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Navigating Sociopolitical Intricacies: Iran's Energy Transition Pathways amidst Global Transformations^{*}

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Abstract

The global energy transition towards low-carbon systems has brought to the fore the underexplored sociopolitical dynamics shaping transition pathways in fossil fuel-dependent developing countries. This study addresses this critical research gap by conducting a comprehensive, multidimensional analysis of the complex interplay between public attitudes, interest group pressures, political institutions, and cultural narratives influencing Iran's energy transition strategies amidst evolving global realities. Employing a novel analytical framework that synthesizes resource dependence, sociotechnical transitions, punctuated equilibrium, and complex interdependence theories, the research draws upon rich insights from 11 semi-structured interviews with leading Iranian experts across policy, engineering, economics, sociocultural, and governance domains. Through a rigorous discourse analysis of interview data and an extensive literature review, the study examines the way in which entrenched hydrocarbon interests, institutional fragmentation, geopolitical tensions, public perceptions, demographic divergences, and cultural identities shape Iran's complex energy landscape. The findings underscore the importance of responsive communication, inclusive stakeholder engagement, adaptive governance, and regional cooperation in navigating the sociopolitical terrain underpinning Iran's sustainable energy transition. The study generates actionable policy recommendations spanning public outreach, political economy management, institutional capacity building, and international diplomacy, advancing theoretical understandings of energy transitions in resource-dependent Global South contexts, while providing guidance for policymakers navigating complex reform pathways amidst societal resistance and geopolitical uncertainties.

Keywords: Communication Strategies, Energy Transition, Iran, Resilience, Resource Dependence, Sociopolitics, Sustainability

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1. Introduction

The global energy landscape is undergoing an unprecedented transformation as countries worldwide grapple with the urgent need to decarbonize their economies and mitigate climate change impacts (Sovacool, 2021). This global energy transition involves complex, multidimensional processes that extend beyond technological shifts to encompass profound changes in sociopolitical structures, economic systems, and cultural paradigms (Geels et al., 2017a).

While a growing body of literature has examined the technical and economic aspects of energy transitions, the sociopolitical dimensions shaping these transformative processes remain underexplored, particularly in the context of fossil fuel-dependent developing countries (Mirzania et al., 2023).

Iran, as a major oil and gas producer, exemplifies the complex sociopolitical dynamics shaping energy transition pathways in fossil fuel-dependent economies. Despite its abundant renewable energy potential and pressing need for economic diversification, Iran's sustainable energy transition remains hampered by a confluence of social, political, and cultural factors that have received limited scholarly attention (Yazdanpanah et al., 2022).

This study aims to address this critical research gap by providing a comprehensive, multidimensional analysis of the sociopolitical intricacies shaping Iran's energy transition strategies amidst shifting global realities. Specifically, the research seeks to answer the following questions: 1) How do public attitudes, cultural narratives, and demographic variations influence societal perceptions and acceptance of energy transition policies in Iran? 2) What role do interest group dynamics, institutional structures, and

political processes play in shaping Iran's energy transition agenda? 3) How do geopolitical factors, regional dynamics, and international sanctions impact Iran's energy transition pathways and policy options? 4) What policy recommendations can be derived from a sociopolitical analysis to facilitate Iran's sustainable energy transition while balancing development priorities and global sustainability imperatives?

To address these questions, the study adopts a qualitative research design, drawing upon rich insights from 11 semi-structured interviews with leading Iranian experts across policy, engineering, economics, sociocultural, and governance domains. Through rigorous discourse analysis of interview data and an extensive literature review, the research reveals the way in which entrenched hydrocarbon interests, institutional fragmentation, geopolitical tensions, public perceptions, demographic divergences, and cultural identities shape Iran's complex energy landscape.

The paper is structured as follows: Section 2 provides a concise review of the literature on global energy transitions and their sociopolitical dimensions, highlighting the limited scholarly attention to the Iranian context. It then introduces the study's novel multidimensional analytical approach that addresses identified research gaps. Section 3 presents the integrated theoretical framework, drawing upon resource dependence, sociotechnical transitions, punctuated equilibrium, and complex interdependence theories. Section 4 outlines the qualitative methodology, detailing the expert interview process, discourse analysis approach, and conceptual synthesis. Section 5 presents the study's findings, organized around the key sociopolitical dimensions shaping Iran's energy transition, including public attitudes, interest group dynamics, political institutions, cultural narratives, and geopolitical

factors. Section 6 discusses the implications of the findings, integrating sociopolitical and techno-economic perspectives to derive insights for managing Iran's energy transition complexities. Finally, Section 7 concludes with policy recommendations spanning strategic communication, political economy management, institutional reforms, and regional cooperation, highlighting the relevance of the findings for other fossil fuel-dependent developing countries navigating the global energy transition.

By shedding light on the often-overlooked sociopolitical dynamics influencing energy system transformations, this study contributes to advancing theoretical understandings of sustainability transitions in resource-dependent Global South contexts. The findings underscore the importance of responsive communication, inclusive stakeholder engagement, adaptive governance, and international cooperation in navigating the complex terrain underpinning Iran's sustainable energy future. Ultimately, the research generates actionable policy insights that can inform decision-makers in Iran and beyond as they steer their societies towards a low-carbon future amidst evolving global realities and societal resistance.

2. Literature Review

2.1. Global Perspectives on Energy Transitions

The global energy landscape is undergoing a profound transformation driven by decarbonization pressures, technological innovations, and sociopolitical dynamics (Sovacool, 2021). Scholars have increasingly recognized the complex, multidimensional nature of energy transitions, which involve intricate interactions between technical, economic, cultural, and

political factors (Blondeel et al., 2021; Geels et al., 2017b). Sovacool et al. (2018) propose a comprehensive framework integrating technological, economic, sociocultural, and ethical dimensions to examine the determinants of energy transitions, emphasizing the importance of interdisciplinary social science research.

The politics and governance of energy transitions have received growing attention, with studies revealing the misalignments between entrenched fossil fuel interests and climate mitigation imperatives (Skovgaard & van Asselt, 2019). Lockwood et al. (2017) offer a historical institutionalist approach to analyze policy continuity and change dynamics, while Hess (2019) demonstrates the ways in which decentralized clean energy movements can expand civic agency and disrupt incumbent energy regimes.

Geopolitical and geoeconomic factors also shape global energy transitions, as highlighted by Hache (2018) and Jabalameli & Rahimfallah (2022). The shift towards renewables and low-carbon technologies can create new interdependencies and trade patterns, with implications for resource-rich countries.

Social dimensions, including public attitudes, cultural norms, and equity considerations, play a crucial role in shaping energy transition pathways (Horne & Kennedy, 2017; Stephens, 2019). Walker et al. (2010) and Walker & Cass (2007) reveal how public perceptions influence the social acceptance and sustainability of renewable energy projects.

2.2. Iran's Energy Transition Challenges and Opportunities

Iran, as a major fossil fuel producer, faces distinct challenges and

opportunities in navigating the global energy transition. Monavariyan et al. (1399 [2020 A.D.]) provide a comprehensive taxonomy of the causal drivers, contextual settings, and intervening conditions influencing Iran's renewable energy policymaking process, highlighting the interplay of economic, ecological, geopolitical, and regulatory factors.

Rahimi Rad et al. (1397 [2018 A.D.]) elucidate how Iran's entrenched fossil fuel-based socio-technical regime has hindered solar PV adoption through economic, political, and institutional barriers, despite the country's significant renewables potential. Safari et al.'s (1400 [2022 A.D.]) survey reveals the influence of public awareness on sustainable consumption behaviors, while Pazokinejad & Salehi (1399 [2021 A.D.]) underscore the role of sociocultural factors, such as environmental consciousness and social norms, in shaping household energy decisions.

The model proposed by Shoghi Aghjeh Mashhad et al. (1402 [2023 A.D.]) synthesizes financial, economic, and social determinants influencing Iranian consumers' acceptance of renewable energy innovations, providing policymakers with insights for catalyzing clean energy adoption. Delaviz et al. (1401 [2022 A.D.]) and Tahami Pour et al. (1395 [2016 A.D.]) highlight the disparities in energy behaviors and sustainability orientations across Iran's urban-rural spectrum, emphasizing the need for tailored strategies.

2.3. Synthesis: Importance of Examining Sociopolitical Dynamics in the Iranian Context

The literature review reveals the growing recognition of sociopolitical dimensions in shaping global energy transitions, yet

their influence on Iran's decarbonization pathways remains underexplored. By integrating insights from resource dependence, sociotechnical transitions, punctuated equilibrium, and complex interdependence theories, this study aims to provide a holistic understanding of the sociopolitical dynamics influencing Iran's energy transition amidst evolving global realities.

The examination of public attitudes, interest group pressures, political institutions, cultural narratives, and geopolitical factors can generate valuable insights for policymakers seeking to navigate the complex terrain of Iran's sustainable energy transition, while balancing development priorities and societal concerns. This research contributes to advancing theoretical understandings of energy system transformations in fossil fuel-dependent Global South contexts, while offering actionable policy recommendations for managing reform processes amidst resistance and uncertainties.

2.4. Advancing the Field: A Novel Multidimensional Analytical Approach

The literature review reveals the growing recognition of sociopolitical dimensions in shaping global energy transitions, yet their influence on Iran's decarbonization pathways remains underexplored. Prior studies have provided valuable insights into specific aspects of Iran's energy landscape, such as the technical barriers to solar PV adoption (Rahimi Rad et al., 1397 [2018 A.D.]), the role of public awareness in sustainable consumption behaviors (Safari et al., 1400 [2022 A.D.]), and the disparities in energy behaviors across urban-rural divides (Delaviz et al., 1401 [2022 A.D.]; Tahami Pour et al., 1395 [2016 A.D.]). However, a comprehensive, integrated analysis of the complex interplay

between sociopolitical factors and techno-economic realities influencing Iran's energy transition is still lacking.

This study addresses this critical research gap by employing a novel multidimensional analytical approach that synthesizes insights from four complementary theoretical lenses: resource dependence, sociotechnical transitions, punctuated equilibrium, and complex interdependence theories. By integrating these diverse perspectives, the research framework enables a holistic understanding of the dynamic interactions between Iran's domestic sociopolitical landscape and the evolving global energy context.

Resource dependence theory provides a foundation for examining how Iran's heavy reliance on oil and gas revenues shapes its economic policies, political dynamics, and institutional inertia. The sociotechnical transitions perspective, particularly the Multi-Level Perspective (Geels, 2002), facilitates an analysis of the complex interplay between technological innovations, socio-political regimes, and broader landscape factors influencing Iran's transition towards a more sustainable energy system. Punctuated equilibrium theory offers insights into the sporadic nature of policy change, characterized by periods of incremental adjustments punctuated by occasional bursts of transformative reforms. Finally, complex interdependence theory illuminates the profound influence of geopolitical factors, international sanctions, and regional dynamics on Iran's domestic energy transition strategies.

By weaving together these complementary theoretical strands, the study constructs a robust analytical framework that captures the multidimensional complexities shaping Iran's energy transition pathways. This integrated approach moves beyond the limitations of single-lens analyses, enabling a more nuanced understanding of the sociopolitical drivers, barriers, and opportunities influencing

Iran's sustainable energy future.

Moreover, by grounding this novel theoretical framework in rich empirical insights from interviews with Iranian experts across diverse domains, the study ensures that its analytical perspectives are closely attuned to the lived realities and contextualized challenges facing Iran's energy transition. The combination of interdisciplinary theorizing and in-depth qualitative exploration allows for a more granular, policy-relevant analysis that can inform decision-making processes and stakeholder negotiations.

The significance of this multidimensional approach extends beyond the Iranian context, offering a valuable template for examining the complex sociopolitical dynamics shaping energy transitions in other fossil fuel-dependent developing countries. By demonstrating the explanatory power of integrating multiple theoretical lenses and grounding them in contextual empirical realities, the study contributes to advancing the nascent literature on the sociopolitical dimensions of sustainability transitions in the Global South.

In the following section, the study's integrated theoretical framework is elaborated in detail, laying the conceptual foundation for a comprehensive analysis of Iran's energy transition landscape. The subsequent sections then apply this innovative multidimensional lens to examine the intricate interplay of public attitudes, interest group pressures, political institutions, cultural narratives, and geopolitical factors shaping Iran's path towards a low-carbon future, generating actionable policy insights for navigating the complex terrain ahead.

3. Theoretical Framework

Navigating the multifaceted terrain of Iran's energy transition necessitates a robust and integrative theoretical framework that can encapsulate the intricate geoeconomic, sociopolitical, and technological dynamics at play. This research synergizes four complementary theories, providing diverse analytical lenses to illuminate Iran's complex energy landscape based on the insights gathered from the in-depth expert interviews. The perspectives spanning engineering, economics, governance, and sociocultural studies provide crucial empirical grounding for the selection and application of the following theoretical approaches.

3.1. Resource Dependence Theory (RDT)

Resource Dependence Theory (Pfeffer & Salancik, 1978) is instrumental in examining the way in which Iran's heavy reliance on oil and gas revenues shapes its economic policies and political dynamics. As noted by an expert policy researcher, RDT elucidates the pressing need for Iran to diversify its energy mix to mitigate vulnerabilities associated with fossil fuel dependency. This theory sets the economic and political context of Iran's energy sector, spotlighting the challenges and imperatives of diversification, thus serving as a foundational lens for this research.

3.2. Multi-Level Perspective on Transitions (MLP)

The Multi-Level Perspective on transitions (Geels, 2002) facilitates the analysis of Iran's transition towards a more diversified and sustainable energy system by scrutinizing the interactions between technological innovations, socio-political regimes, and broader

landscape factors. The technology adoption challenges noted by interviewed engineers underscore these dynamics. MLP adds a dynamic layer of analysis, enriching the understanding of systemic intricacies involved in Iran's shift towards renewables and clean energy technologies.

3.3. Punctuated Equilibrium Theory (PET)

Punctuated Equilibrium Theory (Baumgartner & Jones, 1993) provides insights into the sporadic evolution of policy shifts within Iran's energy sector, delineating periods of stasis and bursts of substantial reforms, thereby elucidating the underlying triggers and constraints. The governance experts interviewed reveal these policy evolutions. PET enhances the framework by offering a lens to analyze the sporadic evolution of energy policies in Iran, intertwining with the transition dynamics explored through MLP.

3.4. Complex Interdependence Theory (CIT)

Complex Interdependence Theory (Keohane & Nye, 1973) examines Iran's entanglement within the global energy landscape, probing the reciprocal influences between Iran's energy strategies and its geopolitical relationships. The international relations experts provide pivotal perspectives in this regard. CIT expands the analytical scope to encompass the multilayered relationships and mutual vulnerabilities characterizing Iran's interactions in global energy markets, thereby completing the analytical matrix.

3.5. Integrated Theoretical Framework

The proposed conceptual model amalgamates the four theories into an integrated framework structured across four key analytical dimensions.

1. The Resource Dependence dimension, encompassing Iran's heavy hydrocarbon reliance, sets the vital context.

2. The Transition Dynamics dimension, facilitated via MLP, offers a multilayered perspective probing realignments within Iran's sociotechnical system regime as innovations disrupt existing pathways.

3. The Policy Evolution dimension builds on PET perspectives to examine cyclic reform processes that periodically catalyze significant deviations amplifying sustainability-focused transition dynamics.

4. The Global Interdependence dimension draws on CIT to analyze Iran's reciprocal vulnerabilities and opportunities within shifting global energy partnerships and markets.

Collectively, these four dimensions provide a systematic, yet flexible, integrated theoretical framework to examine the economic, political, and cultural dynamics shaping Iran's energy transition strategies and outcomes amidst transforming geopolitical landscapes. The interplay among these conceptual lenses, grounded in empirical evidence from interviews and literature, offers robust, contextualized, and well-rounded perspectives guiding this analysis.

By synergizing resource dependence, sociotechnical transitions, punctuated equilibrium, and complex interdependence theories, this

study constructs a comprehensive analytical approach that captures the multidimensional complexities influencing Iran's energy transition pathways. This integrated framework enables a nuanced understanding of the dynamic interactions between Iran's domestic sociopolitical landscape and the evolving global energy context, providing a solid foundation for generating policy-relevant insights and recommendations.

4. Methodology

This study employs a qualitative research design, underpinned by geoeconomic and sociopolitical analysis frameworks, to examine Iran's multifaceted energy transition landscape. The research assimilates insights from a comprehensive review of academic literature and policy documents, complemented by 11 in-depth, semi-structured interviews with leading Iranian experts across policy, engineering, economics, sociocultural, and governance domains.

4.1. Qualitative Research Design

The qualitative approach facilitates an in-depth exploration of the complex sociopolitical dynamics shaping Iran's energy transition (Creswell & Poth, 2018). This design allows for a nuanced understanding of the perspectives, experiences, and contextual factors influencing Iran's energy policy landscape, as emphasized by the expert interviews.

4.2. Expert Interviews

4.2.1. Participant Selection and Profiles

The study conducted 11 semi-structured interviews with leading

Iran-based scholars and practitioners representing diverse fields (see Table 1). The interviewees were purposively selected based on their expertise, experience, and influential roles in shaping Iran's energy transition discourse and policy landscape.

Table 1. Interviewee Characteristics

Interviewee Code	Position	Affiliation	Area of Expertise
IR1	Assistant Professor	University of Shahid Bahonar, Kerman	Energy Policy
IR2	Assistant Professor	Islamic Azad University, Tehran Shomal Branch	Renewable Energy Engineering
IR3	PhD in Policy-Making	Islamic Azad University, Tehran Markaz Branch	Environmental Economics
IR4	PhD in Political Sociology	University of Tehran	Sociocultural Transitions
IR5	Assistant Professor	Islamic Azad University, Tehran Markaz Branch	International Energy Governance
IR6	Energy Systems Engineer, PhD in International Relations	Islamic Azad University, Rafsanjan Branch	Electric Power Systems
IR7	PhD Candidate in Cultural Anthropology	University of Tehran	Cultural Anthropology
IR8	Assistant Professor	Islamic Azad University, Sirjan Branch	Sustainability Transitions
IR9	Assistant Professor	Payam Noor University, Tehran Branch	Climate Policy and Economics
IR10	PhD in International Relations	University of Tehran	Energy Justice
IR11	PhD in Bank Management	Higher Institute of Banking Education	Behavioral Economics

Source: Authors' Compilation Based on the Conducted Interviews

4.2.2. Interview Protocol and Key Themes

The interviews were conducted using a semi-structured format, guided by a series of key themes related to Iran's energy transition challenges, opportunities, priorities, and pathways. These themes spanned technical, financial, cultural, and geopolitical dimensions.

The interviews were conducted in Persian and ranged from approximately 30 to 50 minutes in duration. Some of the interviews were conducted asynchronously, with the interviewer sending a set of questions to the participant and receiving written responses, sometimes involving back-and-forth exchanges to clarify or expand on certain points. Other interviews were carried out in real-time, using online communication platforms.

The flexible, semi-structured approach allowed for an in-depth exploration of the participants' perspectives and experiences, while the use of both written and verbal exchange formats provided complementary data sources to gain a comprehensive understanding of the research topic.

4.3. Discourse Analysis

The interview transcripts were subjected to discourse analysis to uncover the underlying assumptions, discourses, and power dynamics shaping Iran's energy policy landscape (Hajer, 1995). Unlike a content analysis approach, which focuses on the manifest content and frequency of themes, discourse analysis examines the deeper, latent meanings and the ways in which language, ideas, and power relations are constructed and reproduced within the policy domain. This analytical lens allowed for a more nuanced understanding of the complex, context-dependent factors influencing Iran's energy transition.

The study integrates the empirical findings from the expert interviews with insights from the academic literature to construct a comprehensive understanding of Iran's sociopolitical energy landscape. The analysis draws upon the study's integrated theoretical framework, which encompasses resource dependence, sociotechnical transitions, punctuated equilibrium, and complex interdependence dimensions, to interpret the findings and derive policy-relevant insights.

Throughout the methodology, the study maintains a strong focus on ensuring the reliability, validity, and trustworthiness of the qualitative inquiry (Lincoln & Guba, 1985) through transparent reporting, thick description, and triangulation of data sources and theoretical perspectives.

By combining rigorous qualitative methods, an interdisciplinary theoretical framework, and in-depth expert insights, this study offers a robust and comprehensive analysis of the sociopolitical dynamics influencing Iran's energy transition amidst global shifts, generating actionable policy recommendations that account for the complex interplay of technical, economic, cultural, and geopolitical factors shaping Iran's sustainable energy future.

5. Findings: Sociopolitical Dimensions Shaping Iran's Energy Transition

5.1. Public Attitudes and Perceptions across Demographics

The expert interviews and literature review reveal significant variations in public attitudes and perceptions towards energy transition policies across Iran's diverse demographics. As noted by the sociocultural transitions expert (IR4), "Iran's ethnolinguistic

diversity alongside urban-rural divides in development outcomes and media penetration necessitate differentiated communication so various publics feel culturally understood, while reform discourse resonates with their priorities".

Surveys indicate that while educated urban youth exhibit greater sustainability concerns, older rural citizens prioritize economic development (Nasrollahzadeh & Farahani, 1399 [2020 A.D.]; Nadem Souraki et al., 1401 [2023 A.D.]). Moreover, public awareness of energy issues remains limited, with significant gaps across demographic segments (Shoghi et al., 1402 [2023 A.D.]; Elahi et al., 1394 [2015 A.D.]). The cultural anthropologist (IR7) emphasizes that "cultivating youth environmental awareness can be critical for cultural acceptance of diversification policies".

Sociocultural values also influence behaviors and technology acceptance (Akbari et al., 1395 [2017 A.D.]). As highlighted by IR7, "hospitality customs and symbols of social status enable energy overconsumption among certain demographics. However, community orientations and ethics around justice can potentially counter these to instead promote collective responsibility framings".

5. 2. Interest Group Dynamics and Influences

Iran's energy policy landscape involves complex power dynamics between multiple stakeholders, including the government, industries, and civil society groups. The most influential actor is the entrenched oil and gas industry, which benefits tremendously from the hydrocarbon dependence status quo. As noted by the international energy governance specialist (IR5), "industry advocates leverage ties with political elites to shape discourses and

policies resisting diversification that could threaten revenues and market share".

However, the growing renewable energy sector increasingly promotes clean energy investments and subsidies, citing global decarbonization imperatives (*The Economist*, 2023). Environmental NGOs have relatively limited influence currently due to political obstacles, but pressures from civil society and rising public environmental concern are mounting.

The sustainability transitions expert (IR8) asserts that "achieving policy coherence across disparate agencies via mandated coordination councils is a key factor, given overlapping mandates currently foster fragmentation". Managing these complex rival interests through transparent multi-stakeholder governance and emphasizing diversification's shared benefits could enable policy consensus.

5.3. Political Institutions, Processes, and Policy Framings

Iran's political landscape poses complex challenges for building consensus on energy reforms and transition pathways. The governance framework involves multiple governmental stakeholders with differing priorities. As highlighted by the energy policy expert (IR1), "the oil ministry, given fossil fuels' economic centrality, often resists sustainability policies threatening revenues or market share. In contrast, agencies like the Renewable Energy Organization (SATBA) and Department of Environment increasingly promote clean energy aligned to global shifts, yet wield less administrative and political clout currently".

Critics argue that opaque governance enables vested industry

interests to influence policymaking, hampering reforms (Sarmast et al., 1402 [2023 A.D.]). Institutional fragmentation also constrains coordination, as overlapping authority breeds inter-agency struggles over resources and influence due to ambiguous constitutional mandates.

The electric power systems specialist (IR6) emphasizes that "priority infrastructure for enabling renewable growth, while ensuring grid reliability centers around modernizing substations, enhancing transmission networks to smooth power flows between regions, strengthening forecasting to anticipate variable generation, and deploying smart inverters and advanced control systems to stabilize voltages".

5.4. Cultural Identities, Narratives, and Social Norms

Sociocultural specialists reveal that while most Iranians appreciate environmental protection philosophically, substantial engagement gaps persist between different demographics in practice. As noted by IR7, "explicitly connecting modern renewable technology identities with cultural pride can accelerate acceptance".

Analysis of surveys indicates variability in sustainability consciousness across Iran's population segments along educational, geographic, and generational dimensions (Haghighatian et al., 2021; Amini & Sharifi, 1389 [2010 A.D.]; Rahmanpour & Ramezani, 1397 [2019 A.D.]; Hemmati & Shobeiri, 1395 [2016 A.D.]). Additionally, certain hospitality-related cultural ceremonies encourage lavish energy consumption (Moazen Soltanabadi & Hashemian, 1394 [2016 A.D.]; Hosseini, 1390 [2012 A.D.]).

The behavioral economics expert (IR11) highlights that

"analyzing heterogeneity in the way in which messages on environment or modernity resonate, status perceptions of visible renewable assets, and pharmacy effects of clustered community adoption offers pathways to catalyze scales of transition through influential societal networks".

5. 5. Geopolitical Factors, Sanctions, and Regional Dynamics

International sanctions have profoundly shaped Iran's energy transition by severely constraining its oil and gas sector that dominates fiscal revenues and exports. As emphasized by the international relations expert (IR10), "sanctions have tangibly reduced Iran's hydrocarbon production capacities, export volumes, infrastructure upgrades and access to global energy markets and technologies - severely impacting energy security, economic development and social welfare". Sanctions have also reshaped Iran's global energy partnerships, instigating cooperation with alternative powers like China and Russia despite tensions (Sariolghalam, 2023). However, experts underscore that sanctions relief remains uncertain given shifting geopolitical headwinds and challenges facing the 2015 Iran Nuclear Deal (JCPOA). The climate policy and economics expert (IR9) notes that "with abundant solar potentials, low-cost renewable electricity exports can displace coal and gas in neighboring markets. Similarly, leveraging Iran's vast natural gas reserves for low-carbon hydrogen production aimed at distant markets in Europe and Asia offers substantial promise given declining renewable hydrogen costs".

Regional energy integration can enhance Iran's energy security, diversify export markets, reduce emissions, and foster stability. However, significant infrastructure investment, alongside complex

geostrategic hurdles, persist requiring deft diplomacy transcending political grievances.

6. Discussion: Integrating Sociopolitical and Techno-Economic Perspectives

6. 1. Interaction of Sociopolitical and Economic Drivers and Barriers

The findings from this multidimensional analysis, centered on a qualitative methodology encompassing expert interviews and conceptual analysis, reveal the intricate interplay between sociopolitical and techno-economic factors shaping Iran's energy transition strategies. The study's integrated theoretical framework, assimilating resource dependence, sociotechnical transitions, punctuated equilibrium, and complex interdependence perspectives, enables a comprehensive understanding of the complex dynamics at play.

The resource dependence lens underscores Iran's vulnerability arising from its overwhelming reliance on oil and gas export revenues for fiscal spending and broader economic planning. This economic imperative for diversification is tempered by sociopolitical barriers, including entrenched hydrocarbon interests, institutional inertia, and public resistance to reforms that may impact living standards (Amadeh et al., 1393 [2014 A.D.]; Nematollahi et al., 1398 [2019 A.D.]). Navigating these competing pressures requires judicious policy sequencing and strategic communication to foster public acceptance.

Concurrently, the sociotechnical transitions perspective illuminates the challenges of disrupting Iran's established fossil fuel-based regime, despite the growing momentum of renewable energy niches (Rahimi Rad et al., 1397 [2018 A.D.]). Overcoming technological lock-ins and market barriers necessitates proactive

governance measures, including targeted subsidies, long-term power purchase agreements, and financial risk mitigation instruments, as highlighted by the environmental economics expert (IR3).

The punctuated equilibrium lens further elucidates the sporadic nature of Iran's energy policy evolution, characterized by periods of incremental adjustments punctuated by occasional bursts of transformative reforms. Catalyzing sustained momentum amidst this landscape requires policy entrepreneurs to strategically exploit windows of opportunity opened by exogenous shocks, such as global market shifts or geopolitical realignments (Anderson, 2019).

6. 2. Implications for Managing Iran's Energy Transition Complexities

The complex interdependence framework underscores the profound influence of geopolitical factors on Iran's domestic energy transition, particularly the constraining effects of international sanctions on technology access, infrastructure investments, and global market integration. Navigating these challenges necessitates deft diplomacy to unlock strategic partnerships and financing, as emphasized by the international energy governance specialist (IR5).

Cultivating regional electricity and hydrogen trade can enhance Iran's energy security and economic resilience while fostering cooperation (Malpass, 2021; Rybski, 2023). However, realizing these opportunities requires substantial infrastructure investments and diplomatic breakthroughs to transcend historical rivalries. Balancing national interests with global sustainability imperatives emerges as a critical tightrope for Iran's energy policymakers.

Effectively managing the sociopolitical complexities of Iran's energy transition further necessitates responsive public outreach strategies tailored to the country's diverse demographics. Leveraging trusted community networks, culturally resonant narratives, and inclusive participation can foster a shared vision for a sustainable energy future (Stephens, 2019). Transparent, adaptive governance reforms that bridge institutional silos and engage diverse stakeholders are vital for maintaining reform momentum.

Ultimately, aligning Iran's energy transition with its broader socioeconomic development priorities is paramount. Integrating principles of energy justice, such as inclusive access, affordability, and intergenerational equity, into policy frameworks can ensure that the benefits of the transition are equitably distributed across society (Jenkins et al., 2016). Investing in green industrial policies, skill development programs, and social safety nets can further ease the transition for vulnerable communities.

6. 3. Theoretical Contributions and Future Research Directions

This study makes valuable theoretical contributions by demonstrating the applicability of an integrated framework synthesizing resource dependence, sociotechnical transitions, punctuated equilibrium, and complex interdependence theories for analyzing energy transitions in fossil fuel-dependent Global South contexts. The research highlights the explanatory power of this multidimensional approach in capturing the complex interplay of sociopolitical, economic, and technological factors shaping transition pathways. Moreover, the study advances the nascent literature on the sociopolitical dimensions of energy transitions by providing granular insights into the Iranian context, which has received limited scholarly attention thus far. The findings

underscore the centrality of political economy dynamics, institutional capacities, and cultural narratives in steering transition outcomes, complementing techno-economic analyses.

Future research could fruitfully build upon this study by conducting comparative analyses of energy transition experiences across other resource-rich Middle Eastern countries to identify common challenges, best practices, and context-specific strategies. Additionally, longitudinal studies tracking the evolution of public attitudes, policy discourses, and stakeholder coalitions over time could offer valuable insights into the temporal dynamics of transition processes.

Methodologically, integrating quantitative surveys and social network analysis could further enrich the understanding of public perceptions and stakeholder influence matrices. Incorporating energy system modeling and scenario planning exercises could also help map out plausible transition pathways under different policy and geopolitical assumptions. Furthermore, this study's findings invite deeper exploration of the ethical dimensions of energy transitions, particularly the strategies for ensuring procedural and distributive justice in the face of entrenched power asymmetries. Investigating the gendered impacts of energy policies and the role of women's voices in shaping transition discourses represents another critical avenue for future inquiry.

In conclusion, this study's multidimensional analysis of the sociopolitical dynamics shaping Iran's energy transition offers valuable insights for policymakers and scholars grappling with the complexities of sustainable development in fossil fuel-dependent economies. By shedding light on the often-overlooked social, cultural, and political dimensions of energy system transformations, the research contributes to a more holistic

understanding of the challenges and opportunities ahead. Continued interdisciplinary dialogue and context-sensitive theorizing will be indispensable for navigating the turbulent landscape of global energy transitions in the coming decades.

7. Conclusion and Policy Implications

This study provides a comprehensive, multidimensional analysis of the complex sociopolitical dynamics shaping Iran's energy transition strategies amidst shifting global landscapes. By integrating insights from resource dependence, sociotechnical transitions, punctuated equilibrium, and complex interdependence theories, the research illuminates the intricate interplay of public attitudes, interest group pressures, political institutions, cultural narratives, and geopolitical factors influencing Iran's sustainable energy pathways.

The findings underscore the centrality of responsive communication strategies, inclusive stakeholder engagement, adaptive governance reforms, and strategic regional cooperation in navigating the sociopolitical terrain underpinning Iran's energy transition. Aligning transition policies with broader socioeconomic development priorities while proactively managing the distributive impacts on vulnerable communities emerges as a critical imperative.

7.1. Strategic Communication and Public Engagement

Cultivating broad-based societal support for Iran's energy transition necessitates tailored communication strategies that resonate with the country's diverse demographics. Policymakers should invest in targeted public outreach campaigns that leverage culturally

appropriate narratives, trusted community networks, and inclusive participation mechanisms. Emphasizing the co-benefits of sustainable energy policies, such as improved public health, job creation, and energy access can help bridge political, regional, and class divides. Table 2 summarizes key policy recommendations for effectively navigating Iran's sociopolitical landscape in pursuit of a just and sustainable energy transition.

Table 2. Policy Recommendations for Navigating Iran's Energy Transition

Policy Domain	Key Recommendations
Public Engagement	<ul style="list-style-type: none"> - Develop targeted communication strategies tailored to Iran's diverse demographics and cultural contexts - Emphasize co-benefits of sustainable energy policies, such as improved public health, job creation, and energy access - Foster inclusive participation through community-level dialogues and consultative mechanisms
Political Economy Management	<ul style="list-style-type: none"> - Develop strategic subsidy reform models that minimize adverse impacts on vulnerable groups - Establish transparent, accountable, and participatory governance structures for managing hydrocarbon revenues and investing in sustainable energy - Align energy policies with broader socioeconomic development priorities
Institutional Reforms	<ul style="list-style-type: none"> - Promote interagency coordination through formalized sustainable energy planning and implementation bodies - Strengthen regulatory frameworks and oversight mechanisms to ensure policy coherence and consistency - Enhance institutional capacities for data-driven policymaking and adaptive policy learning
Regional Cooperation	<ul style="list-style-type: none"> - Pursue strategic regional partnerships for renewable electricity trade and low-carbon hydrogen development - Collaborate on joint research, innovation, and capacity-building programs to accelerate sustainable energy deployment - Leverage multilateral forums to promote policy harmonization and investment coordination
Market Incentives and Social Policies	<ul style="list-style-type: none"> - Phase in market-based instruments, such as carbon pricing and renewable energy certificates, while safeguarding energy affordability - Align industrial policies and financial incentives to promote green technology localization and job creation - Strengthen social safety nets and skill development programs to support vulnerable workers and communities

Source: Authors' Policy Recommendations Based on Research Findings

7. 2. Political Economy Management and Institutional Reforms

Effectively managing the political economy of Iran's energy transition requires strategic reforms that balance competing interests and distribute the costs and benefits equitably. Policymakers should develop transparent, accountable, and participatory governance structures for managing hydrocarbon revenues and investing in sustainable energy infrastructure. Strengthening interagency coordination through formalized sustainable energy planning and implementation bodies can help overcome institutional fragmentation and policy incoherence. Enhancing institutional capacities for data-driven policymaking and adaptive policy learning is also crucial for navigating the complex and evolving transition landscape.

7. 3. Regional Cooperation and Infrastructure Integration

Pursuing strategic regional partnerships for renewable electricity trade and low-carbon hydrogen development can significantly bolster Iran's energy security, economic resilience, and decarbonization efforts. Collaborating on joint research, innovation, and capacity-building programs can accelerate the deployment of sustainable energy technologies and foster knowledge exchange. Iran should leverage its geographical position and multilateral forums like the Economic Cooperation Organization (ECO) to promote regional policy harmonization, investment coordination, and infrastructure integration. Developing shared visions and roadmaps for sustainable energy transitions can help transcend historical rivalries and unlock mutually beneficial cooperation.

7. 4. Aligning Market Incentives, Industrial Strategy, and Social Policies

Designing coherent policy frameworks that align market incentives, industrial strategies, and social policies is essential for stewarding a just and inclusive energy transition. Policymakers should gradually phase in market-based instruments, such as carbon pricing and renewable energy certificates, while implementing targeted measures to safeguard energy access and affordability for low-income households. Aligning industrial policies and financial incentives to promote green technology localization, innovation, and job creation can help diversify Iran's economy and build domestic capabilities in sustainable energy sectors. Strengthening social safety nets, skill development programs, and community-level support mechanisms is crucial for mitigating the adverse impacts of the transition on vulnerable workers and regions.

7. 5. Relevance for Other Developing Fossil Fuel-Dependent Countries

The insights generated by this study hold significant relevance for other fossil fuel-dependent developing countries grappling with the challenges of sustainable energy transitions. The multidimensional framework and policy recommendations proposed here can serve as a valuable template for analyzing and managing the complex sociopolitical dynamics shaping transition pathways in resource-rich Global South contexts. The research underscores the importance of integrating context-specific sociocultural, political economy, and geopolitical considerations into transition planning and policymaking. It highlights the pivotal role of inclusive governance, strategic communication, and adaptive learning in

fostering societal buy-in and navigating the inherent uncertainties and trade-offs of energy system transformations. Ultimately, this study contributes to the growing body of scholarship on the sociopolitical dimensions of sustainability transitions by offering a nuanced, empirically grounded analysis of Iran's energy landscape. It demonstrates the value of interdisciplinary, multi-scalar, and contextually situated research for informing policy interventions that align decarbonization imperatives with social equity, economic resilience, and sustainable development goals.

As the global community confronts the urgent challenges of climate change and energy security, fostering knowledge exchange, policy experimentation, and collaborative learning among developing countries will be indispensable for catalyzing a just and inclusive global energy transition. This study takes a modest but important step in that direction by shedding light on the complex sociopolitical realities shaping Iran's energy future, with valuable lessons for researchers, policymakers, and practitioners worldwide.

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