

**ECONOMIST  
IMPACT**

# **Switching on ASEAN: accelerating cross-border energy connectivity**



# Contents

**2** Sponsor foreword

**3** Introduction

**4** Executive summary

**6** ASEAN's race to fuel growth, not emissions

**9** Supersizing ASEAN's grid

Power in partnership

**12** Adapting global lessons to regional realities

Codified rules to lower friction

Governance institutions to build trust

Policy instruments to crowd-in capital

Building critical infrastructure for transmission

Digitalisation for optimised integration

People, not just power

**18** The prize of connection

**19** References

# Sponsor foreword

Ambition for the ASEAN Power Grid reflects a growing recognition that energy security, affordability and decarbonisation are increasingly interlinked. As the findings in this report show, regional interconnection can strengthen these outcomes by widening access to renewable resources, improving system flexibility and supporting economies that are becoming more electricity intensive.

The report's call for clearer governance, earlier project preparation and more predictable frameworks highlights a central challenge. Physical links alone will not deliver a regional grid in ASEAN. Progress depends on institutions that can co-ordinate between jurisdictions and on rules that reduce uncertainty for planners and investors. Financing is available from multilateral and private sources, but effective mobilisation requires consistent standards and well-prepared pipelines.

Recent exchanges among Southeast Asian utilities and energy institutions echo many of these conclusions. At the Southeast Asia High-Level Roundtable, held during the Sustainability and Renewable Energy Forum in September 2025, participants noted that political support remains essential for aligning national plans with regional objectives. The discussion, between utility leaders, the ASEAN Centre for Energy and other regional institutions, also highlighted structural constraints, including global shortages and long lead times for high-voltage equipment. Co-ordinated procurement and diversified supply channels were identified as possible ways to manage these risks, alongside a phased development approach that allows technical and regulatory arrangements to advance in parallel.

Borneo, an island divided among three ASEAN members, illustrates how sub-regional integration can contribute to the wider regional vision. The island's abundance of renewable energy sources—including hydropower, solar and biomass—together with its evolving network of interconnections, provides a practical foundation for deeper co-operation. The Sarawak to West Kalimantan link, which moves power from Malaysian Borneo to Indonesian Borneo, will reach its tenth year of operation in 2026 and demonstrates the feasibility of sustained cross-border exchange. Future interconnections involving Sarawak and Sabah, in Malaysia, and Brunei Darussalam, along with the proposed undersea link to Singapore and Peninsular Malaysia, indicate how Borneo's grid could interface with broader regional efforts and serve as one of the building blocks of the ASEAN Power Grid.

A well co-ordinated and interconnected ASEAN power system remains a long-term pathway toward a more resilient, sustainable and competitive regional energy landscape.

**Datuk Haji Sharbini Suhaili**

Group chief executive officer, Sarawak Energy

# Introduction

For almost 30 years, the Association of Southeast Asian Nations (ASEAN) has aspired to knit its members, which number 11 following Timor-Leste's accession in October 2025, into a single regional power grid, moving electricity seamlessly across borders.<sup>1</sup> Today, the idea of an ASEAN power grid is gaining urgency, with more than a dozen major infrastructure and energy projects already planned or under way. Rapid urbanisation and industrialisation in ASEAN mean energy consumption is expected to more than double by 2050.<sup>2</sup> This demand is also spurred by electric vehicles, data-centre expansion, rising air-conditioning demand and new manufacturing hubs.<sup>3</sup> By 2050, ASEAN's urban population alone will be 521m, about 47% larger than in 2023, adding further pressure on already stretched energy infrastructure.<sup>4</sup> Beyond rising demand, climate impacts and geopolitics are making energy supply more vulnerable, with extreme weather events disrupting hydropower in parts of the region.<sup>5</sup> Tensions at maritime chokepoints disrupting the transit of oil and in critical-mineral supply chains are further fuelling price and delivery risks.<sup>6,7</sup>

Accelerating energy connectivity could boost ASEAN's national GDPs by 0.8–4.6%, create 2,000–9,000 direct annual jobs in the energy supply chain and cut regional electricity costs by 3–3.9% as countries share cheaper power and avoid costly backup generation.<sup>8</sup> A connected grid could also smooth supply and reduce emissions by allowing countries to take advantage of their neighbours' renewable energy sources.

But ensuring cheap and reliable power for growth often collides with the imperative to decarbonise. Fossil fuels still dominate even as renewables scale up, and national policies within ASEAN range from ambitious net-zero pledges

to protectionist energy policies.<sup>9</sup> Furthermore, a lack of rules and uneven infrastructure complicate grid integration. Geopolitical tensions add another layer of complexity with economic conflict intensifying between America and China. Energy interconnection could become an arena where the region uses external competition to its advantage, positioning itself not as a casualty of great-power rivalry, but as a beneficiary.

This report, drawing on extensive research and interviews with experts, examines the drivers and roadblocks shaping ASEAN's long-held ambition for regional energy interconnection. It will also analyse the opportunities it presents to meet soaring energy demand while advancing towards 2030 climate goals.

We would like to thank the following experts for their time and insights:

- **Datuk Razib Dawood**, executive director, ASEAN Centre for Energy
- **Peter duPont**, co-founder and co-chief executive, ACE Partners
- **Hongpeng Liu**, director of energy division, UNESCAP
- **Keiju Mitsuhashi**, director, Energy Sector Office, Asian Development Bank
- **Nuki Agya Utama**, director, Energy Policy and head, Asia Zero Emission Center, ERIA
- **Khan Yow**, managing director, Seraya Partners

The report was written by Gillian Parker and edited by Elizabeth Mackie, Satvinderjit Kaur and Divya Sharma.

# Executive summary

ASEAN's ambition to connect its national grids into a regional power grid has never been more urgent. While there have been signs of progress, climate imperatives and industrial competition demand more than the incremental pilot schemes currently underway. The experience of countries elsewhere shows that what makes or breaks regional grids is not just cables, but rules, trust and finance. The European Union's (EU's) system demonstrates that cross-border power trade works best when underpinned by strong regional operators and clear cost-sharing rules which ensure the costs of interconnectors—the high-voltage cables linking national grids—are fairly split among beneficiaries.<sup>10</sup> Elsewhere, Central America has a regional trading layer that sits on top of countries' existing power markets, allowing trade to grow despite national differences.<sup>11</sup> ASEAN can adapt these lessons in cross-border governance, beginning with setting rules for how to charge for moving electricity (known as wheeling) and settlement rules that turn one-off projects into bankable, replicable investments.

## Key findings:

- **Re-energising momentum.** Rising energy demand, new economic and technological realities and price volatility are sharpening the case for the ASEAN Power Grid (APG). Singapore, reaffirming its commitment to regional energy integration, has raised its low-carbon import target from its neighbours by 50%, to 6 gigawatts by 2035.<sup>12</sup> Projects such as the Lao–Thailand–Malaysia–Singapore Power Integration Project (LTMS-PIP), Malaysia's ENEGEM digital renewable-energy trading platform and the Monsoon Wind exports from Laos to Vietnam demonstrate tangible progress.
- **Rules before cables.** Project bankability depends on long-term policy stability, harmonised grid codes, trading rules and standardised wheeling and settlement charges. Without them, projects sink into drawn-out, bespoke negotiations. Enforcing common standards through official bodies such as the ASEAN Centre for Energy would build trust across borders. Practical steps, such as unlocking flexibility in existing power plants, improving forecasting, updating grid codes and modernising grid monitoring, can happen while deeper reforms take shape.
- **Finance as the fulcrum.** A mix of risks, including offtake risk (buyers' purchase commitments), currency risks, energy policy uncertainty, costly and complex technologies and unclear cross-border settlement rules, deter investment. Transmission projects are often treated as public goods, and without clear cost-recovery, private investors remain cautious. Development banks can play the role of neutral brokers, but a robust ASEAN Power Grid Financing (APGF) facility, modelled on the EU's, could blend early-stage funding and guarantees to de-risk projects and crowd-in capital.

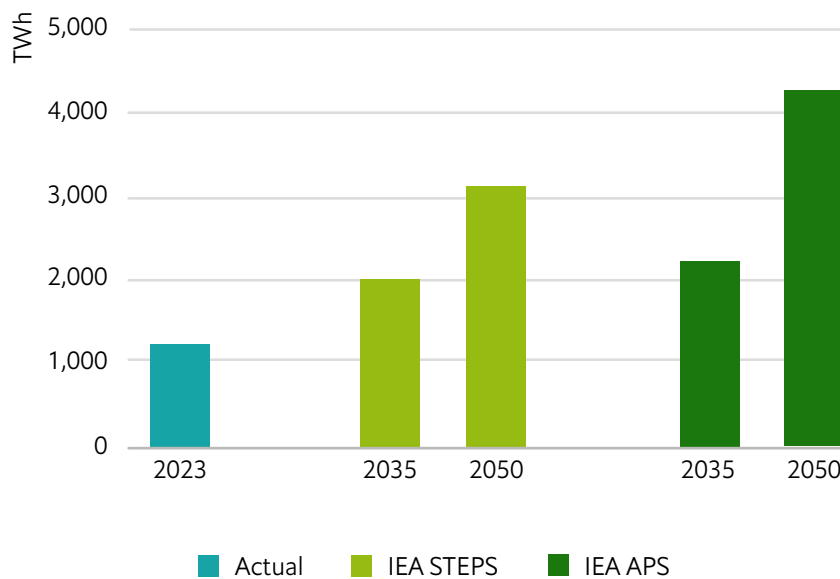
- **Powering the know-how.** High-Voltage Direct Current (HVDC) cables (which can transmit energy over long distances and undersea), real-time digital telemetry (continuous and automated data measurement from remote energy assets) and artificial intelligence (AI) powered systems underpin the ability of countries to share surplus energy. These demand highly specific technical skills largely absent in ASEAN. Without co-ordinated training and research and development hubs, the region risks swapping dependence on fossil fuels for reliance on foreign technology and know-how.
- **Leveraging its current advantage.** ASEAN sits at the intersection of a great geopolitical power rivalry between America and China. By harmonising policies and deepening trade, it can position itself not as a casualty of competition but as a beneficiary, leveraging external finance and supply-chain partnerships so it becomes a natural industrial partner to all.
- **Integration with a social contract.** Policymakers remain wary of price volatility and stranded-asset risks, while state utilities that are risk-averse and politically powerful may resist deeper integration. Cross-border co-operation must therefore balance competitiveness with inclusivity, ensuring that reforms support jobs and equitable growth.
- **The bigger prize.** Interconnection, once seen as a national-security risk, is increasingly recognised as a way to strengthen energy security. It diversifies supply and enables emergency power-sharing. If ASEAN can move from pilots to a co-ordinated framework, double annual grid investment by 2035 and embed co-operation in credible institutions, it could transform from a patchwork of national systems into a coherent clean-energy hub that keeps its economies competitive in a decarbonising world.

# ASEAN's race to fuel growth, not emissions

ASEAN's electricity demand grew by more than 7% in 2024, nearly twice the global average<sup>13</sup> and is on track to double between 2023 and 2050 based on IEA's Stated Policies Scenario (STEPS) (Figure 1).<sup>14</sup> Clean, reliable energy is fast becoming the foundation of economic competitiveness, as industries and cities alike face mounting pressure to curb emissions and secure affordable energy.

**Figure 1: More wants, more watts**

*Electricity demand in Southeast Asia by scenario, 2023–50*



Source: IEA. 2024. Southeast Asia Energy Outlook 2024.  
Notes: STEPS = Stated Policies Scenario. APS = Announced Pledges Scenario.

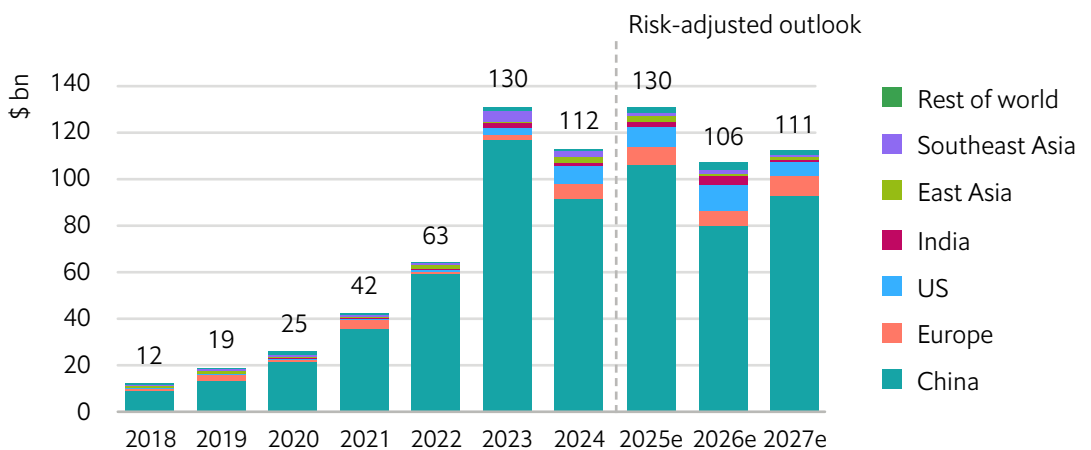
Industrial strategies increasingly hinge on access to affordable low-carbon electricity. Reliable power is the currency of modern manufacturing, determining where factories, data centres and investors choose to locate. Yet, Southeast Asia’s industries still rely heavily on fossil fuels. To keep its manufacturing edge, the region must slash emissions from production or risk losing ground to rivals with cleaner grids.

The path to decarbonisation, however, is uneven. Each ASEAN country’s starting point reflects its industrial base, energy mix and natural resources. For instance, Laos and Malaysia benefit from substantial hydropower,<sup>15</sup> while Singapore has limited domestic renewable-energy potential and relies on imports or regional trade to decarbonise.<sup>16</sup> These differences provide opportunities for collaboration. “The way we see it is to look at the benefits for not only the energy importers, but also for the exporters...that leads to an opportunity for manufacturing-based value chain development,” says Keiju Mitsuhashi, director of the Energy Sector Office of the Asian Development Bank. Import-reliant markets like Singapore can offer long-term, bankable offtake while resource-rich neighbours supply renewably-generated power and hardware, converting one-off projects into a regional industrial pipeline.

Southeast Asia already has the makings of a manufacturing hub powered by renewable energy. Clean-energy value chains—spanning factory facilities, equipment production and the mining and refining of battery metals—have already generated more than 85,000 jobs since 2019.<sup>17</sup> The industry drew \$130bn in investment in 2024, a figure projected to rise to \$160bn in 2025.<sup>18</sup> China dominates globally, with 76% of clean-tech factory investment in 2024 and is expected to retain the majority until at least 2027 (Figure 2).<sup>19</sup> For Southeast Asia, competing for factory investment is critical to deepening industrial capacity and anchoring the region in fast-growing renewable-energy markets, rather than being seen as a mere source of raw materials. For example, Indonesia and the Philippines, supplying about 65% of the world’s mined nickel—an element critical to battery and sustainable energy supply chains—must clean up electricity-hungry nickel smelters which are still largely powered by coal.<sup>20</sup>

**Figure 2: China leads the way**

*Global clean-tech factory investment by geography*



Source: BloombergNEF, Energy Transition Investment Trends 2025

Note: Clean-tech includes factory investment across the manufacture of solar (polysilicon, wafers, cells and modules), batteries (separators, electrolytes, cathodes, anodes and cells), wind turbines (nacelles only), and hydrogen electrolyzer manufacturing (stack assembly only).

Abundant, reliable and low-carbon power is also becoming a prerequisite for attracting investment in technology, including data centres. “The tech industry is going to be a key driver—a catalyst, if you will—for making renewables happen across the world, including in Asia,” says Khan Yow, managing director at Seraya Partners. “It’s about working with them, understanding their needs.” The value of ASEAN’s burgeoning data-centre sector is projected to reach \$11.8bn by 2030.<sup>21</sup> But these facilities are energy-hungry, with electricity demand expected to more than double by 2030, partially due to the presence of a regional data-centre hub in Singapore and southern Malaysia.<sup>22</sup> Operators are under pressure from net-zero pledges, tougher disclosure rules and activist investors to clean up their power-intensive operations. For ASEAN, credibility and scale in renewable energy will be decisive. “Unless you have clean energy sources, you won’t be able to attract FDI [foreign direct investment],” says Mr Mitsuhashi, adding that export opportunities will also diminish without clean energy fuelling production. “It’s really an imperative to strengthen energy security with clean energy technologies.”

However, ASEAN must improve its investment climate to attract more private capital into the power sector, competing not only with advanced economies but also with emerging markets that offer clearer rules, lower risks and faster project approvals. Between 2020 and 2023, renewable industries attracted \$27bn a year in greenfield projects representing around one-quarter of ASEAN’s FDI,<sup>23</sup> but the region captured just 2% of global clean-energy investment.<sup>24</sup> While Southeast Asia’s renewable resources are increasingly cost-competitive, they are not yet deployed at scale. “Even if renewables show a very competitive LCOE [Levelised Cost of Energy]<sup>25</sup>, sunk costs are slowing adoption,” says Mr Yow, “that’s why deployment hasn’t kept pace with the economics.” The billions already invested in coal plants and ageing grid infrastructure create powerful incentives to keep them running, even when renewables are cheaper to build.



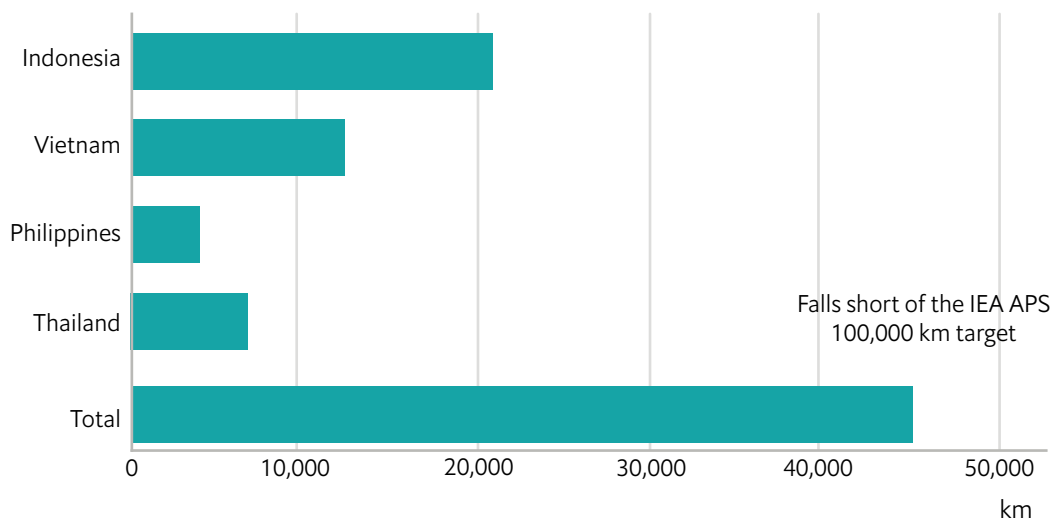
# Supersizing ASEAN's grid

Realising a regional, renewable energy grid will require more than new generation capacity. It will need modern transmission networks that can move renewable power across borders, spreading costs and benefits more evenly throughout the region. Most national grids in Southeast Asia were designed for domestic markets, not large-scale cross-border trade, complicating access to the cheapest solar, wind and hydro resources, which are often far from where demand is concentrated.<sup>26</sup> Thermal and hydro have traditionally provided flexibility to the power grid by adjusting their output to match fluctuations in demand and renewable supply. However, their reliability is weakening under climate stress with rising temperatures reducing thermal efficiency, while droughts and erratic rainfall constrain hydropower generation.<sup>27,28</sup> Lacking reach and capacity, grids struggle to absorb renewables at scale, forcing governments to fall back on coal and gas to guarantee supply. Without new interconnectors, cheap electrons remain stranded.

Experts argue that ASEAN's energy ambitions will falter without a step-change in grid investment and government commitment to infrastructure. "When you're trying to increase and upgrade your power, like it or not, you have to upgrade your grid. The key is not only leaving it up to the private sector, the government has to be responsible for the infrastructure. ASEAN is still three levels below [Europe's standard]," says Nuki Agya Utama, director for energy policy and head of Asia Zero Emission Center, ERIA. Southeast Asia must more than double annual grid investment to \$22bn by 2035<sup>29</sup> and expand its transmission and distribution network by around 1.7m km by 2030 to meet rising demand (Figure 3).<sup>30</sup>

**Figure 3: Closing the distance**

*Length of new transmission lines (2023-30) in km, combined voltages*



Source: Ember. 2025. Wired for profit: Grid is the key to unlock ASEAN energy investment

The difficulty is that grid and interconnection projects sit awkwardly between public infrastructure and fully commercial ventures, requiring catalytic finance including tools such as currency hedging, credit and permit-stage guarantees or first-loss capital to attract investors. Many cross-border interconnection projects stall before reaching financial close due to a lack of clear cost-sharing, payment-security guarantees or persistent currency risks. The cost of capital for clean energy projects in Southeast Asia is at least twice as high as in advanced economies or China,<sup>31</sup> reflecting a mix of market immaturity, currency volatility and policy uncertainty that elevate perceived risk premiums.<sup>32</sup> To attract capital and move projects beyond the feasibility stage, ASEAN must prove that regional power projects can deliver predictable returns. Standardised cost-recovery and transparent risk-allocation frameworks would help de-risk investments.

Integration also demands harmonised regulations and liberalised markets. But these conditions are largely absent in ASEAN's single-buyer systems. Shared infrastructure and cross-border flows promise lower costs, but this can be at odds with protecting national interests and the desire to preserve strategic autonomy. Incumbent utilities, which are often state-owned, have little incentive to cede market dominance to a more competitive regional structure.<sup>33</sup> Indonesia's state-owned electricity company, for example, would see its market dominance eroded under a more competitive regional network. High-cost generators, many owned by state utilities, could struggle if wholesale prices converged under deeper integration. Risk-averse and politically influential, these incumbents can slow progress by citing technical or security concerns.<sup>34</sup>

Technical gaps further complicate integration. The Philippines, for example, runs its grid at 60 hertz, while most of ASEAN operates at 50 hertz. Connecting grids with mismatched frequencies is possible using HVDC links, but these require costly infrastructure and complex engineering, making it difficult to establish them at scale.<sup>35</sup> Digital readiness is also patchy. Telemetry systems, the data backbone which tracks real-time flows, demand and outages, are advanced in some markets but still reliant on manual updates in others. Without common technical language and systems, balancing supply and demand across borders becomes cumbersome, limiting the efficiency gains of regional trade and discouraging private investment.



Lastly, a lack of political will remains a major barrier in ASEAN. Some governments, hedging against intermittency, are doubling down on fossil fuels to guarantee dispatchable power even as renewables expand. Vietnam ramped up coal imports by 31% in 2024, fuelled by a manufacturing boom and industry relocations from China.<sup>36</sup> Such fallback measures risk locking in old dependencies just at a time when integration could deliver scale. Unclear benefit-sharing makes the politics of cross-border projects harder. "Why would Indonesians open up large [tracts] of land just to serve Singapore's power needs? The political messaging is awkward," says Mr Yow. Unless ASEAN overcomes these financial, institutional and political hurdles, its transition to cleaner electricity could stall, leaving the region with the paradox of low-cost renewable energy that cannot be delivered.

## Power in partnership

Experts increasingly acknowledge that competitiveness and resilience cannot be secured through go-it-alone strategies. “ASEAN is an advanced regional platform for economic co-operation, for energy co-operation and for sustainable development,” says Hongpeng Liu, director of the energy division at UNESCAP, pointing to specific technical working experts and sector-specific ministerial meetings within the bloc. The challenge is translating this latent potential into practice.

Momentum for co-operation, however, is building. Unlike past efforts that stalled amid political caution and underinvestment, today’s push is backed by pressure from multinational manufacturers to decarbonise supply chains and the growing strain of energy security and affordability concerns; giving governments stronger incentives to co-operate than in previous decades. “The need to have a more resilient grid and to lower costs is forcing governments to the table, to try to put agreements for grid access rules and interconnections in place to increase energy trade,” says Peter duPont, co-founder and co-chief executive ACE Partners. “That, to some extent, overcomes the previous barriers, which were based on national interest and feelings of if you’re exporting power, you are less energy secure.”

In 2025 the World Bank and Asian Development Bank pledged more than \$12bn to advance the APG, alongside an earlier \$7.7m grant earmarked for project preparation.<sup>37,38</sup> Concrete actions are also emerging. The LTMS-PIP, launched in 2022, plans in Phase Two to expand cross-border hydropower capacity from 100 megawatts to a maximum of 200 megawatts, enabling multidirectional power flows across four grids.<sup>39</sup> Hydropower and geothermal meet much of the region’s renewable demand<sup>40</sup> and was the first renewable energy traded multilaterally. “The project has demonstrated the technical feasibility of wheeling power across multiple national systems, showing that ASEAN’s grids can be operated in a co-ordinated way when protocols are agreed in advance,” says Datuk Razib Dawood, executive director of the ASEAN Centre for Energy.

After a decade of talks and negotiations, the Monsoon Wind project started exporting power from Laos to Vietnam in August 2025. It is Asia’s first cross-border wind energy project and the largest wind farm in Southeast Asia.<sup>41</sup> Financed by a syndicate of regional and global lenders, it also delivers \$1.1m annually to local development initiatives ranging from scholarships and health, to supporting coffee farmers. Other regional efforts include Malaysia’s ENEGEM, which launched in 2024 as a digital trading auction platform enabling cross-border renewable energy transactions with Singapore.

Sustained political will is more decisive than technical or financial readiness, argues Mr Dawood: “Political capital is the first capital to realise the APG dream.” The Enhanced APG agreement, signed by ASEAN members in October 2025, signals renewed political momentum.<sup>42</sup> But turning commitments into co-ordinated reforms will test ASEAN’s ability to harmonise standards, regulations and business models for regional trade. By transforming a patchwork of national markets into a coherent low-carbon platform, ASEAN could position itself as a credible hub for clean energy in an era of shifting geopolitical power dynamics.

# Adapting global lessons to regional realities

ASEAN need not start from scratch. It can leverage the existing grid infrastructure and create a unified market framework that makes better use of today's national grids while laying the groundwork for tomorrow's regional link. "The primary lesson is to develop the APG as a common trading platform that offers the benefit of optimising existing infrastructures and initiating future interconnections," explains Mr Dawood. Other regions have pioneered policy tools that could be adapted to the region's more fragmented markets. For ASEAN, the challenge is to combine these lessons into a pragmatic and gradual model that reflects its own political economy, but with a clear direction toward a regional clean-energy system.

## Codified rules to lower friction

Codified rules are essential to reduce friction and move beyond ad hoc bargaining. ASEAN still lacks region-wide arrangements for aspects like wheeling metering, loss factors, data sharing and settlement (reconciling and paying for power traded and lost across borders). The LTMS-PIP negotiations over wheeling charges were protracted, with some stakeholders disagreeing over rates, with no clear formula to anchor decisions. In the end, charges were set largely to get the deal moving.<sup>43</sup> Without a common rulebook covering such details, every new project risks the same drawn-out process. Establishing clear, consensus-based standards would provide predictability for investors and trust among governments, turning one-off political compromises into bankable regional assets.

By comparison, the Central American Electrical Interconnection System (SIEPAC) has codified rules for transmitting power across borders and how it is paid for, though with some limitations due to partial commitment and weak enforcement.<sup>44</sup> The trading layer created by SIEPAC explicitly allows regional generators and large consumers to contract across borders using the shared transmission line. The regional transmission company provides non-discriminatory access and wheeling charges are set under regional regulation. By creating a neutral trading layer with its own operator, regulator and asset company, SIEPAC sidesteps conflicts of interest and enables trade among otherwise disparate national markets.



### Governance institutions to build trust

Integration cannot advance on rules alone. Trusted institutions must enforce them. The EU's regional co-ordination centres ensure grid security across borders, while cross-border cost allocation rules set by the EU Agency for the Cooperation of Energy Regulators guarantee that those who benefit from infrastructure also share its costs. Together, they underpin the EU's integrated day-ahead and intraday markets,<sup>45</sup> allowing electricity to flow automatically to where it is most needed.

ASEAN's consensus-driven model lacks such supranational authority, but lighter institutions are possible. A co-ordination centre could begin with practical tasks such as outage planning and cross-border capacity studies, while a regional transparency hub could publish standardised data on demand, generation and outages—much like the European network of transmission system operators for electricity.<sup>46</sup> Today, some ASEAN governments treat energy data as confidential, and grid operators and investors often work with incomplete or opaque information. Closing this trust gap is as important as building interconnectors themselves.

### Policy instruments to crowd-in capital

Even with rules and institutions in place, investors will not move at scale without predictable returns and credible risk-sharing. Feed-in tariffs, which are policies that can guarantee renewable generators a fixed, long-term price for the electricity they supply to the grid, can encourage investment by offering stable, above-market payments from renewable sources, as in Europe.<sup>47</sup> Today in the EU, contracts for difference—government guarantees that top up revenues when market prices dip and claw them back when they rise—provide long-term price stability, lowering financing costs for offshore wind and other capital-intensive projects.<sup>48</sup> The Connecting Europe Facility for Energy, an EU funding programme that is part technical support, part concessional finance, part guarantee platform, helps implement the Trans-European Networks for Energy policy. By blending these elements, Europe has moved high-risk interconnectors across the financial finish line.

The lesson for ASEAN is to adopt the principle of certainty by creating long-term frameworks that reduce risk and stabilise cash flows. The APGF can help prepare and de-risk projects, but will only succeed if it goes beyond loans. Singapore's plan to grant 30-year licences for renewable imports is a rare example of providing investors with the certainty needed to justify high upfront costs.<sup>49</sup> Extending such instruments region-wide, backed by an enhanced APGF, could bridge the gap between cheap technology and hesitant capital. "The key is to develop ways for the private sector to participate in funding transmission and distribution infrastructure in a way that's safe for them. One way is through public-private partnerships or risk-sharing mechanisms. Otherwise governments will hit debt ceilings," says Mr duPont.



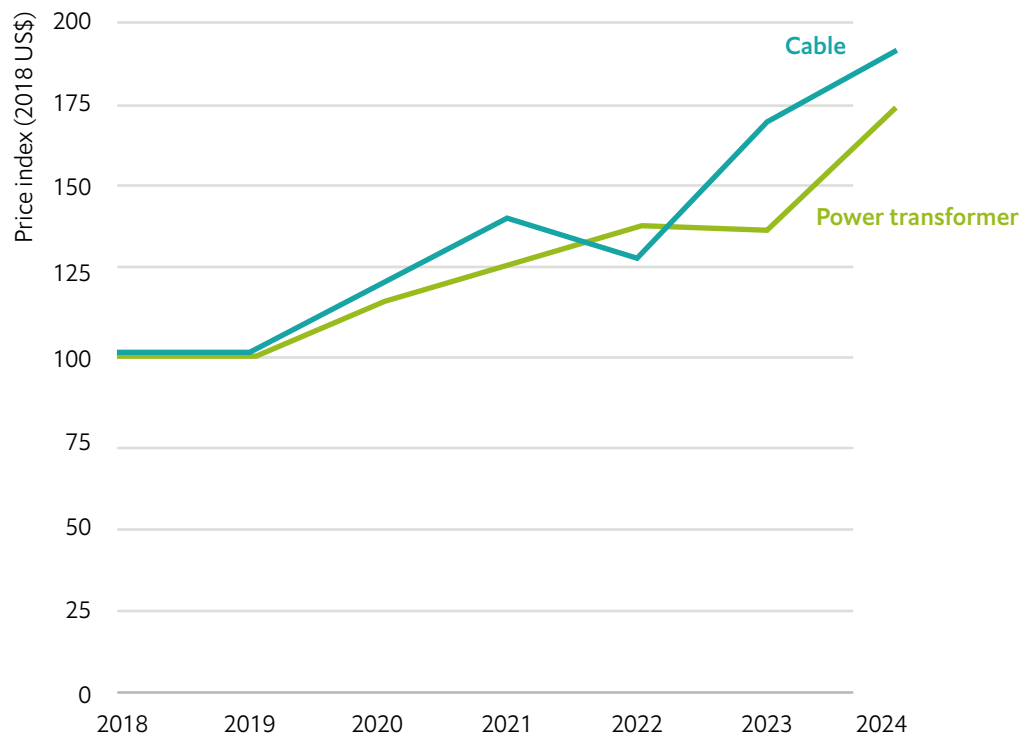
## Building critical infrastructure for transmission

To knit together fragmented systems and unlock regional trade in clean energy, ASEAN must expand its transmission lines. HVDC technology, especially subsea cables, is critical as it allows large volumes of electricity to be transported efficiently across long distances and between systems with different frequencies, making them indispensable for ASEAN's archipelagic geography.

Existing examples provide helpful use cases for ASEAN. In Europe, the 720km North Sea Link between Norway and Britain—the world's longest subsea interconnector—enables surplus hydropower to stabilise Britain's wind-heavy grid. Africa's Kenya–Ethiopia HVDC connector marks a step change on a continent where nearly half of the population lacks reliable access to electricity. The 1,045km HVDC line links Ethiopia's hydropower with Kenya's grid, and eventually the wider East African Power Pool, cutting costs and improving reliability.<sup>50</sup> Additional projects connecting Kenya and Tanzania under the Programme for Infrastructure Development in Africa, are extending this network, making cross-border power sharing increasingly feasible across Eastern and Southern Africa.<sup>51</sup>

Despite the upsides, there are challenges with HVDC technology. The global supply chain for cables, converters and laying vessels is already stretched. Prices and waiting times for cables and transformers have nearly doubled in the past five years (Figure 4), as Europe and China have pre-booked much of the available capacity.<sup>52</sup> It can take two to three years to procure cables and up to four years to secure large power transformers, according to a survey by the International Energy Agency.<sup>53</sup> ASEAN must be more proactive in co-ordinating procurement or risk costly delays.



**Figure 4: Wiring the transition is not cheap***Power transformer and cable price index in real terms, 2018-2024*

Source: Building the Future Transmission Grid, IEA, 2024.

Subsea and underground HVDC cables face added risks, such as anchor strikes and thermal limitations, especially in densely packed corridors.<sup>54</sup> "There are technical issues with subsea cables, as well as regulatory and legal issues over ownership and the licence permit authority for their construction," says Mr Mitsuhashi, emphasising the need for a robust upstream legal regulatory framework that will provide assurance to investors.

**Digitalisation for optimised integration**

Physical interconnectors are not enough. Smart systems are essential to make renewables manageable at scale. Even in countries like Spain and Portugal, where physical grid infrastructure is strong and well-developed, the shift towards variable renewable energy sources demands an extra layer of intelligence, notes Mr Utama. Traditional infrastructure can generally handle steady baseload power, but when supply fluctuates, it requires advanced forecasting, smart grids and AI-driven demand-response platforms to maintain balance.

Digitalisation will be indispensable. Advanced sensors, real-time data sharing and AI forecasting can help smooth variable renewable output and reduce reliance on costly backup generation. The shift from the traditional bilateral trade to a genuinely regional system will also demand new skills, from operating subsea HVDC cables to managing digital platforms for regional power flows. Without this, ASEAN risks building physical infrastructure that cannot be fully optimised.

### People, not just power

Climate impacts are already destabilising ASEAN. Rising seas and increasing intensity and frequency of typhoons and heatwaves disrupt grids and livelihoods. Yet energy remains a neglected adaptation priority, with most governments still treating it mainly as a mitigation issue.<sup>55</sup> National transition speeds differ sharply, influenced by politics and resources, making co-ordination difficult.

Equity is the sharpest fault line. The coal industry provides millions of jobs so removing it without alternatives risks unrest. At the same time, poor households and indigenous communities face exclusion if energy policy focuses on megawatts over affordability. Without trust, infrastructure projects stall on access to land, permits and political will. “To secure support for grand ASEAN power-grid initiatives, it is vital to show how the benefits reach the whole of society,” says Mr Mitsuhashi.

Rolling out advanced technologies will require a new generation of engineers, data specialists and technicians. “There are gaps in cross-border power trade mechanics such as insufficient skills and institutional experience in designing and enforcing harmonised grid codes, congestion management practices, settlement systems and market models that can sustain multilateral exchanges,” says Mr Dawood. Building these skills domestically is essential if ASEAN is to avoid swapping fossil-fuel dependence for a new reliance on imported expertise and equipment. Clean-energy trade also needs to be framed as a pathway to equitable growth by ensuring that communities hosting generation assets gain jobs and affordable access to power, rather than seeing it be exported while they remain in the dark.

ASEAN can learn lessons from elsewhere. Europe’s integrated market shows how cross-border trade can cut costs and boost resilience. The EU’s internal electricity market already saves consumers about €34bn (\$40bn) per year compared with more fragmented national systems. With further integration (more interconnectors and harmonised rules), projected savings rise to €40–43bn (\$47–50bn) by 2030.<sup>56</sup>

Other regions highlight the importance of equity and local capacity. Brazil’s vast hydropower exports to its neighbours have been paired with programmes to expand rural electrification, ensuring domestic communities also benefit. Alongside the Ethiopia–Kenya

HVDC interconnector, utilities invested in training engineers and operators in HVDC technologies, with staff from Kenya and Ethiopia receiving training on how to build long-term technical capacity.<sup>57</sup> Communities along the route gained access to mini-grids and new connections, while livelihood restoration programmes supported those who had been displaced.

“If you have common interconnection standards, access and common rules on grid operation, it will be more equitable; more equitable than a bilateral [deal] where you have a ‘big brother’ and a junior [partner],” says Mr duPont. For ASEAN, such examples show that designing regional grid projects with embedded training, skills transfer, community electrification and clear benefit-sharing arrangements will help build trust and social legitimacy—not just the wires and contracts.

# The prize of connection

ASEAN's power puzzle is less about engineering than about politics, capital and trust. A functioning regional grid promises to enhance growth and energy security, yet inertia threatens to strand cheap electrons in sun-drenched fields and hydro-rich valleys. While HVDC cables can be laid, without agreeing on and applying codified rules and regulatory mechanisms to share both risk and reward, the wires will carry little beyond ambition. Yet if ASEAN can move from piecemeal deals and one-off pilots to a coherent market, it could turn its fragmented grids into a continental hub of clean power, in turn attracting investment and anchoring new industries from data centres to green hydrogen. The region could convert great-power rivalry into leverage, using FDI and technology to accelerate its own transition.



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