The Arabian Energy Corridor as a Strategic Infrastructure for Global Energy Security and Supply Chain Resilience

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Abstract: **The global energy system remains structurally dependent on a limited number of strategic maritime chokepoints, with the Strait of Hormuz representing the most critical artery for oil and gas exports from the Gulf region. Approximately one-fifth of global oil trade and a substantial share of liquefied natural gas (LNG) flows transit through this narrow passage, creating a significant concentration of risk within the global energy supply chain. This dependency exposes international markets to geopolitical disruptions, supply uncertainty, and price volatility, particularly during periods of regional instability. Recent geopolitical tensions and military escalations in the Middle East have underscored the fragility of this arrangement, where even perceived threats to maritime security can lead to immediate disruptions in shipping operations and global price fluctuations.**

This study evaluates the feasibility and strategic relevance of the Arabian Energy Corridor (AEC) as an alternative infrastructure-based energy transport system designed to bypass the Strait of Hormuz. The research adopts a scenario-based analytical framework comparing two configurations: a standalone crude oil pipeline and a multi-stream integrated corridor incorporating oil and gas flows from major Gulf producers, including Saudi Arabia, the United Arab Emirates, and Qatar. The analysis combines economic evaluation with geopolitical assessment to determine both financial viability and strategic necessity.

The findings indicate that while a standalone pipeline offers limited commercial returns due to high capital costs and constrained revenue streams, an integrated corridor significantly enhances economic performance through economies of scale, diversified throughput, and additional revenue channels such as storage, processing, and export services. A key contribution of the study is the introduction of the concept of the Energy Security Premium, which captures the economic value of reducing disruption risks in global energy supply chains—an element often overlooked in traditional infrastructure evaluation models.

The study concludes that the Arabian Energy Corridor represents a transformative shift from maritime dependency toward resilient, land-based energy infrastructure. By integrating economic efficiency with geopolitical risk mitigation, the AEC offers a scalable and cooperative framework capable of enhancing global energy security, strengthening regional integration, and supporting long-term supply stability.

Keywords— **Global Energy Security, Strengthening Regional Integration, And Supporting Long-Term Supply Stability.**

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I. INTRODUCTION AND PROBLEM STATEMENT

Global energy markets are fundamentally shaped by the geography of resource distribution and the infrastructure through which these resources are transported. Among the various elements of this system, maritime chokepoints play a disproportionately critical role in determining the stability and resilience of global energy supply chains. The Strait of Hormuz, located between the Persian Gulf and the Arabian Sea, stands as the most strategically significant of these chokepoints. It facilitates the transit of approximately 20% of global oil consumption and a major portion of liquefied natural gas (LNG) exports, primarily from Gulf Cooperation Council (GCC) countries.

This high concentration of energy flows through a single narrow maritime passage creates a structural vulnerability within the global energy system. Any disruption—whether due to military conflict, geopolitical tension, or even perceived threats—can have immediate and far-reaching consequences for global markets. Historical incidents, including regional conflicts and targeted attacks on energy infrastructure, have demonstrated that the Strait of Hormuz is not merely a logistical route but a geopolitical pressure point capable of influencing global economic stability.

In recent years, the risk profile associated with the Strait has intensified. Escalating tensions between regional and global powers, combined with evolving security dynamics in the Middle East, have increased the likelihood of disruptions. Importantly, the impact of such risks is not limited to physical blockades or direct attacks; even the perception of instability can lead to increased insurance costs, rerouting of shipments, and volatility in global energy prices. This highlights a critical limitation in the current energy transport model: its overreliance on a single chokepoint that lacks redundancy.

While existing pipeline infrastructure within the Gulf region—such as Saudi Arabia's East-West Pipeline and the UAE's Abu Dhabi Crude Oil Pipeline to Fujairah—provides partial alternatives, these systems are limited in capacity, scope, and integration. They do not offer a comprehensive solution capable of accommodating the full scale of regional energy exports while ensuring long-term resilience and scalability. Furthermore, these pipelines operate largely as isolated systems rather than components of an integrated regional network.

This gap in infrastructure underscores the need for a more comprehensive and strategically designed solution. The Arabian Energy Corridor (AEC) is proposed in this study as a response to this structural challenge. Conceptualized as a multi-dimensional energy transport system, the AEC aims to

create a land-based corridor linking major hydrocarbon producers in the Gulf region to export terminals on the Arabian Sea, thereby bypassing the Strait of Hormuz entirely.

The significance of this proposal lies not only in its physical infrastructure but also in its conceptual framework. Unlike traditional pipeline projects, which are typically evaluated based on cost efficiency and transport capacity, the AEC incorporates a broader perspective that includes geopolitical risk mitigation, regional cooperation, and long-term supply security. This shift in perspective is essential for addressing the complexities of modern energy systems, where economic and geopolitical factors are deeply intertwined.

The central problem addressed in this study is therefore twofold. First, it examines the structural vulnerability of global energy supply chains arising from excessive dependence on maritime chokepoints. Second, it evaluates whether an integrated, land-based energy corridor can provide a viable and sustainable alternative that enhances both economic efficiency and geopolitical resilience.

To address this problem, the study develops a scenario-based analytical framework comparing a standalone pipeline model with a fully integrated corridor system. By doing so, it seeks to answer a critical question: can the Arabian Energy Corridor emerge as a commercially viable and strategically necessary solution in the evolving global energy landscape?

The remainder of this paper is structured as follows. The next section reviews existing literature on energy security, infrastructure diversification, and pipeline geopolitics. This is followed by a description of the research methodology and analytical framework. Subsequent sections present the economic and geopolitical analysis of the proposed corridor, discuss key findings and implications, and conclude with policy recommendations and directions for future research.

II. LITERATURE REVIEW

The concept of energy security has evolved significantly over the past two decades, expanding beyond supply availability to include reliability, affordability, and resilience against geopolitical disruptions. A central theme in the literature is the vulnerability of global energy systems to maritime chokepoints, particularly the Strait of Hormuz, which is widely recognized as the most critical oil transit route in the world [1]. According to the U.S. Energy Information Administration, approximately one-fifth of global petroleum liquids consumption passes through this narrow passage, highlighting the concentration of risk within a single geographic corridor [2].

Scholarly research emphasizes that chokepoints represent systemic vulnerabilities due to their exposure to geopolitical tensions, military conflicts, and asymmetric threats [3]. Even in the absence of physical disruptions, perceived risks associated with these routes can lead to increased insurance premiums, supply delays, and price volatility in global markets [4]. This has led to growing interest in infrastructure diversification as a means of enhancing energy security.

Pipeline infrastructure has historically served as an alternative to maritime transport, offering more controlled and secure energy transit routes. Notable examples include Saudi Arabia's East–West Pipeline and the Abu Dhabi Crude Oil Pipeline, which were developed to partially bypass the Strait of Hormuz [5]. However, existing pipeline systems in the Gulf region are limited in scale and integration, functioning primarily as national projects rather than components of a coordinated regional network [6].

The literature on pipeline geopolitics further highlights the strategic role of energy corridors in shaping regional power dynamics and economic relationships. Energy infrastructure is increasingly viewed not only as a logistical asset but also as a geopolitical instrument capable of influencing alliances, trade patterns, and investment flows [7]. In this context, integrated corridor models have been proposed as a means of enhancing both economic efficiency and geopolitical stability through shared infrastructure and cooperative frameworks [8].

In addition, recent studies on energy resilience emphasize the need to incorporate risk mitigation into infrastructure evaluation models. Traditional cost-benefit analyses often underestimate the economic value of supply security, focusing primarily on transport efficiency and capital costs [9]. This has led to calls for more comprehensive frameworks that account for disruption risks, redundancy, and long-term system stability [10].

Despite these advancements, there remains a gap in the literature regarding fully integrated, multi-country energy corridors that combine economic viability with geopolitical risk mitigation in a unified framework. Existing studies tend to focus either on individual pipeline projects or on broader energy security concepts without bridging the two. This study addresses this gap by proposing the Arabian Energy Corridor as a scalable, multi-stream infrastructure model that integrates regional energy flows while enhancing global supply resilience.

III. RESEARCH METHODOLOGY

This study adopts a qualitative and scenario-based analytical approach to evaluate the feasibility and strategic relevance of the Arabian Energy Corridor (AEC). Given the conceptual and forward-looking nature of the proposed infrastructure, the research does not rely on primary data collection but instead utilizes secondary data sources, policy reports, and existing literature on energy markets, infrastructure development, and geopolitical risk.

The methodological framework is designed to integrate economic analysis with geopolitical assessment, recognizing that energy infrastructure projects are influenced by both financial viability and strategic considerations. The study therefore follows an interdisciplinary approach, combining elements of energy economics, political economy, and infrastructure planning.

At the core of the analysis is a comparative scenario evaluation consisting of two primary configurations. The first scenario examines a standalone crude oil pipeline originating from Saudi Arabia's Eastern Province and extending to an export terminal on the Arabian Sea. This configuration is assessed primarily in terms of capital cost, transport efficiency, and expected revenue streams based on throughput capacity.

The second scenario expands the analysis to a multi-stream integrated corridor model, incorporating not only crude oil but

also natural gas flows from key Gulf producers, including Saudi Arabia, the United Arab Emirates, and Qatar. This configuration introduces additional components such as storage facilities, processing units, and export terminals, thereby transforming the project from a single-purpose pipeline into a comprehensive energy corridor. The comparative analysis evaluates differences in scale, revenue diversification, and long-term financial sustainability between the two models.

To complement the economic assessment, the study incorporates a geopolitical risk analysis framework. This involves evaluating the extent to which each scenario reduces dependence on the Strait of Hormuz and enhances supply chain resilience. Key factors considered include exposure to regional conflicts, vulnerability to maritime disruptions, and the potential for cross-border cooperation among participating countries.

A key conceptual contribution of the methodology is the introduction of the Energy Security Premium, defined as the economic value associated with reducing the probability and impact of supply disruptions. Unlike traditional cost-benefit models, which focus primarily on direct financial returns, this approach incorporates the broader economic implications of enhanced reliability and risk mitigation. The Energy Security Premium is not quantified in precise monetary terms within this study but is used as an analytical lens to compare the strategic value of alternative infrastructure configurations.

The research also considers a demand-side investment perspective by evaluating the potential role of major Asian energy-importing economies as stakeholders in the corridor. This aspect is analyzed qualitatively, focusing on how aligning infrastructure investment with long-term energy demand can improve financial viability and reduce geopolitical tensions.

Overall, the methodology provides a structured framework for assessing both the economic and strategic dimensions of the Arabian Energy Corridor. By combining scenario analysis with geopolitical evaluation, the study offers a comprehensive approach to understanding the feasibility and long-term significance of the proposed infrastructure.

IV. ECONOMIC AND GEOPOLITICAL FRAMEWORK

The Arabian Energy Corridor (AEC) is conceptualized as a strategic, land-based energy infrastructure system designed to bypass the Strait of Hormuz and provide a secure and scalable alternative route for hydrocarbon exports from the Gulf region. The proposed corridor originates in Saudi Arabia's Eastern Province, the primary hub of oil and gas production, and extends southward through Oman to the port of Duqm on the Arabian Sea. This geographic configuration enables direct access to international shipping routes without transiting through the Strait of Hormuz, thereby significantly reducing exposure to geopolitical risks associated with maritime chokepoints.

The corridor is not limited to a single pipeline but is envisioned as a multi-stream, integrated infrastructure system. It incorporates crude oil and natural gas flows from major Gulf producers, including Saudi Arabia, the United Arab Emirates, and Qatar. Potential integration points include connections from the UAE's Fujairah export terminal and Qatar's gas infrastructure via Saudi territory, creating a unified regional network. This integrated approach enhances throughput capacity, supports economies of scale, and enables the development of complementary infrastructure such as storage facilities, processing hubs, and export terminals.

From an economic perspective, the viability of the AEC depends on its structural configuration. A standalone crude oil pipeline, while offering strategic benefits in terms of risk diversification, faces limitations in financial performance. High capital expenditure, combined with relatively narrow revenue streams based solely on oil transport, reduces its attractiveness from an investment standpoint. In contrast, the integrated corridor model significantly improves economic feasibility by expanding both capacity and functionality. The inclusion of natural gas transport, storage services, and potential downstream processing activities creates diversified revenue streams, thereby enhancing overall project returns.

A central contribution of this study is the conceptualization of the Energy Security Premium, which reflects the economic value of reduced supply disruption risks. Traditional infrastructure evaluation models primarily focus on cost efficiency and return on investment, often neglecting the broader economic impact of supply instability. However, disruptions in energy supply chains can have significant macroeconomic consequences, including price volatility, inflationary pressures, and reduced industrial productivity. By providing a reliable alternative to the Strait of Hormuz, the AEC generates value not only through direct revenue but also through risk mitigation, which benefits both producers and consumers. This premium, although difficult to quantify precisely, represents a critical factor in evaluating the true economic viability of the corridor.

In addition to its economic benefits, the AEC carries substantial geopolitical implications. The current energy transport system places significant strategic importance on the Strait of Hormuz, making it a focal point of geopolitical tensions. By reducing reliance on this chokepoint, the corridor alters the regional energy security landscape and enhances the strategic autonomy of Gulf producers. It also reduces the potential for external actors to influence global energy markets through control or disruption of maritime routes.

The corridor is envisioned as a Saudi-led initiative with participation from other Gulf Cooperation Council (GCC) countries, reinforcing regional economic integration. Unlike military alliances, this model emphasizes economic cooperation through shared infrastructure, creating interdependencies that can contribute to regional stability. The development of a unified energy corridor aligns with broader regional objectives of diversification, infrastructure development, and long-term economic sustainability.

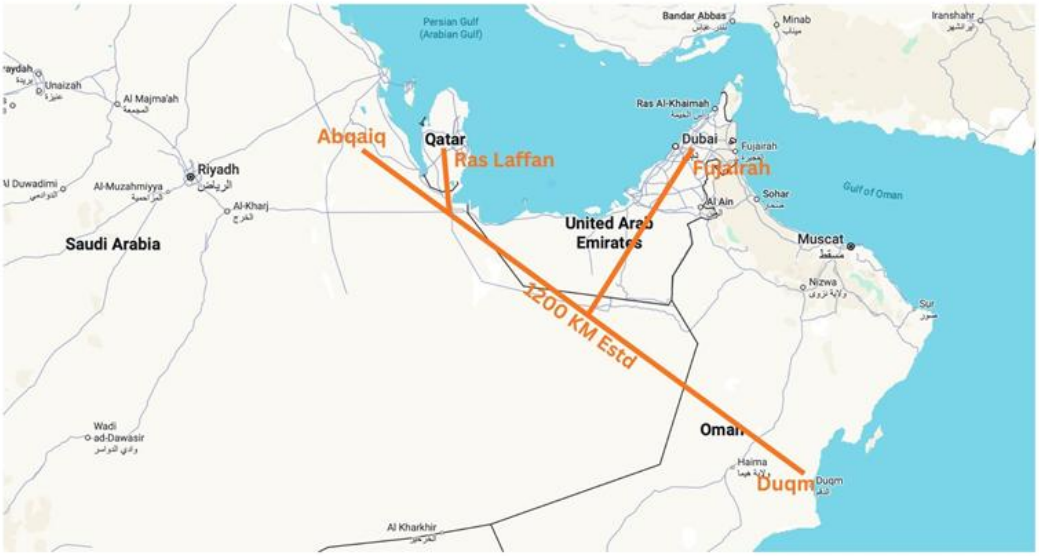
An important dimension of the AEC is its potential to incorporate demand-side participation from major Asian energy-importing economies, including China, India, Japan, and Pakistan. These countries represent the primary consumers of Gulf energy exports and have a strong interest in supply security. By involving them as co-investors or strategic partners, the corridor can align infrastructure development with long-term demand patterns. This approach enhances financial viability by securing stable demand while

also reducing geopolitical tensions by transforming the corridor into a shared economic asset rather than a purely regional project.

Furthermore, the AEC contributes to the diversification of global energy transport routes, which is increasingly important in the context of evolving geopolitical dynamics and energy transition policies. While the global shift toward renewable energy may influence long-term demand for hydrocarbons, the transition is expected to be gradual, and fossil fuels will continue to play a significant role in the global energy mix in the medium term. In this context, ensuring reliable and secure transport infrastructure remains a critical priority.

From a strategic perspective, the AEC can be understood as part of a broader shift toward infrastructure-based energy security. Rather than relying solely on naval protection or geopolitical alliances to secure maritime routes, the corridor represents a structural solution that reduces exposure to risk by redesigning the physical geography of energy transport. This approach is inherently more sustainable, as it addresses the root causes of vulnerability rather than merely managing their consequences.

PROPOSED ARABIAN ENERGY CORRIDOR



In summary, the Arabian Energy Corridor combines economic efficiency with geopolitical risk mitigation, offering a comprehensive solution to one of the most critical vulnerabilities in the global energy system. Its integrated design, regional cooperation model, and alignment with global demand patterns position it as a transformative infrastructure project with both regional and international significance.

V. DISCUSSION

The analysis of the Arabian Energy Corridor (AEC) highlights a fundamental shift in how energy infrastructure should be evaluated in an increasingly uncertain geopolitical environment. Traditional energy transport systems have prioritized cost efficiency and logistical convenience, often overlooking systemic vulnerabilities associated with concentrated chokepoints. The findings of this study suggest that such an approach is no longer sufficient in a context where geopolitical risks can rapidly disrupt global supply chains.

A key insight emerging from the analysis is the limited viability of a standalone crude oil pipeline when assessed purely on conventional economic criteria. While such a pipeline offers strategic benefits in terms of route diversification, its financial performance is constrained by high capital costs and reliance on a single revenue stream. This makes it less attractive for large-scale investment, particularly in a competitive global energy market where alternative transport options already exist.

In contrast, the integrated corridor model demonstrates significantly stronger long-term potential. By combining crude oil and natural gas transport with additional infrastructure components such as storage, processing, and export facilities, the corridor transforms from a single-purpose asset into a multi-functional energy platform. This integration not only increases throughput but also diversifies revenue streams, thereby improving overall financial resilience. The ability to generate income from multiple sources reduces dependence on oil transport alone and enhances the project's adaptability to changing market conditions.

Another critical dimension highlighted in the discussion is the role of the Energy Security Premium. The concept underscores the inadequacy of traditional cost-benefit analyses in capturing the full value of infrastructure projects that enhance supply reliability. Energy disruptions—whether caused by geopolitical conflict, security threats, or logistical constraints—carry substantial economic costs that extend beyond the energy sector, affecting industrial **output, inflation, and overall economic stability. By** reducing exposure to such risks, the AEC generates indirect economic

benefits that are not immediately reflected in standard financial metrics. This reinforces the argument that strategic infrastructure should be evaluated within a broader framework that incorporates resilience and risk mitigation.

From a geopolitical perspective, the AEC represents a structural solution to the longstanding vulnerability associated with the Strait of Hormuz. Rather than relying on military deterrence or diplomatic stability to secure maritime routes, the corridor offers an alternative that reduces dependence on a single chokepoint. This shift has important implications for regional and global energy security, as it redistributes risk and enhances supply flexibility.

However, the implementation of the corridor is not without challenges. The integrated model, while economically and strategically superior, requires substantial coordination among multiple stakeholders, including Gulf producers and potential international investors. Differences in national priorities, regulatory frameworks, and political considerations may complicate the development process. Additionally, the high capital investment required for such a large-scale project necessitates innovative financing structures and long-term commitment from participating countries.

The inclusion of demand-side stakeholders, particularly major Asian energy-importing economies, emerges as a critical factor in addressing these challenges. By aligning infrastructure development with long-term consumption patterns, this approach strengthens the financial viability of the corridor while fostering shared ownership and reducing geopolitical tensions. It also reflects a broader trend in global energy markets, where consumer countries increasingly seek to secure supply chains through direct investment in upstream and midstream infrastructure.

TABLE I: COMPARATIVE EVALUATION OF CORRIDOR CONFIGURATIONS

Model	Key Advantages	Key Limitations
Standalone Pipeline	Lower structural complexity; faster implementation	Limited revenue streams; weaker financial viability; minimal scalability
Integrated Energy Corridor	Economies of scale; diversified income streams; enhanced resilience; regional integration	High capital cost; complex coordination; longer implementation timeline

The comparative analysis clearly indicates that while the standalone pipeline may offer short-term feasibility, the integrated corridor provides a more sustainable and strategically robust solution in the long term. The trade-off between complexity and value becomes evident, with the integrated model delivering superior benefits despite higher initial challenges.

Overall, the discussion reinforces the central argument of this study: that the Arabian Energy Corridor should not be viewed merely as an infrastructure project but as a strategic transformation in global energy transport systems. Its value lies not only in its physical capacity but also in its ability to enhance resilience, promote cooperation, and redefine the economic logic of energy security in a volatile geopolitical landscape.

VI. CONCLUSION

The Arabian Energy Corridor (AEC) represents a strategic reconfiguration of global energy transport architecture, addressing one of the most critical vulnerabilities in the current system—overdependence on the Strait of Hormuz. By proposing a land-based, integrated infrastructure model, this study highlights the potential to significantly enhance energy supply resilience while maintaining economic viability.

The analysis demonstrates that conventional approaches to energy infrastructure, which prioritize cost efficiency and operational simplicity, are insufficient in an environment characterized by increasing geopolitical uncertainty. While a standalone crude pipeline offers limited diversification benefits, it fails to deliver the financial robustness required for long-term sustainability. In contrast, the integrated corridor model provides a more comprehensive solution by combining multiple energy streams, expanding revenue opportunities, and enabling economies of scale.

A key contribution of this study is the introduction of the concept of the Energy Security Premium, which reframes infrastructure evaluation by incorporating the economic value of risk mitigation. This perspective underscores the importance of considering supply stability and disruption avoidance as integral components of economic analysis, particularly in global energy markets where volatility can have far-reaching consequences.

From a geopolitical standpoint, the AEC offers a structural alternative to traditional reliance on maritime security and military deterrence. By bypassing the Strait of Hormuz, the corridor reduces exposure to regional tensions and enhances the strategic autonomy of Gulf energy producers. Furthermore, its design as a cooperative, multi-country infrastructure project promotes regional integration and aligns with broader economic diversification goals within the Gulf Cooperation Council (GCC).

The inclusion of major Asian energy-importing economies as potential stakeholders introduces an additional dimension of strategic alignment between supply and demand. This demand-side participation model not only strengthens the financial feasibility of the corridor but also contributes to reducing geopolitical friction by transforming the project into a shared economic asset with mutual benefits.

Despite its significant advantages, the implementation of the AEC will require careful consideration of financial, political, and operational challenges. High capital investment, cross-border coordination, and security concerns must be addressed through phased development strategies, innovative financing mechanisms, and strong institutional frameworks.

In conclusion, the Arabian Energy Corridor should be understood not merely as an infrastructure project but as a strategic platform for redefining energy security in the 21st century. Its integrated design, combined with its potential to enhance resilience and cooperation, positions it as a

transformative initiative with both regional and global significance. Future research may focus on quantitative modeling of the Energy Security Premium, detailed route optimization, and the development of financing structures to support large-scale implementation.

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