENA region requires a unified approach to institutional reform, as evidenced by the application of the neo-institutional framework in various analyses. This strategy underscores the need for evidence-based reforms that respond to the specific socio-economic and political landscapes of the region, focusing on the institutional barriers to energy transition highlighted in previous discussions.

Lessons from the experiences of different MENA countries show that coherent legal and policy frameworks play a key role in enabling energy transitions. The case of Tunisia, with its challenges related to policy inconsistencies and governance inefficiencies [107,108], as well as Algeria's struggle with the effects of fossil fuel subsidies [65,66], point to the urgent need for a comprehensive overhaul of institutional frameworks to support sustainable energy development. The establishment of clear, measurable, and ambitious energy transition targets, similar to those set by the European Union for 2030, is critical for MENA countries. Such targets act as catalysts for action, aligning national efforts with global sustainability goals and fostering societal commitment to the energy transition. Algeria's early establishment of the Solar Energy Institute and the Center for the Development of Renewable Energies (CDER) exemplifies how setting targets can stimulate renewable energy deployment and underscore Algeria's potential to lead the region's energy transition [65,68,115]. Furthermore, the design and implementation of comprehensive legal and regulatory frameworks are essential to foster an enabling environment for renewable energy investment. Morocco's legal reforms, which have significantly boosted renewable energy deployment, provide valuable lessons on the importance of legal frameworks in supporting energy transitions [48,50,106]. Moreover, it is essential to mobilize investment and finance for renewable energy initiatives through innovative financial mechanisms. The Jordan Renewable Energy and Energy Efficiency Fund (JREEEF) exemplifies how strategic financial planning can mitigate investment risks and strengthen the economic viability of renewable energy projects [80,81,84]. This comprehensive approach underscores the critical role of institutional reforms, strategic financial mechanisms, and the setting of ambitious targets in moving the MENA region toward a sustainable and equitable energy future.

5.2. Strengthening Governance and Policy Frameworks

To effectively manage the complex journey of energy transition, MENA countries need to significantly strengthen their governance and policy frameworks. This task goes beyond mere regulatory adjustments to encompass a comprehensive overhaul of institutional structures that promote effective governance, accountability, and innovation in the energy sector. Insights from neo-institutional theory illuminate the way forward, suggesting reforms based on regional experiences and identified challenges.

Robust governance structures are essential to effectively manage energy transitions. The exemplary success of Moroccan initiatives led by agencies such as MASEN and IRESEN underscores the importance of clear roles and accountability, setting a benchmark for governance excellence [48,50]. In contrast, Lebanon's governance problems, characterized by political instability and bureaucratic inertia, illustrate how governance deficits can impede sectoral flexibility and innovation [91,92].

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A key recommendation for MENA countries, inspired by neo-institutional insights, is to establish or strengthen independent regulatory authorities. These bodies are critical for ensuring transparency, promoting competition, and overseeing policy implementation. The effectiveness of Jordan's JREEEF in improving investor confidence and stimulating investment in renewable energy demonstrates the central role of regulatory autonomy [80,82,86,116].

Strategic reorientation of policy frameworks is essential to support a holistic energy transition that not only incentivizes renewable energy, but also addresses the broader socioeconomic impacts. Tunisia's National Renewable Energy Action Plan exemplifies the transformative potential of comprehensive policy instruments to steer the sector towards sustainable practices [107,108].

Adopting a participatory model of policy development can significantly improve the effectiveness of governance. Engaging a wide range of stakeholders enriches policymaking with diverse perspectives, thereby enhancing policy legitimacy and societal support. In addition, embracing technological innovation is critical for governance and policy development in the MENA region. Leveraging digital solutions for policy enforcement, regulatory compliance, and renewable resource management can streamline energy sector operations. For example, smart grid technologies and data analytics provide real-time insights into energy dynamics, enabling agile and efficient management.

The findings of Nouri et al. [117] highlight the need for policy frameworks that are both comprehensive and tailored to unique socio-economic and institutional landscapes, underscoring the nuanced approach required for successful energy transitions. The experiences of Jordan and the United Kingdom, where regulatory reforms have led to increased market efficiency and streamlined processes, also highlight the importance of establishing independent regulatory bodies [118]. These bodies build investor confidence and facilitate renewable energy investment by ensuring transparency and accountability in the energy sector.

Lessons from global benchmarks, such as Germany's Energiewende and Denmark's integration of wind power, demonstrate the power of cohesive policy frameworks, effective governance, and stakeholder engagement in driving successful renewable energy transitions [119]. These examples highlight the importance of innovative governance models and technology integration in realizing renewable energy ambitions, and provide valuable blueprints for the MENA region's sustainable energy future.

5.3. Strengthening Market Dynamics and Infrastructure

Strengthening market dynamics and infrastructure is paramount for a robust energy transition in the MENA region, recognizing that structured markets and resilient infrastructure are essential for the rapid deployment of renewable energy technologies. Insights from diverse regional experiences and neo-institutional analysis identify critical areas for progress, aligning with global contexts and innovative practices.

Market dynamics in the energy sector are closely linked to the regulatory and policy environment. Morocco's success in renewable energy, driven by progressive policies and clear regulatory frameworks, illustrates the importance of an enabling market environment to attract investment and spur innovation [48,50].

Financial mechanisms and incentives are critical for mitigating the investment risks associated with renewable energy. Inspired by global best practices, feed-in tariffs, tax benefits, and risk-sharing frameworks can significantly reduce barriers to market entry. Jordan's Renewable Energy and Energy Efficiency Fund is an example of how strategic financial instruments can enhance the attractiveness of the sector [80,81,85].

Investment in infrastructure, which includes both physical elements such as grid expansion and modernization to accommodate renewables, and digital infrastructure for energy management systems, is critical. The European Union's initiative to digitize the energy sector offers valuable lessons for MENA countries to improve grid flexibility and efficiency.

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Market segmentation and liberalization can encourage competition and innovation. Tunisia's efforts to liberalize its energy market, despite challenges, demonstrate the potential benefits of increased competition and private sector participation in advancing the energy transition [107,108].

Capacity building and knowledge transfer are fundamental to strengthening the energy sector. Improving the skills and awareness of stakeholders across the energy chain increases the resilience and adaptability of the sector. The European Union's Horizon 2020 program demonstrates the impact of research and development investments in driving innovation and strengthening the renewable energy workforce.

Public-private partnerships, such as the Noor Ouarzazate Solar Complex in Morocco, prove the effectiveness of collaborative investment models in implementing large-scale renewable energy projects and demonstrate the importance of joint efforts in infrastructure development [48].

MENA countries are encouraged to apply a wide range of international experiences to their unique situations. Singapore's technology-driven approach to energy efficiency and the UK's regulatory reforms to stimulate the renewable energy market provide additional frameworks to strengthen the region's energy transition efforts.

5.4. Fostering Regional Cooperation and Knowledge Sharing

Enhancing regional cooperation and knowledge sharing is critical for the MENA region to overcome institutional and infrastructural challenges in its energy transition journey. Drawing on neo-institutional insights, the importance of collective efforts and shared learning in complex energy environments becomes clear. Establishing regional dialogues and partnerships can anchor such collaborative efforts. Initiatives such as the Arab Renewable Energy Commission (AREC) and the Regional Center for Renewable Energy and Energy Efficiency (RCREEE) underscore the power of regional cooperation in sharing best practices, policy insights, and technological advances, mirroring the global contributions of the International Renewable Energy Agency (IRENA).

Knowledge exchange through these forums can accelerate the regional adoption of effective energy solutions. Notable examples include Morocco's solar energy achievements and Jordan's renewable energy financing strategies [50,80,81], which, if disseminated, can catalyze similar progress in neighboring countries.

In addition, capacity-building efforts are essential to strengthening regional collaboration. Initiatives such as workshops, training sessions, and collaborative research projects aim to strengthen the technical and policymaking skills essential for energy transitions. The European Union's twinning projects provide a paradigm for transferring regulatory knowledge and practices that could be tailored to the MENA region to strengthen institutional frameworks.

Leveraging regional networks for technology transfer and securing financial support addresses critical barriers to scaling up renewable energy projects. Partnerships with global financial institutions, including the World Bank and the European Investment Bank, have provided critical funding for renewable energy initiatives. Such collaborations could be intensified through regional cooperation to better facilitate financial flows and investment in sustainable energy.

Finally, the promotion of regional energy markets and grid interconnectivity is a fruitful area for cooperation with significant benefits. Cross-border infrastructure projects, such as the Mediterranean Solar Plan, hold the promise of enhancing energy security, optimizing resource allocation, and integrating renewable energy sources across the region, highlighting the transformative potential of joint regional efforts to achieve a sustainable energy future.

5.5. Integrating Equity and Sustainability in the Energy Transition

Achieving an equitable and sustainable energy transition in the MENA region requires a comprehensive strategy that places equal emphasis on social equity and environmental protection. This approach is consistent with the findings of neo-institutional analysis, which advocates for policies that are not only technically feasible, but also socially equitable and environmentally responsible.

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Energy equity is essential to ensure universal access to affordable, reliable and sustainable energy. Jordan's initiative through the Jordan Renewable Energy and Energy Efficiency Fund (JREEEF) is an example of a successful model for improving financial access to renewable energy projects [80,81,83,85], addressing both affordability and accessibility. The Noor Ouarzazate Solar Complex in Morocco also demonstrates how renewable energy projects can strengthen national energy security and provide economic benefits to local communities [48,50].

Sustainability in energy transitions requires a commitment to minimizing environmental impacts and emphasizing renewable energy. Tunisia's solar initiatives and Algeria's transition away from hydrocarbon dependence [65–67] illustrate the critical role of renewable energy in promoting sustainable development in the MENA region.

For transitions to be both equitable and sustainable, it is imperative that MENA countries focus on capacity building and public engagement. Educating all stakeholders about the benefits of renewable energy and involving communities in the planning and implementation of energy projects can foster social acceptance and support. Egypt's renewable energy strategies [70,71,74] highlight the importance of stakeholder participation in achieving sustainability goals.

Addressing the socio-economic dimensions of energy transitions is also essential. This includes creating employment opportunities in the renewable energy sector and providing support and training for workers transitioning from traditional energy industries. The European Green Deal serves as a model for integrating social considerations into energy strategies, ensuring that workers and communities are supported throughout the transition process. In this vein, the research by Belaïd [120] on the socio-economic implications of energy transitions underscores the importance of policies to alleviate fuel poverty and ensure equitable access to energy. This will ensure the inclusive benefits of the transitions across Egyptian society, reinforcing the principle that equitable access to energy is a cornerstone of a just and sustainable energy transition.

5.6. The Just and Sustainable Energy Transition (JSET) Model

The just and sustainable energy transition (JSET) model, as illustrated in Figure 1, provides a comprehensive blueprint for the MENA region's journey towards an energy system that is consistent with the twin imperatives of equity and environmental sustainability. Rooted in the insights of neo-institutional theory and further refined by the conceptual framework proposed by Mebratu and Swilling [121], the JSET model embodies a multidimensional approach. It integrates seven critical dimensions: systems thinking, well-being economics, circular economy, socio-technological innovation, collaborative governance, equitable consumption, and social inclusion, thereby charting a course for the transition to energy systems that are not only efficient and powered by renewable resources, but also characterized by their equitable distribution and inclusiveness.

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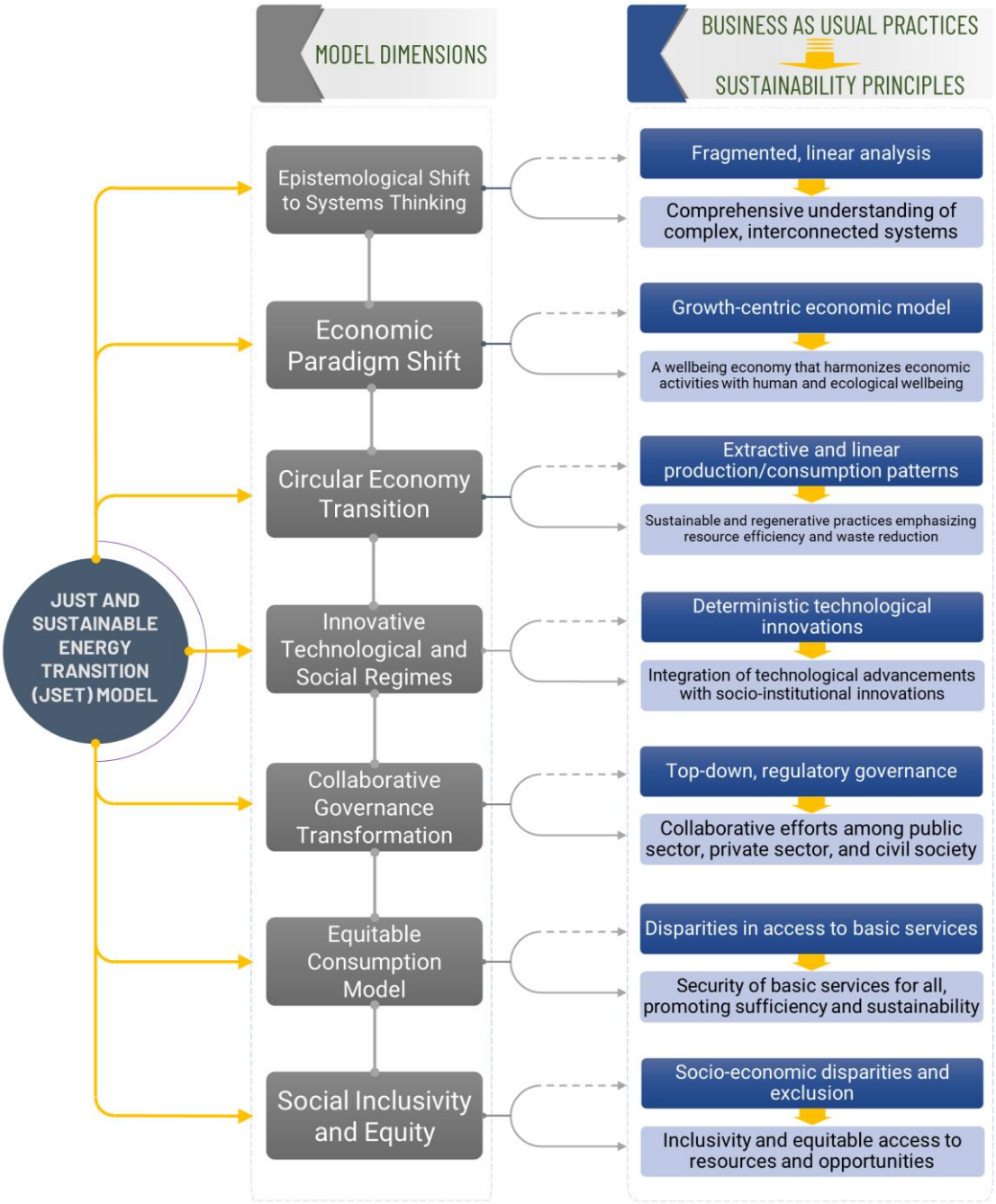

Figure 1. The Just and Sustainable Energy Transition (JSET) Model for the MENA Region. (Source: Adapted from Mebratu and Swilling [121]).

Systems thinking advocates a comprehensive understanding of the interconnectedness of energy systems with the broader socio-economic and environmental spheres. It calls for an overarching analytical perspective and strategic planning that can skillfully navigate the complex interrelationships and feedback mechanisms inherent in these systems. This approach emphasizes the importance of considering the cumulative impacts of policies and actions and encourages a move away from siloed thinking towards more integrated solutions.

Well-being economics proposes a paradigm shift from conventional measures of economic growth to a more nuanced conception of prosperity that emphasizes human well-being and environmental sustainability as primary indicators of economic performance. This reorientation requires a radical rethinking of the goals of energy policy and economic development, privileging the pursuit of long-term ecological integrity and the enhancement of societal well-being over mere economic expansion.

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Circular economy principles, when applied to the energy sector, emphasize the need to maximize resource efficiency, minimize waste, and promote the recycling and reuse of materials. This approach aims to cultivate energy systems that are inherently sustainable, reducing environmental degradation while optimizing the use of renewable resources.

Socio-technological innovation emphasizes the critical role of aligning technological advances with societal aspirations and needs, ensuring that energy innovations are both accessible to and aligned with society's broader goals. This dimension promotes the development and diffusion of renewable energy technologies that are tailored to the needs of different segments of society, thereby facilitating a more inclusive and equitable energy transition.

Collaborative governance involves the active participation of a broad range of stakeholders in the formulation and management of energy policies and projects. It promotes an ethos of policy coherence, transparency and mutual trust, achieved through the collaborative efforts of government agencies, the private sector, civil society and local communities. Such inclusive governance models are critical to developing energy policies that are both effective and equitable, reflecting a wide range of perspectives and interests.

Equitable consumption ensures that the transition to sustainable energy systems is characterized by fairness in access and affordability, and addresses disparities in energy consumption patterns among different social groups. This focus on equitable distribution is essential to ensure that the benefits of the energy transition are widely shared, thereby supporting vulnerable populations and mitigating existing inequalities in energy access.

Social inclusion emphasizes the importance of including diverse voices and perspectives in the energy transition process to ensure that energy policies and projects are truly inclusive and reflect the priorities of different communities. By emphasizing the value of broad-based support and engagement, the JSET model aims to foster a collective sense of ownership and commitment among all stakeholders to sustainable energy initiatives.

Operationalizing the JSET model across the MENA region requires strategic alignment of policy, implementation, and research efforts. It represents a transformative shift towards energy systems that prioritize not only sustainability and efficiency, but also social equity and adaptability to ever-changing global and regional dynamics. By adhering to the guiding principles of the JSET model, MENA countries can move toward a future where energy transitions not only contribute to environmental preservation, but also promote social equity and economic inclusion, laying the foundation for a truly sustainable and equitable energy landscape.

6. Conclusion

The journey towards addressing the multiple barriers to energy transition in the MENA region is characterized by its pressing urgency and complex nature, as extensively analyzed through a neo-institutional lens in this study. Applying the nuanced perspectives of neo-institutional economics, this research has shed light on the critical influence of both formal and informal institutional mechanisms in shaping the energy transition narrative in the MENA region. Going beyond traditional analytical methods, this research has delved into the complexities of the energy transition challenges, highlighting the pivotal role of governance, the regulatory environment, and institutional flexibility in guiding the region towards a sustainable energy paradigm.

The analysis underscores a dichotomy between the region's rich renewable energy potential and its entrenched dependence on fossil fuels, further complicated by socio-economic and infrastructural challenges. Exploration of different MENA countries has revealed a spectrum of institutional contexts, each with different challenges and opportunities for energy transition. From Morocco's progress in governance and policy to Lebanon's struggles with political instability, the findings argue for targeted, context-sensitive institutional reforms. These reforms aim to synchronize energy policy with societal needs, improve the efficiency of governance, and encourage broad stakeholder participation.

A strategic framework for a just and sustainable energy transition in the MENA region emerges from this analysis. Anchored in equity, sustainability, and inclusive governance, the JSET model

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outlines a holistic approach to implementing the study's recommendations. It calls for systemic transformations that integrate the principles of well-being economics, circular economy, socio-technological innovation, and equitable consumption to ensure a comprehensive and inclusive energy transition process.

At this critical juncture, the MENA region stands at a crossroads between its current energy realities and the potential for significant transformation. The insights and strategic recommendations presented in this study provide an important roadmap for policymakers, industry stakeholders, and international partners, and underscore the need for collaborative efforts to rethink energy policies and implement profound institutional and governance reforms. Such collective efforts are essential to navigate the complex institutional dynamics that define the energy transition in the MENA region and pave the way for a sustainable energy future. Moreover, this critical juncture requires a thorough reassessment of energy policies and a strategic pivot toward new institutional frameworks and governance practices. The comprehensive roadmap outlined in this study calls for collaborative action among policymakers, stakeholders, and international partners to advance the energy transition. By directly addressing the complex institutional dynamics, the MENA region can seize the opportunity to cultivate a sustainable energy future. Future research should continue to examine the role of institutions in energy transitions, using interdisciplinary approaches that combine technological, economic, and socio-political insights. Such ongoing scholarly engagement is critical to addressing new challenges and capitalizing on emerging opportunities, thereby advancing the pursuit of sustainable energy solutions in the MENA region and beyond. This continued pursuit of knowledge and innovation will shape a resilient, sustainable, and equitable energy landscape for future generations.

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