Advancing Southeast Asia's Energy Integration through the ASEAN Power Grid



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This report has been developed by the Southeast Asia Public Policy Institute to inform stakeholders about the situation of Southeast Asia's energy integration.

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Introduction

Industrial growth, rapid urbanization, and expanding access to electricity are driving demand for power and fuel across Southeast Asia. However, investment in energy systems has not kept pace with this growth, increasing pressure on countries to balance energy security, affordability, and sustainability.

Meanwhile, geopolitical tensions expose risk and vulnerability in the global energy supply. This has been most recently demonstrated by the military conflict involving the United States, Israel, and Iran, resulting in the closure of the Strait of Hormuz, a critical route for oil and liquefied natural gas (LNG).

While there are hydrocarbon resources in the region, Southeast Asian countries remain highly dependent on imported fuels, for both transport and power generation. Recent experience has underlined the need for Southeast Asian governments to view energy security more broadly than access to oil and gas. These considerations strengthen the case for accelerating the energy transition as well as diversifying supply, and overall ensuring that national energy systems can withstand future shocks.

Although global or regional crises often affect countries at the same time, their impacts are uneven. Differences in domestic resources, geography, market structures, and government policies shape how each country respond to energy disruptions. Southeast Asian countries have different demand patterns, generation mixes, and levels of flexibility in managing energy risks.

But at the same time, their economies and energy systems are increasingly connected through trade, investment, and supply chains. Disruptions in one country can therefore spread across borders, leaving neighboring countries exposed even when their own energy systems remain relatively stable.

Building greater connectivity is one pathway to both national and regional resilience. Acting alone, countries remain vulnerable to external shocks and domestic constraints. Deeper regional integration would allow Southeast Asia to share energy resources, infrastructure, and system flexibility more effectively. By connecting national energy systems and coordinating their operation, ASEAN can better absorb disruptions, manage fluctuations in supply and demand, and transform individual vulnerabilities into collective resilience.

Recent developments suggest that ASEAN is beginning to translate these ambitions into more concrete implementation efforts. At the 44th ASEAN Ministers on Energy Meeting (44th AMEM) in October 2026, ASEAN Member States reached consensus on the Enhanced ASEAN Power Grid (APG) Memorandum of Understanding (MoU) and endorsed workplans to advance APG implementation. These developments reflect growing momentum behind the APG and reinforce the importance of regional electricity connectivity in strengthening Southeast Asia's energy security, resilience and energy transition.

Southeast's Asia Energy Situation

Southeast Asia's energy demand is rising rapidly. Under current policy settings, the region is projected to account for nearly 20 percent of global energy demand growth through 2035. Electricity is becoming more central to Southeast Asia's energy system. Since 2015, electricity consumption has increased by around 60 percent,[1] growing significantly faster than overall energy use. It now accounts for almost one-quarter of the region's total final energy consumption.[2]

Southeast Asia's regional energy mix

Fossil fuels continue to dominate the regional energy mix, with oil, natural gas, and coal together accounting for 81.9 percent of total energy supply.[3] Coal generates around half of Southeast Asia's electricity and remains the backbone of its power sector.[4] Natural gas is also an important source for electricity generation and industry, particularly in Singapore, Thailand, Malaysia, and parts of Indonesia, while oil remains central to transport. Indonesia's position as a major coal producer provides the region with access to a relatively stable coal supply. However, oil and gas production is declining as fields in Indonesia, Malaysia, Myanmar, and Thailand mature.

Southeast Asia is therefore already a net oil importer and is moving towards being a net gas importer as well. Thailand and Singapore are particularly exposed because of their heavy reliance on imported pipeline gas (from Myanmar to Thailand) and LNG. The Middle East is the region's main external source of crude oil and also supplies a significant share of its LNG imports.

Southeast Asian countries' energy mix[5]

	Coal and coal products	Oil and oil products	Natural gas	Hydropower	Solar, wind and other renewables	Biofuels and waste
Brunei Darussalam	17.1%	21.8%	61.0%	-	0.01%	-
Cambodia	28.3%	37.6%	-	4.6%	0.8%	28.7%
Indonesia	35.6%	26.3%	15.6%	0.8%	10.7%	11.0%
Lao PDR	38.0%	9.6%	-	34.2%	0.1%	18.2%
Malaysia	22.2%	31.5%	41.8%	2.6%	0.3%	1.6%
Myanmar	4.3%	27.7%	14.5%	3.6%	0.1%	49.8%
Philippines	33.9%	29.5%	3.8%	1.3%	14.3%	17.1%
Singapore	1.1%	64.8%	31.5%	-	0.4%	2.2%
Thailand	11.6%	41.2%	27.0%	0.4%	0.6%	19.2%
Vietnam	49.7%	24.7%	6.4%	6.8%	3.3%	9.1%

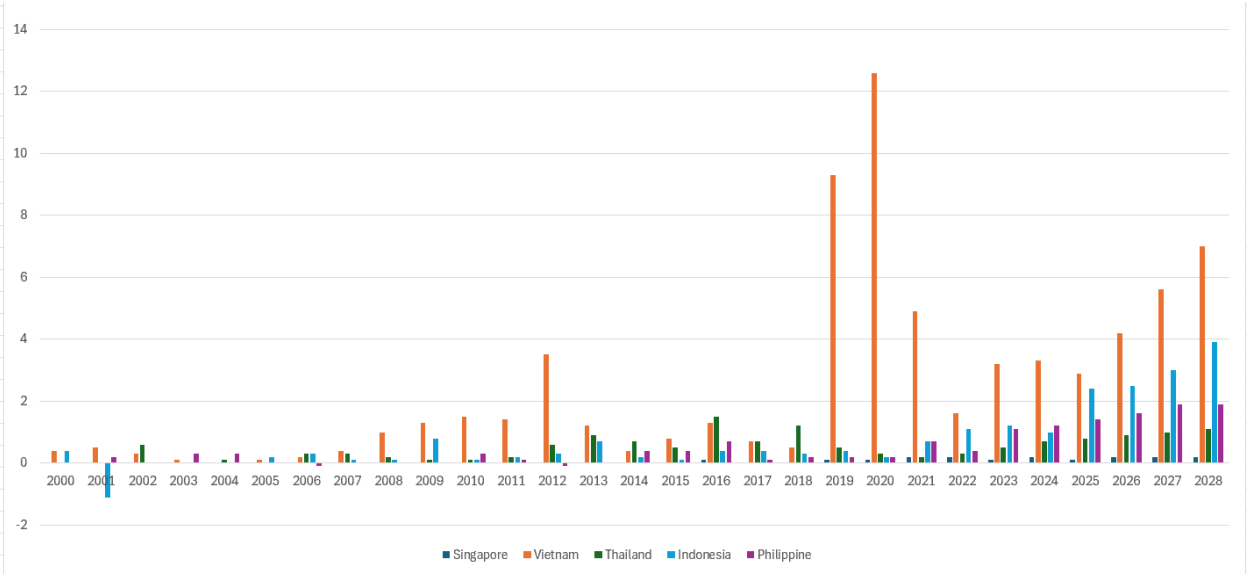
1 International Energy Agency, Southeast Asia Energy Outlook 2026, June 16, 2026.
2 ibid
3 United States Studies Centre, Southeast Asia's energy transition: Opportunities for Australia and the United States, March 6, 2025.
4 International Energy Agency, Southeast Asia Energy Outlook 2026, June 16, 2026.
5 International Energy Agency, Countries & Regions.

Southeast Asia's energy transition

Southeast Asia is working to accelerate its transition toward cleaner energy. The ASEAN Renewable Energy Long-Term Roadmap, together with the ASEAN Plan of Action for Energy Cooperation 2026–2030, sets a pathway toward increasing renewable energy to 30 percent of total primary energy supply and 45 percent of installed power capacity by 2030.[6] Although the share of renewable energy is growing, it still accounts for less than one-fifth of the regional energy mix and remains far from displacing fossil fuels. This share also remains below ASEAN's earlier target of 23 percent by 2025 under the ASEAN Plan of Action for Energy Cooperation 2016–2025.[7]

Southeast Asia's renewable energy supply includes traditional and modern bioenergy, hydropower, geothermal, solar, and wind. However, resource availability and development vary widely across countries, largely because of differences in geography and natural endowments. Strong river systems have made hydropower a major energy source in Lao PDR and Cambodia, as well as Myanmar and East Malaysia. Indonesia and the Philippines, located along the Pacific Ring of Fire, have substantial geothermal potential due to their volcanic activity and underground heat resources, although next generation geothermal technologies may improve the availability of geothermal power. Meteorological conditions make offshore wind energy a significant prospect along the Pacific rim across Vietnam, the Philippines, East Malaysia and Indonesia. Both utility and distributed solar generation potential remains high across the region, though noting its intra-day and seasonal monsoon variability it is necessary to pair it with firm generation or storage.

RE deployment per year 2000-2028 (SG, VN, TH, ID, PH)[8]



Perhaps more importantly, the development of renewable energy generation has been determined by differences in government policies on issues such as feed-in tariffs and the ability to attract investment. These varying conditions have led Southeast Asian countries to pursue different pathways for energy development.

[6] ASEAN Climate Change and Energy Project, Shaping ASEAN's Clean Energy Future: Finalisation of ASEAN Renewable Energy Long-term Roadmap and APAEC RE Programme Design, September 23, 2025.

[7] ASEAN Secretariat, Priority Areas of Cooperation.

[8] Southeast Asia Public Policy, Southeast Asia's Energy Transition: Policy and Deployment, 23 January 2025.

Growing Pressure: How Southeast Asian Countries Are Being Tested

Key takeaways

- Southeast Asia is projected to account for a significant share of global energy demand growth through 2035. However, current investment is not keeping pace.
- Climate change puts pressure on both electricity supply and demand, particularly by reducing generation efficiency and increasing cooling needs.
- Dependence on external oil and gas supplies leaves the region vulnerable to energy shocks arising from geopolitical disruptions.
- National efforts face constraints related to resource endowments, geography, and policies, highlighting the need for greater regional cooperation.

Demand surpasses investment efforts

Southeast Asia accounts for around 9 percent of the world's population and 5 percent of global energy demand, both of which are expected to continue growing over the coming decade. By 2035, the region is expected to account for 20 percent of the increase in global energy demand. Yet the region accounts for only around 3 percent of global energy investment. As a result, investment in energy infrastructure, particularly clean power generation, is failing to keep pace with rising demand.[9]

Demand growth is being supercharged, beyond the historical drivers urbanization and industrialization. The electrification of the transport sector and the rapid expansion of data centers is placing additional pressure on national energy systems. Indonesia, Malaysia, the Philippines, Singapore, Thailand, and Vietnam are becoming destinations for data center development, with data centers projected to account for between 2 and 30 percent of national electricity demand across these markets by 2030.[10] Regional electricity consumption by data centers is expected to increase by more than 100 terawatt-hours over the next three to four years.[11]

The challenge extends beyond generating sufficient electricity. Grid infrastructure must also be upgraded quickly enough to transmit reliable power and support the continuous operation of data centers and other energy-intensive industries, as well as the variation of power demand throughout the 24 hours cycle. This is made more complex as variable renewable energy sources

[9] International Energy Agency, Southeast Asia Energy Outlook 2026, June 16, 2026.
[10] ASEAN Climate Change and Energy Project, The Rise of Data Centres, Artificial Intelligence, and ASEAN's Decarbonisation Goal, June 24, 2025.
[11] Reuters, SE Asia's power demand from data centres, EVs to grow by more than 100TWh in next 5 years, report says, May 18, 2026.

such as solar and wind account for a greater share of generation. Yet, Southeast Asia is projected to face an annual grid investment shortfall of around US$ 18 billion by 2035.[12]

Climate change adds another layer of risk

Southeast Asian countries have so-far relied on largely self-contained national electricity systems. But challenges to the grid including variable power generation and climate change are making this model increasingly vulnerable. Rising temperatures increase electricity demand for cooling while simultaneously reducing the efficiency of electricity generation. Droughts can constrain hydropower output, while extreme heat can lower the efficiency of solar panels. Severe floods and storms can also damage generation and grid infrastructure.

A powerful El Niño, for example, can reduce rainfall and lower reservoir levels, limiting hydropower generation. The 2023–2024 El Niño brought record temperatures and contributed to a 21 TWh decline in regional hydropower output compared with 2022, despite the addition of 500 MW of new capacity.[13] Such disruptions impact countries that depend heavily on hydropower and can force them to increase coal- and gas-fired generation, or even diesel generators, leaving the region more exposed to imported fuels and external supply disruptions.

At the same time, Southeast Asia's decarbonization commitments are placing demands on its energy systems. ASEAN aims to increase renewable energy to 30 percent of total primary energy supply and 45 percent of installed power generation capacity by 2030, while individual countries have committed to achieving net-zero emissions between 2050 and 2060. Meeting these goals will require countries to reduce their reliance on fossil fuels and rapidly expand renewable energy and supporting infrastructure. However, renewable energy development is struggling to keep pace with rising demand. This can lead countries to rely on readily available fossil fuels to close short-term supply gaps, potentially increasing both emissions and exposure to energy supplies from outside the region.

Geopolitics is redefining regional energy security

Southeast Asia has long relied on fossil fuels to meet its energy needs. Although the region has access to a relatively stable coal supply, it is becoming increasingly vulnerable to difficulties in securing oil and natural gas. Declining regional oil production and tightening gas balances are increasing reliance on imports. Southeast Asia is already dependent on imports of oil and is projected to become a net natural gas importer by 2027.[14] If this trend continues, the region will become even more exposed to global price shocks and supply disruptions.

Disruptions to oil and gas shipments through the Strait of Hormuz have highlighted structural vulnerabilities in Southeast Asia's energy system. Before the crisis, the Middle East supplied around 60 percent of the region's crude oil imports, while nearly half of the petroleum products refined or consumed in Southeast Asia were produced from Middle Eastern crude. The near-total suspension of energy shipments through the strait has therefore had wide-ranging consequences, including shortages of petrochemical feedstocks, chemical products, and liquefied petroleum gas used by many households for cooking.[15]

[12] ibid

[13] ASEAN Climate Change and Energy Project, Before the Next Dry Season: Building Drought-Resilient Energy Systems in ASEAN, October 21, 2025.

[14] ASEAN Centre for Energy, Energy Security in Transition: ASEAN's Path to Strategic Resilience, November 26, 2025.

[15] International Energy Agency, Strait of Hormuz crisis reinforces need for Southeast Asia to tackle major energy vulnerabilities, June 16, 2026.

ASEAN lacks common emergency-response mechanisms and a shared strategic petroleum reserve to manage prolonged supply shortages. In the absence of deeper regional integration, member states have largely sought to strengthen national resilience by diversifying their external suppliers. However, their capacity to absorb shocks varies considerably. Better-prepared countries, such as Singapore, Malaysia, and Indonesia, can cushion disruptions more effectively, while more import-dependent countries face greater price, fiscal, and supply risks. These vulnerabilities do not remain within national borders. Through interconnected markets and supply chains, weak responses in one country can create spillover effects across the wider region.

Despite efforts to close energy gaps and address emerging challenges, Southeast Asian countries still face structural constraints that are difficult to overcome through national action alone. In Singapore, limited domestic energy resources and land scarcity restrict the expansion of power generation, making energy imports essential. In Indonesia, the country's fragmented archipelagic geography makes it difficult and costly to connect electricity systems and provide reliable power to remote communities. More broadly, as stated in earlier section, differences in geography and natural resource endowments give countries varying capacities to develop different energy sources. These constraints strengthen the case for coordinated regional action that complements domestic resources and infrastructure. Greater cooperation could help countries overcome national limitations while building a more resilient energy system across the region.

The Case for Deeper Regional Integration

Key takeaways

- Connected electricity systems allow countries to draw on neighboring supplies, helping balance electricity supply and demand across the region.
- Regional trade also enables access to potentially lower-cost renewable resources and helps manage the intermittency of sources such as wind and solar.
- However, realizing the full potential of energy integration requires both physical infrastructure and a framework for sustained cooperation.

Regional integration does not eliminate the need for countries to maintain adequate domestic energy systems, but it changes how reliable power and overall resilience can be achieved. From a buyer's perspective it also broadens the opportunities to source reliable clean energy.

A direct benefit of regional integration is greater optionality. An interconnected system gives countries access to a wider portfolio of energy resources and greater flexibility in managing generation, reserves, and unexpected disruptions. When power systems operate independently, each country must maintain enough backup capacity to meet peak demand and respond to outages. Interconnections allow countries to draw on neighboring systems, reducing the need to maintain the same level of standby capacity individually, or supply neighboring systems in times of excess generation. This cooperation is particularly valuable when countries experience peak demand or generation shortfalls at different times.

Integration can also improve system efficiency and reduce costs by allowing electricity to flow from areas with available, lower-cost generation to those facing shortages or higher production costs. Southeast Asia currently faces both underutilized generation capacity and mismatches between renewable resources and electricity demand. [16] High-potential renewable sites are often located far from major demand centers, while limited transmission capacity at both national and regional levels prevents some countries from making full use of their installed capacity. For example, the region's estimated 20 TW of technical solar and wind potential remains constrained by insufficient grid connectivity.[17] Without stronger transmission networks, surplus electricity cannot be shared effectively, and demand centers will continue relying on fossil fuel backup.

A connected regional grid could reduce wasted generation while creating benefits for both electricity exporters and importers. Access to regional demand could strengthen the commercial viability of new generation projects and create revenue opportunities for exporting countries. At the same time, countries or entities importing energy would gain access to a wider range of supply options, helping ease cost pressures and reduce dependence on energy sources from outside the region.

[16] The Future Atlas, Explaining ASEAN's Renewable Energy Bottleneck.

[17] Reccessary, IEA urges stronger ASEAN grid to unlock Southeast Asia's 20 TW solar and wind potential, November 14, 2025.

A more connected system would also support greater use of variable renewable energy, particularly solar and wind, where reduced generation – due to low wind, cloud cover, etc. – may be offset by variable or firm renewable generation elsewhere. Combining resources across a wider geographic area would overall smooth fluctuations in the regional power system.

However, these benefits require sustained cooperation and mutual trust, in addition to connected transmission infrastructure. Clear rules governing grid access, pricing, emergency coordination, and dispute resolution are necessary to build confidence among participating countries. Regional cooperation has to also demonstrate tangible value through reliable electricity exchanges, measurable cost savings, and fair arrangements for sharing costs and benefits.

The European Union illustrates how energy integration can support the three dimensions of the energy trilemma that Southeast Asia must also address: security, affordability, and sustainability. Cross-border electricity markets and interconnectors allowed European countries to draw on neighboring supplies during the 2022 energy crisis, helping electricity flow from lower-price to higher-price areas and enabling countries to share flexible resources.[18] However, it is important to recognize that integration cannot prevent or resolve an energy crisis. The European Union has also broadened its energy supply by expanding renewable energy and reducing its reliance on Russian gas pipelines, supported by other proactive policies to strengthen resilience.

The lesson for Southeast Asia is that integration must be accompanied by diversification. A regional grid can strengthen resilience, but only if generation sources, supply routes, suppliers, and emergency arrangements are also present in adequate volumes and resilient. Common rules should facilitate the trade of power under normal conditions and clearly define how scarce capacity will be allocated during disruptions.

[18] European Union Agency for the Cooperation of Energy Regulators, Cross-border capacity and market integration are essential for electricity wholesale market resilience, November 3, 2023.

ASEAN Power Grid as a Foundation for Regional Energy Integration

Key takeaways

- After decades of planning, the APG has progressed from operational bilateral connections to the early stages of multilateral electricity trade.
- The LTMS-PIP, which first phase has been completed, demonstrates how regional energy integration can connect countries with different electricity market structures through coordination.
- ASEAN continues to expand energy integration through initiatives including new mainland and maritime connections, the expansion of the LTMS-PIP, and preparations for BIMP-PIP pilots.
- Renewable energy is becoming increasingly important to APG development. Singapore is leading this shift through its low-carbon electricity imports using APG infrastructure.

Energy integration in Southeast Asia is not starting from zero. The region has a long history of cross-border electricity connectivity, with the ASEAN Power Grid (APG) serving as the central initiative for developing a secure and integrated regional power system.

The APG concept first appeared in the ASEAN Vision 2020 in 1997, which called for interconnected arrangements for electricity and natural gas. The ASEAN Plan of Action for Energy Cooperation 1999–2004 subsequently incorporated the APG into the broader Trans-ASEAN Energy Network. However, it took almost a decade for ASEAN member states to formalize their cooperation through the Memorandum of Understanding on the ASEAN Power Grid, signed in Singapore in 2007.

The 2007 MoU established a broad framework for bilateral and multilateral power cooperation across the region. It assigned the Heads of ASEAN Power Utilities/Authorities (HAPUA) responsibility for advancing the APG through programs supporting cross-border interconnection and electricity trade. It also established the ASEAN Power Grid Consultative Committee (APGCC) under HAPUA to support and facilitate the MoU's implementation.[19]

Alongside these institutional arrangements, the ASEAN Interconnection Masterplan Study (AIMS) has provided the strategic and technical foundation for APG development. Successive AIMS studies have gradually expanded the initiative's scope and level of detail. Completed in 2003, AIMS I proposed the foundations of a regional electricity transmission network and helped inform the subsequent APG framework. AIMS II built on this work by developing a more comprehensive plan for cross-border interconnections and updating the network design as national power systems expanded.

[19] ASEAN Secretariat, Memorandum of Understanding on the ASEAN Power Grid, August 23, 2007.

AIMS III marked a further shift from primarily developing bilateral physical interconnections toward establishing practical arrangements for multilateral electricity trade among ASEAN member states. This third phase also addresses the integration of variable renewable energy and the harmonization of technical and operational standards across national systems. Covering the period through 2045, the study provides a long-term pathway toward a fully interconnected ASEAN power grid.[20]

Overview of the ASEAN Grid Capacity[21]

8 operational interconnections out of 18 identified projects	**2.8 GW** operational gird-to-grid capacity	**7.7 GW** operational generation-to-grid capacity
266 GWh total of cross-border power trade through LTMS-PIP	**13.7 GW** planned interconnection capacity by 2040	**6** Future Submarine Interconnections

The Current State of the APG

The ASEAN Power Grid (APG) is envisioned as developing through three stages: bilateral electricity trade, subregional multilateral trade, and, ultimately, a fully integrated regional power system.[22] The APG is currently in a transitional phase, with established bilateral interconnections and early subregional trading initiatives as stepping stones toward deeper integration. The next stage will be to expand these arrangements into a more reliable, accessible, and interconnected regional network.

As of 2025, eight of the APG's 18 identified interconnection projects were commercially operational, providing approximately 2.8 GW of cross-border transmission capacity. With all planned projects now operational, the APG has reached a total interconnection capacity of approximately 7.7 GW.[23]

The most significant achievement in multilateral electricity trade is the Lao PDR–Thailand–Malaysia–Singapore Power Integration Project (LTMS-PIP). First proposed at the ASEAN Senior Officials Meeting on Energy in Manado, Indonesia, in 2013, the LTMS-PIP became ASEAN's first multilateral cross-border electricity trading project. It began as the Lao PDR–Thailand–Malaysia initiative, which enabled unidirectional electricity flows from Lao PDR to Malaysia, before expanding to Singapore in 2022.

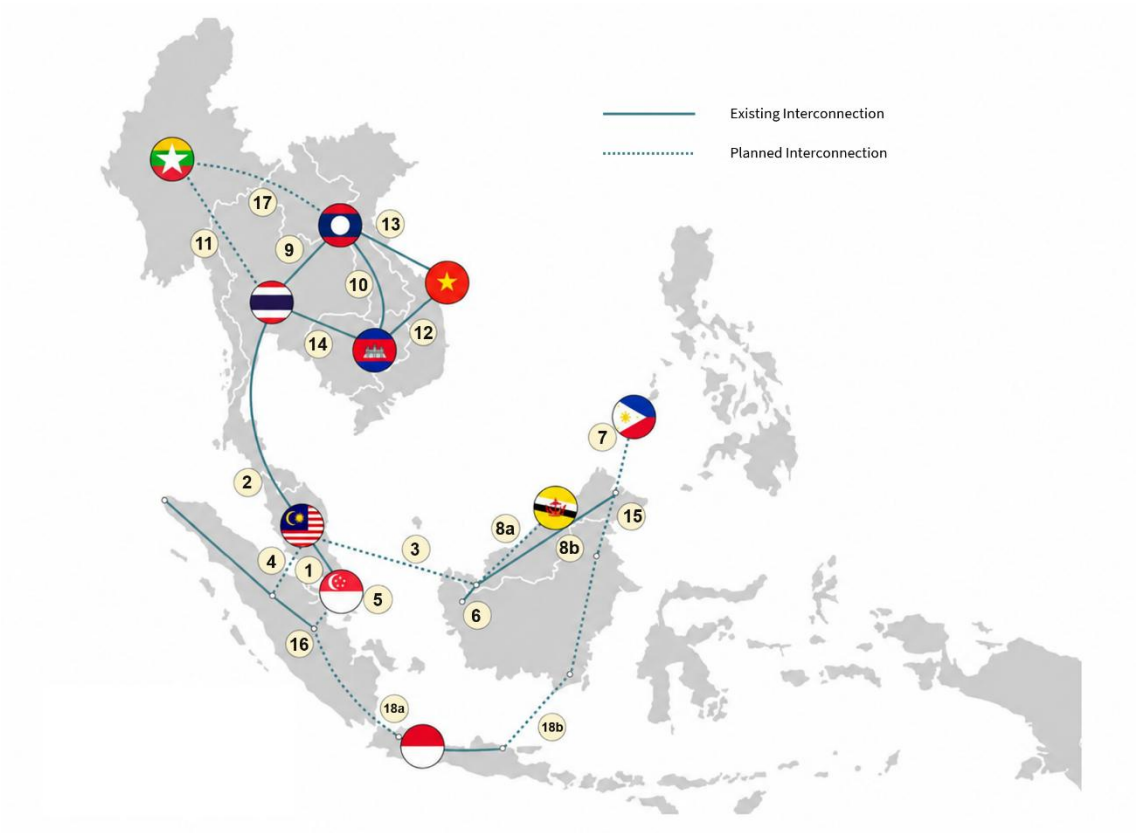
[20] ASEAN Centre for Energy, ASEAN Interconnection Masterplan Study (AIMS) III Phase 3: Minimum Requirements for Multilateral Power Trade in ASEAN, May 4, 2026.
[21] ASEAN Centre for Energy, ASEAN Power Grid Updates 2025, November 27, 2025.
[22] ISEAS - Yusof Ishak Institute, Accelerating the ASEAN Power Grid 2.0, December 12, 2023.
[23] CASE for Southeast Asia, ASEAN Power Grid Advancement Programme (APG-AP).

Phase 1 of the LTMS-PIP concluded in 2024, having transmitted 266 GWh of electricity from Lao PDR to Singapore through Thailand and Malaysia, with a maximum capacity of 100 MW.[24] By using existing interconnections, the project demonstrated how ASEAN's nonbinding and consensus-based model could connect a liberalized electricity market with state-owned utilities through sustained coordination, without requiring full structural harmonization. Phase 2 aims to expand trading capacity to 200 MW and enable two electricity flows: from Lao PDR to Singapore and from Malaysia to Singapore. The expanded arrangement has recorded an additional 14.99 GWh of cumulative electricity trade.

The Pipeline and Next Agenda

The current agenda combines the expansion of existing trading corridors with the development of new connections across mainland and maritime Southeast Asia. The Brunei Darussalam–Indonesia–Malaysia–Philippines Power Integration Project (BIMP-PIP), launched in 2023, is the next major subregional initiative. It seeks to explore cross-border electricity trade in eastern ASEAN, following a pathway similar to the LTMS-PIP in the Mekong subregion. A dedicated BIMP-PIP Working Group has been established to address technical, legal, regulatory, commercial, and tariff-related issues.[25] As of 2026, the initiative remains at the feasibility assessment and pilot-planning stage.

Current and Ongoing Grid Interconnections Project[26]



[24] ASEAN Centre for Energy, ASEAN Power Grid Updates 2025, November 27, 2025.
[25] ASEAN Secretariat, Joint Statement of Brunei Darussalam, Indonesia, Malaysia and the Philippines Power Integration Project (BIMP-PIP), August 24, 2023.
[26] ASEAN Centre for Energy, ASEAN Power Grid Updates 2025, November 27, 2025.

ASEAN is also advancing several bilateral interconnection projects, including links between Peninsular Malaysia and Sumatra, Peninsular Malaysia and Sarawak, Sarawak and Brunei Darussalam, and the Philippines and Sabah. These projects are being pursued alongside further expansion of interconnections in the Mekong subregion and within Indonesia.[27]

The 43rd ASEAN Ministers on Energy Meeting, held in Kuala Lumpur in October 2025, marked an important shift from planning toward implementation. ASEAN ministers endorsed the Enhanced APG Memorandum of Understanding, launched the ASEAN Power Grid Financing Initiative, endorsed the Terms of Reference for the ASEAN Submarine Power Cable Development Framework, and endorsed the ASEAN Plan of Action for Energy Cooperation 2026–2030.[28] They also recognized the strategic role of the ASEAN Centre for Energy as the APG Secretariat. Building on these commitments, the 44th ASEAN Ministers on Energy Meeting (44th AMEM), held in Manila in October 2026, welcomed further progress on the APG, including the finalization of strategic workplans for the APG Task Forces and the development of a Regional Planning Framework to support coordinated regional power-system planning.[29] Together, these developments provide a stronger framework for coordinating infrastructure development, regulatory preparation, and investment.

The Enhanced APG MoU expands the initiative's focus beyond bilateral interconnections to include multilateral electricity trade, renewable energy integration, and investment. It also provides a stronger and more transparent institutional foundation, allowing task forces and working arrangements to address the policy, regulatory, and technical requirements for implementation more systematically.[30] Financing support has also become more structured. ASEAN, the Asian Development Bank, and the World Bank have launched the APG Financing Initiative. The Asian Development Bank has indicated support of up to USD 10 billion over ten years, while the World Bank has announced an initial contribution of USD 2.5 billion through its Accelerating Sustainable Energy Transition program.[31]

Moving Toward the Next Phase: A Green APG

When the ASEAN Power Grid was first initiated, it was framed primarily around energy security, electricity trade, and economic efficiency. These objectives remain important, but the expansion of renewable energy has added a new dimension to regional integration. As Southeast Asian countries pursue their decarbonization targets, they increasingly need power supply that is not only secure and affordable but also sustainable and low carbon. However, differences in geography and natural resource endowments mean that not every country can meet these needs through domestic capacity alone. Recent studies suggest that linking national power systems could reduce the overall net present cost of ASEAN's decarbonization by approximately USD 800 billion compared with a country-by-country approach.[32]

Singapore provides a clear example. The country aims to import 6 GW of low-carbon power by 2035, equivalent to around one-third of its projected electricity demand.[33] Singapore already imports renewable hydropower through the Lao PDR–Thailand–Malaysia–Singapore Power Integration Project and electricity from Malaysia through other cross-border arrangements. In August 2026, its Energy Market Authority granted conditional approvals for an additional 900 MW of imports from solar and

[27] ASEAN Centre for Energy, ASEAN Power Grid Interconnections Project Profiles, November 18, 2024.
[28] ASEAN Centre for Energy, 43rd AMEM: Reaffirming ASEAN's Energy Connectivity and Sustainability Vision, December 10, 2025.
[29] ASEAN, Joint Media Statement of the Forty-Fourth ASEAN Ministers on Energy Meeting (44th AMEM), October 8, 2026.
[30] ASEAN Centre for Energy, ASEAN Energy in 2026, February 3, 2026.
[31] Southeast Asia Development Solutions, ADB, World Bank Back ASEAN Power Grid Financing Initiative, October 1, 2025.
[32] Det Norske Veritas Group, ASEAN Interconnector Study: Taking a regional approach to decarbonization, April 15, 2024.
[33] Ministry of Trade and Industry, Low-Carbon Electricity Import, August 20, 2026.

battery storage projects in Peninsular Malaysia.[34] These developments indicate that renewable energy will play an increasingly central role in future cross-border electricity trade.

This transition also raises important governance questions. Electricity buyers need credible information about the carbon intensity and environmental attributes of imported power. Future power purchase agreements and operational frameworks should therefore establish clear systems for tracking and verifying renewable electricity across borders. This could include the cross-border recognition and use of Renewable Energy Certificates as credible evidence of green electricity consumption,[35] an arrangement that has not yet been fully implemented and remains under development.

[34] New Straits Times, Singapore grants conditional approvals for 900MW electricity import from Malaysia, August 7, 2026.

[35] ASEAN Centre for Energy, Cross-Border Renewable Energy Certificates.

Striving to Achieve: The Gap Between Regional Ambition and Implementation

Key takeaways

- Regional connectivity depends on stronger domestic grids. Transmission bottlenecks in mainland countries and costly subsea links across maritime Southeast Asia can limit progress.
- Enabling multilateral electricity trade requires addressing differences in grid codes, dispatch practices, tariffs, and market-access rules.
- Financing is central to APG development, and the region still needs greater investment. Unclear wheeling charges, revenue arrangements, permitting requirements, and cost-recovery mechanisms also make projects harder to finance.
- The lack of a regional authority to enforce implementation can slow progress. Southeast Asia needs to strengthen the capacity of existing regional bodies.

The ASEAN Power Grid has been under discussion for decades, and it has taken around 20 years to translate that regional ambition into multilateral electricity trade through the LTMS-PIP. Its development continues to face obstacles, including varying levels of national commitment and coordination, limited regulatory harmonization, differences in technical capacity, substantial financing requirements, and the need for effective risk-mitigation mechanisms. Although ASEAN's interconnected regional bodies have addressed some of these challenges through consultation and consensus-building, many remain unresolved. Without faster progress, these constraints could delay ASEAN's ambition to achieve a fully interconnected regional power grid by 2045.

Interconnected Infrastructure

Multilateral initiatives such as the LTMS-PIP have demonstrated that cross-border electricity sharing is possible. However, expanding these arrangements into a region-wide grid presents substantial infrastructure challenges.

Southeast Asia's archipelagic geography is a major obstacle. Connecting mainland systems with island nations, particularly Indonesia and the Philippines, presents complex engineering and financial challenges. In Indonesia, linking Sumatra, Java, and Kalimantan with neighboring countries would require extensive subsea cables and high-voltage transmission infrastructure.[36] The development of an eastern ASEAN electricity network connecting Brunei Darussalam, Indonesia, East Malaysia, and the Philippines will therefore depend heavily on the progress of initiatives such as the BIMP-PIP.

[36] Center for Strategic and International Studies, Plugging into Reality: The ASEAN Power Grid, March 30, 2026.

The viability of a regional grid also depends on the strength of domestic electricity networks. Several Southeast Asian countries have aging transmission systems and underdeveloped infrastructure. Myanmar and Cambodia face limited grid coverage and transmission bottlenecks, while Lao PDR, despite being known as the "Battery of Southeast Asia," experiences frequent local outages partly because of weaknesses in its domestic grid. Recognizing this challenge, the 42nd ASEAN Ministers on Energy Meeting agreed that APG development should address domestic grid upgrades alongside cross-border interconnections.[37] However, strengthening these networks to handle and redirect large volumes of electricity reliably will require substantial investment.

Regulatory Alignment

Physical infrastructure is the most visible component of the APG but harmonized technical and market rules are equally important to its operation. Southeast Asian countries have widely different electricity market structures, grid codes, tariff systems, dispatch practices, reserve requirements, market-access rules, and approaches to renewable energy procurement. These differences create regulatory mismatches and friction in cross-border electricity trade.

Without compatible regional grid codes, managing continuous and multidirectional electricity flows safely and efficiently becomes highly complex. Some alignment has been achieved through bilateral arrangements, but the region still lacks a sufficiently coordinated system to support larger-scale multilateral trade. Greater harmonization of technical standards is therefore needed to lower barriers to participation and facilitate the APG's expansion.

ASEAN has begun addressing this issue through research and policy initiatives, including One Grid, Common Rules: Technical Standards Harmonisation for Catalysing the Multilateral Power Trade Expansion under the ASEAN Power Grid.[38] However, the development and implementation of comprehensive and binding regional standards remain incomplete.

Financial Architecture

Bankability is another major barrier to APG development. The Asian Development Bank and the World Bank have announced approximately US$ 12.5 billion in combined support for the APG, but this remains below the region's broader financing needs. The International Energy Agency estimates that APG interconnections alone will require around US$ 27 billion, excluding investments in domestic grids, generation capacity, and supporting infrastructure.[39] Broader estimates associated with the ASEAN Power Grid Financing Initiative suggest that realizing the full APG vision by 2045 could require approximately US$ 800 billion.[40] Subsea transmission projects, in particular, involve high upfront costs and complex risk profiles. ASEAN must therefore identify suitable financing models and risk-sharing mechanisms to close the investment gap.

Regulatory and market uncertainty can further weaken project bankability. Lengthy permitting processes and unclear regulatory requirements can delay projects and raise financing costs. Uncertainty surrounding licensing arrangements, wheeling charges, transmission tariffs, and cost-recovery mechanisms also makes it more difficult for investors to assess risks and commit long-term capital.

[37] ASEAN Secretariat, ADB and World Bank Group Launch the ASEAN Power Grid Financing Initiative with the ASEAN Secretariat and the ASEAN Centre for Energy (ACE), October 15, 2025.

[38] ASEAN Centre for Energy, One Grid, Common Rules: Technical Standards Harmonisation for Catalysing the Multilateral Power Trade Expansion under the ASEAN Power Grid (APG), July 10, 2026.

[39] International Energy Agency, Financing the ASEAN Power Grid, March 10, 2026.

[40] World Bank, ASEAN Power Grid Financing (APGF) Initiative, October 20, 2025.

Clearer Institutional Roles

One of the APG's most significant challenges is its institutional gap. ASEAN has a shared vision for regional grid connectivity, but it does not have a regional system operator, regulator, or enforcement mechanism to oversee the transition toward an integrated electricity market. Organizations such as HAPUA and the APGCC perform important coordinating, advisory, and technical functions, but they cannot enforce decisions, mandate project implementation, or require the real-time cross-border data sharing needed for efficient electricity trade.

APG development involves multiple organizations, including HAPUA, the APGCC, the ASEAN Centre for Energy, the ASEAN Energy Regulators' Network, national energy ministries, regulators, and utilities. Although these arrangements support dialogue and coordination, responsibilities remain fragmented. These regional institutions also have limited resources and implementation capacity.

Establishing a supranational authority with binding powers may be difficult because ASEAN's consensus-based approach emphasizes informal consultation and national sovereignty. The immediate priority should therefore be to strengthen the mandates and resources of existing institutions. These bodies need greater capacity to coordinate across countries, develop mutually compatible frameworks, clarify responsibilities, and support implementation without displacing national regulators or utilities.

Building the Future of ASEAN Energy Integration

Deeper energy integration can help Southeast Asian countries meet growing demand more effectively while strengthening energy security and advancing the energy transition. The ASEAN Power Grid provides a foundation for this effort, but progress requires more than physical connectivity. Countries also need the policy authority to establish and enforce clear rules, the technological capabilities to operate increasingly interconnected systems, and the strategic autonomy to make informed choices about their energy future. Building on existing initiatives, the following recommendations outline how ASEAN can strengthen these foundations and translate regional cooperation into a more secure, affordable, and cleaner energy system.

- **Strengthen domestic systems and scale up through bilateral and subregion projects:** Southeast Asian countries should strengthen their domestic electricity systems while progressively expanding cross-border trade. This includes upgrading transmission networks, improving system operations, and ensuring that domestic grids can safely receive, transmit, and redirect electricity from different sources. Bilateral projects can provide a practical starting point because they generally require less institutional and regulatory coordination than multilateral arrangements. Once these projects demonstrate reliable trading arrangements, they can be connected through subregional initiatives and gradually expanded into wider multilateral markets. Domestic upgrades, bilateral interconnections, and subregional trade should therefore advance in parallel, with each stage providing technical experience and institutional confidence for deeper integration.

- **Establish minimum common rules and strengthen implementation capacity:** Southeast Asia should establish a minimum set of compatible legal, regulatory, and technical requirements for cross-border electricity trade. Each member state will also need sufficient institutional capacity to implement these requirements domestically, including clear regulatory responsibilities, capable system operators, and reliable compliance and data-sharing arrangements. Southeast Asia can build on the recommendations in One Grid, Common Rules, which identifies differences in grid development, technical standards, and regulatory frameworks as major barriers to multilateral power trade. It recommends broader technical harmonization that builds on existing bilateral arrangements. Technical rules alone, however, will not be sufficient. Sustained political commitment across changes in government will be needed to translate regional agreements into long-term implementation. Southeast Asia should therefore establish clear national commitments, implementation timelines, and mechanisms for regularly monitoring progress.

- **Build bankable pipeline for priority projects:** The ASEAN Power Grid Financing Initiative can serve as an important regional platform for coordinating project preparation and mobilizing investment. It offers technical assistance and financial instruments such as loans, guarantees, political-risk coverage, public-private partnership advice, and equity support. However, mobilizing finance will also require ASEAN to develop a transparent pipeline of technically feasible and commercially viable projects. For each priority project, participating countries should clarify ownership, revenue arrangements, risk allocation, permitting requirements, procurement processes, and cost-recovery mechanisms. A major priority is the development of more transparent and compatible frameworks for wheeling charges and transmission tariffs, which affect both project revenues and the final electricity price paid by consumers. The current

reliance on project-by-project negotiations is complex and difficult to scale. Greater regional coordination would improve price visibility, reduce transaction costs, and give investors greater confidence in long-term project revenues.

- **Clarify institutional roles and accountability:** Southeast Asia may not be ready to establish a supranational electricity authority, but it can strengthen coordination by giving existing institutions clearer responsibilities, resources, and lines of accountability. Europe provides a useful reference, although its model should be described carefully. ENTSO-E does not independently impose legally binding obligations on national system operators. It develops and coordinates technical network codes that can become binding after adoption through the European Union's legislative and regulatory processes. Within ASEAN, institutional responsibilities should be also clearly defined. The ASEAN Centre for Energy, as the APG Secretariat, should maintain a consolidated project pipeline, publish progress reports, coordinate technical work, and preserve institutional knowledge. The APGCC should coordinate implementation of the Enhanced APG MoU, while HAPUA should lead cooperation among utilities and system operators. The ASEAN Energy Regulators' Network should guide regulatory alignment, including tariff principles and market-access rules. At the national level, ministries and regulators should appoint empowered focal points to make decisions or escalate unresolved issues.

- **Leverage the APG to accelerate the energy transition:** The APG should support not only regional energy security and system reliability but also Southeast Asia's transition toward low-carbon electricity. Stronger cross-border transmission would allow countries to access renewable resources beyond their borders and manage variable solar and wind generation across a wider geographic area. The next phase of APG development should therefore place renewable energy at its center, supported by sufficient firm and flexible resources such as hydropower, storage, and other low-carbon technologies. National renewable energy plans should also be coordinated with APG infrastructure and cross-border trading projects. Bilateral trade can provide an initial pathway for testing these arrangements before they are expanded into subregional and regional markets. ASEAN should also develop a credible cross-border system for recognizing Renewable Energy Certificates. Common rules for issuing, transferring, tracking, and retiring certificates would help verify the environmental attributes of traded electricity and prevent double counting.

Conclusion: From Connectivity to Shared Resilience

Southeast Asia has already established much of the structural and institutional foundation for deeper energy integration. Drawing on decades of planning and cooperation, the ASEAN Power Grid has supported operational bilateral interconnections and pioneering multilateral initiatives. The region is now advancing a broader pipeline of subregional projects, a strengthened political framework, and efforts to harmonize technical standards. Considerable progress has been made over the past two decades, providing ASEAN with a strong foundation on which to build.

The challenge now lies in translating ambition into implementation. Recent progress on the ASEAN Power Grid reflects growing momentum behind regional electricity connectivity, but sustained effort will be needed to turn plans into operational infrastructure and integrated markets. Domestic grid upgrades, cross-border interconnections, and multilateral trading arrangements must be carefully planned and delivered step by step. Common rules, clearer institutional roles, effective resource sharing, and sound financial planning will all be essential. ASEAN's energy system will remain diverse and nationally governed, but it can also become more connected, flexible, and resilient. By building on existing progress and strengthening regional cooperation, Southeast Asia can transform national vulnerabilities into shared regional resilience while advancing a more secure, affordable, and sustainable energy future.

