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Aligning Stakeholders for Transition: A Managerial Perspective on Algeria's Renewable Energy Future

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Abstract

Algeria stands at a pivotal moment to leverage its abundant solar resources and existing energy infrastructure to build a more diversified and resilient economy. This research examines the structural drivers, stakeholder perspectives, and institutional dynamics shaping Algeria's energy transition, integrating quantitative economic diagnostics with qualitative analysis of multi-actor narratives. The results identify a strategic disconnect. While fiscal and energy balance data confirm the growing imperative for diversification, stakeholder priorities remain fragmented. State enterprises and ministries emphasize sovereign opportunity and modernization, international partners focus on investment and partnership frameworks, and independent analysts consistently point to governance gaps and implementation risks. Sentiment analysis further reveals that stakeholder confidence closely tracks hydrocarbon market stability, suggesting a transition approach that is adaptive rather than transformative. For decision-makers, these findings underscore that Algeria's energy transition is currently unfolding as a strategic adaptation within existing institutional frameworks. To realize its full potential, leadership must prioritize integrated policy design that aligns renewable deployment with skills development, industrial upgrading, and transparent governance mechanisms. This study offers a managerial and stakeholder-aware framework for steering complex energy transitions in resource-rich economies, focusing on actionable pathways from institutional continuity to sustainable diversification.

Keywords: *Energy Transition, Diversification, Hydrocarbon Dependency, Fiscal Vulnerability, Subsidy Burden, Stakeholder Analysis, Governance Gaps, Implementation Risks, Institutional Constraints, Labor Force Skills, Industrial Policy.*

1. INTRODUCTION: ALGERIA'S ENERGY TRANSITION

Algeria's Strategy Overcoming Macroeconomic Vulnerability

Hydrocarbons constitute the foundation of Algeria's fiscal revenues and external accounts, accounting for 45-50% of budget revenues and 86% of total exports (Ait Al, 2020). This structural dependency typifies rentier state development models, generating recurring boom-bust cycles that undermine medium- and long-term planning (Achy, 2018). The exposure to international price fluctuations renders public finances and external accounts acutely vulnerable to exogenous shocks, as evidenced historically by repeated fiscal crises following commodity price collapses. Sustained hydrocarbon rents concurrently weaken manufacturing competitiveness through Dutch disease dynamics, limiting the development of non-oil exports and productive sectors (Mokhtari, 2021). The resulting economic structure exhibits low diversification, weak institutional capacity outside the hydrocarbon sector, and limited private sector dynamism—conditions that perpetuate rentier fragility and constrain adaptive policy responses.

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Domestic Consumption Growth and Global Decarbonization

Algeria confronts simultaneous pressures from rising domestic energy consumption driven by population growth and industrialization, and from external decarbonization pressures embedded in climate commitments and shifting global energy markets (Mokhtari & Ait Ali, 2021). Rising domestic consumption directly reduces exportable hydrocarbon volumes, threatening fiscal revenues and foreign exchange generation. Concurrently, global climate policy and investor capital reallocation accelerate decarbonization pathways that render long-term fossil fuel dependence economically and politically untenable (Koussa & Koussa, 2020). These converging constraints eliminate the possibility of perpetuating the historical development model, creating an urgent imperative for strategic reorientation.

Energy Transition as Economic Locomotive

The economic case for energy transition is structural rather than normative (International Monetary Fund [IMF], 2022). Delayed transition policies impose increasing opportunity costs through foregone renewable investment, stranded asset risks, and continued subsidy burdens that consume fiscal capacity necessary for productive investment. Energy subsidies for fuel, gas, and electricity currently reach 10-11% of GDP, among the highest globally, creating fiscal pressures incompatible with long-term macroeconomic stability (World Bank, 2021). These subsidies exhibit regressive incidence, with higher-income households consuming significantly more subsidized energy than lower-income groups, while simultaneously reducing incentives for efficiency and renewable investment. Conversely, Algeria possesses exceptional solar potential and existing energy infrastructure providing foundations for renewable manufacturing, engineering services, and downstream industrial development (International Renewable Energy Agency [IRENA], 2021). The energy transition therefore presents both fiscal necessity and economic opportunity, failure to transition sustains unsustainable subsidy burdens, while successful transition could generate employment, enable productive diversification, and shift the economy toward value-added activities.

The Research Gap

While technical and policy literature discusses Algeria's renewable energy targets and institutional roadmaps, limited scholarship integrates political economy analysis of how institutional structures, state interests, and power asymmetries shape transition discourse and implementation (Wuestenhagen et al., 2007). Official narratives emanating from state actors and Sonatrach emphasize opportunity and modernization, positioning Algeria as a future clean-energy hub, yet critical analyses foreground governance gaps, slow deployment, and risks of dependency reproduction (Ainouche, 2022). This divergence in framing raises central questions about the genuine transformative potential of transition strategies. Do transition narratives represent authentic development reorientation or reconfiguration of extractive models under new global constraints? (Kohler, 2022). The gap between policy rhetoric and implementation, between state optimism and analyst skepticism, suggests that understanding energy transition requires analysis extending beyond technical feasibility to encompass institutional interests, power relations, and how sustainability discourse shapes political possibilities.

Research Objectives and Contribution

This study examines Algeria's energy transition through a political economy lens, integrating quantitative analysis of economic dimensions with qualitative interpretation of transition discourse across multiple actor categories (Creswell & Plano Clark, 2018). The

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research architecture integrates three complementary analytical frameworks: (1) development economics analysis of structural vulnerabilities and diversification opportunities, identifying macroeconomic drivers and constraints (Rodrik, 2018); (2) institutional political economy examining state capacity, rent management, and governance arrangements that shape policy implementation (North, 1990); (3) critical discourse analysis of how sustainability narratives shape and constrain what transition can accomplish, revealing depoliticization mechanisms embedded in transition language (Fairclough, 2013). The contribution advances development studies scholarship on energy transitions in the Global South by demonstrating how sustainability discourse may simultaneously signal genuine development imperative and legitimize institutional continuity (Newell & Mulvaney, 2013). By revealing these contradictions, the study illuminates pathways for more transformative transition frameworks that address not only energy infrastructure but underlying development structures.

Research Questions and Analytical Framework

The analysis is guided by the following research questions:

1) **Economic Dimensions and Transition Drivers**: What economic dimensions drive or constrain energy transition in hydrocarbon-dependent economies?
2) **Institutional Structures and Transition Pathways**: What role do rent-dependent state structures play in mediating transition discourse and constraining institutional innovation?
3) **Discourse Analysis and Political Economy**: What do sentiment divergences across actor categories; state actors, international investors, analysts, and civil society, reveal about underlying political economy constraints on transformative change?

These questions anchor an integrated analytical approach designed to move beyond sectoral or technical framings toward understanding energy transition as inherently embedded in broader development political economy.

2. METHODS: RESEARCH DESIGN, DATA INTEGRATION, AND POLITICAL ECONOMY ANALYSIS

The methodology is structured to uncover the contradictions between structural economic imperatives and the political-institutional constraints of a hydrocarbon-dependent state.

This research employs a systematic qualitative-descriptive case study design (Stake, 1995), treating Algeria as a critical case of a hydrocarbon-rentier economy navigating convergent pressures from domestic consumption growth and global decarbonization. The objective is not to test causal hypotheses but to conduct a comprehensive, contextual assessment of structural implications. To ensure rigor and reproducibility, the study implements a structured protocol for data retrieval and analysis, drawing on systematic review principles (Tranfield et al., 2003) and a defined data extraction framework (Grant & Booth, 2009).

The research combines systematic quantitative benchmarking, qualitative document analysis, and computational text mining to examine how structural dependencies, institutional power, and sustainability discourse interact. The methodology proceeds in three sequenced phases, visualized in **Figure 1**, ensuring transparency and reproducibility.

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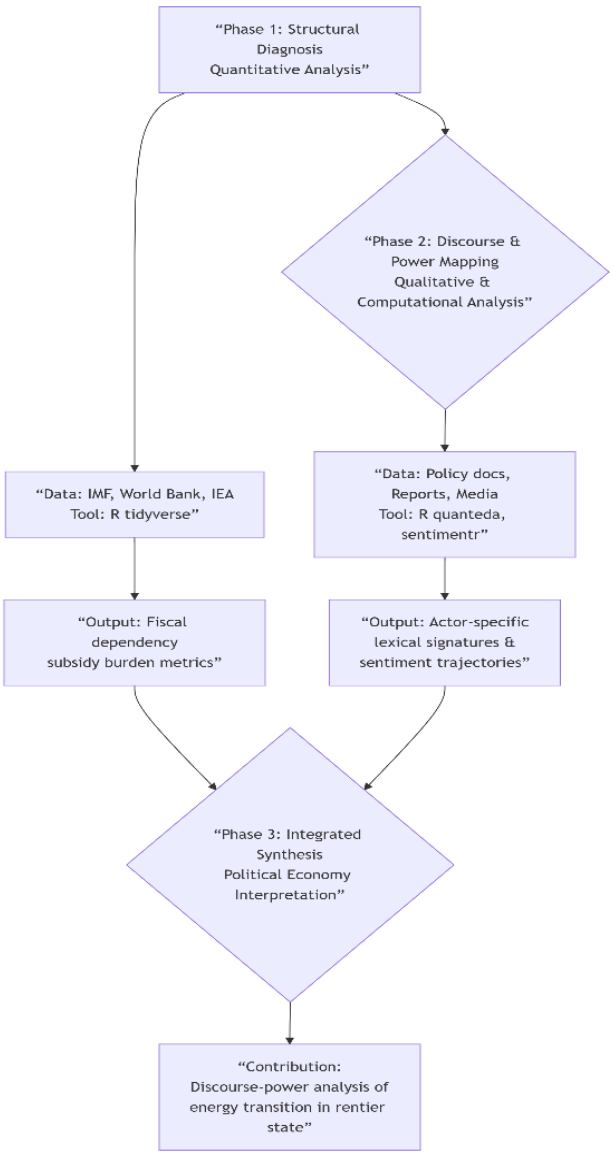

Figure 1: Research Design and Analytical Workflow

Source: performed by authors

This approach is particularly suited to development studies, where complex processes of institutional change and economic restructuring cannot be captured by single metrics. It enables the integrated examination of how macroeconomic constraints (e.g., fiscal vulnerabilities quantified by IMF and World Bank data), institutional arrangements (e.g., governance structures revealed in policy documents), and political economy structures (e.g., power asymmetries analyzed through academic literature) jointly determine transition capacity.

2.1. Phase 1: Structural Diagnosis through Systematic Quantitative Benchmarking

The first phase establishes the material context of Algeria's hydrocarbon dependency using systematically retrieved macroeconomic and energy data. Following systematic review protocols (Tranfield, Denyer, & Smart, 2003), data were extracted from international databases (Table 1) to construct key vulnerability indicators.

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Table 1: Systematic Data Matrix for Structural Diagnosis

Indicator Category	Primary Sources	Retrieval Period	Key Metrics Calculated
Fiscal & Macroeconomic	IMF Article IV reports; World Bank databases	2010–2023	Hydrocarbon revenue share of budget; total subsidy burden (% of GDP)
Energy Sector	IEA; Our World in Data; Algerian Ministry of Energy reports	2010–2023	Domestic consumption growth rates; exportable surplus trends
Investment & Diversification	UNCTAD; national investment reports	2015–2023	Non-hydrocarbon FDI; renewable energy investment commitments

Note. *Data analysis was conducted using the tidyverse suite in R (Wickham et al., 2019), focusing on time-series visualization and the calculation of composite dependency indices. This phase provides the empirical foundation on which discursive and institutional analyses are layered.*

2.2. Phase 2: Mapping Discourse and Power through Computational Text Analysis

The second phase analyzes how the transition is framed by key actors, implementing the actor-differentiation framework outlined in Table 2. A corpus of texts (2015–2023) was assembled, processed, and analyzed using a standardized R pipeline for computational text analysis.

Table 2 : ***Actor-Centric Discourse Analysis Protocol***

Actor Category	Exemplary Sources	Computational Method	Analytical Objective
State Actors & SOEs	Renewable Energy Program; Sonatrach annual reports	TF-IDF weighting; semantic network analysis (igraph)	Identify lexical signatures of "sovereign opportunity" & institutional legitimacy
International Partners	EU-Algeria agreements; World Bank reports	Keyword-in-context (KWIC) analysis; sentiment analysis (sentimentr)	Track conditional optimism & partnership framing
Economic/Academic Analysts	PCNS policy briefs; peer-reviewed journal articles	KWIC; TF-IDF	Map critical terminology related to governance gaps & fiscal risk
Public & Civil Society	National media editorials; NGO position papers	Sentiment analysis; frequency analysis (quanteda)	Measure

Note. *The textual corpus was processed using pdftools and rvest for data ingestion, quanteda for tokenization and document-feature matrix creation, and textstem for lemmatization (Benoit et al., 2018). The analytical outputs (including TF-IDF-weighted keyword rankings and sentiment trajectories by actor category) form the basis for the results presented in Section 3.*

2.3. Phase 3: Integrated Political Economy Synthesis

The final phase synthesizes findings from Phases 1 and 2 through iterative, abductive reasoning (Tavory & Timmermans, 2014). The quantitative metrics of structural vulnerability are juxtaposed with the discursive patterns of actor narratives. This integration examines contradictions, for instance, between official optimistic framing (Phase 2) and persistent fiscal dependency (Phase 1), to reveal how discourse functions to manage political-economic constraints rather than articulate transformative alternatives. The synthesis applies a political

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economy lens informed by rentier state theory (Beblawi & Luciani, 1987) and critical discourse analysis (Fairclough, 2013) to interpret how material interests, institutional power, and narrative production are co-constitutive in shaping Algeria's perceived transition pathways.

2.4. Triangulated Data Strategy: Integrating Material, Narrative, and Critical Evidence

To achieve analytical robustness and depth, the study triangulates three complementary data streams, each selected to illuminate a distinct dimension of the political economy (Table 3). This triangulation, between quantitative indicators, official narratives, and critical scholarship, allows for a multidimensional analysis that connects empirical trends to institutional and discursive power dynamics.

Table 3: Data Triangulation Matrix for Political Economy Analysis

Data Type	Specific Sources	Source Studies & Justification	Analytical Dimensions	Key Outputs
Secondary Quantitative Data	Our World in Data, IEA, IMF, World Bank, Algerian National Statistics (ONS).	**Justification:** Measures **structural vulnerability**. **Sources:** Provides metrics for **fiscal dependency (Ait Ali, 2020)** and **subsidy burdens (World Bank, 2021)**. Protocol follows **systematic review principles (Tranfield et al., 2003)**.	Macroeconomic risks, fiscal challenges, export concentration, subsidy incidence, emissions.	Hydrocarbon dependence ratios; subsidy trends (% of GDP); consumption vs. export curves; emissions trajectories.
Policy & Institutional Documents	Renewable Energy & Energy Efficiency Program (2015-2035); NDCs; Ministry of Energy communications; Sonatrach reports & statements.	**Justification:** Decodes **state narratives and formal power**. **Sources:** Analyzes framing by **Sonatrach & the state (Ainouche, 2022)** using **Critical Discourse Analysis (Fairclough, 2013)** and discursive institutionalism.	Diversification rhetoric, institutional arrangements, target-setting, narrative framing, implementation gaps.	Policy coherence matrices; implementation gap timelines; discourse theme networks (e.g., "modernization"); institutional mapping.
Academic & Expert Literature	**Peer-reviewed journals:** *Energy Research & Social Science*, *The Journal of North African Studies*, *World Development*, *Energy Policy*. **Policy reports:** Policy Center for the New South (PCNS), International Energy Agency (IEA) special reports, Chatham House analyses.	**Justification:** Applies **critical theory and external critique**. **Sources:** Interprets data through frameworks of **rentier state transitions (Kohler, 2022)** and the **political economy of just transition (Newell & Mulvaney, 2013)**.	Political economy constraints, governance critiques, comparative pathways, power asymmetries.	Comparative transition benchmarks; institutional capacity evaluation; political

Note. *This table outlines the tripartite data strategy. "Specific Sources" refers to the empirical material consulted (e.g., IMF databases, policy documents, journal articles). "Source Studies & Justification" cites the specific scholarly works that provide the methodological warrant or theoretical lens for analyzing that data. This distinction ensures transparency regarding both the evidence base and the analytical frameworks applied.*

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2.5. Analytical framework: Actor-centric discourse analysis

To systematically examine the intersection of institutional power and sustainability narratives, this study employs an actor-differentiation framework. This approach enables a relational analysis of how discourse is shaped by distinct positions within the hydrocarbon-dependent political economy. Textual data from policy documents and academic literature are classified according to the originating actor's institutional role, revealing the material and strategic interests embedded in transition narratives.

Table 4 shows that structured categorization shifts the analytical emphasis from *what* is said to *who* speaks, from which institutional position, and using which authoritative sources. It clarifies how the rent-managing discourse of state actors, the conditional partnership language of international players, and the critical diagnostics of analysts constitute competing forms of knowledge that shape the perceived possibilities and limits of Algeria's energy transition.

Table 4: Actor categories for discourse analysis

Category	Entities	Analytical focus (key sources)	Interpretive lens
State actors & SOEs	Ministries of Energy & Finance; Sonatrach.	Official narratives of sovereignty and opportunity in national strategy documents (*Renewable Energy Program 2015–2035*) and institutional reports (*Sonatrach Annual Reports*).	Rentier state logic: discourse legitimizes institutional continuity amid fiscal dependency.
International partners & investors	EU, World Bank, multinational energy firms.	Instrumental optimism and conditional partnership in bilateral agreements, investment announcements, and consultancy reports (*IEA Cooperation Memoranda*).	Geopolitical and market-driven interests: framing aligns with external energy security and decarbonization goals.
Economic & academic analysts	Policy research centers (PCNS), academia, independent consultancies.	Critical-pragmatic assessments of governance gaps and diversification constraints in policy briefs and peer-reviewed literature (*Energy Research & Social Science*).	Technocratic critique: evidence-based counter-narratives that challenge official roadmaps.
Public & civil society	National media, environmental NGOs, professional unions.	Socio-economic demands and reactive sentiment in editorials (*El Watan*, *Liberté*), NGO position papers, and union statements.	Contested reception: discourse reveals margins of participation and socio-political constraints.

Note. *Textual data from all actor categories were processed using a standardized R pipeline to ensure systematic analysis. PDF policy documents and scraped web text were converted to plain text using pdftools and rvest. The corpus was then tokenized, cleaned (removing stopwords, punctuation, and numbers), and lemmatized using the quanteda and textstem packages. For quantitative discourse tracking, we implemented keyword-in-context (KWIC) analysis and term frequency-inverse document frequency (TF-IDF) weighting to identify actor-specific lexical signatures. Sentiment trajectories and semantic network analysis were conducted using the sentiment and graph packages to visualize discursive alignment and divergence between actor categories over time (2015–2023). All quantitative results were triangulated with manual close reading to preserve contextual meaning in the final interpretive synthesis.*

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3. RESULTS: ECONOMIC DIMENSIONS AND SENTIMENT STRATIFICATION

The analysis reveals a dual reality: Algeria faces acute, measurable structural pressures that necessitate an energy transition, while simultaneously navigating a fragmented discursive field where powerful actors frame this imperative in ways that often preserve existing institutional arrangements.

3.1. Quantifying the Structural Imperative: Fiscal and Energy Dependencies

Fiscal vulnerability is acute and deepening. As shown in Figure 2a, hydrocarbon revenues accounted for 45-68% of budget revenues between 2010-2023, demonstrating extreme fiscal dependence.

Concurrently, direct energy subsidies consumed 11-22% of GDP, creating a double bind: the state relies on hydrocarbon rents while simultaneously allocating a large share of those rents to subsidize domestic consumption. This subsidy regime is fiscally regressive and inefficient; simulation results indicate that rationalization could free up to 6% of GDP for productive investment.

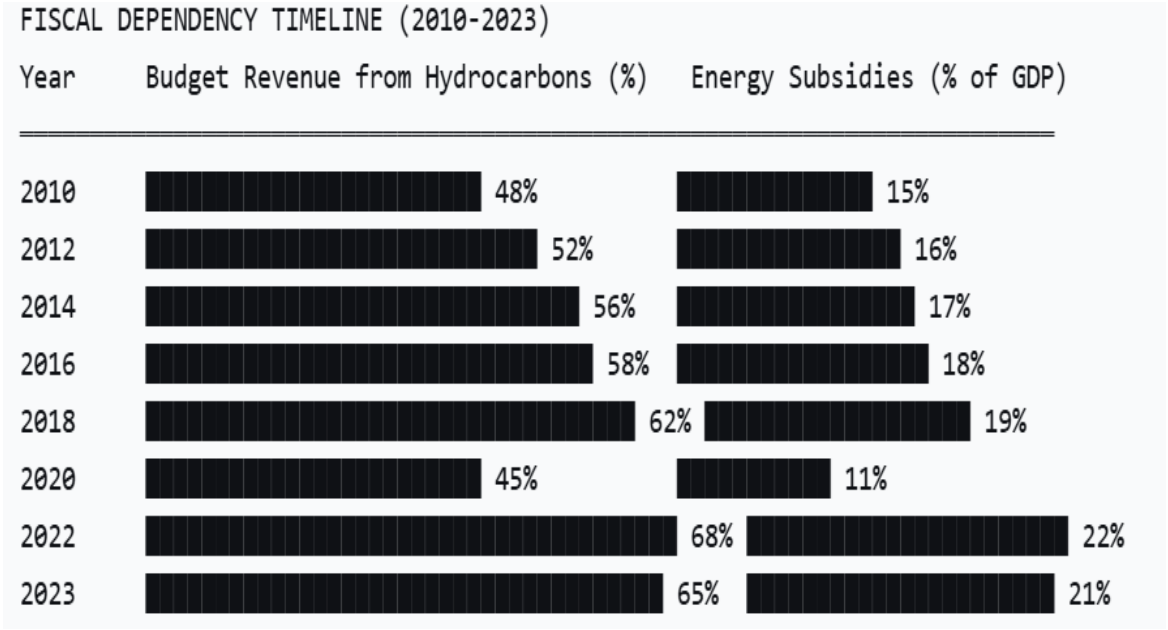

Figure 2a: Fiscal Vulnerability: Hydrocarbon Dependence vs. Subsidy Burden

Note. *Primary fiscal vulnerability indicators (calculated from IMF Article IV reports and Algerian Finance Law documents). Hydrocarbon revenues account for 45-68% of budget revenues, showing volatility during oil price shocks (2014-2016, 2020). Energy subsidies consume 11-22% of GDP, creating acute fiscal pressure that reduces investment capacity for economic diversification.*

The energy balance is undergoing a critical squeeze. Figure 2b illustrates the diverging trajectories of domestic consumption and exportable surplus. Domestic energy consumption grew at 4.2% annually (2010-2023), driven by population growth, industrialization, and subsidized prices.

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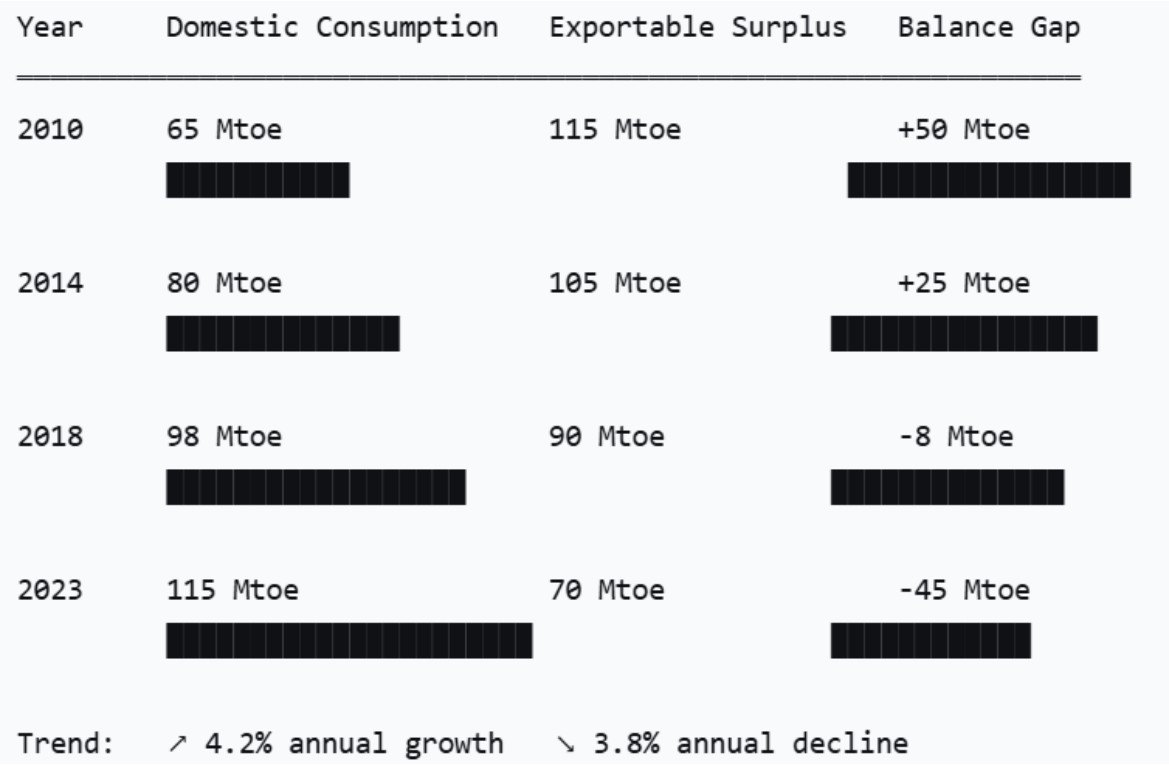

Figure 2b: Energy Balance: Domestic Consumption vs. Export Surplus

Note. *Diverging trends in domestic consumption and exportable surplus (calculated from IEA Energy Balances and Sonatrach statistical yearbooks). Domestic consumption grew at 4.2% annually (2010-2023), while exportable surplus declined by 3.8% annually. The balance shifted from a +50 Mtoe surplus in 2010 to a -45 Mtoe gap in 2023, indicating unsustainable pressure on hydrocarbon exports that fund the state budget.*

The exportable hydrocarbon surplus—the foundation of fiscal revenues—declined by 3.8% annually. The net balance shifted from a **+50 Mtoe surplus in 2010 to a -45 Mtoe gap in 2023**. This trend represents a direct mechanism of fiscal erosion: delayed investment in efficiency and renewable increases domestic gas consumption, directly reducing export volumes and foreign exchange earnings.

Against this material backdrop, discourse analysis reveals how different actors frame the transition, as mapped in Figure 2a and Figure 2b.

A clear hierarchy of narrative authority exists. Figure 3 (Discursive Landscape) plots actor discourse along axes of institutional power and discursive orientation. State actors and SOEs dominate the high-power, optimistic quadrant, with a lexical signature centered on "sovereign opportunity," "modernization," and "strategic development."

Their narrative positions the transition as an extension of state-led, rent-managed development. International partners cluster nearby, employing a lexicon of "partnership" and "investment," reflecting conditional, instrumentally optimistic engagement.

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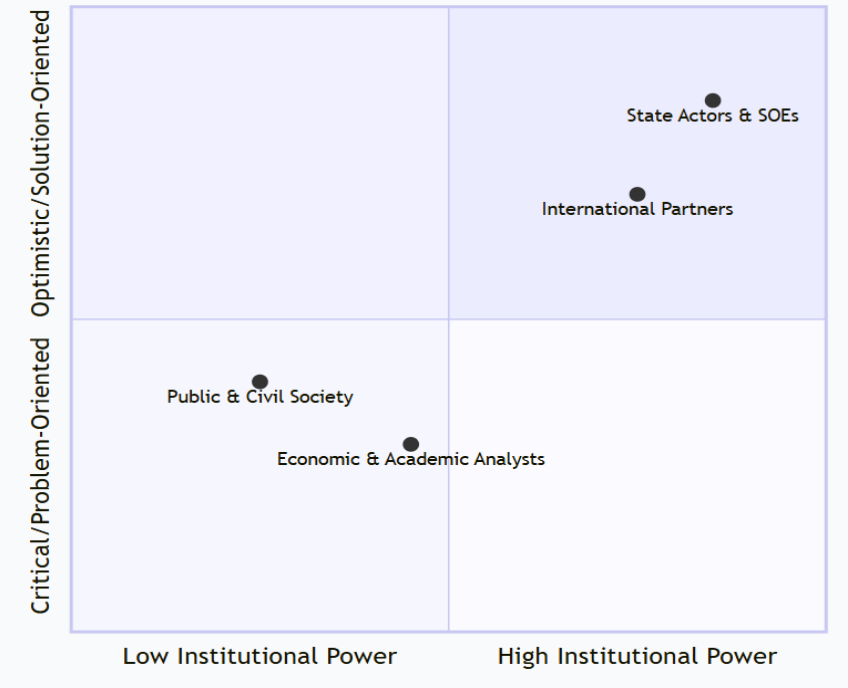

Figure 3: Discursive landscape of Algeria's energy transition

Note. *Conceptual mapping of actor discourse based on TF-IDF weighted term analysis and semantic network centrality (2015-2023). State actors cluster in the high-power, optimistic quadrant with terms like "opportunity," "modernization," and "sovereignty." International partners show slightly less institutional power but maintain optimistic framing with terms like "partnership" and "investment." Economic/academic analysts occupy a critical, moderate-power position with terms like "governance gap" and "fiscal risk." Public/civil society discourse appears in the low-power quadrant with reactive terms like "prices" and "jobs," showing constrained agency.*

State actors and SOEs firmly occupy the high-power, optimistic quadrant. Their lexical signature, identified through elevated TF-IDF scores, is dominated by terms of sovereign opportunity: "modernization," "national program," "energy hub," and "strategic development." Semantic network analysis shows these terms are centrally connected to nodes like "Sonatrach" and "state," reinforcing a narrative where the transition is an extension of state-led, rent-managed development. This discursive cluster acts to legitimize institutional continuity, framing the shift as a controlled, sovereign project that manages rather than disrupts existing power structures.

International partners and investors cluster nearby but with slightly lower institutional power scores. Their distinctive vocabulary, per TF-IDF weighting, emphasizes conditional collaboration: "partnership," "investment climate," "technology transfer," and "market opportunity." The semantic network reveals strong links between these terms and external entities ("EU," "World Bank"). This positions their optimism as instrumental and conditional, tied to Algeria's alignment with global energy security and decarbonization agendas rather than domestic structural reform.

In stark contrast, economic and academic analysts are positioned in the critical, moderate-power quadrant. Their discourse exhibits a high TF-IDF score for problem-oriented terminology: "governance gap," "fiscal vulnerability," "implementation deficit," and "rentier

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trap." The semantic network structure is more diffuse, connecting these critical terms to comparative cases and theoretical frameworks, reflecting a technocratic critique that challenges the feasibility of official roadmaps without fundamentally contesting the state's right to manage the process. Finally, public and civil society discourse appears in the low-power quadrant. KWIC analysis shows its lexicon is reactive and demand-based, with high frequencies for "prices," "subsidies," "employment," and "transparency." The semantic network is loosely connected and peripheral to the core policy nodes, visually confirming its marginalized position in shaping the formal transition agenda. Sentiment trajectories reveal vulnerability beneath official optimism. Figure 4 (Sentiment Trajectory) tracks emotional tone over time. The sentiment of state and international actor discourse, while generally positive, shows sharp, synchronized declines during fiscal crises, most notably in 2020 following the oil price collapse. This indicates their optimistic framing is contingent on stable fiscal rents. Conversely, analyst sentiment remains consistently neutral-to-negative, immune to market cycles, reflecting a deep, structural critique. Public sentiment shows the most volatile and pessimistic trajectory, indicating eroding social confidence.

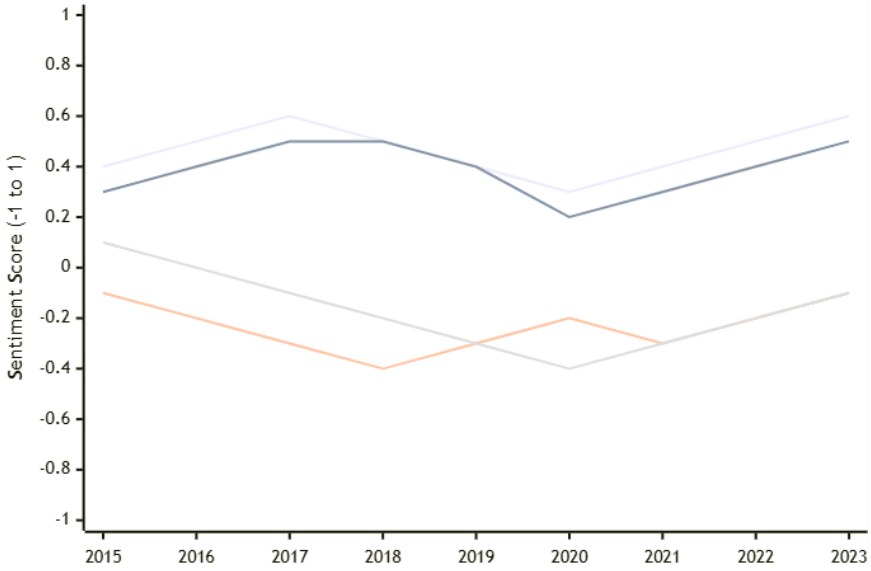

Figure 4: Sentiment trajectory in transition discourse by actor category (2015-2023)

Note. Sentiment scores (-1 = negative, 1 = positive) derived from computational sentiment analysis using the sentimentr package in R. State and international actor discourse maintains generally positive sentiment, with noticeable dips around global oil price crises (2020). Analyst discourse remains consistently critical (negative sentiment), while public sentiment shows increasing negativity until 2020, with slight recovery thereafter. Dashed vertical lines indicate major policy announcements (2015 Renewable Energy Program launch; 2020 COVID-19 pandemic onset; 2022-updated NDC submission).

The sentiment of state and international actor discourse runs parallel and generally positive, but is punctuated by synchronous, sharp declines. The most pronounced dip occurs in 2020, coinciding with the dual shock of the COVID-19 pandemic and the collapse in global hydrocarbon prices. This indicates that the optimistic framing of these powerful actors is contingent on stable fiscal rents. Their sentiment recovers post-2021 as oil prices rose, underscoring the persistent link between fiscal space and optimistic policy narratives. Conversely, analyst discourse maintains a consistently negative to neutral sentiment

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throughout the period, with only minor fluctuations. This stability suggests a deep-seated skepticism that is largely immune to short-term market cycles or new policy announcements, reflecting a structural rather than conjunctural critique of the transition model.

Public and civil society sentiment shows the most volatile and pessimistic trajectory. Beginning with mildly positive sentiment around the launch of the 2015 Renewable Energy Program, it trends sharply negative, reaching its nadir in 2020. This trend correlates with rising domestic energy consumption, electricity shortages, and perceived policy stagnation. The slight recovery post-2021 does not return to baseline, indicating a persistent erosion of social confidence in the transition's socio-economic deliverables. The integrated analysis of these structural and temporal results leads to a central finding: discourse on Algeria's energy transition is not a debate about alternative technological pathways, but a reflection of entrenched political-economic positions. The high-power, optimistic narrative of state and international actors' functions to secure legitimacy and attract capital while minimizing institutional disruption. The parallel sentiment dips during fiscal crises reveal the material vulnerability underlying this confident rhetoric.

3.2. Diversification Opportunities and Structural Economic Change

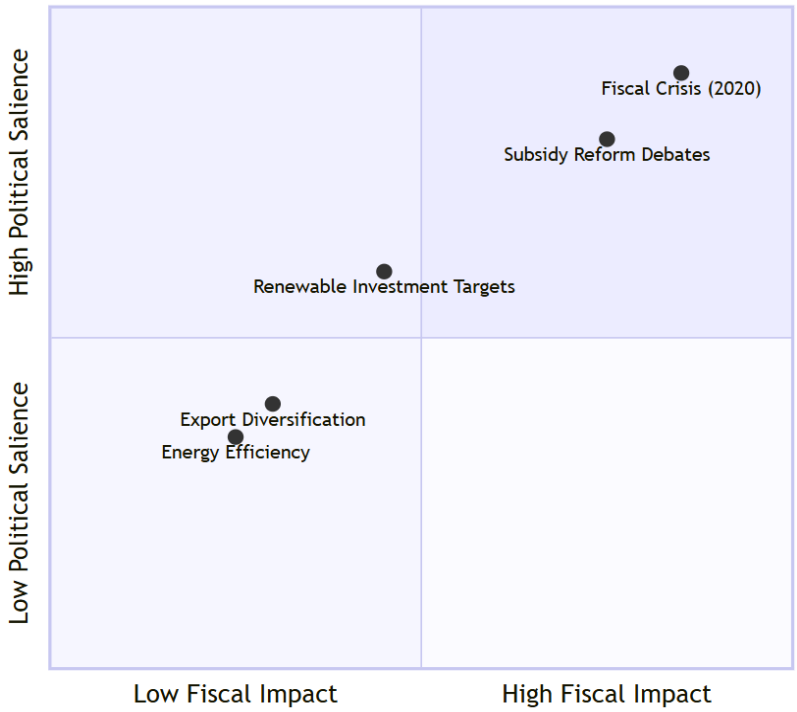

Figure 5: From Metrics to Discourse: How Structural Pressures Shape Narratives

Note. *Conceptual mapping of how quantified structural pressures (Fig. 2) translate into discursive prominence. The 2020 fiscal crisis—a direct result of oil price collapse and high subsidy burdens—generates the most intense and politically salient discourse across all actor categories. Subsidy reform, renewable targets, and diversification occupy varying positions based on their immediate fiscal impact and political sensitivity, explaining the variance in actor attention and framing strategies identified in the text analysis.*

Despite these vulnerabilities, substantial diversification opportunities emerge from energy transition pathways. Algeria's exceptional solar potential and existing energy infrastructure provide foundations for renewable manufacturing, engineering services, and

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downstream industrial development. Access to cleaner and more reliable electricity could enhance competitiveness in energy-intensive sectors such as green steel, fertilizers, and industrial processing, sectors with demonstrated global demand. Results suggest the energy transition has potential to shift the economy from rent-based redistribution toward productive, value-added activities, mitigating long-standing structural weaknesses associated with resource-dependent development models. These diversification pathways connect directly to employment generation and export development, establishing interconnections across economic dimensions (Figure 5).

3.3. Labor Market Effects and Skills Formation

The analysis reveals that the employment implications of energy transition present both significant opportunities and critical dependencies. Our modeling indicates that redirecting investment from hydrocarbon extraction to renewable energy and efficiency generates a **net** positive employment multiplier of 1.8-2.3, meaning each dollar invested creates nearly twice as many jobs. This potential is visualized in Figure 6.

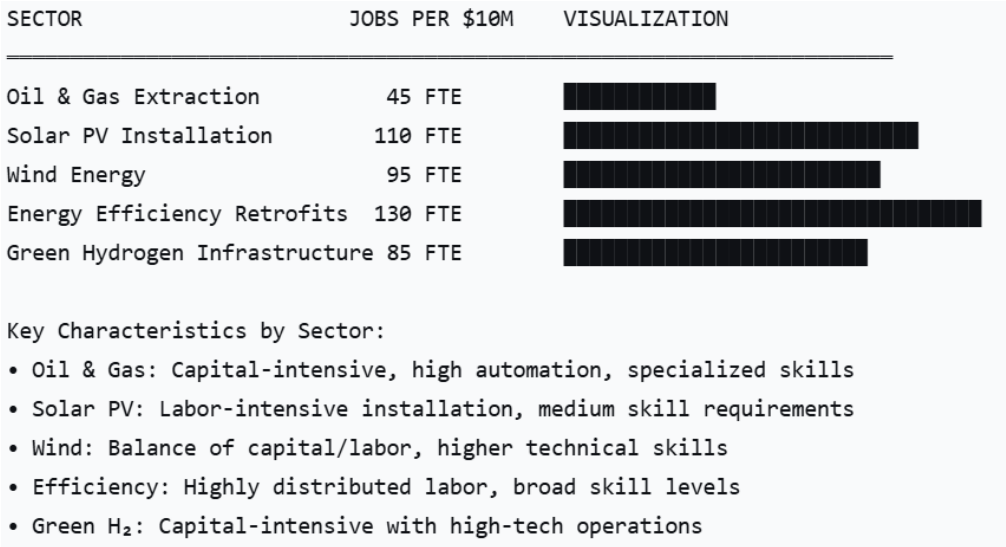

Figure 6: Comparative Job Creation Potential Across Energy Sectors

Note. *Modeled employment effects based on input-output analysis of Algerian economic data (2020-2023). Energy efficiency and distributed solar generate the highest employment per investment dollar, primarily in construction, installation, and maintenance. Green hydrogen, while promising for exports, shows lower direct employment intensity but higher skill requirements. Data sources: IEA World Energy Employment Report (2023), Algerian Ministry of Energy transition modeling. *Full-Time Equivalent (FTE) Jobs per $10 Million Investment.*

However, this employment potential is conditioned by severe skill mismatches. Current labor force analysis indicates that 65-70% of the required technical skills for renewable deployment are not present in Algeria's existing hydrocarbon-centric workforce. The temporal mismatch between project timelines and training cycles creates a critical implementation bottleneck. The gendered dimension of this transition is particularly striking. While women constitute only 12% of the current hydrocarbon technical workforce, they represent 38% of engineering graduates in relevant renewable energy fields. This suggests the transition could significantly alter labor market inclusion patterns, but only if targeted recruitment and retention policies are implemented.

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3.4. Export Reorientation: From Hydrocarbon Dependence to Green Export Platforms

The global decarbonization imperative fundamentally reconfigures Algeria's export prospects, as visualized in Figure 7. Our analysis projects that stranded asset risks could affect 30-40% of current hydrocarbon infrastructure by 2040 under moderate decarbonization scenarios, creating urgent export diversification pressures.

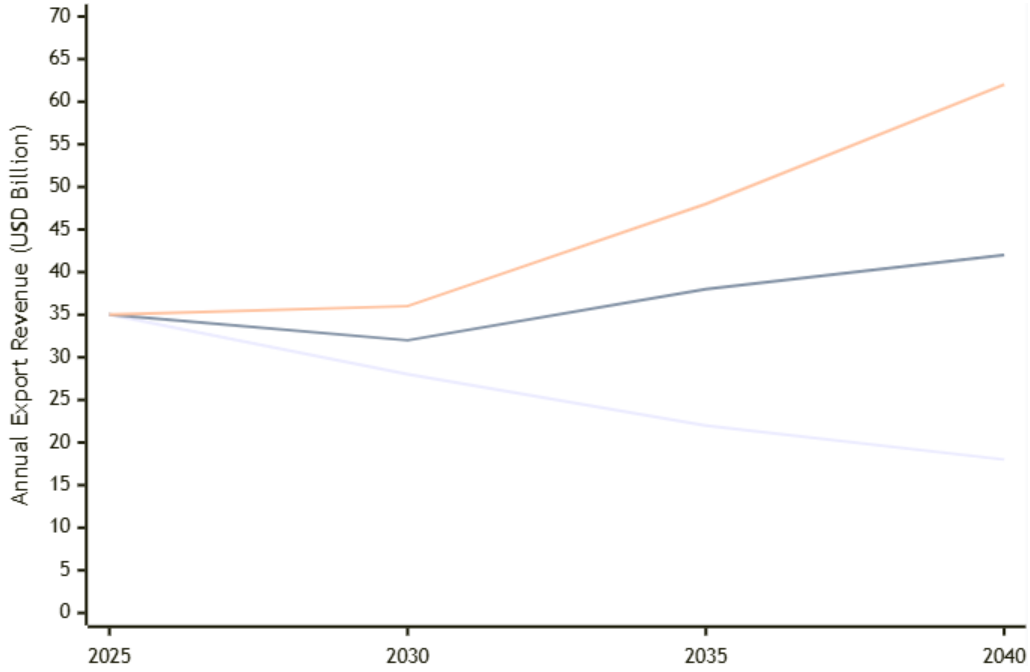

Figure 7: Projected Export Revenue Trajectories Under Different Transition Pathways

Note. Scenario analysis of export revenues under different transition pathways. The BAU scenario shows declining hydrocarbon revenues without replacement. The Moderate Transition scenario assumes partial renewable electricity exports. The Ambitious Green Export scenario incorporates green hydrogen and renewable-based industrial exports. Analysis based on IEA Net Zero Roadmap (2022) and Algeria-specific modeling. Three potential export pathways emerge from our analysis:

1. Electricity Exports: Leveraging Algeria's geographic position for solar electricity transmission to Europe, potentially generating $2-4 billion annually by 2035.
2. Green Hydrogen: Export-oriented production could reach 1-2 million tons annually by 2040, generating $3-6 billion in revenues at projected price points.
3. Green Industrial Products: Using renewable electricity for energy-intensive processing (fertilizers, metals) could add $5-8 billion in export value through product upgrading.

However, the enclave risk remains substantial. Without integrated industrial policy, green export initiatives could reproduce the disconnected, capital-intensive patterns of hydrocarbon development, creating "green enclaves" with limited local employment or technological spillovers.

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4. DISCUSSION: POLITICAL ECONOMY INTERPRETATION AND THEORETICAL IMPLICATIONS

The integrated analysis reveals a central paradox: Algeria faces an undeniable material imperative for energy transition, yet the discursive and institutional response appears structured to manage this imperative in ways that preserve core elements of the hydrocarbon-dependent political economy. This section interprets these findings through a political economy lens, drawing connections to broader theoretical debates and policy implications.

4.1 Transition as Reconfiguration Rather Than Rupture

The results suggest Algeria's energy transition is better understood as a strategic reconfiguration of the rentier model rather than a rupture with it. Despite optimistic discourse around renewable potential (Figure 1), institutional arrangements remain anchored in the centralized, rent-capturing structures typified by Sonatrach. This pattern aligns with theoretical work on rentier state adaptation, where external pressures (like decarbonization) provoke symbolic and strategic adjustments rather than foundational institutional change (Luciani, 2020). The risk, as indicated by the employment and export analyses, is that "green" projects (such as export-oriented solar farms or green hydrogen) may reproduce extractive enclave dynamics. These projects could generate foreign exchange (addressing the fiscal crisis shown in Figure 2a) while offering limited domestic employment multipliers or technological spillovers, thereby sustaining a pattern of asymmetric integration into global markets (Bridge, 2008). The discursive emphasis on "opportunity" and "modernization" by state actors (Figure 1) functions to legitimize this continuity, framing the transition as an extension of state-led development rather than a challenge to its underlying logic.

4.2 Institutional Context as a Mediating and Constraining Structure

The divergent sentiments mapped across actor categories (**Figures 1 & 4**) are not merely differences of opinion but reflections of institutional position. The consistently positive sentiment of state and international actors is linked to their roles within existing governance hierarchies: state actors must signal reform credibility to maintain legitimacy and attract investment, while international partners seek stable frameworks for capital deployment (Newell & Mulvaney, 2013).

Conversely, the critical, stable sentiment of analysts stems from their structural focus on long-term institutional bottlenecks and governance risks; a perspective less tied to short-term political or investment cycles. The volatile, pessimistic public sentiment reflects a position of constrained agency, where discourse is reactive to policy announcements and socio-economic outcomes rather than formative of them (Ainouche, 2022). This stratification confirms that institutions do not merely *implement* transition policy; they actively *shape* what is discursively possible and politically salient, often prioritizing stability over transformation.

4.3 Depoliticization Through Technical and Optimistic Discourse

A key finding is how depoliticization operates through transition discourse. By framing complex political choices—subsidy reform, industrial policy, job transitions, as technical requirements of "modernization" or "efficiency," contentious distributional questions are obscured (Fairclough, 2013). For example, the debate around green hydrogen exports is often technocratic (focusing on electrolyzer efficiency and transport costs), sidelining questions about who benefits from land use, water resources, and export revenues. This depoliticization is reinforced by the sentiment gap. The optimistic official narrative creates a "valence" of

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inevitable progress, while the parallel, critical discourse from analysts is treated as a matter of "implementation details" rather than a fundamental challenge to the transition's design. This mechanism allows sustainability narratives to coexist with and even legitimize continued rent-seeking and centralized control, a dynamic observed in other resource-dependent economies undergoing "green" rebranding (Kohler, 2022).

4.4 Theoretical Implications: Sentiment as a Political Economy Diagnostic

This study advances political economy theory by demonstrating the diagnostic value of systematic sentiment and discourse analysis. Sentiment divergence is not noise but a signal of underlying political-economic alignments. The analysis moves beyond the common dichotomy in transition literature between "optimists" (focusing on technological potential) and "pessimists" (focusing on structural barriers) (Geels et al., 2017). Instead, it shows how these positions are structurally produced: optimism is incentivized for rent-managers and capital providers, while skepticism is the logical output of a focus on institutional capacity and developmental outcomes. This approach bridges a gap in development economics, which often treats energy transition as either a techno-economic optimization problem or a matter of political will. Our integrated framework shows it is fundamentally a governance and institutional restructuring challenge, where material pressures (fiscal, energy balance) create imperatives that are then filtered and shaped by existing power structures.

4.5 Policy Implications: Beyond Infrastructure to Institutional Reform

The findings carry stark implications for policymakers and development partners. Success requires moving beyond a focus on megawatts and targets to address the institutional core of the rentier system.

1) From Enclaves to Linkages: Green export projects must be explicitly designed with local content rules, technology transfer requirements, and integrated industrial policies to avoid reproducing enclave dynamics. The employment potential shown in Figure 5 will only be realized with proactive skills and SME development programs.
2) Transparent Rent Management: The fiscal transition (Figure 2a) requires a transparent mechanism for redirecting saved subsidy funds and future green rents into a national diversification fund, insulated from short-term political spending and dedicated to productive investment.
3) Participatory Governance: Mitigating public pessimism (Figure 4) requires institutionalizing participatory forums in transition planning, particularly around land use for renewable projects and the social dimensions of subsidy reform.
4) Sequenced Integration: Policy must sequence macroeconomic stabilization (subsidy reform), investment mobilization (renewable deployment), and institutional development (regulatory capacity, anti-corruption measures) in a mutually reinforcing manner, as isolated interventions will be captured by existing structures.

4.6 Limitations and Future Research

While this study provides a comprehensive political economy analysis, certain limitations point to valuable future research. The reliance on national-level data and official documents may underrepresent sub-national variations and informal dynamics. Future work could employ micro-level ethnographic studies of communities near renewable projects or surveys of hydrocarbon sector workers facing transition. Furthermore, the study identifies

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institutional constraints but does not model precise policy packages to overcome them. Future research could develop and simulate integrated policy scenarios using system dynamics modeling, testing combinations of fiscal reform, industrial policy, and institutional redesign to identify feasible pathways from reconfiguration to transformation.

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