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LTMS-PIP for ASEAN Energy Integration: How the Members' National Interests Drive the Cooperation

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Abstract

This article analyzes the involvement of Lao PDR, Thailand, Malaysia, and Singapore in the Lao PDR-Thailand-Malaysia-Singapore Power Integration Project (LTMS-PIP) using a descriptive, qualitative approach based on a literature review, emphasizing each country's national interests. LTMS-PIP marks the first multilateral electricity trading project in ASEAN and represents the initial step toward realizing the ASEAN Power Grid. This article explains how each country's national interests shape cooperation that drive this project's success, and how these interactions reflect complex interdependence in international relations. The results indicate that the LTMS-PIP succeeds when the national interests of the four countries align. Lao PDR uses the LTMS-PIP to expand its electricity export market, aiming to overcome geographical limitations and strengthen state revenue. Thailand secures strategic advantages by controlling the Mekong region's transmission network through EGAT's role. Malaysia leverages this project to reinforce its position as a transit hub while advancing the energy transition agenda in NETR. Meanwhile, Singapore deploys LTMS-PIP as an energy diversification instrument to reduce its reliance on natural gas and achieve its decarbonization goals.

Key Words: ASEAN Power Grid, LTMS-PIP, National Interests, hydropower, multilateral cooperation, renewable energy.

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INTRODUCTION

Global energy demand will inevitably increase alongside economic and population growth. Southeast Asia is a dynamic region already experiencing a sharp rise in energy demand. The Southeast Asian economy will become the fourth-largest in the world, with a population of 770 million, by 2040 (Allurentis, 2022). This combined demographic and economic growth will drive regional electricity demand to triple from 1,002 terawatt-hours in 2017 to 3,123 terawatt-hours in 2040 (Nian et al., 2022). Yet, in 2020, more than 76 percent of power plants in Southeast Asia relied on fossil fuels, mainly coal (ASEAN Center for Energy, 2022). As a result, CO2 emissions are on track to increase 2.5 times by 2040 (ASEAN Center for Energy, 2021). Countries in the region aim to transition to low-carbon energy by 2050 to 2065. However, production capacity and energy resource availability remain uneven. Some countries possess major electricity potential, such as Laos and parts of Vietnam with large hydropower capacity, while others face high energy needs with limited domestic resources, such as Singapore. These disparities in resources and market structures drive the development of regional electricity interconnection initiatives, which are essential for sharing renewable energy resources and reducing reliance on fossil fuels (Huda et al., 2023).

Southeast Asian countries have promoted regional energy cooperation through ASEAN. One of its main initiatives is the ASEAN Power Grid (APG), launched in 1997 (SIEW Thinktank Roundtabl, 2021). The APG represents ASEAN's ambition under the ASEAN Vision 2020 to connect the electricity grids of all Southeast Asian countries through cross-border transmission lines (SIEW Thinktank Roundtabl, 2021). The initiative aims to interconnect cross-border electricity systems across the region. Its goals are to improve energy security, supply efficiency, and support the transition to sustainable energy. Yet, more than two decades after its launch, the APG is not fully realized. The regional electricity network requires enormous technical and investment resources, so development remains based on bilateral agreements (Huda, 2024).

In 2022, ASEAN promoted a more integrated and multilateral pilot project. This involved four countries: the Lao PDR-Thailand-Malaysia-Singapore Power Integration Project (LTMS-PIP). This project is the first concrete step toward multilateral electricity trade in Southeast Asia. The main objective of LTMS-PIP is to improve regional energy connectivity by using hydropower from Laos to meet rising demand in neighboring countries like Thailand, Malaysia, and Singapore (ASEAN Center for Energy, 2023). By facilitating hydropower trade, the project aims to reduce reliance on fossil fuels, promote renewable energy, enhance energy

security, and demonstrate multilateral cooperation in cross-border electricity trade within ASEAN (Huda et al., 2023).

The implementation of LTMS-PIP requires technical and regulatory coordination between four different national electricity systems, including the setting of transmission tariffs, power sales mechanisms, and export capacity agreements (Chen et al., 2024). However, this project is fundamentally shaped not just by technical issues of electricity grid interconnection, but also by the political and economic dynamics between countries. This article argues that national interests and bargaining positions strongly determine the direction of cooperation, the negotiation process, and prospects for expansion in the LTMS-PIP. Thus, the core focus of this research is to analyze how the national interests of the countries involved influence the implementation of LTMS-PIP, and to examine the resulting interdependence within the context of ASEAN regional energy integration.

Literature Review

Previous studies have explored ASEAN energy integration. (Ahmed et al., 2017)), highlight Southeast Asia's energy infrastructure and ASEAN's renewable energy potential, emphasizing that regional integration could boost welfare if renewables are optimized. Likewise, (Kanchana & Unesaki, 2015)) studied ASEAN energy security and found that, despite abundant resources for transition, their use remains suboptimal due to capacity constraints and uneven infrastructure.

Building on these perspectives, (Do & Burke, 2023) complemented this discourse by examining the dynamics of cross-border electricity trade and found that the ASEAN energy integration process is progressing very slowly, except for Laos, which has been able to significantly increase its electricity exports. They assessed that economic and institutional barriers remain difficult to overcome soon, making bilateral trade the most realistic option. These findings are relevant to this article because LTMS-PIP demonstrates how cross-border electricity trade can be expanded incrementally, despite ASEAN's limited readiness for full multilateral integration.

In a more specific context, several studies have mapped countries' motivations and methods in regional energy cooperation. For example, (Islam et al., 2022) examined Malaysia's involvement in two projects: the Malaysia-Thailand Joint Development Area (MT-JDA) and APG. The study found that, while Malaysia lacks an explicit energy diplomacy strategy, it consistently relies on the ASEAN Way, a non-confrontational, consensus-based, and peaceful approach, when managing cross-

border energy cooperation. These findings show that ASEAN energy cooperation is strongly shaped by regional political dynamics and a diplomatic style focused on stability in inter-state relations.

Further broadening the discussion, another study by (Shi et al., 2019) reviewed ASEAN's electricity connectivity and identified that regional electricity grid integration still faces complex political, legal, economic, and technical obstacles. The study emphasized that cross-border electricity trade can only develop if ASEAN countries have a high level of political trust and can harmonize their regulations and technical standards. These various obstacles indicate that multilateral integration is not yet fully possible, thus requiring stronger regional coordination mechanisms to accelerate energy cooperation. This study recommends strengthening coordination forums and high-level dialogue as important prerequisites before ASEAN can move towards more integrated electricity trade. These findings are relevant to this study because LTMS-PIP emerges as a concrete example of how cross-border coordination can overcome these structural limitations and pave the way for the gradual integration of ASEAN energy.

While existing studies have provided insights into ASEAN's energy potential, integration barriers, and energy diplomacy, they remain insufficient to explain how multilateral electricity cooperation is politically negotiated and implemented in practice. Most analyses emphasize technical feasibility, institutional design, or depoliticized process. As a result, the role of national interests and bargaining positions in shaping concrete multilateral energy projects remains underexplored. This limitation is particularly evident in the case of the LTMS-PIP, which represents the first operational multilateral electricity trading arrangement in ASEAN and therefore offers a critical empirical opportunity to examine how interest-driven cooperation produces structured interdependence within regional energy integration. Based on this gap, this article addresses the following research question: How do national interests shape the implementation of the LTMS-PIP and the resulting patterns of interdependence, as part of ASEAN regional energy integration?

Theoretical Framework

a. National Interest

According to Hans J. Morgenthau, national interest reflects a country's ability to survive. It focuses on protecting its physical, political, and cultural identity from external threats (Morgenthau, 1952). More generally, national interest refers to the shared goals a country pursues to meet society's needs. This view rejects the idea that society is only a tool for legitimizing political decisions. Instead, it sees the national community as an entity united by political norms and ethics.

National interests serve as a nation's identity to other nations. Each country needs goals to uphold its existence and dignity. Achieving national interests often depends on a country's ability to mobilize its resources. Thus, national interests include more specific goals, such as protecting strategic assets vital for security. These goals may involve ports, military bases abroad, or other important controls. In practice, states divide national interests based on what is most urgent at a given time.

National interests are the primary basis for a country's international decisions. Each country defines these interests differently, but the concept guides foreign policy and represents collective aspirations. National interests are broken down into operational objectives that countries pursue through tools such as diplomacy and cooperation. With these instruments, countries seek to implement both economic and political strategies in line with prevailing international conditions.

The theory of national interest provides the analytical lens to explain why the Lao PDR-Thailand-Malaysia-Singapore Power Integration Project (LTMS-PIP) has been able to move forward as the first operational multilateral electricity trading scheme in ASEAN. Rather than viewing regional energy cooperation as driven by normative commitments or institutional ideals, the theory allows this article to identify the concrete political and economic motivations that shape each country's participation, bargaining position, and role within the project.

b. Complex Interdependence

Robert Keohane and Joseph Nye, in their book "Power and Interdependence," put forward the concept of complex interdependence, which was developed from a simple form of interdependence (Keohane & Nye, 2004). Complex interdependence refers to a situation in which multiple forms of reliance connect countries, going beyond traditional patterns of dependence, which typically involve one-sided reliance of one country on another. In this context, an "actor" means any participant in international relations, including states and non-state entities such as

international organizations or corporations. Modern international relations are no longer dominated by military power, as countries are now bound in a broad, multidimensional network of mutual dependence. Interdependence, in a broad sense, refers to a condition in which the decisions or actions of one actor affect others. This interconnectedness arises through various forms of cooperation, such as economic, environmental, socio-cultural, and energy ventures, that support statehood and international relations. These sectors are interlinked, with high levels of interaction among them. Complex interdependence describes the condition where countries rely on each other to fulfill vital needs, providing a strong incentive to avoid conflict because the costs rise as reciprocal relationships deepen.

Keohane and Nye emphasize that in the context of complex interdependence, international relations are no longer dominated by a single formal channel between governments (Keohane & Nye, 2004). Instead, relations occur through a broader network that includes non-state actors, international organizations, and even bureaucratic units within a country. This condition creates a new dynamic because each international actor has different goals, varying levels of capacity, and dependencies that are not always balanced.

Based on these developments, Keohane and Nye identify three main characteristics of complex interdependence:

1. The presence of multiple channels of interaction that go beyond official diplomatic relations. Here, "channels" refers to the ways in which information and influence can flow, such as through exchanges among government agencies, international organizations, or non-state actors.
2. The existence of various issues that do not have a fixed hierarchy, where non-traditional security issues, such as economic, environmental, and socio-cultural issues, can become more dominant than traditional security issues, namely military issues. Here, “hierarchy” relates to the absence of a predetermined ranking of issues in importance, emphasizing that priorities can shift depending on context.
3. The increasingly limited role of military force in addressing issues between international actors. In this context, "international actors" include not only nation-states but also organizations, corporations, and other entities operating across borders.

In addition, Keohane and Nye introduced two elements: sensitivity and vulnerability. Sensitivity indicates the level of response or direct impact a country experiences due to changes in other actors under conditions of interdependence. Vulnerability describes a country's ability to respond or seek alternatives when

these changes affect its interests. The distinction between the two is that sensitivity measures immediate effects, while vulnerability assesses the ability to adapt or find substitutes.

In the context of increasingly complex interdependence, the concept of diversification has also emerged. Diversification refers to actions by actors, such as countries, companies, or organizations, to spread their dependencies across multiple partners or sectors, reducing reliance on any single channel or resource. From a realist perspective, diversification is understood as an effort to reduce excessive dominance or dependence on one party to maintain stability and reduce political vulnerability. Within a liberal framework, diversification is seen as a strategy for multilateral cooperation that promotes economic growth, trade, and peace between countries (Keohane & Nye, 2004). Both approaches show that diversification is a logical response to deep dependence and is directly connected to modern sectors such as energy and trade. Diversification involves not only states but also multinational companies, international organizations, NGOs, and the private sector, indicating that the process occurs through multi-actor collaboration that reflects diverse interests and issues.

Keohane and Nye also highlight that complex interdependence brings a number of consequences. First, each actor has different goals. Here, "actor" includes both states and transnational actors. Second, the power of actors in interdependent networks is influenced by the resources they possess; in this context, "resources" refers to assets such as economic strength, technological capacity, or political influence. Third, international regimes, meaning sets of rules, norms, and institutions governing international interactions, are becoming increasingly important as arenas for coordination, transparency, and the formation of a common agenda to address cross-border issues.

Overall, the theory of complex interdependence offers a more comprehensive perspective on understanding contemporary international relations. Interdependence is no longer just a matter of economic interconnection, but encompasses the entire spectrum of mutually influential global issues. Therefore, multi-sector and multi-actor cooperation is an inevitable necessity to maintain stability, improve welfare, and manage increasingly complex dependencies among countries.

In this article, the theory of complex interdependence provides an analytical lens to explain how cooperation among Lao PDR, Thailand, Malaysia, and Singapore is structured and sustained within the LTMS-PIP. Rather than interpreting regional energy cooperation as a hierarchical or power-dominated arrangement, this

framework highlights how multiple non-military channels, asymmetric patterns of dependence, and institutionalized coordination shape interaction among participating states. Through this lens, the article examines how sensitivity and vulnerability influence bargaining positions, risk-sharing, and role differentiation within the project, thereby explaining how multilateral electricity trade can function despite unequal capabilities and interests.

METHOD

This study adopts a qualitative case study design focusing on the Lao PDR-Thailand-Malaysia-Singapore Power Integration Project (LTMS-PIP). Qualitative method is chosen based on the suitability based on the fact that it is a research approach that seeks to understand social phenomena by exploring participants' experiences, meanings, and perspectives in their natural settings through non-numerical data such as interviews, observations, and documents (Creswell, 2014). In another consideration, qualitative method is used because of this study focus on specific phenomena in a certain region which aligns with the nature of qualitative approach that focuses on interpreting meanings and understanding how individuals construct reality within specific social and cultural contexts, emphasizing depth, process, and context rather than measurement and generalization (Denzin & Lincoln, 2018).

The case study approach is selected to allow an in-depth examination of the political and institutional dynamics shaping the implementation of the project. The analysis is based on secondary data, including official ASEAN documents, government policy papers, project reports, publications from regional energy institutions, news articles, and journal articles. Data were analyzed through qualitative analysis, focusing on how national interests and bargaining positions are reflected in project design, negotiation outcomes, and implementation arrangements. The findings are interpreted using national interest theory by Hans J. Morgenthau, and complex interdependence theory by Keohane and Nye (Keohane & Nye, 2004; Morgenthau, 1952).

RESULT AND DISCUSSION

Mechanisms of Cooperation in the Lao PDR-Thailand-Malaysia-Singapore Power Integration Project (LTMS-PIP)

The LTMS-PIP initiative began as a pilot project for the first multilateral electricity interconnection in Southeast Asia, first announced in 2013 at the ASEAN Senior Officials Meeting on Energy in Manado, Indonesia (International Energy Agency, 2019). From the perspective of national interest theory, the gradual evolution of the project reflects the cautious alignment of state preferences in a politically sensitive sector. Initially, the project did not include Singapore and was proposed as the LTM-PIP in 2018, involving the transfer of 100 megawatts (MW) of electricity from Laos to Malaysia. In 2020, during the 38th ASEAN Ministers on Energy Meeting (AMEM), Laos, Thailand, Malaysia, and Singapore committed to start cross-border electricity trading in a Joint Statement at the 1st LTMS Ministerial Meeting (Keppel Electric Pte Ltd, 2022). This commitment was reaffirmed at the 39th AMEM through a Second Joint Statement. The project officially commenced on June 23, 2022, with a two-year pilot period facilitating the import of 100 MW of electricity from Laos to Singapore via Thailand and Malaysia. After 2024, the import capacity is scheduled to increase to 300 MW for the subsequent five years (International Energy Agency, 2019).

The LTMS-PIP electricity trading mechanism includes several key steps: generation, transmission/transit, and import, as shown in Figure 1. First, hydropower plants at the Xayaburi and Nam Theun dams in Laos generate electricity. The transmission network in Thailand acts as the transit country, wheeling the electricity through its AC transmission lines, and then the High Voltage Direct Current (HVDC) network transmits the power to Malaysia as the off-taker country that receives the electricity from Thailand. In this process, Laos pays transmission fees to both countries. Furthermore, Singapore, as the main buyer, imports electricity from Malaysia through the AC network. As of August 2023, one year after the first transaction, the four countries have traded a total of 280,000 MWh of energy (TENAGA NASIONAL BERHAD, 2023).

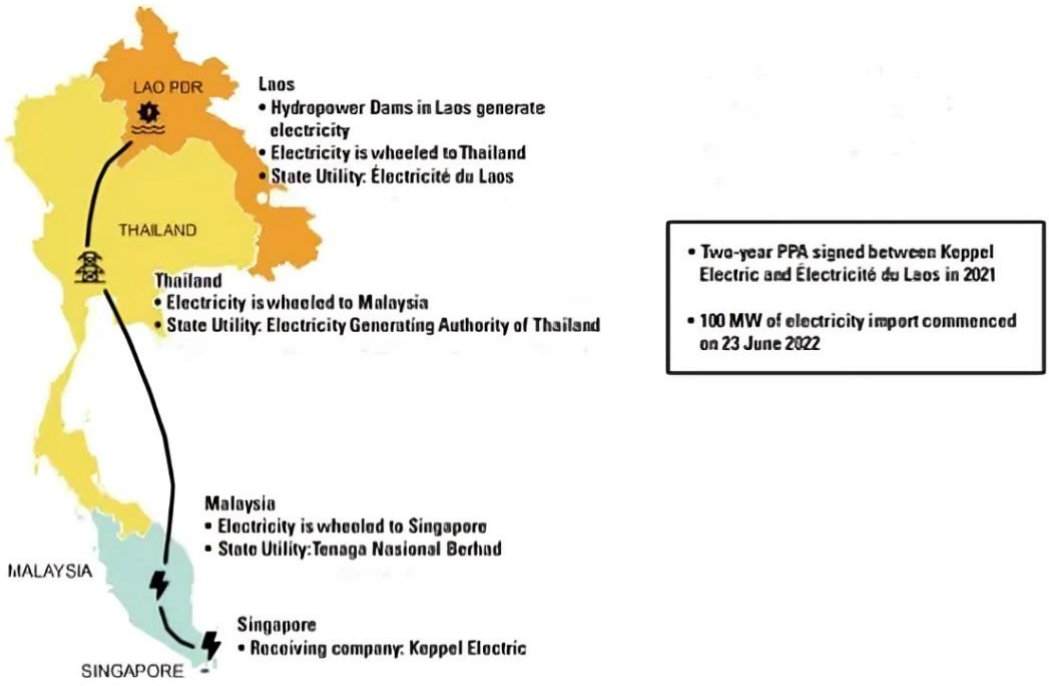

Figure 1. The Lao PDR-Thailand-Malaysia-Singapore Power Integration Project *(Tenaga Nasional Berhad, 2023)*.

Institutionally, LTMS-PIP demonstrates how state-led cooperation under complex interdependence operates through government-controlled actors rather than centralized regional authority. Each participating country is represented by its state-owned electricity company: *Électricité du Laos* (EDL), Electricity Generating Authority of Thailand (EGAT), Tenaga Nasional Berhad (TNB), and SP Power Assets (SPPA). As national grid operators, these entities are authorized to manage cross-border electricity transmission. Consequently, LTMS-PIP operates as an intergovernmental process in which political commitments are operationalized through formal technical, regulatory, and commercial agreements (Tenaga Nasional Berhad, 2023).

The flow of electricity across borders is governed by a series of layered technical agreements that reflect bargaining dynamics among interdependent states. For electricity from Laos to flow to Singapore, a set of technical agreements is required to govern transit through Thailand and Malaysia. The key document at this stage is the LTMS Energy Wheeling Agreement involving EDL, EGAT, and TNB. This agreement stipulates the wheeling fee arrangements, transmission capacity, and technical responsibilities of each grid operator. EGAT plays a strategic role in setting operational terms and parameters, including network stability aspects, as Thailand is the main transit country. Furthermore, the continuity of electricity flow

requires the refinement of the Interconnection Agreement between Malaysia and Singapore, as outlined in the Fifth Supplemental Agreement between TNB and SPPA. Additionally, a Supplemental Letter to the HVDC System Interconnection Agreement between EGAT and TNB was developed to ensure the readiness of the HVDC infrastructure on the Thailand-Malaysia route. Together, these agreements establish a coordinated technical architecture that enables electricity to flow through three jurisdictions before reaching its final point of consumption (Tenaga Nasional Berhad, 2023).

Viewed through the lens of complex interdependence, LTMS-PIP cooperation operates across multiple levels of interaction involving both state and non-state actors. At the intergovernmental level, national grid operators regulate infrastructure, interconnection, system stability, and physical electricity transmission. At the commercial level, electricity purchase agreements are conducted between Malaysia and Singapore, allowing private actors such as Keppel Electric Pte Ltd to participate through Corporate Power Purchase Agreements (PPAs). Although Keppel Electric is not directly involved in interconnection agreements, it plays a critical role in distributing imported electricity within Singapore's liberalized electricity market. This dual structure illustrates how state oversight and private sector mechanisms coexist within the LTMS-PIP framework (Keppel Electric Pte Ltd, 2022).

In addition to the main agreements, LTMS-PIP is also regulated by working groups and four task forces focusing on technical feasibility, legal and regulatory frameworks, commercial arrangements, and tax and tariff structures led by each relevant country to collectively contribute to project development, as shown in Figure 2. This working structure has successfully coordinated stakeholders from various utility companies, regulatory bodies, and ministries across the four countries to regulate energy trading (Huda et al., 2023).

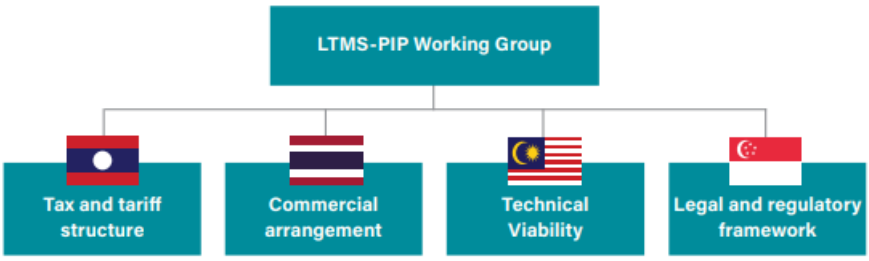

Figure 2. Governance Structure of LTMS-PIP (Huda et al., 2023)

The LTMS-PIP project gained strong legitimacy due to consistent, high-level political support from participating countries. For nine years, this project appeared in every Joint Ministerial Statement at the ASEAN Ministerial Meeting on Energy (AMEM) from the 32nd to 41st sessions. This shows that the interconnection is discussed beyond the technical level and is prioritized in the region's diplomatic agenda (Huda, 2024). Support is also evident in forums with state leaders and in statements from foreign ministry officials. This indicates LTMS-PIP is part of ASEAN's long-term strategic commitment to energy integration. The project, therefore, stands on a mature political foundation, which is essential for large-scale interconnection initiatives to succeed.

Taken together, the cooperation mechanisms established under the LTMS-PIP demonstrate how multilateral electricity trading is structured through negotiated arrangements rather than purely technical integration. From the perspective of national interest theory, these mechanisms reflect efforts by participating states to safeguard their respective preferences and bargaining positions through institutional, regulatory, and contractual frameworks. At the same time, viewed through the lens of complex interdependence, the LTMS-PIP creates patterns of cross-border reliance by linking electricity infrastructure, coordinating multiple state and non-state actors, and prioritising economic and energy security considerations over military concerns. The interaction of these dynamics indicates that cooperation in LTMS-PIP emerges from the alignment of interests within an interdependent setting, without requiring the erosion of state authority or centralized regional governance.

Lao PDR as the Battery of Southeast Asia

In LTMS-PIP, Laos acts as the main supplier of electricity from its hydroelectric dams. This important role is closely tied to its geographical position. Specifically, as a landlocked country, Laos faces structural challenges in economic development. This geographical situation, in turn, limits the country's ability to interact freely with the international economic system. As a result, Laos must contend with high logistics costs, dependence on neighboring countries' infrastructure, and limited access to international markets (Wicaksono, 2017). Consequently, Laos' GDP grows slightly more slowly than that of its neighbors and is classified as a low-income country. For example, in 2013, Laos' GDP per capita was USD 1,548, far below the

ASEAN average (USD 3,832), as shown in Figure 3 (King Mongkut's Institute of Technology Ladkrabang (KMITL) et al., 2017).

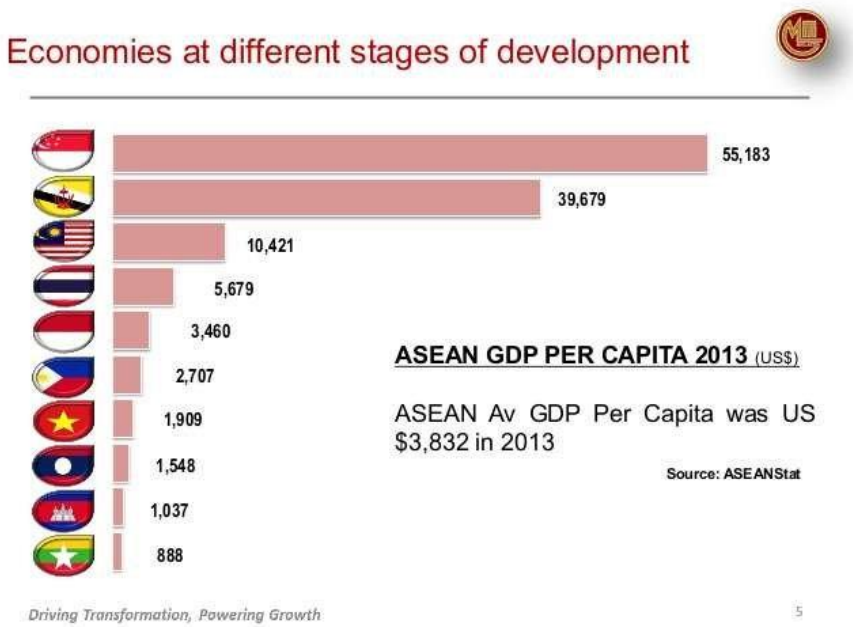

Figure 3. Economies at Different Stages of Development (King Mongkut's Institute of Technology Ladkrabang (KMITL) et al., 2017)

From a national interest perspective, these structural constraints shape Laos' preference for outward-oriented economic strategies that rely on regional cooperation rather than domestic market expansion. As a landlocked country, Laos faces structural challenges in its economic development process. The lack of sea access means that Laos has to bear higher logistics costs than other ASEAN countries. All foreign trade activities must go through the ports of neighboring countries, such as Thailand and Vietnam. This dependence increases transportation costs and limits Laos' economic competitiveness, especially in manufacturing and trade (Wicaksono, 2017). Therefore, to catch up with its neighbors, Laos should view these geographical barriers as an incentive to build constructive cooperation with transit countries. Strengthening regional relations and developing cross-border infrastructure can help Laos reduce logistics costs and expand connectivity, thereby enabling it to expand its economic activities.

Given these geographical limitations, Laos must optimize its domestic resources with high economic potential. Water is one of the most abundant resources. This resource-based strategy illustrates how national interests are defined by the need to compensate for geographical disadvantages through sectoral specialization. Laos has a large river network, including the Mekong River and its tributaries. This

potential encouraged Laos to develop the hydropower sector as a key part of its national economic strategy. As of 2021, Laos had 78 operating hydroelectric dams with a total capacity of 8,108 MW. This capacity shows the country has become one of the largest hydropower producers in the Mekong region (Runde et al., 2022). Using water as an energy commodity is a realistic step for Laos to overcome its geographical limitations and expand its economic space.

This policy direction is reflected in the Electricity Development Strategy of Lao PDR (2021–2030). The strategy affirms that Laos' energy mix will remain dominated by hydropower at 75 percent. Coal-fired thermal power follows at 14 percent, and other renewable energy at 11 percent. The strategy emphasizes not only energy production development but also expanding domestic transmission connectivity. It also develops cross-border interconnection networks to support electricity trade in the Mekong and ASEAN regions. Laos also targets increasing electricity reserve capacity to 15 percent of total domestic demand. This is a measure to ensure energy security and maximize export potential (Huda et al., 2023).

Laos' energy export plans are on a large scale. The government targets electricity exports of over 9,000 MW to Thailand, 5,000 MW to Vietnam, 3,000 MW to Cambodia, 500 MW to Myanmar, and 300 MW to Malaysia (Huda et al., 2023). The large amount directed overseas shows this sector has become the backbone of Laos' income. Thus, Laos' involvement in LTMS-PIP is not an incidental decision. Rather, it is a planned economic strategy to expand exports to Malaysia and Singapore, which have higher purchasing power and steady energy demand. Diversifying electricity export markets reduces Laos' dependence on Thailand as its main buyer and transit route. This enhances Laos' bargaining position in regional energy trade.

Therefore, Laos' identity as the "Battery of Southeast Asia" is not just a slogan. It is a logical consequence of a national development strategy that uses water potential to overcome geographical limitations and drive economic growth. This strategy also strengthens regional energy integration through schemes such as LTMS-PIP (Wicaksono, 2017).

Observed through the lens of national interest theory, Laos' engagement in the LTMS-PIP reflects a rational strategy to convert structural constraints into economic opportunities by leveraging hydropower as a core national asset. The development of electricity exports is not merely a technical response to energy demand, but a deliberate policy choice aimed at expanding economic space, securing foreign revenue, and improving bargaining capacity within regional energy arrangements. At the same time, from a complex interdependence perspective, Laos' participation in LTMS-PIP embeds its energy strategy within a network of

cross-border infrastructure, institutional coordination, and long-term contractual relations. These interdependencies do not eliminate Laos' national priorities, but rather provide a cooperative framework through which those priorities can be pursued in an interconnected regional energy system.

Thailand's Leverage as the Mekong Transmission Hub

Although Thailand does not play a major role as an electricity supplier or buyer in the LTMS-PIP scheme, its involvement is still driven by significant national interests. As a transit country, Thailand gains strategic advantages that align with its national energy agenda and its role in regional integration. Thailand has long been the center of the Mekong sub-region's electricity network. It has the most advanced transmission infrastructure and is connected to Laos, Malaysia, Cambodia, and Myanmar (Sangpetch, 2024). Through LTMS-PIP, Thailand strengthens its position as a "Regional Grid Hub," becoming an important node in ASEAN cross-border electricity trade (samym, 2025). A regional energy (or grid) hub refers to a geographically and institutionally central node where energy flows are coordinated, transmitted, and regulated across borders, supported by advanced infrastructure and governance capacity (Harbinger Content Team, 2025). In the context of ASEAN, a regional energy hub reflects a country which possesses the infrastructure, regulatory capacity, and cross-border connectivity that enables it to become a regional electricity trading hub and distributor. This status gives Thailand greater political and technical influence over regional energy development. The Mekong-ASEAN interconnection scheme is likely to depend on Thailand's infrastructure and regulations. From a national interest perspective, Thailand's role as a transit country allows it to convert infrastructural centrality into regulatory and political leverage within regional electricity cooperation.

Second, Thailand's participation in this project will provide economic benefits. These include transit fees, use of EGAT infrastructure, and increased network efficiency. Laotian electricity flowing south, whether to Malaysia or Singapore, must pass through Thailand's transmission system. This creates new revenue and strengthens EGAT's position as a key player in regional energy trade (samym, 2025). Increased electricity flows across the domestic network help Thailand maximize the use of existing infrastructure. This reduces operating costs per unit and strengthens network stability. In other words, Thailand gains economic benefits even though it is not an electricity buyer. These economic gains demonstrate that Thailand's participation in LTMS-PIP is driven not by electricity consumption needs, but by the strategic value of controlling transmission corridors in a regionalized energy system.

On the other hand, Thailand's involvement in LTMS-PIP matches its long-term energy strategy. This strategy is outlined in the Power Development Plan (PDP) 2018-2037 and the Thailand Integrated Energy Blueprint. The country aims to increase the share of clean energy, reduce emissions, and strengthen regional energy links to achieve carbon neutrality by 2050. This target includes increasing renewable energy above 50 percent and boosting energy efficiency above 30 percent. Thailand has also adopted the 4DIE strategy: decarbonization, digitalization, decentralization, deregulation, and electrification. This framework guides its energy sector modernization. In the PDP, Thailand aims to have more than half of the new power plants use renewable energy. The plan also sets a carbon emissions limit of 63 $MtCO_2e$ (Huda et al., 2023). Thailand is committed to becoming a key transit country in the APG. LTMS-PIP provides a foundation to test network interoperability, regulatory harmonization, and cross-border technical standards. By participating in the project, Thailand strengthens its energy security and its chances of becoming a regional electricity trading hub in the future.

Politically, Thailand's involvement strengthens its diplomatic relations with Laos, a major electricity supplier that helps meet part of its domestic needs (samym, 2025). Although Thailand acts as a transit country, participation in LTMS-PIP adds substantial political and economic benefits. Thailand strengthens its position as the center of the Mekong and ASEAN electricity networks. It also generates economic revenue from cross-border electricity flows and supports its national clean energy agenda.

Thailand's participation in the LTMS-PIP represents a strategic effort to transform infrastructural centrality into political and regulatory advantage within regional energy cooperation. By functioning as a transit country, Thailand can derive economic returns, advance domestic energy policy objectives, and exercise influence over the operational rules governing cross-border electricity flows without bearing the costs associated with large-scale production or consumption. Within a context of complex interdependence, Thailand's transmission centrality creates sustained patterns of reliance among interconnected electricity systems, requiring continuous coordination and institutional engagement. These interdependencies do not constrain Thailand's autonomy, instead they enhance its leverage by making regional electricity exchanges increasingly dependent on its infrastructure and governance capacity.

Malaysia's Dual Role: Transit State and Future Clean Energy Exporter

Malaysia's role in LTMS-PIP is as a transit country connecting electricity flows from Laos to Singapore. However, Malaysia's involvement in this project also reflects more strategic and substantial national interests. This cannot be separated from Malaysia's long history of promoting ASEAN energy integration. Since the inception of APG, Malaysia has been one of the most active countries in developing regional energy connectivity. Malaysia was the APG coordinating country for the 2013–2017 period, played an important role in the High-Level Task Force on ASEAN Power Grid (HLTF-APG) until 2023, and has been involved in HAPUA since the 1990s (Basu-Das et al., 2025). In addition, Malaysia has strong technical capital through two active interconnections, Malaysia–Thailand (MY-TH) and Malaysia–Singapore (MY-SG), making it one of the most strategic power grid nodes in Southeast Asia. This reputation positions Malaysia as one of the driving forces behind regional energy cooperation, making its involvement in LTMS-PIP not merely complementary but part of its consistent role in promoting regional energy integration. Malaysia's position in this configuration is critical because the project will not proceed without Malaysia's participation, as electricity from Laos to Thailand cannot reach Singapore without passing through Malaysia's grid. Thus, Malaysia is both a bottleneck and a determinant of the success of LTMS-PIP. Malaysia's active involvement demonstrates its long-term commitment to ASEAN energy integration, strengthens its credibility as a country with a stable electricity grid infrastructure, and solidifies its position as a potential transit hub for regional electricity trade in the future.

This aligns with Malaysia's domestic energy policy, which increasingly emphasizes the importance of LTMS-PIP in its national strategy. Through the Malaysia Renewable Energy Roadmap (2021) and the National Energy Transition Roadmap (NETR) 2023, Malaysia aims to increase the share of renewable energy to 31 percent by 2025 and 40 percent by 2035. In the long term, Malaysia aims to increase installed renewable energy capacity to 70 percent by 2050 (Huda et al., 2023). This energy transformation not only focuses on domestic low-carbon energy production. It also aims to strengthen cross-border energy trade, enabling ASEAN energy market integration. In this context, Malaysia views LTMS-PIP as an instrument that not only opens up regional electricity trade channels but also strengthens Malaysia's capacity to export renewable energy in the future, especially to premium markets such as Singapore. In other words, Malaysia sees LTMS-PIP as part of its national energy transition strategy, not merely a transit scheme.

Beyond technical interests, Malaysia's political motivation in LTMS-PIP is much greater. First, Malaysia has a long-term ambition to become an ASEAN Energy Hub, as reflected in NETR 2023, which explicitly targets renewable energy export opportunities (Hananto, 2025). Singapore is the most profitable and stable energy market. LTMS-PIP serves as a starting point for testing and normalizing energy trade with Singapore before Malaysia exports green energy on a large scale (The Malaysia Voice, 2024). Malaysia's participation reflects a deliberate strategy to assert regional leadership in ASEAN energy integration. Historically, Malaysia has played a central role in advancing ASEAN Power Grid (APG) initiatives, signaling its long-term commitment to regional cooperation. Its active role in the High-Level Task Force on ASEAN Power Grid (HLTF-APG) and as the APG coordinating country from 2013 to 2017 shows Malaysia's enduring leadership in energy governance. Through these engagements, Malaysia has cultivated not only institutional credibility but also technical expertise and diplomatic capital. Its established interconnections with Thailand (MY–TH) and Singapore (MY–SG) provide a practical foundation for further regional integration. In the context of LTMS-PIP, these interconnections symbolize Malaysia's readiness to function as the central node linking continental and maritime Southeast Asia. Thus, Malaysia's role is not passive, it is that of a facilitator and architect of the ASEAN power grid. Without Malaysia's infrastructure and coordination, the project's success would be structurally impossible.

Second, Malaysia's involvement in LTMS-PIP allows the country to maintain leverage in the Mekong region. It aligns seamlessly with its domestic policy priorities. The Malaysia Renewable Energy Roadmap (MyRER, 2021) and National Energy Transition Roadmap (NETR, 2023) both underscore the government's ambition to transform the national energy landscape toward renewable energy and cross-border trade. Malaysia's renewable energy targets demand not only internal generation but also external market access and technological collaboration. LTMS-PIP offers a real-world mechanism for Malaysia to operationalize these strategies. By facilitating electricity flow between Laos and Singapore, Malaysia gains valuable experience in managing large-scale grid integration, balancing cross-border power systems, and ensuring grid stability. Furthermore, the project positions Malaysia to eventually export its own renewable energy particularly solar and hydro once its domestic generation capacity expands. In this way, LTMS-PIP functions as both a rehearsal for and an enabler of Malaysia's long-term energy export ambitions. Malaysia has an interest in remaining part of the Mekong–ASEAN energy architecture to avoid being sidelined from strategic developments in the subregion. Third, economically, as a transit country, Malaysia gains benefits through transit fees and control over regional electricity nodes. This structurally provides political

influence because regional electricity flows depend on the stability of Malaysia's grid (Basu-Das et al., 2025).

The political motivations behind Malaysia's participation are equally significant. Malaysia views energy connectivity not only as an economic instrument but as a diplomatic tool to strengthen its influence within ASEAN. The project reinforces Malaysia's strategic presence in the Mekong subregion, an area often dominated by the Laos–Thailand energy axis. By acting as the indispensable intermediary between mainland and maritime ASEAN, Malaysia ensures it remains integral to the regional energy architecture. This prevents strategic marginalization and provides Malaysia with leverage in both bilateral and multilateral negotiations. Additionally, the ability to control electricity transit flows offers Malaysia structural power: any disruption or delay in the Malaysian grid could impact electricity trade between neighboring states. This technical dependency translates into geopolitical influence, enhancing Malaysia's bargaining position within ASEAN energy diplomacy.

Thus, Malaysia's involvement in LTMS-PIP is based on decisions that strengthen its political, economic, and energy position. LTMS-PIP provides Malaysia with the opportunity to establish itself as the center of the ASEAN energy network. It also allows Malaysia to increase revenue and strategic control, strengthen regional diplomatic relations, and advance the national energy transition agenda. Malaysia's participation in LTMS-PIP illustrates how national interest is pursued through institutionalized interdependence rather than direct control. By functioning as the sole transmission corridor linking mainland and maritime Southeast Asia, Malaysia converts grid infrastructure into a source of structural power that generates both economic benefits and political influence. This position creates an asymmetric pattern of interdependence, while Laos and Singapore are highly sensitive to the reliability of Malaysia's transmission system, Malaysia itself remains less vulnerable because it does not rely on LTMS-PIP electricity imports to satisfy domestic demand. At the same time, Malaysia's long-standing engagement in APG-related institutions and technical coordination reflects the logic of complex interdependence, where influence is exercised through regulatory capacity, credibility, and agenda-setting across multiple non-military channels. In this sense, LTMS-PIP serves not merely as a transit arrangement but as a strategic mechanism through which Malaysia consolidates its hub ambition, prepares future renewable energy exports, and embeds itself structurally within ASEAN's evolving energy governance framework.

Singapore and the Quest for Energy Diversification

Singapore is known for its highly integrated economic structure with global markets. Political stability, clear regulations, and a competitive business environment make Singapore one of the largest investment destinations in Asia. High foreign investment inflows over several decades have driven Singapore's consistent economic growth, making it one of the most advanced economies in ASEAN with the highest standard of living (Setyawati & Lolla, 2024). However, this economic growth has been accompanied by rising energy demand, as expanding commercial and industrial activities require more energy. As Singapore's economy depends heavily on global business activity, continued growth directly increases the nation's overall energy consumption, as shown in Figure 4.

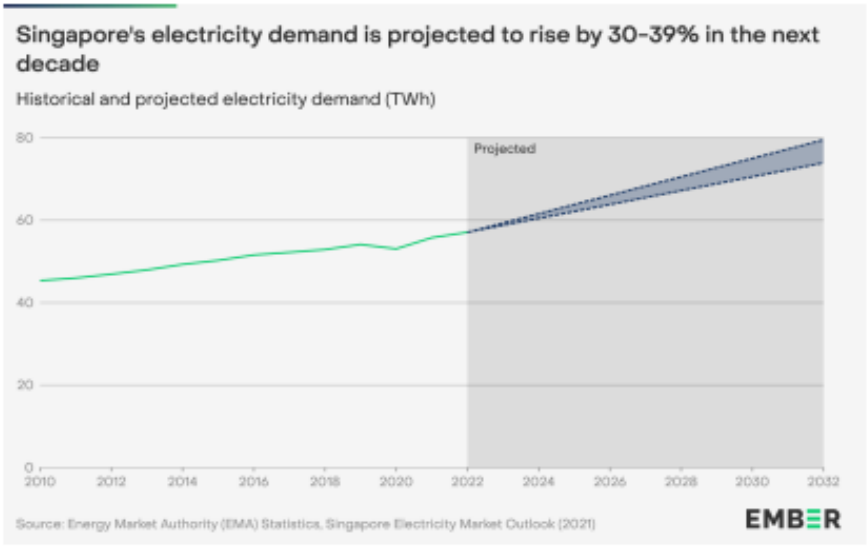

Figure 4. Singapore's Electricity Demand (Setyawati & Lolla, 2024).

The EMBER report shows that Singapore's year-on-year GDP growth is closely correlated with electricity consumption. This is because most of Singapore's electricity is still generated from natural gas. As a result, an increase in energy consumption directly leads to higher emissions (Setyawati & Lolla, 2024). This creates a strategic challenge for Singapore. The country must ensure its energy supply remains sufficient and secure to support the economy, while also reducing emissions in line with national targets. Thus, one of Singapore's top priorities is to find ways to break the link between economic growth and the rate of emissions increase.

In this context, Singapore needs to expand its use of renewable energy and improve energy efficiency. EMBER notes that the transition to clean energy can help Singapore weaken the link between electricity consumption and emissions growth. However, Singapore faces a classic dilemma: limited land and a lack of domestic natural resources constrain its ability to produce large amounts of renewable energy. Solar is the only renewable source with significant potential. The maximum technical capacity is around 8.6 GW by 2050. Beyond that, other renewable energy options are constrained by geography. Wind potential, both onshore and offshore, is very limited because Singapore's sea area is a busy shipping lane. Hydropower cannot be developed because Singapore lacks the fast-flowing rivers needed for hydroelectric power plants. These constraints make Singapore highly dependent on energy imports. Thus, the domestic energy transition must be combined with an external energy strategy (Setyawati & Lolla, 2024).

The Singaporean government, through the Singapore Green Plan 2030 and the Energy Market Authority (2021) policy, is committed to prioritizing energy diversification. This is intended to strengthen long-term energy security. Singapore is targeting an increase in solar energy capacity to 2 gigawatts-peak by 2030 while reducing its dependence on natural gas. However, the government acknowledges that domestic electricity production will not meet all long-term needs. Therefore, Singapore plans to import up to 4 GW of electricity from neighboring countries by 2035. This aligns with the ambition to become Asia's Renewable Energy Hub, a center for trade, connectivity, and clean energy financing. Several initiatives show this policy direction. These include plans to import more than 7 GW of renewable energy from Indonesia, Vietnam, and Cambodia, as well as a megaproject involving a submarine cable spanning more than 4,000 km from Australia. Singapore also participates in India's One Sun One World One Grid initiative and collaborates with Indonesia on carbon trading and carbon capture storage (Toby, 2023). These efforts follow Singapore's strategy since 1965 to position itself as a "hub" for regional economic and technological activity (Huda et al., 2023).

Singapore's reliance on imported gas highlights the urgency of energy diversification. For decades, the country's electricity system has depended on gas supplies from Malaysia and Indonesia (Toby, 2023). In 2023, gas accounted for about 92 percent of electricity generation (53 TWh). The contribution of domestic renewable energy was very small, about 2 percent from solar, 3 percent from bioenergy, and less than 1 percent from regional electricity imports (Setyawati & Lolla, 2024). This dependence risks fossil fuel lock-in, trapping the energy system in fossil fuels and making a clean energy transition difficult. International gas price volatility and incidents, such as the 2004 blackout and the 2021 disruption in

Indonesia, have caused electricity prices to spike (Setyawati & Lolla, 2024). This dependency makes Singapore sensitive to global supply or price changes, which impact economic stability. Such vulnerability has prompted the government to seek multilateral cooperation to mitigate these risks.

The LTMS-PIP illustrates this complex interdependence. The scheme involves multiple countries: Laos, Thailand, Malaysia, and Singapore. It also brings in institutions such as the ASEAN Ministers on Energy Meeting (AMEM). Through LTMS-PIP, supply risks are shared in a multilateral cooperation framework that prioritizes consultation and regional stability. The project is based solely on economics, technology, and sustainability. It does not involve military aspects or sensitive issues, which align with the characteristics of complex interdependence. Choosing LTMS-PIP is a rational political strategy for Singapore. The project offers greater energy security, diplomatic stability, and lower political risks than reliance on a single supplier country (Siang, 2024).

Singapore's engagement in LTMS-PIP demonstrates how national interest is pursued under conditions of complex interdependence. Structural constraints and heavy reliance on imported natural gas have increased Singapore's sensitivity to external supply and price fluctuations, while limited domestic renewable capacity heightens its vulnerability in the absence of diversification. By embedding electricity imports within a multilateral framework, LTMS-PIP allows Singapore to reduce vulnerability by spreading dependence across multiple partners rather than concentrating it on a single supplier. This institutionalized, non-military cooperation reflects the core logic of complex interdependence as outlined by Keohane and Nye. Consequently, LTMS-PIP functions as a strategic instrument through which Singapore safeguards energy security, supports decarbonization goals, and reinforces its position within ASEAN's evolving energy governance architecture.

Differentiated National Interests and Interdependent Roles in LTMS-PIP

The LTMS-PIP demonstrates that ASEAN energy cooperation is sustained not by uniform motivations but by the alignment of differentiated national interests embedded within a structure of complex interdependence. Although Lao PDR, Thailand, Malaysia, and Singapore occupy distinct positions in the regional electricity network, their participation converges around a shared incentive to manage structural constraints and opportunities through cooperation. Lao PDR seeks market expansion to monetize its hydropower surplus. Thailand consolidates control over transmission infrastructure in the Mekong subregion. Malaysia

positions itself as a central transit and future export hub, and Singapore pursues diversification to mitigate energy vulnerability. These varied objectives do not contradict one another but instead form a complementary configuration that allows the LTMS-PIP to function as a multilateral scheme rather than a collection of disconnected bilateral arrangements.

This configuration produces asymmetric patterns of interdependence among participating states. Laos is highly dependent on downstream transit countries to access premium electricity markets, increasing its sensitivity to transmission access and pricing. Thailand and Malaysia, by contrast, occupy structurally advantageous positions as transit states, enabling them to convert infrastructure control into economic benefits and bargaining leverage while maintaining relatively low vulnerability due to their diversified domestic energy systems. Singapore represents the opposite end of the spectrum, as a demand-driven importer with limited domestic resources, it exhibits high sensitivity and vulnerability to external supply disruptions. Under conditions of complex interdependence, these asymmetries do not result in domination but instead generate incentives for institutionalized cooperation, as each actor's gains depend on the stability and reliability of the entire network.

Collectively, the LTMS-PIP illustrates how national interest is pursued through the management of interdependence rather than through unilateral power projection. Influence within the scheme is exercised through non-military channels such as regulatory coordination, technical standards, long-term planning, and institutional credibility, consistent with Keohane and Nye's framework of complex interdependence. The project shows that ASEAN energy integration advances not by equalizing capabilities, but by accommodating differentiated roles within a shared governance structure. In this sense, LTMS-PIP serves as a model for regional cooperation in which asymmetric positions are transformed into mutually reinforcing relationships, enabling participating states to secure national objectives while contributing to broader regional stability.

CONCLUSION

The implementation of LTMS-PIP cooperation illustrate on how well the ASEAN member countries' interests complement one another. This project did not arise

only from technical needs. It instead came from the convergence of different strategic interests among Laos, Thailand, Malaysia, and Singapore. These differences have become the foundation that enables LTMS-PIP to function as the first operational regional energy trading scheme in ASEAN.

When examined as an integrated arrangement, the constellation of these four countries shows how ASEAN's energy relations are shaped by interrelated political and economic considerations. Laos needs market access. Thailand gains leverage through network control. Malaysia strengthens its regional position and opens up energy export channels. Singapore seeks a secure supply of low-carbon energy. National grid operators, including EDL, EGAT, TNB, and SPPA, regulate physical interconnection aspects. Private actors such as Keppel Electric participate in commercial mechanisms. This demonstrates the key characteristics of complex interdependence: a large number of actors, the diversity of non-military issues, and the interdependence that binds these countries without inviting confrontation.

With its multilevel governance structure, high-level political support, and intersecting interests, LTMS-PIP is a concrete example of how regional energy cooperation can be built not on uniformity of interests but on compatibility of needs. Ultimately, LTMS-PIP is not just a pilot project for the ASEAN Power Grid. It also demonstrates how economic connectivity, institutional interdependence, and strategic calculations can produce stable, mutually beneficial cooperation. This cooperation has the potential to deepen ASEAN energy integration in the future.

Beyond describing the LTMS-PIP experience, this study carries broader implications for ASEAN energy integration. Theoretically, the findings suggest that regional energy cooperation in Southeast Asia is better explained through the interaction of national interest and complex interdependence than through assumptions of institutional uniformity or normative regionalism. LTMS-PIP shows that asymmetric positions, such as exporter, transit hub, and importer, do not hinder cooperation as long as governance mechanisms accommodate differentiated roles and distribute benefits across participants. Empirically, the project demonstrates that multilateral electricity trade can be operationalized incrementally through existing bilateral infrastructure, institutionalized coordination, and strong political support, rather than through comprehensive region-wide integration from the outset. From a policy perspective, LTMS-PIP provides a practical reference for future ASEAN power interconnection initiatives, suggesting that flexibility, role differentiation, and alignment with domestic energy strategies are essential for sustaining cooperation. As ASEAN moves toward deeper energy connectivity, LTMS-PIP offers a replicable model in which compatibility of

interests, rather than uniform commitments, underpins durable regional integration.

REFERENCES

Ahmed, T., Mekhilef, S., Shah, R., Mithulananthan, N., Seyedmahmoudian, M., & Horan, B. (2017). ASEAN power grid: A secure transmission infrastructure for clean and sustainable energy for South-East Asia. *Renewable and Sustainable Energy Reviews*, *67*, 1420–1435. https://doi.org/10.1016/j.rser.2016.09.055

Allurentis. (2022). *Investing in ASEAN*. ASEAN.org. https://asean.org/wp-content/uploads/2022/12/investment-report-2023.pdf

ASEAN Center for Energy. (2021, July 13). *ASEAN CO2 emissions from coal-fired power plants: A baseline study*. https://aseanenergy.org/asean-co2-emissions-from-coal-fired-power-plants-a-baseline-study/

ASEAN Center for Energy. (2022). *The 7th ASEAN energy outlook*. https://aseanenergy.org/the-7th-asean-energy-outlook/

ASEAN Center for Energy. (2023). *ASEAN energy transition and LTMS-PIP AIMS III project team CASE discussion series: Energy storage and power grid interconnection*. https://caseforsea.org/wp-content/uploads/2023/06/ACE-Presentation_-ASEAN-Powr-Grid_20230627_Ambiyah.pdf

Basu-Das, S., Gopalakrishnan, B. N., Espinoza, K. B., Lee, H., & Kang, J. W. (2025, April 6). *ASEAN Power Grid and its Economic Impact on Malaysia*. https://asiacleanenergyforum.adb.org/wp-content/uploads/2025/06/2025-06-02-Malaysia-APG-Study_ACEF-2025_DDW-on-APG-BN_rev1.pdf

Chen, J., Apañada, M., & Gonçalves, T. (2024). Accelerating power grid interconnectivity in Southeast Asia: A private sector perspective. *IOP Conference Series: Earth and Environmental Science*, *1395*(1), 012018. https://doi.org/10.1088/1755-1315/1395/1/012018

Creswell, J. W. (2014). Research design: Qualitative, quantitative, and mixed methods approaches (4th ed.). SAGE Publications

Denzin, N. K., & Lincoln, Y. S. (2018). The SAGE handbook of qualitative research (5th ed.). SAGE Publications.

Do, T. N., & Burke, P. J. (2023). Is ASEAN ready to move to multilateral cross-border electricity trade? *Asia Pacific Viewpoint*, *64*(1), 110–125. https://doi.org/10.1111/apv.12343

Hananto, A. (2025, June 11). *Malaysia Positions ASEAN as a Hub for Sustainable Growth*. Seasia.Co. https://seasia.co/2025/11/06/malaysia-positions-asean-as-a-hub-for-sustainable-growth

Harbinger Content Team. (2025, October 4). *What Are Regional Energy Hub Designs? Understanding Their Role in Sustainable Energy Solutions*.

https://blog.harbingerland.com/what-are-regional-energy-hub-designs-understanding-their-role-in-sustainable-energy-solutions/

Huda, M. S. (2024, February 22). The ASEAN Power Grid: How the LTMS-PIP Can Inform the BIMP-PIP's Development. *Fulcrum.Sg*. https://fulcrum.sg/the-asean-power-grid-how-the-ltms-pip-can-inform-the-bimp-pips-development/

Huda, M. S., Seah, S., & Jiahui Qiu. (2023). *THE ASEAN Power Grid 2.0: Lessons from the Lao PDR-Thailand-Malaysia-Singapore Power Integration Project (LTMS-PIP)*. https://doi.org/10.13140/RG.2.2.25121.99683

International Energy Agency. (2019). *Establishing Multilateral Power Trade in ASEAN*. https://iea.blob.core.windows.net/assets/37a2b2f0-bab0-47e0-a618-1a0259926b26/Establishing_Multilateral_Power_Trade_in_ASEAN.pdf.

Islam, R., Dharfizi, A. D.-H., & Sultana, S. (2022). The impact of motivations behind malaysia's energy initiatives. *Journal of Governance and Development (JGD)*, *18*(2), 39–58. https://doi.org/10.32890/jgd2022.18.2.3

Kanchana, K., & Unesaki, H. (2015). Assessing Energy Security Using Indicator-Based Analysis: The Case of ASEAN Member Countries. *Social Sciences*, *4*(4), 1269–1315. https://doi.org/10.3390/socsci4041269

Keohane, R. O., & Nye, J. S. (2004). *Power and interdependence* (3. ed., [Nachdr.]). Longman.

Keppel Electric Pte Ltd. (2022). *Annex factsheet on the lao pdr-thailand-malaysia-singapore power integration project (LTMS-PIP) background*. https://www.keppel.com/en/file/media/media-releases-sgx/2022/06-jun/23-june-2022-ki-mr/annex.pdf

King Mongkut's Institute of Technology Ladkrabang (KMITL), Netrthanon, S., Petsangsri, S., King Mongkut's Institute of Technology Ladkrabang (KMITL), Pimdee, P., & King Mongkut's Institute of Technology Ladkrabang (KMITL). (2017). Constructionism learning skills for Thai vocational student internship teachers: Comparing conceptual models. *Asian International Journal of Social Sciences*, *17*(4), 95–110. https://doi.org/10.29139/aijss.20170405

Morgenthau, H. J. (1952). Another "Great Debate": The National Interest of the United States. *American Political Science Review*, *46*(4), 961–988. https://doi.org/10.2307/1952108

Nian, V., Mignacca, B., & Locatelli, G. (2022). Policies toward net-zero: Benchmarking the economic competitiveness of nuclear against wind

and solar energy. *Applied Energy*, *320*, 119275. https://doi.org/10.1016/j.apenergy.2022.119275

Runde, D. F., Bandura, R., & Lee, R. (2022). *Opportunities for Development Cooperation in Lao Strategic Sectors: Renewable Energy, High-Value Agriculture, and SME Development Renewable Energy, High-Value Agriculture, and SME Development on JSTOR*. https://www.jstor.org/stable/resrep53671?seq=1

samym. (2025, May 16). Thailand, Laos Explore Direct Energy Investments. *Bangkok Local Info*. https://bangkoklocal.info/2025/05/16/thailand-laos-explore-direct-energy-investments/

Sangpetch, T. (2024, May 6). *Laos-Thailand-Malaysia-Singapore (LTMS) Interconnection and its Prospect to be connected to the rest GMS countries*. https://www.greatermekong.org/g/sites/default/files/06%20LTMS.pdf

Setyawati, D., & Lolla, A. (2024). *Regional grids key to Singapore's energy future*. https://ember-energy.org/app/uploads/2024/04/Report-Regional-grids-key-to-Singapores-energy-future.pdf

Shi, X., Yao, L., & Jiang, H. (2019). Regional power connectivity in Southeast Asia: The role of regional cooperation. *Global Energy Interconnection*, *2*(5), 444–456. https://doi.org/10.1016/j.gloei.2019.11.020

Siang, N. H. (2024, September 20). *Singapore doubles renewable electricity imports through regional power project, with added supply from Malaysia*. CNA. https://www.channelnewsasia.com/singapore/singapore-electricity-imports-double-capacity-laos-malaysia-power-asean-prower-project-4620571

SIEW Thinktank Roundtabl. (2021, October 29). *ASEAN Power Grid (APG): Regional integration on electricity interconnectivities*. https://www.siew.gov.sg/docs/default-source/default-document-library/unescap/tricom_siew2021_thinktank-roundtable_unescap_beni-suryadi.pdf?sfvrsn=201c1579_2

TENAGA NASIONAL BERHAD. (2023, October). *Laos-Thailand-Malaysia-Singapore Power Integration Project (LTMS PIP)*. https://www.unescap.org/sites/default/d8files/event-documents/Laos-Thailand-Malaysia-Singapore%20Power%20Integration%20Project_Malaysia.pdf

The Malaysia Voice. (2024, November 12). *Exporting renewable energy to Singapore*. https://themalaysiavoice.com/2024/12/11/exporting-renewable-energy-to-singapore/

Toby. (2023, December 8). *Could Singapore Become Asia's Renewable Energy Hub? - SingNRG*. https://singnrg.com/energy/could-singapore-become-asias-renewable-energy-hub/

Wicaksono, E. (2017). Koridor Ekonomi sebagai Jembatan Keterkuncian Geografis: Kasus Pertumbuhan Ekonomi Laos 2000-2010. *Jurnal Hubungan Internasional*, *10*(1), 32. https://doi.org/10.20473/jhi.v10i1.4395