

From Resource Development to System Governance: Rethinking Indonesia's National Gas System

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ABSTRACT

Indonesia's natural gas sector is undergoing a fundamental transformation from an export-oriented industry into an integrated national energy system that simultaneously supports energy security, industrial development, domestic value creation, and the transition to a lower-carbon economy. Existing studies generally examine upstream production, LNG exports, infrastructure, pricing, or domestic utilization separately, providing limited understanding of how these components interact within a unified governance system. This study addresses this gap by proposing the National Gas System Framework (NGSF), an integrated political economy framework that conceptualizes Indonesia's gas sector as a system of seven interdependent dimensions: resource availability, infrastructure integration, market organization, institutional governance, gas allocation, energy transition, and strategic national outcomes. Employing a qualitative Strategic Policy Assessment (SPA), the research draws upon documentary analysis of government policies, industry reports, and international literature to examine how interactions among these dimensions shape long-term gas governance. The analysis demonstrates that Indonesia's principal challenge has shifted from maximizing natural gas production and LNG exports toward optimizing national value creation through coherent system governance. The findings further show that sustained competitiveness depends less on geological resource abundance than on effective institutional coordination, integrated infrastructure, transparent market organization, balanced domestic and export allocation, and the incorporation of low-carbon technologies such as biomethane and carbon capture and storage. The study contributes to the literature by extending political economy perspectives on natural resource governance beyond conventional value-chain analysis and introducing the NSGF as a transferable analytical framework for resource-rich economies facing similar structural transitions. It concludes that integrated governance, rather than resource endowment alone, will increasingly determine the long-term competitiveness, resilience, and sustainability of national gas systems.

Keywords: National Gas System Framework (NGSF); natural gas governance; LNG; political economy; energy transition; Indonesia

INTRODUCTION

Natural gas is undergoing a profound transformation in the twenty-first century. Once regarded primarily as a commercial fuel and an export commodity, it has increasingly become a strategic resource whose value extends far beyond energy production. Governments now rely on natural gas to strengthen energy security, support industrialization, facilitate the integration of renewable energy, reduce dependence on more carbon-intensive fuels, expand household energy access, and maintain international competitiveness. As countries pursue decarbonization while sustaining economic growth, the central policy challenge has shifted from producing more gas to governing increasingly complex gas systems that must balance multiple—and often competing—national objectives (IEA, 2023; Stern, 2022).

These changes are particularly evident in resource-rich developing economies. Historically, natural gas development focused on monetizing upstream resources through pipeline exports or liquefied natural gas (LNG). Today, however, gas-producing countries face a more complicated policy environment. Domestic demand is rising rapidly as governments promote industrial downstreaming, gas-fired electricity generation, petrochemical production, fertilizer industries, city gas networks, and cleaner household energy. At the same time, they remain

committed to long-term export contracts that generate foreign exchange earnings and sustain international commercial relationships. Consequently, natural gas has evolved from a commodity traded in discrete projects into an integrated national system whose performance depends on the interaction of upstream production, transmission infrastructure, market institutions, regulatory frameworks, pricing policies, and strategic allocation decisions (Victor, Jaffe, & Hayes, 2006; Heather, 2024).

Indonesia provides an important example of this transformation. During the late 1970s and 1980s, the country emerged as one of the pioneers of the global LNG industry through the Arun and Badak LNG projects, becoming one of the world's largest LNG exporters. Government policy was largely directed toward monetizing abundant offshore gas resources and maximizing export revenues. Over subsequent decades, however, declining production from mature fields, expanding domestic demand, institutional reforms, and changing international gas markets fundamentally altered the role of natural gas within the national economy (Nugroho, Hidayatullah, & Saputra, 2026; IEA, 2023). Today, gas is expected simultaneously to support electricity generation, fertilizer production, petrochemical industries, mineral processing, city gas networks, household energy access, and the development of Indonesia's new capital city (IKN) (Nugroho, 2020, Nugroho et al., 2026), while continuing to underpin LNG exports through projects such as Tangguh and the planned Abadi LNG development (MEMR, 2024).

Recent developments have accelerated this transition. Several long-standing pipeline gas export contracts from Sumatra and offshore Natuna are approaching expiration or have already terminated, creating opportunities to redirect gas toward domestic markets. At the same time, Indonesia has expanded its gas transmission and distribution infrastructure through projects such as the Cirebon–Semarang pipeline, sections of the Trans-Java gas transmission system, LNG regasification terminals, mini-LNG facilities, and city gas networks. The consolidation of PT Perusahaan Gas Negara into PT Pertamina Gas Negara as Pertamina's Gas Subholding has strengthened institutional integration across the downstream gas sector, although coordination among the Ministry of Energy and Mineral Resources, SKK Migas, BPH Migas, Pertamina, regional governments, and private contractors remains a continuing governance challenge (PGN, 2024; SKK Migas, 2024). Meanwhile, growing interest in biomethane, carbon capture and storage (CCS), and low-carbon gas systems illustrates that Indonesia's gas policy is becoming increasingly intertwined with the broader energy transition (IEA, 2024).

These developments reveal that Indonesia's principal challenge is no longer simply expanding natural gas production. Instead, it is governing an integrated national gas system capable of balancing multiple strategic objectives. Gas resources are concentrated primarily in eastern Indonesia, including Papua, East Kalimantan, and the future Abadi Masela project, whereas the largest centres of demand are located in Java and Sumatra. This geographical mismatch requires substantial investment in pipelines, LNG logistics, regasification facilities, and distribution networks. At the same time, policymakers must reconcile competing priorities among exports, electricity generation, fertilizer production, petrochemical industries, mineral processing, households, and emerging low-carbon applications while preserving investor confidence and maintaining the competitiveness of upstream development (Asian Development Bank [ADB], 2023).

Although extensive research has examined Indonesia's LNG industry, upstream investment, domestic gas pricing, energy security, and pipeline infrastructure, these topics are generally analysed independently. Existing studies tend to focus on individual segments of the gas value chain rather than on how institutions, infrastructure, markets, and allocation policies interact within an integrated national system (Nugroho, in press; Victor et al., 2006). As Indonesia enters a new phase of gas development characterized by rising domestic demand, expanding infrastructure, institutional restructuring, and accelerating energy transition, a broader analytical perspective is required.

This paper addresses that gap by analysing Indonesia's natural gas industry through the concept of the National Gas System Framework (NGSF). Rather than treating upstream production, LNG exports, pipelines, domestic utilization, market organization, and institutional governance as separate policy domains, the framework conceptualizes them as interdependent components of a single national system whose effectiveness depends upon coherent governance. The paper argues that Indonesia's long-term gas competitiveness will depend less on expanding production alone than on strengthening the governance of an integrated national gas system capable

of simultaneously supporting energy security, industrial development, domestic value creation, export competitiveness, and the transition toward a lower-carbon economy.

Methodologically, the study employs a qualitative Strategic Policy Assessment combining institutional analysis, policy review, and political economy perspectives. Building upon the proposed National Gas System Framework, the paper examines how seven interrelated dimensions—resource availability, infrastructure integration, market organization, institutional governance, gas allocation, energy transition, and strategic national objectives—collectively shape the evolution of Indonesia's gas sector.

The paper makes four principal contributions. First, it develops an integrated political economy analysis that links upstream development, downstream markets, infrastructure, institutions, and energy transition within a single governance framework. Second, it introduces the National Gas System Framework as a conceptual model for understanding how resource-rich countries govern increasingly complex gas systems under conditions of competing domestic and international priorities. Third, it demonstrates that Indonesia's principal policy challenge has evolved from maximizing gas production toward optimizing national value creation through integrated gas governance. Finally, it identifies policy priorities for strengthening investment, infrastructure, institutional coordination, and domestic market integration that are relevant not only for Indonesia but also for other gas-producing economies confronting similar structural transitions.

LITERATURE REVIEW AND ANALYTICAL FRAMEWORK

Political Economy of Natural Gas Governance

The political economy of natural resources has traditionally focused on how countries transform geological endowments into long-term economic development. Early scholarship emphasized the concept of the **resource curse**, arguing that abundant natural resources often coexist with weak institutions, economic volatility, rent-seeking behaviour, and limited structural transformation (Auty, 2001; Humphreys, Sachs, & Stiglitz, 2007). More recent research, however, suggests that resource abundance is neither inherently beneficial nor detrimental. Rather, development outcomes depend primarily on governance quality, institutional capacity, policy consistency, and the ability of governments to manage natural resource wealth effectively (North, 1990; Acemoglu & Robinson, 2012).

Natural gas presents a distinctive governance challenge because it differs fundamentally from most extractive commodities. Unlike crude oil or minerals, natural gas cannot easily be transported or stored without extensive infrastructure. Its commercialization requires coordinated investment in exploration, gas processing facilities, transmission pipelines, LNG liquefaction plants, regasification terminals, storage facilities, distribution networks, and final consumption systems. Consequently, the economic value of natural gas depends not only on resource availability but also on the effectiveness of institutions governing these interconnected components (Victor, Jaffe, & Hayes, 2006; Stern, 2022).

Recent geopolitical developments have further expanded the strategic importance of natural gas. Supply disruptions following the Russia-Ukraine conflict, increasing concerns regarding energy security, and accelerating commitments toward net-zero emissions have repositioned natural gas as both a transition fuel and a strategic geopolitical commodity. Governments now evaluate gas policy not solely in terms of export revenues but also with respect to industrial competitiveness, electricity reliability, energy security, regional development, and economic resilience (IEA, 2024; Heather, 2024).

This broader perspective suggests that natural gas governance should be analysed as an integrated system of interconnected institutions, infrastructure, markets, and policy coordination rather than as separate upstream and downstream activities.

Natural Gas as a Network Industry

Unlike internationally traded commodities such as coal or crude oil, natural gas functions fundamentally as a network industry. Its economic value depends upon continuous physical connectivity linking producers with

consumers through pipelines, LNG facilities, storage systems, regasification terminals, transmission networks, and local distribution infrastructure (Victor et al., 2006).

International experience demonstrates considerable diversity in governance models. North America relies primarily on competitive wholesale gas markets supported by extensive interstate pipeline systems. Europe has pursued market liberalization, cross-border interconnections, and gas trading hubs to enhance competition and supply security. Meanwhile, major LNG exporters—including Qatar, Norway, Australia, and Malaysia—have developed governance arrangements reflecting their own resource endowments, domestic institutions, and long-term development priorities (Stern, 2022; IEA, 2024).

Despite these institutional differences, successful gas industries exhibit several common characteristics. They combine sustained upstream investment, integrated infrastructure, transparent regulatory institutions, commercially viable pricing systems, and coherent long-term strategic planning. Weaknesses in any one of these dimensions may constrain the performance of the entire gas system.

Infrastructure and Institutions

Infrastructure is frequently regarded simply as a technical requirement for transporting natural gas. Political economy perspectives, however, recognise infrastructure as an expression of state capacity because it shapes market integration, industrial development, investment incentives, and national energy security (North, 1990).

Transmission pipelines determine regional market integration. LNG terminals create flexibility in geographically fragmented markets. City gas systems expand household energy access, while regasification terminals and storage facilities strengthen supply resilience during market disruptions (IEA, 2023).

Indonesia illustrates this relationship particularly well. Gas reserves are concentrated primarily in eastern Indonesia—including Papua, East Kalimantan, and the future Abadi Masela project—whereas demand is concentrated in Java and Sumatra. Bridging this spatial imbalance requires an integrated combination of transmission pipelines, LNG shipping, floating storage and regasification units (FSRUs), mini-LNG systems, LNG trucking, and urban distribution networks (MEMR, 2024; SKK Migas, 2024).

Infrastructure planning therefore becomes a governance challenge rather than merely an engineering exercise.

Emerging Challenges in National Gas Governance

The governance of natural gas is becoming increasingly complex because governments must simultaneously pursue multiple policy objectives: attracting upstream investment, ensuring regulatory certainty, expanding domestic gas utilisation, maintaining export credibility, supporting industrial downstreaming, reducing LPG imports, expanding household gas access, integrating renewable gases, and advancing energy transition while maintaining affordability (IEA, 2024; World Bank, 2023; Nugroho, in press).

At the same time, many gas-producing countries are experiencing declining production from mature fields while relying increasingly on frontier exploration, deep-water discoveries, marginal fields, and unconventional resources. Commercialising these resources often requires new contractual arrangements, shared infrastructure, regulatory innovation, and stronger institutional coordination (Stern, 2022).

Consequently, governance increasingly involves balancing competing national objectives rather than maximising production alone.

Research Gap

Existing literature has significantly improved understanding of individual aspects of Indonesia's gas sector, including LNG exports, upstream investment, domestic gas pricing, pipeline development, gas allocation, and energy security (Nugroho, in press; IEA, 2024). Nevertheless, these studies remain largely sector-specific.

Few studies examine how upstream production, infrastructure development, institutional coordination, market organisation, domestic allocation, and energy transition interact within an integrated national governance framework. This analytical fragmentation limits understanding of how governments optimise natural gas as a strategic national resource under increasingly complex economic, institutional, and geopolitical conditions.

Accordingly, a broader analytical framework is required.

National Gas System Framework (NGSF)

This study proposes the National Gas System Framework (NGSF) as an integrated political economy framework for analysing natural gas governance. This framework extends the analytical framework for LNG industry governance developed in our previous study (Nugroho, in press), broadening its scope to encompass the wider national gas system and its strategic policy dimensions.

Rather than viewing exploration, production, LNG exports, transmission pipelines, city gas networks, domestic markets, and institutional governance as separate policy domains, the framework conceptualizes them as interdependent components of a single national system.

The framework consists of seven mutually reinforcing dimensions:

1. Resource Availability, encompassing exploration, reserves, production, and future supply;
2. Infrastructure Integration, including pipelines, LNG facilities, regasification terminals, storage, mini-LNG, LNG trucking, and distribution networks;
3. Market Organization, covering pricing mechanisms, contractual arrangements, market structure, and commercial institutions;
4. Institutional Governance, involving the Ministry of Energy and Mineral Resources, SKK Migas, BPH Migas, Pertamina, Pertamina Gas Negara, regional governments, private investors, and regulatory coordination;
5. Gas Allocation, referring to the distribution of gas among exports, electricity generation, industry, petrochemicals, fertilizer production, households, transportation, and strategic domestic users;
6. Energy Transition, encompassing natural gas as a transition fuel, biomethane, renewable gases, carbon capture and storage (CCS), and decarbonized gas systems;
7. Strategic National Outcomes, including energy security, industrial competitiveness, fiscal revenues, regional development, export performance, and progress toward net-zero emissions.

The central proposition of the framework is that national gas competitiveness is an emergent property of interactions among these seven dimensions. Countries possessing similar resource endowments may achieve substantially different economic outcomes depending on the quality of governance integrating these components.

The National Gas System Framework therefore provides a comprehensive analytical lens for understanding Indonesia's evolving gas sector while offering broader applicability to other gas-producing economies undergoing structural transformation.

METHODOLOGY

Research Design

This study employs a qualitative Strategic Policy Assessment (SPA) to examine the political economy of Indonesia's natural gas sector through the perspective of an integrated National Gas System. Rather than forecasting gas production or quantitatively modelling energy demand, the research investigates how resource

availability, infrastructure development, institutional governance, market organization, and public policy interact to shape Indonesia's long-term gas strategy.

A qualitative approach is appropriate because the principal research questions concern governance, institutional coordination, institutional evolution, and policy trade-offs rather than technical optimization or econometric forecasting. The study therefore adopts an interpretive political economy perspective that views natural gas not merely as an economic commodity but as a strategic national resource whose development reflects interactions among government institutions, state-owned enterprises, private investors, industrial consumers, and international markets (Yin, 2018; Creswell & Poth, 2018).

The analysis is policy-oriented rather than predictive. It seeks to explain how Indonesia can strengthen the governance of its national gas system amid increasing domestic demand, evolving international gas markets, infrastructure expansion, and the energy transition. This approach is consistent with qualitative policy research that emphasizes institutional relationships, governance processes, and strategic decision-making in complex public policy environments (Bryman, 2016).

Justification for the Strategic Policy Assessment Approach

Unlike conventional case study research, which typically seeks to explain specific events or organizational behaviour within bounded contexts (Yin, 2018), Strategic Policy Assessment (SPA) is designed to evaluate long-term policy challenges involving multiple institutions, competing objectives, and uncertain future developments. SPA is particularly appropriate for strategic sectors such as energy because policy outcomes depend not only on market behaviour or technological change but also on interactions among government institutions, regulatory frameworks, infrastructure investment, industrial policy, and geopolitical dynamics. Rather than testing causal hypotheses, SPA integrates evidence from diverse sources to assess policy coherence, identify strategic trade-offs, and formulate governance recommendations for complex national systems. This perspective is especially relevant to Indonesia's natural gas sector, where upstream resource development, domestic market expansion, infrastructure integration, and energy transition must be managed simultaneously within a rapidly evolving policy environment (Howlett, Ramesh, & Perl, 2020; OECD, 2020).

Analytical Framework

The study applies the National Gas System Framework (NGSF) developed in the preceding section as its principal analytical framework. The framework conceptualizes Indonesia's gas industry as an integrated system consisting of seven interrelated dimensions:

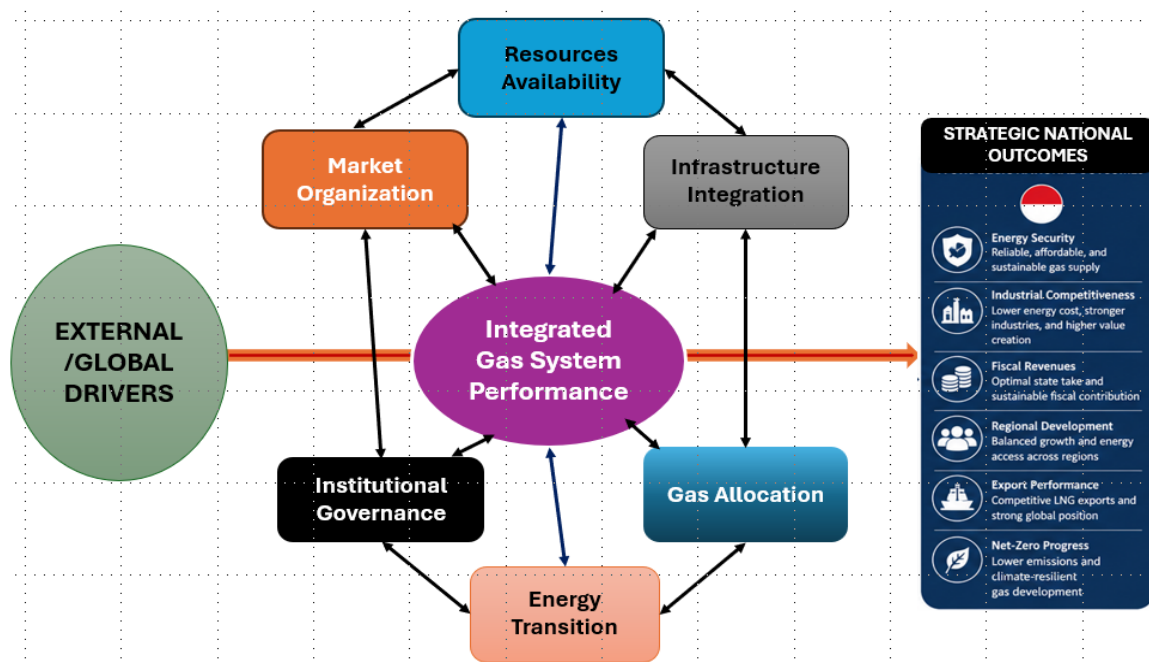
1. Resource availability;
2. Infrastructure integration;
3. Market organization;
4. Institutional governance;
5. Gas allocation;
6. Energy transition; and
7. Strategic national outcomes.

Rather than examining these dimensions independently, the analysis focuses on their interactions. For example, the commercial viability of upstream gas developments depends not only on geological resources but also on regulatory certainty, transmission infrastructure, domestic demand, pricing policies, and institutional coordination. Likewise, decisions regarding domestic gas allocation influence industrial competitiveness, LNG exports, electricity reliability, household energy access, and Indonesia's broader energy transition.

Accordingly, the framework enables the study to move beyond conventional value-chain analysis by examining how governance influences the overall performance, resilience, and strategic effectiveness of the national gas system.

Figure 1 illustrates the simplified analytical framework adopted in this study.

Figure 1. Analytical framework of the study.



Source: Developed by the author

Data Sources

The research is based on qualitative analysis of secondary data collected from authoritative national and international sources. Documentary analysis is widely recognised as an appropriate method for examining institutional development, public policy, and governance systems because it enables the systematic interpretation of official documents, policy reports, and organizational publications (Bowen, 2009).

National sources include legislation, government regulations, policy documents, statistical publications, and reports issued by the Ministry of Energy and Mineral Resources (MEMR), SKK Migas, BPH Migas, Pertamina, PT Pertamina Gas Negara Tbk (PGN), PLN, and other relevant public institutions.

International references include publications from the International Energy Agency (IEA), International Gas Union (IGU), World Bank, Asian Development Bank (ADB), International Monetary Fund (IMF), Oxford Institute for Energy Studies (OIES), and peer-reviewed academic literature concerning gas governance, political economy, infrastructure development, and energy transition.

To ensure that the analysis reflects recent developments, the study also considers contemporary policy and industry trends, including the restructuring of Indonesia's gas sector following the establishment of Pertamina's Gas Subholding, the gradual expiration of several long-term pipeline gas export contracts, expansion of domestic gas infrastructure, increasing utilization of natural gas by households and strategic industries, and emerging opportunities for biomethane and other low-carbon gases.

Data Analysis

The analysis follows a qualitative thematic approach. Documentary evidence is organized according to the seven dimensions of the National Gas System Framework and subsequently interpreted to identify recurring

governance issues, institutional relationships, policy trade-offs, and strategic priorities. This analytical strategy is consistent with thematic analysis commonly employed in qualitative policy research (Braun & Clarke, 2006).

Particular attention is given to four interrelated policy questions:

- How can Indonesia maintain adequate long-term gas supply?
- How should gas infrastructure be developed to improve national connectivity?
- How can competing domestic and export demands be balanced?
- What institutional arrangements are required to strengthen integrated gas governance?

Evidence from multiple documentary sources is triangulated to improve analytical robustness and minimize institutional bias. Rather than testing statistical hypotheses, the research develops an integrated explanation of how governance arrangements influence the performance, resilience, and long-term competitiveness of Indonesia's National Gas System.

RESULTS

Evolution of Indonesia's National Gas System

Indonesia's natural gas industry has undergone three major phases of development over the past five decades. During the first phase (1970s–1990s), natural gas was primarily regarded as an export commodity. The development of the Arun and Badak LNG projects transformed Indonesia into one of the world's leading LNG exporters, while pipeline exports to Singapore and Malaysia generated substantial foreign exchange earnings. Government policy during this period focused on maximizing upstream production and export revenues, whereas domestic utilization remained relatively limited (Victor et al., 2006; Nugroho, in press).

The second phase emerged following the enactment of the Oil and Gas Law and broader energy sector reforms in the early 2000s. Rapid industrialization, population growth, and electricity expansion significantly increased domestic gas demand. Natural gas gradually evolved from an export commodity into an essential input for power generation, fertilizer production, petrochemical industries, manufacturing, and commercial activities. This period also witnessed the expansion of transmission pipelines, LNG receiving terminals, floating storage and regasification units (FSRUs), and city gas networks that connected producing regions with domestic consumers (MEMR, 2024; PGN, 2024; Nugroho, 2022).

Indonesia has now entered a third phase characterized by integrated national gas governance. Several long-term pipeline export contracts from South Sumatra and offshore Natuna are approaching expiration or have already terminated, allowing a larger proportion of production to be redirected toward domestic markets. Simultaneously, new upstream developments—including Tangguh Train-3, deep-water discoveries in East Kalimantan, the planned Abadi Masela project, and exploration success in the Andaman Basin—are expected to strengthen future supply. Government policy has consequently shifted from maximizing export volumes toward optimizing national value creation through an integrated gas system that supports industrial development, electricity reliability, household energy access, and the transition toward a lower-carbon economy (SKK Migas, 2024; IEA, 2024).

This evolution reflects a broader transformation from governing individual gas projects to managing an integrated National Gas System in which upstream development, infrastructure, institutions, markets, and allocation policies are increasingly interdependent.

Resource Availability and Future Supply

Indonesia possesses one of Asia's largest natural gas resource bases. However, sustaining long-term supply presents increasing challenges. Production from mature fields in South Sumatra, East Kalimantan, and Natuna has gradually declined, while domestic demand continues to grow. Future production therefore depends

increasingly on frontier exploration, deep-water developments, and commercialization of marginal and stranded gas resources (MEMR, 2024; SKK Migas, 2024).

Major projects—including Abadi Masela, continued expansion of Tangguh LNG, Andaman Basin discoveries, and deep-water East Kalimantan—provide a promising production outlook. Nevertheless, transforming discoveries into producing fields requires long investment horizons, advanced technology, substantial capital investment, and regulatory certainty (IEA, 2024).

Marginal gas fields deserve particular policy attention. Although individually small, their cumulative contribution could substantially strengthen domestic supply if supported by shared processing facilities, mini-LNG technologies, common infrastructure, and commercially attractive fiscal arrangements. Their development therefore depends not only on geological potential but also on innovative institutional and commercial frameworks.

Investor confidence remains equally important. Fiscal competitiveness, legal certainty, production-sharing contract (PSC) arrangements, environmental regulation, carbon management policies, and efficient licensing procedures directly influence exploration investment. Consequently, upstream governance has become as important as resource availability itself.

Infrastructure Integration and Spatial Connectivity

Infrastructure constitutes the physical backbone of Indonesia's National Gas System. Unlike crude oil, natural gas cannot generate economic value without integrated transportation, processing, storage, and distribution systems.

Indonesia's gas resources are geographically concentrated in eastern Indonesia—including Papua, East Kalimantan, Natuna, and the future Masela development—whereas the largest demand centres are located in Java and Sumatra. This spatial imbalance represents one of Indonesia's most important structural challenges (MEMR, 2024).

Over the past three decades, Indonesia has significantly expanded its transmission network through pipelines connecting South Sumatra with Java and Singapore, while newer projects—including the Cirebon-Semarang (Cisem) pipeline, the partially completed Trans-Java transmission system, and the Dumai–Sei Mangkei pipeline—continue improving national connectivity. LNG receiving terminals, floating storage and regasification units, mini-LNG systems, LNG trucking, and satellite regasification have further extended gas access to regions where pipelines remain uneconomic (PGN, 2024; SKK Migas, 2024).

Future infrastructure planning should increasingly emphasize system integration rather than isolated projects. Pipelines, LNG logistics, storage facilities, distribution networks, and digital system management should operate as complementary components of a unified national gas system capable of delivering gas efficiently across Indonesia's archipelagic geography.

Market Organization and Domestic Gas Allocation

Indonesia's domestic gas allocation has progressively shifted from an export-oriented paradigm toward maximizing national economic value through strategic utilization in electricity generation, fertilizer production, petrochemical industries, mineral processing, and household energy. This evolution reflects a broader policy objective of enhancing industrial competitiveness while reducing dependence on imported fuels, particularly LPG (MEMR, 2024; IEA, 2024).

Domestic Market Obligation (DMO) policies have become an important mechanism for ensuring gas availability to strategic sectors, particularly fertilizer production and PLN's gas-fired power plants. However, allocation decisions increasingly involve balancing affordability, industrial competitiveness, investor incentives, and export commitments.

Expansion of city gas networks has significantly increased household utilization of natural gas. This policy extends beyond energy security by contributing to reduced dependence on imported LPG, lowering fiscal subsidy burdens, and improving household access to cleaner fuels. Similarly, growing utilization of natural gas within industrial estates supports Indonesia's downstream industrialization strategy by providing reliable and relatively low-emission energy for manufacturing.

Future market organization should therefore prioritize national economic value rather than maximizing short-term commercial returns. Transparent pricing mechanisms, efficient gas trading arrangements, and coordinated allocation policies will be essential for optimizing limited domestic resources.

Institutional Governance and Regulatory Reform

The complexity of Indonesia's National Gas System requires effective coordination among multiple institutions with differing mandates and responsibilities.

The Ministry of Energy and Mineral Resources provides overall policy direction, SKK Migas manages upstream operations, BPH Migas regulates downstream activities, while Pertamina and PT Pertamina Gas Negara Tbk perform increasingly important commercial and strategic functions throughout the value chain. Regional governments, private contractors, and industrial consumers also influence investment decisions and infrastructure development.

The integration of PGN into Pertamina's Gas Subholding represents an important institutional milestone by strengthening coordination across transportation, transmission, LNG, city gas, and trading activities. Nevertheless, fragmented decision-making, overlapping authorities, and lengthy licensing procedures continue to constrain investment.

Revision of the Oil and Gas Law presents an opportunity to improve legal certainty, streamline licensing, clarify institutional responsibilities, and strengthen investor confidence. Regulatory reforms should also accommodate emerging issues such as carbon capture and storage (CCS), biomethane, digital gas markets, and integrated infrastructure planning.

Institutional effectiveness ultimately depends not only on organizational structures but also on the ability to coordinate long-term planning across the entire gas value chain.

Natural Gas and Indonesia's Energy Transition

Natural gas occupies a strategic position within Indonesia's energy transition. Although it remains a fossil fuel, its lower carbon intensity relative to coal enables it to support decarbonization while maintaining electricity reliability and industrial competitiveness. Gas-fired power plants provide the operational flexibility required to complement variable renewable energy sources such as solar and wind, making natural gas an important transition fuel in many national energy systems (IEA, 2023; IEA, 2024).

Gas-fired power plants provide operational flexibility that complements variable renewable energy sources such as solar and wind. Consequently, natural gas functions as an important transition fuel while Indonesia gradually increases renewable energy deployment.

Beyond conventional natural gas, future gas policy is likely to incorporate biomethane, renewable gases, synthetic methane, hydrogen blending, and carbon capture and storage technologies. These developments indicate that Indonesia's National Gas System will evolve toward a broader low-carbon gas system rather than remaining exclusively dependent on conventional natural gas.

Maintaining this transition requires careful balancing of environmental objectives, affordability, infrastructure investment, and long-term energy security.

Strategic Policy Implications

The preceding analysis demonstrates that Indonesia's future gas competitiveness depends less on resource abundance than on governance quality.

Five strategic priorities emerge.

First, upstream investment must remain a national priority through accelerated exploration, timely development of frontier discoveries, and commercially attractive conditions for marginal fields.

Second, infrastructure investment should emphasize integrated national connectivity, combining pipelines, LNG logistics, regasification facilities, storage, and digital management into a unified network.

Third, institutional coordination should be strengthened by improving collaboration among MEMR, SKK Migas, BPH Migas, Pertamina, Pertamina Gas Negara, regional governments, and private investors while simplifying licensing procedures.

Fourth, domestic gas allocation should increasingly maximize national economic value by supporting electricity generation, fertilizer production, petrochemicals, strategic manufacturing, household energy access, and industrial downstreaming while preserving Indonesia's reputation as a reliable LNG exporter.

Finally, Indonesia should progressively transform its National Gas System into a low-carbon gas system by integrating biomethane, carbon capture and storage, and other emerging technologies into long-term energy planning.

Taken together, these priorities suggest that Indonesia's comparative advantage will increasingly derive from the effectiveness of integrated gas governance rather than from the size of its geological resources alone.

DISCUSSION

From Resource Development to System Governance

The findings demonstrate that Indonesia's natural gas sector has undergone a structural transformation extending well beyond changes in production, reserves, or export markets. Historically, the country's gas industry was organized around individual upstream projects designed primarily to monetize natural gas through pipeline exports and LNG. Success was measured largely by production volumes, export revenues, and foreign exchange earnings. Today, however, Indonesia's policy objectives have broadened considerably. Natural gas is expected to support electricity generation, industrial downstreaming, petrochemical development, fertilizer production, household energy access, regional development, and the country's transition toward a lower-carbon economy. Consequently, the principal governance challenge has shifted from maximizing resource extraction to optimizing the performance of an integrated National Gas System.

This transformation reflects a broader evolution in the political economy of natural resources. Contemporary resource governance increasingly concerns the management of interconnected systems rather than individual projects or commodities. This finding is consistent with institutional theories that emphasize governance quality, policy coordination, and state capacity as the principal determinants of long-term resource-based development (North, 1990; Acemoglu & Robinson, 2012). In Indonesia, decisions regarding upstream investment, domestic gas allocation, transmission infrastructure, LNG facilities, pricing policies, and institutional coordination are mutually reinforcing. Weaknesses in any one component can constrain the performance of the entire system. Accordingly, governance should be understood as the process of coordinating these interdependent elements to maximize national value creation rather than simply increasing production or exports.

Infrastructure as an Instrument of State Capacity

A second important finding concerns the role of infrastructure. Conventional analyses often treat pipelines, LNG terminals, regasification facilities, and distribution networks as engineering assets whose primary function is to transport natural gas. This study supports a broader interpretation. Gas infrastructure is also an institutional asset through which governments shape market integration, industrial development, regional connectivity, and energy security. This perspective is consistent with the literature on network industries, which argues that infrastructure creates both economic value and institutional capacity by linking geographically dispersed markets (Victor et al., 2006).

Indonesia illustrates this relationship particularly well. Gas reserves are concentrated primarily in eastern Indonesia, whereas the largest demand centres are located in Java and Sumatra. Bridging this geographical imbalance requires an integrated combination of transmission pipelines, LNG shipping, floating storage and regasification units (FSRUs), mini-LNG systems, LNG trucking, and city gas networks. Infrastructure therefore determines not only where gas flows but also where industries develop, households gain access to cleaner fuels, and regional economic opportunities emerge.

Viewed from this perspective, infrastructure investment represents an expression of state capacity. The ability to integrate geographically dispersed resources into a coherent national energy system becomes as strategically important as discovering additional gas reserves.

Governance Determines Competitiveness

The National Gas System Framework proposed in this study argues that the competitiveness of a gas-producing country depends less on geological resource abundance than on the effectiveness of governance. Indonesia continues to possess substantial gas resources and promising exploration prospects, including the Andaman Basin, deep-water East Kalimantan, and the Abadi Masela project. Nevertheless, these resources can only contribute to national development if supported by stable regulation, attractive investment conditions, integrated infrastructure, efficient market organization, and effective institutional coordination.

This finding extends the resource governance literature beyond the conventional resource curse debate. Whereas earlier scholarship focused primarily on the management of resource revenues (Auty, 2001; Humphreys et al., 2007), this study suggests that governance challenges in the natural gas sector increasingly arise from coordinating interconnected infrastructure systems, multiple public institutions, commercial incentives, and competing domestic and international policy objectives. Resource abundance therefore remains a necessary—but by no means sufficient—condition for achieving long-term competitiveness.

One of the principal contributions of this paper is the proposition that **national gas competitiveness is an emergent property of governance**. Rather than being determined solely by reserve size, production levels, or export capacity, competitiveness results from the interaction of resource availability, infrastructure integration, market organization, institutional effectiveness, allocation mechanisms, energy transition strategies, and broader national policy objectives. The National Gas System Framework (NGSF) provides a structured way to analyse these interactions and, in doing so, moves beyond conventional value-chain approaches.

Domestic Markets and the Rebalancing of National Priorities

Indonesia's experience also illustrates an important shift in the relationship between exports and domestic utilization. During the early decades of LNG development, export markets dominated policy decisions. Today, the gradual expiration of several long-term pipeline export contracts, rapid growth in domestic demand, expansion of city gas networks, and increasing gas requirements for electricity generation and strategic industries have fundamentally altered allocation priorities.

Domestic utilization is no longer simply a residual market after export commitments have been satisfied. Instead, it has become a central component of national development policy. Natural gas supports fertilizer production, petrochemical industries, nickel processing (Nugroho et al., 2026b), industrial estates, and household energy access while helping reduce dependence on imported LPG. This evolution reflects broader international trends in which gas-producing countries increasingly seek to maximise domestic value creation rather than relying solely on export earnings (IEA, 2024).

Balancing these domestic priorities with Indonesia's continuing LNG export commitments represents one of the country's most significant governance challenges. Gas allocation has therefore become a strategic policy instrument rather than merely a commercial transaction.

Natural Gas in the Energy Transition

The study further demonstrates that the role of natural gas within Indonesia's energy transition is becoming increasingly multidimensional. While natural gas remains a fossil fuel, its lower carbon intensity relative to coal enables it to support renewable energy integration by providing dispatchable electricity generation and operational flexibility. This finding is consistent with the IEA's assessment that natural gas will continue to play a significant, albeit evolving, role during the transition to lower-carbon energy systems, particularly in emerging economies where energy demand continues to expand (IEA, 2024).

At the same time, Indonesia's gas system is beginning to incorporate new technologies and policy objectives, including biomethane, carbon capture and storage (CCS), and other low-carbon gas solutions. These developments suggest that the National Gas System should be viewed not as a static infrastructure network but as an adaptive governance platform capable of accommodating technological innovation and changing policy priorities over time.

Consequently, energy transition should not be understood as replacing natural gas in the short term but as progressively transforming the gas system into a lower-carbon energy platform that continues to support national development while contributing to long-term decarbonization goals.

Broader Implications for Resource-Rich Economies

Although this study focuses on Indonesia, its implications extend beyond a single national case. Many resource-rich countries are confronting similar challenges as domestic demand expands, infrastructure networks become more complex, and governments seek to balance export competitiveness with industrialization, energy security, and climate commitments.

The National Gas System Framework provides a transferable analytical perspective for examining these challenges. Rather than evaluating gas sectors solely through production, reserves, or exports, the framework emphasizes interactions among resources, infrastructure, markets, institutions, allocation mechanisms, and strategic policy objectives. It therefore offers a broader conceptual approach to understanding natural gas governance in an era characterized by increasing economic complexity and accelerating energy transition.

For ease of reference, Table 1 presents the evolution of Indonesia's national gas governance, whereas Table 2 summarizes the key challenges, policy responses, and strategic outcomes within Indonesia's national gas system framework.

Table 1. Evolution of Indonesia's National Gas Governance

Era	Dominant Objective	Main Infrastructure	Key Institutions	Governance Paradigm
1970s–1990s	LNG and pipeline exports	LNG plants, export pipelines	Pertamina	<i>Project-based resource development</i>
2000s–2015	Domestic market expansion	Transmission pipelines, FSRUs	MEMR, SKK Migas, PGN	<i>Market liberalization and infrastructure development</i>
2015–Present	National value creation	Integrated pipelines, city gas, mini-LNG, regasification	Pertamina Group, PGN, MEMR, SKK Migas	<i>Integrated National Gas System governance</i>
Future (2035+)	Low-carbon integrated gas economy	Biomethane, CCS, hydrogen-ready infrastructure, smart gas networks		

Table 2. National Gas System Framework: Governance Challenges, Policy Responses, and Strategic Outcomes

NGSF Dimension	Key Challenges	Strategic Policy Responses	Expected Outcomes	National
Resource Availability	Declining mature fields; slow exploration; marginal fields; investment uncertainty	Accelerate frontier exploration; develop marginal fields; improve fiscal incentives and regulatory certainty	Sustainable long-term gas supply; increased reserves; improved investor confidence	
Infrastructure Integration	Supply-demand geographical mismatch; incomplete transmission network; limited regasification in remote areas	Complete Trans-Java and strategic pipelines; expand mini-LNG, LNG trucking, FSRUs, city gas, and digital network management	Better national connectivity; lower logistics costs; improved energy security	
Market Organization	Fragmented gas market; pricing distortions; inefficient allocation	Develop transparent pricing, strengthen gas trading mechanisms, establish an effective Gas Aggregator	More efficient gas market; improved investment climate; optimized gas utilization	
Institutional Governance	Overlapping authority; lengthy licensing; coordination gaps among MEMR, SKK Migas, BPH Migas, Pertamina, and PGN	Regulatory reform; strengthen institutional coordination; improve legal certainty through Oil and Gas Law revision	More effective governance; faster investment decisions; stronger policy coherence	
Gas Allocation	Competition between exports, power generation, fertilizer, petrochemicals, industry, households, and transport	Prioritize national value creation through transparent Domestic Market Obligation (DMO) and integrated planning	Higher industrial competitiveness; reduced LPG imports; balanced export and domestic supply	
Energy Transition	Coal dependence; need for flexible generation; emerging renewable gases	Position gas as transition fuel; expand biomethane; integrate CCS/CCUS and low-carbon gas technologies	Lower emissions; improved renewable integration; resilient low-carbon gas system	
Strategic National Outcomes	Balancing energy security, industrialization, exports, affordability, and climate commitments	Implement integrated National Gas System governance across the entire value chain	Energy security, industrial development, export competitiveness, fiscal resilience, and progress toward Net Zero Emissions	

CONCLUSION

This study has examined Indonesia's natural gas sector through the perspective of an integrated National Gas System, arguing that the country's principal challenge has evolved from maximizing natural gas production toward governing a complex system capable of simultaneously supporting energy security, industrial development, export competitiveness, and the transition to a lower-carbon economy. As domestic demand expands, infrastructure networks become more extensive, and institutional responsibilities grow increasingly interconnected, governance has become as strategically important as geological resource endowment. This finding reinforces the broader literature that emphasizes institutions and governance as the principal determinants of long-term resource-based development (North, 1990; Acemoglu & Robinson, 2012).

The analysis demonstrates that Indonesia's future gas competitiveness depends upon the interaction of seven mutually reinforcing dimensions: resource availability, infrastructure integration, market organization, institutional governance, gas allocation, energy transition, and strategic national outcomes. Together, these dimensions constitute the **National Gas System Framework (NGSF)** proposed in this study. Unlike conventional approaches that evaluate gas industries primarily through production volumes, reserves, or export

performance, the framework emphasizes that national competitiveness emerges from the effectiveness with which these dimensions are coordinated within an integrated governance system.

Several policy implications follow. First, sustaining long-term gas supply requires continued upstream investment supported by regulatory certainty, competitive fiscal arrangements, and accelerated development of frontier and marginal fields. Second, infrastructure policy should prioritize integrated national connectivity through transmission pipelines, LNG logistics, regasification facilities, storage, and city gas networks capable of linking geographically dispersed resources with major demand centres. Third, institutional coordination among the Ministry of Energy and Mineral Resources, SKK Migas, BPH Migas, Pertamina, PT Pertamina Gas Negara Tbk, regional governments, and private investors should be strengthened to reduce regulatory fragmentation and improve implementation efficiency. Fourth, domestic gas allocation should increasingly maximize national value creation by supporting electricity generation, fertilizer production, petrochemical industries, mineral processing, household energy access, and efforts to reduce dependence on imported LPG while maintaining Indonesia's reputation as a reliable LNG supplier. Finally, long-term gas policy should progressively integrate biomethane, carbon capture and storage (CCS), and other low-carbon technologies into the broader evolution of Indonesia's gas system (IEA, 2024; MEMR, 2024).

Beyond Indonesia, this study contributes to the literature on the political economy of natural resources by proposing the National Gas System Framework as an integrated approach to natural gas governance. The framework extends existing scholarship on the resource curse and energy governance by shifting the analytical focus from resource abundance alone toward the governance of interconnected systems comprising institutions, infrastructure, markets, and strategic policy objectives. In doing so, it offers a conceptual framework that is potentially applicable to other resource-rich economies seeking to reconcile resource development, industrial transformation, energy security, and decarbonization.

This study is not without limitations. As a qualitative Strategic Policy Assessment, it does not employ quantitative modelling of gas supply, demand, pricing, or infrastructure optimization. Consequently, the findings should be interpreted as a governance-oriented analysis rather than as a forecasting exercise. Future research could complement the National Gas System Framework by incorporating scenario analysis, system dynamics modelling, techno-economic assessment, or comparative studies across gas-producing countries to evaluate how different institutional arrangements influence long-term gas system performance.

In conclusion, the future success of gas-producing nations will depend not merely on the volume of natural gas they extract or export, but on how effectively they govern integrated gas systems that transform geological resource endowments into energy security, industrial competitiveness, environmental sustainability, and broad-based national prosperity.

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