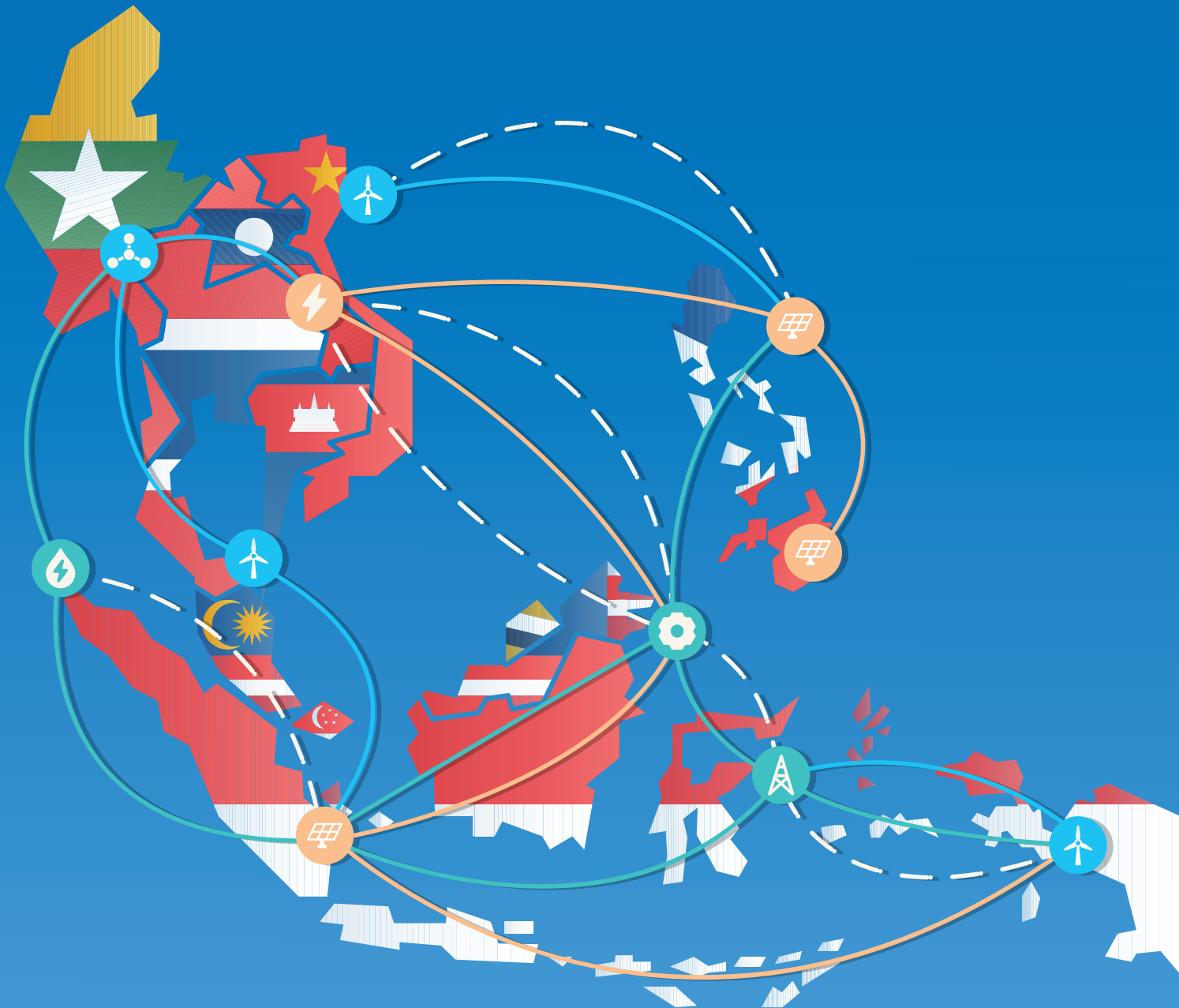


# Unlocking Private Capital in **ASEAN:**

Third-party Investment Models  
for Grid Decarbonization and  
Regional Integration



## Acknowledgements

### About the publication

*Unlocking Private Capital in ASEAN: Third-party Investment Models for Grid Decarbonization and Regional Integration* is developed by the Institute for Environment and Sustainability (IES), Lee Kuan Yew School of Public Policy (LKYSPP), National University of Singapore (NUS), under a two-year research project on grid decarbonisation and energy connectivity in ASEAN. The project was led by Maitreyee Mukherjee (Research Fellow, IES, LKYSPP, NUS), with research support from Anmol Nayak (Research Associate, IES, LKYSPP, NUS).

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### About the Institute for Environment and Sustainability

The Institute for Environment and Sustainability (IES) at the Lee Kuan Yew School of Public Policy, National University of Singapore, is a policy-focused think tank advancing practical solutions for Southeast Asia's environmental and sustainability challenges. IES bridges research and policy by helping governments, institutions, and stakeholders translate sustainability ambitions into effective, durable outcomes through applied analysis, dialogue, training, and capacity building.

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## Foreword

Southeast Asia stands at a pivotal point in its energy transition. Economic growth, urbanisation, digitalisation, and emerging technologies are driving demand for reliable, affordable, and sustainable electricity. At the same time, ASEAN has set ambitious goals for decarbonisation, renewable energy deployment, and regional energy cooperation. Achieving these objectives will depend not only on new generation capacity, but also on the strength, resilience, and connectivity of the grids that underpin the region's energy system.

Transmission infrastructure is the backbone of this transition. Without investment in grid expansion, modernisation, and cross-border interconnection, ASEAN's ambitions for renewable energy integration, energy security, competitiveness, and regional power trade will remain constrained. Equally important are the institutional, regulatory, and financial frameworks needed to deliver bankable projects.

This publication, *Unlocking Private Capital in ASEAN: Third-party Investment Models for Grid Decarbonization and Regional Integration*, makes a valuable contribution to this discussion. It highlights a fundamental reality: capital is available, but investment flows only where projects are bankable, risks are appropriately allocated, and revenues are predictable. ASEAN's grid challenge is as much about institutions and implementation as it is about finance.

The analysis comes at a timely moment. Momentum behind the ASEAN Power Grid, new cross-border electricity initiatives, and growing investor interest are creating opportunities for deeper regional connectivity. Yet governments alone cannot meet the scale of investment required. Mobilising private capital, supported by blended finance and effective de-risking mechanisms, are essential to accelerating transmission development across the region.

Importantly, the publication avoids a one-size-fits-all approach. Recognising the diversity of ASEAN energy systems, it offers a practical framework for policymakers, utilities, investors, and development partners to assess conditions for private participation. By examining domestic grid investments and cross-border interconnections, the study underscores that regional energy integration is not solely an infrastructure challenge, but also one of cooperation, trust, interoperability, and shared vision.

The decisions taken this decade will shape Southeast Asia's energy future. By establishing the institutional foundations for scalable transmission investments, ASEAN can unlock private capital and create new pathways to energy security, economic resilience, and sustainable growth.

This publication serves as a resource for policymakers, regulators, utilities, investors, development institutions, and other stakeholders advancing ASEAN's energy transformation. It will stimulate further discussion on how regional cooperation, innovative financing, and forward-oriented policy can build the grids that will power the region's energy future.

**Peter Govindasamy**  
Executive Director, Energy Studies Institute  
National University of Singapore

## Executive Summary

ASEAN's energy transition and long-term economic growth will depend on stronger transmission networks as much as new generation capacity. Recent estimates suggest the region will need more than USD 300 billion in grid expansion and modernisation from 2025 to 2040. Most of this investment will be for domestic grid expansion, reinforcement, and modernisation, while ASEAN Power Grid interconnectors represent a smaller but distinct asset class with more complex bankability challenges.

This whitepaper argues that ASEAN's grid-financing challenge is not simply a shortage of capital. It is a bankability and delivery challenge. Transmission assets are capital-intensive, long-tenored, often embedded in state-led utility systems, and dependent on regulated or utility-backed revenues. Mobilising private capital therefore requires credible revenue arrangements, predictable regulation, bankable counterparties, clear risk allocation, and sufficient implementation capacity.

To assess transmission bankability across ASEAN, the paper develops a comparative framework organised around three pillars:

- **Market and regulatory structure:** whether sector organisation, transmission operating models, regulation, and tariff frameworks can support predictable revenues, cost recovery, and enforceable investment conditions.
- **Policy and implementation readiness:** whether policy ambition is matched by instruments that enable transmission investment in practice.
- **Financing and delivery capacity:** whether utilities, financing channels, and implementing institutions can move projects from planning to execution.

Applying this framework reveals a differentiated landscape. Transmission remains largely state-led across ASEAN, even where generation has been opened to private participation. Policy ambition around renewable integration and regional interconnection is widespread, but operational instruments remain uneven, often incomplete. Financing capacity also varies: some systems benefit from stronger utilities and deeper domestic capital markets, while others depend on sovereign borrowing, concessional finance, or structured project-level support.

The analysis identifies three broad transmission bankability profiles. These are not rankings, but qualitative profiles of different country contexts.

More mature systems — *Singapore, Peninsular Malaysia, and Thailand* — have stronger regulatory and institutional foundations, as well as better financing capacity. Their main challenge is delivery speed, coordination, and creating controlled pathways for private participation in selected grid and interconnector assets.

Intermediate systems — *Vietnam, the Philippines, and Indonesia* — combine high investment need and reform momentum with uneven bankability. Key constraints include payment security, tariff uncertainty, project preparation, utility or counterparty risk, and implementation bottlenecks.

More constrained systems — *Cambodia and Lao PDR* — face weaker system-wide bankability, limited utility creditworthiness, and greater dependence on concessional or bilateral finance. Yet they also show that private or quasi-private participation can emerge through project-level structures such as BOT-type assets, strategic partnerships, or generation-linked export infrastructure.

The paper also emphasises that domestic readiness is necessary but not sufficient for cross-border transmission. Interconnectors require an additional layer of bilateral and regional arrangements covering legal authority, revenue recovery, wheeling and settlement, technical coordination, cost allocation, and dispute resolution.

Several private participation models relevant to ASEAN are reviewed, including independent transmission projects, tariff-based competitive bidding, generation-linked transmission, utility-developer joint ventures, whole-of-grid concessions, and merchant transmission. These models are not bankable by themselves; they require different de-risking approaches depending on country and project context. Blended finance should therefore be treated as an enabling layer to address specific bankability gaps, including weak utility creditworthiness, tariff affordability, foreign-exchange exposure, first-mover risk, political risk, and cross-border settlement uncertainty.

The paper concludes with four policy priorities. **First**, ASEAN needs to convert grid ambition into bankable project pipelines with clear revenue models, credible counterparties, permitting pathways, risk allocation, procurement timelines, and durable long-term revenue arrangements. The case evidence shows why this is important: India's transmission projects under tariff-based competitive bidding model rely on long-term Transmission Service Agreements, often structured around 35-year concession periods, while Monsoon Wind's 25-year Power Purchase Agreement with EVN helped provide the revenue certainty needed to support long-tenor finance. **Second**, private participation models and de-risking tools should be matched to specific bankability challenges rather than applied uniformly across countries or project types.

**Third**, blended finance should be used selectively and with discipline, targeting specific risks such as weak utility creditworthiness, tariff affordability, foreign exchange exposure, first-mover challenges, and cross-border settlement uncertainty. **Fourth**, ASEAN needs to move from ambition to realisation by structuring bankable transmission projects that can progressively build toward open-access, multi-user regional infrastructure. Brazil's transmission auction model and Greenlink's cap-and-floor interconnector regime show that standardised rules for access, revenue recovery, procurement, and risk allocation are central to making multi-user transmission investable. Ultimately, the priority is to build the institutional architecture that makes transmission investment bankable, repeatable and scalable across domestic and cross-border contexts.

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CHAPTER

# 1

## Introduction





ASEAN's energy transition and long-term economic growth will depend not only on new generation capacity, but also on stronger transmission networks. Whatever the pace of the transition, countries across the region will need far greater investment in grid expansion and modernisation<sup>i</sup>. Yet transmission remains one of the hardest infrastructure asset classes to finance. These assets are capital-intensive, long-tenored, often sit within state-dominated utility structures, and face regulatory, political, permitting, and right-of-way risks<sup>ii</sup>. Public and multilateral funding will remain essential but are unlikely to be sufficient on their own to meet the scale of grid investment required. This places grid bankability at the centre of the financing challenge: whether projects can be structured, financed, and delivered on terms that attract long-term private capital. In practice, that depends on credible revenue and tariff frameworks, durable regulatory commitment, and risk-allocation arrangements that can support long-tenor finance at acceptable cost<sup>iii</sup>.

ASEAN's electricity demand is projected to more than double from 2022 levels by 2050<sup>iv</sup>, driven by industrialisation, urbanisation, and fast-growing digital infrastructure (Figure 1). In contrast, based on available data, current transmission expansion plans are estimated to

address only about 45% of the additional infrastructure required<sup>v</sup>. Reliable grid access is also becoming a more immediate investment constraint, as fast-growing demand from new sectors increasingly collides with existing network limits. In Malaysia<sup>vi</sup>, for example, the data-centre boom is already straining grid and resource capacity<sup>vii</sup>, while across the region the rapid expansion of electric vehicles, especially in Thailand and Vietnam<sup>viii</sup>, is adding new structural and peak-load pressures.

Even as most ASEAN member states have adopted mid-century net-zero ambitions, fossil fuels still accounted for roughly three-quarters of regional electricity generation in 2024<sup>ix</sup>. Renewable installed capacity has grown, reaching about 33.7% in 2024, but renewables still accounted for a much smaller share of total primary energy supply, at around 14.1%<sup>x</sup>. These figures point to a broader transition challenge: adding renewable capacity is necessary, but not sufficient. As electricity demand grows and more sectors electrify, transmission constraints will increasingly determine where clean energy can be connected, how reliably it can be dispatched, and whether new industrial loads can be served. Grid expansion is therefore no longer a secondary issue at the margins of the transition. It is central to renewable integration, industrial competitiveness, energy security, and regional power trade.

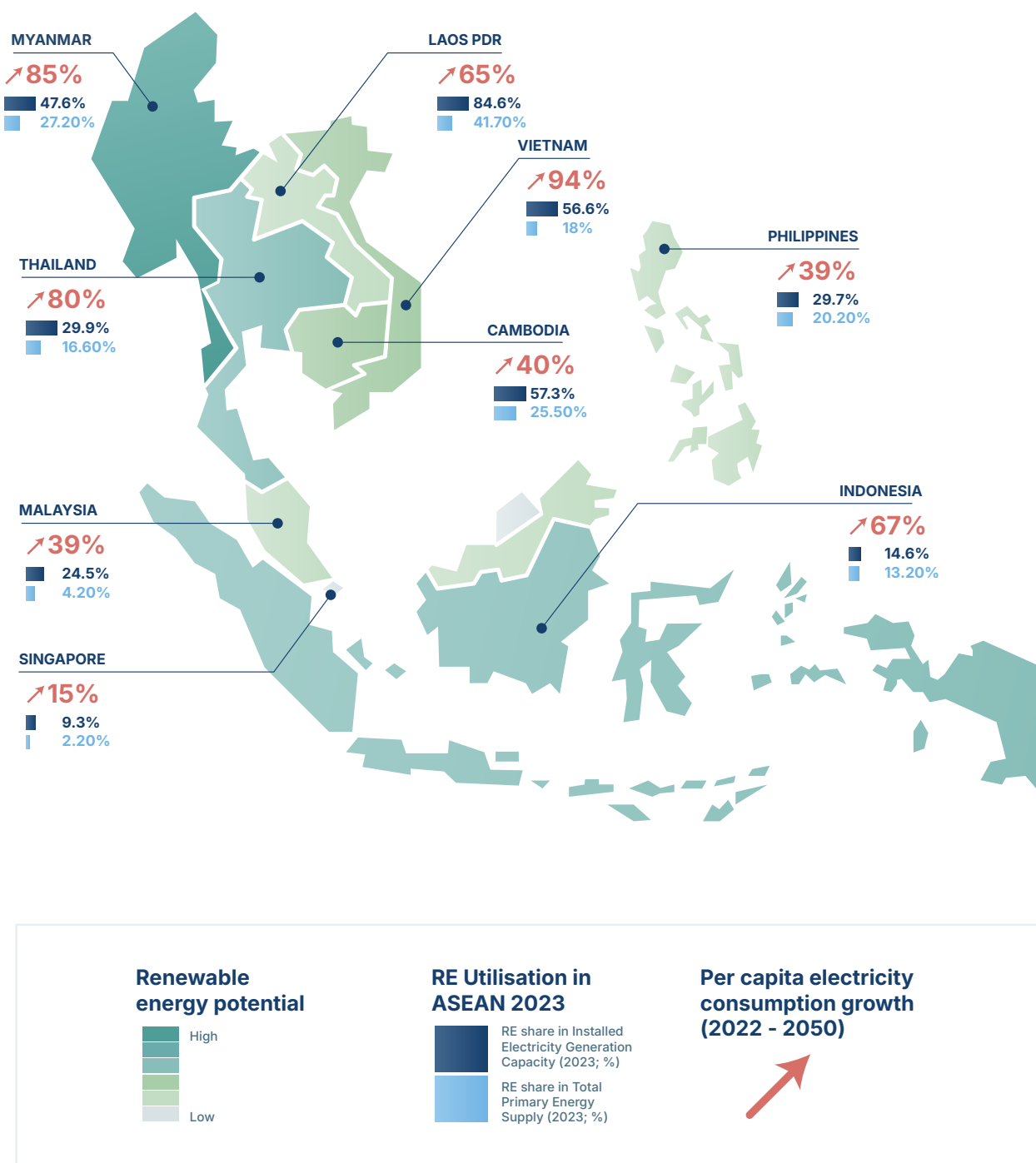
The scale of ASEAN's grid investment requirement is substantial, spanning two related but distinct asset types: domestic grid expansion and cross-border interconnection. Recent IEA analysis estimates that the region will require over USD 300 billion in grid expansion and modernisation from 2025 to 2040<sup>xi</sup>, while planned APG cross-border interconnectors account for around USD 27 billion to 2040<sup>xii</sup>. This shows that the major share of investment lies in domestic grid expansion, reinforcement, and modernisation; while interconnectors form a smaller but distinct asset class with added bankability challenges around legal structure, revenue recovery, cost allocation, wheeling and settlement, technical coordination, and dispute resolution across jurisdictions.

Recent IEA analysis<sup>xiii</sup> has sharpened understanding of the investor-side barriers to regional interconnectors and the business models needed to support APG development. This white-paper complements that perspective by focusing on the national conditions that shape transmission bankability across ASEAN member states. Its contribution is a comparative country-readiness lens that explains why private participation pathways differ across domestic transmission systems, while also showing why cross-border projects require an additional layer of bilateral and regional coordination beyond country-level readiness alone.

The paper asks three questions: how prepared ASEAN power systems are to attract investment for transmission expansion and modernisation; how market, policy, financing, and delivery conditions shape the scope for private participation; and what these differences imply for domestic grid expansion and cross-border interconnection under the ASEAN Power Grid.

It argues that ASEAN's transmission challenge is not simply whether private capital can participate, but under what institutional, regulatory, financial, and project-delivery conditions such participation becomes viable, affordable, and repeatable. The analysis develops a typology of transmission bankability profiles across ASEAN, showing that private participation and de-risking needs vary by country context. Case studies on India's Green Energy Corridor and the Lao PDR-Vietnam Monsoon Wind project, alongside comparative examples from Brazil and UK's Greenlink, are used to draw prospective lessons for domestic grid expansion, generation-linked cross-border projects, and the longer-term move toward open-access, multi-user regional transmission in ASEAN.

# ASEAN Energy Landscape

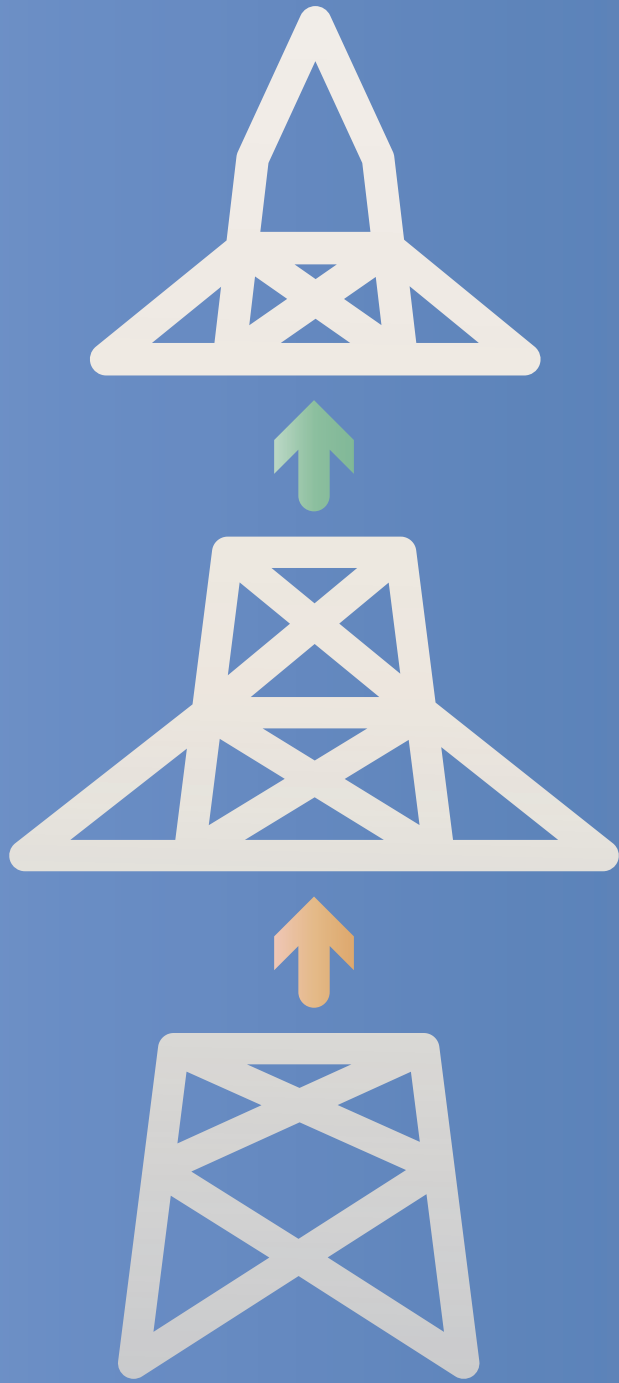


**Figure 1:** ASEAN electricity consumption and renewable energy landscape. The colour differentiated map shows renewable energy (RE) potential across ASEAN Member States. Country-level statistics show projected growth in per capita electricity consumption from 2022 to 2050 (red), the renewable energy share of installed electricity generation capacity (dark blue), and the renewable energy share of total primary energy supply (light blue). (Sources: 8th ASEAN Energy Outlook 2024, IRENA 2024, ASEAN Energy Statistics Leaflet 2025).

CHAPTER

# 2

## Assessing Transmission Bankability across ASEAN

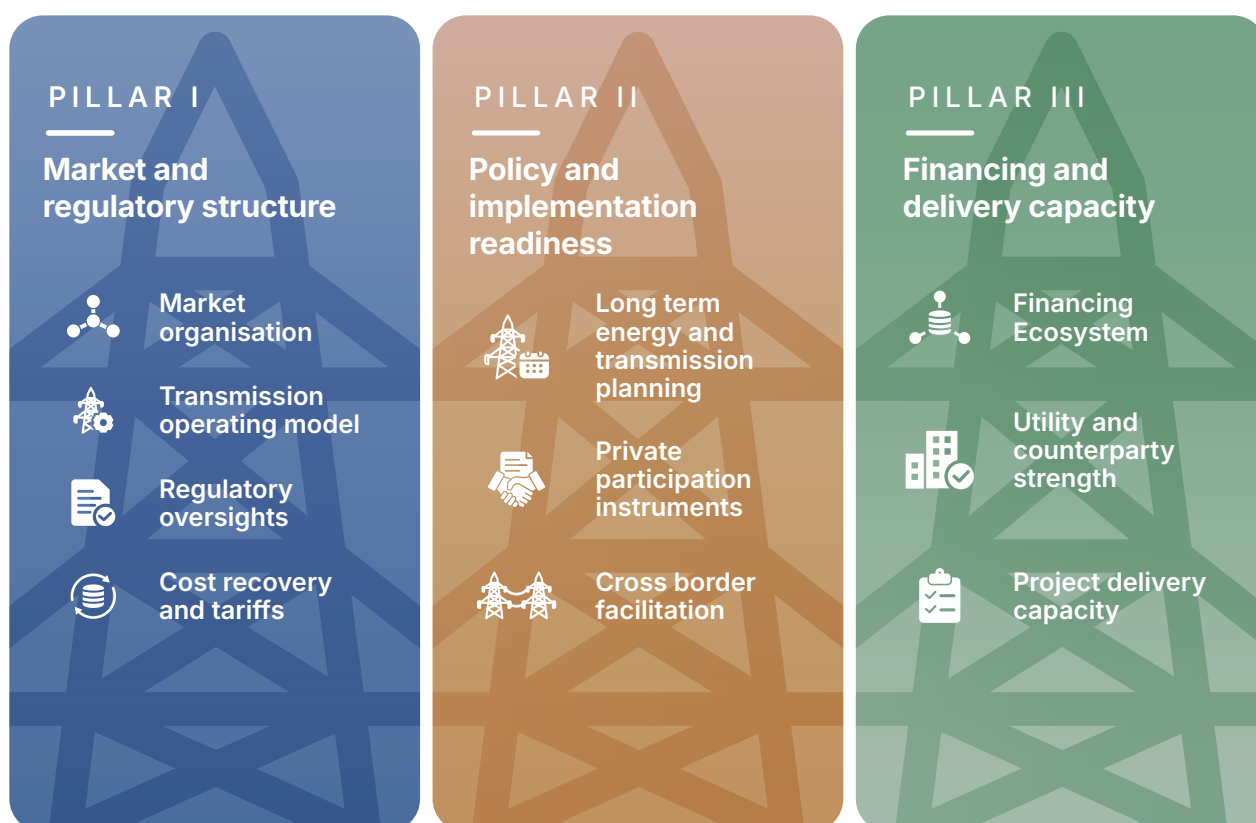


## 2.1. Analytic Framework

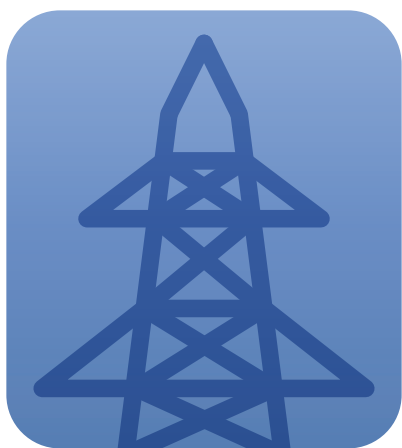
To examine how transmission bankability varies across ASEAN, this paper applies a comparative framework centred on three dimensions: market and regulatory structure, policy and implementation readiness, and financing and delivery capacity (Figure 2). Existing literature has consistently shown that grid readiness is shaped as much by institutions, policy frameworks, market design and incentives as by technological requirements<sup>xiv</sup>.

Transmission is a long-lived, regulated asset class whose bankability depends not only on infrastructure need, but on the interaction between sector structure, implementation readiness, and financing conditions<sup>xv</sup>. Weakness in any one of these dimensions can constrain project delivery. Ambitious renewable energy targets may not translate into investable transmission projects if market entry remains unclear, enabling policy instruments are incomplete, or utilities and counterparties lack the financial strength to support long-tenor capital. The framework therefore shifts the analytical focus from what ASEAN power systems plan to build to the conditions under which transmission projects can actually be financed and delivered.

The framework is designed primarily to assess domestic transmission investment readiness across national power systems. It is also relevant to cross-border projects, but in such cases country-level readiness provides only a first layer of analysis, since interconnectors depend on additional bilateral and regional arrangements that are not fully captured by national conditions alone.



**Figure 2:** Analytic framework to assess domestic transmission bankability (developed by authors)



## Market and regulatory structure

This pillar assesses the institutional foundations that shape transmission bankability, including power sector organisation, the transmission operating model, regulatory oversight, and cost-recovery arrangements. Table 1 summarises the factors assessed under this pillar.

**The first factor is market organisation.** This refers to the overall structure of the electricity sector as they shape the general conditions under which transmission investment takes place. It includes assessment criteria such as the degree of vertical integration or unbundling, the role of the single-buyer model, openness of the power market, extent of private participation across the power supply value chain, and clarity of market-entry conditions.

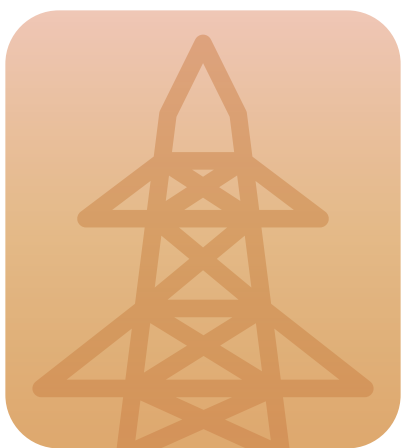
**The second factor is the transmission operating model.** This concerns who owns, operates, and expands the transmission network: a state utility, a regulated monopoly, a concessionaire, a joint venture, or some other hybrid structure. The operating model influences revenue certainty, investment responsibility, the scope for private entry, and the degree to which financing can be structured at project level rather than absorbed within a broader state-led utility framework.

**The third factor is regulatory oversight.** This includes the role and independence of the sector regulator, the clarity of approval and review processes, and the extent to which tariff-setting and investment decisions are governed by predictable rules rather than discretionary intervention. Stronger regulatory oversight supports investor confidence.

**The fourth factor is cost recovery and tariffs.** This refers to whether tariff frameworks are sufficiently predictable and adequate to support transmission investment over time. It includes the credibility of cost-recovery mechanisms, the extent of subsidies and whether revenues can sustain long-term financing obligations.

**Table 1:** Factors assessed under the market and regulatory structure pillar.

| FACTORS                                                                                                                 | CORE QUESTION                              | KEY ASSESSMENT CRITERIA                                                                                  |
|-------------------------------------------------------------------------------------------------------------------------|--------------------------------------------|----------------------------------------------------------------------------------------------------------|
|  <b>Market organisation</b>          | How is the electricity sector structured?  | Unbundling; single-buyer model; market openness; private participation across power supply value chains. |
|  <b>Transmission operating model</b> | Who owns, operates, and expands the grid?  | State utility role: regulated monopoly/ concession/ JV-hybrid; project-level financing scope.            |
|  <b>Regulatory oversight</b>         | Are rules predictable and enforceable?     | Regulator independence; rule-based decisions; tariff/investment oversight.                               |
|  <b>Cost recovery and tariffs</b>    | Can revenues support long-term investment? | Tariff predictability; cost recovery; subsidy exposure.                                                  |



## Policy and implementation readiness

This pillar assesses whether policy ambition is matched by instruments that can enable transmission investment in practice. The emphasis is therefore on implementation readiness rather than policy ambition alone. Countries may have strong transition goals or regional-integration objectives, but where enabling instruments remain incomplete, project bankability and delivery are likely to remain limited. Table 2 illustrates the factors assessed under this pillar.

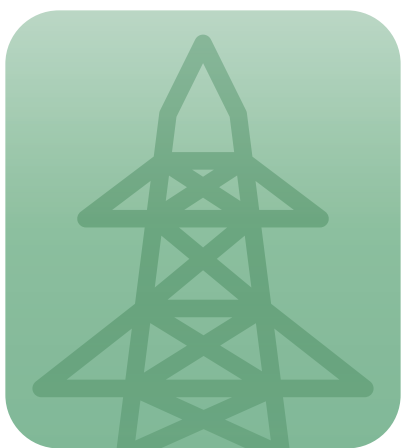
**The first factor is long-term energy and transmission planning.** This includes national energy or power development plans, transmission development plans, and renewable integration strategies. The assessment considers not only the alignment of grid expansion with demand growth and new generation, but also the strategic priority given to domestic network upgrades versus cross-border interconnection. This matters because a country's stated priorities signal where investment and policy attention are most likely to be directed.

**The second factor is private participation instruments.** This includes the legal and regulatory tools that create workable pathways for non-state participation in transmission or transmission-related investment. Examples include PPP laws, third-party access rules, wheeling arrangements, concession (like BOT) tools and direct procurement mechanisms. Their importance lies not simply in signalling openness to reform, but in determining whether projects can be structured, tendered, financed, and delivered.

**The third factor is cross-border facilitation.** This refers to the specific domestic policy and legal arrangements that enable participation in cross-border electricity trade. It is distinct from the strategic priority to interconnect; it assesses the operational readiness to do so. This may include import and export permissions, domestic approval pathways for interconnector projects, and rules that support cross-border transactions or grid use.

**Table 2:** Factors assessed under the policy and implementation readiness pillar.

| FACTORS                                                                                                                               | CORE QUESTION                                                 | KEY ASSESSMENT CRITERIA                                                                                                       |
|---------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------|
|  <b>Long-term energy and transmission planning</b> | Are grid priorities clearly reflected in national plans?      | Power and transmission plans; renewable integration; demand-growth alignment; domestic vs cross-border priorities.            |
|  <b>Private participation instruments</b>          | Are there functional instruments for non-state participation? | PPP laws; TPA rules; wheeling framework; direct procurement rules; concession/BOT provisions; tendering and delivery clarity. |
|  <b>Cross-border facilitation</b>                  | Is the country operationally ready for cross-border trade?    | Import/export permissions; interconnector approvals; cross-border grid access; wheeling and transaction rules.                |



## Financing and delivery capacity

This pillar assesses whether transmission projects can be supported by suitable financing channels, credible counterparties, and implementation capability to move from planning to execution. Table 3 lists the factors assessed under this pillar.

**The first factor is financing ecosystem.** This refers to the range and usability of financing sources available for grid investment, including public budgets, utility or sovereign borrowing, MDB and concessional finance, commercial lending, domestic capital markets, green finance instruments, blended and private capital. The key question though, is not

whether capital exists in principle, but whether it can be mobilised at the scale, tenor, and risk allocation required for long-lived transmission assets.

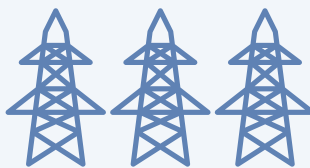
**The second factor is utility and counterparty strength.** This refers to whether utilities, system operators, or other regulated counterparties can credibly support long-term transmission obligations. Relevant indicators include earnings strength, leverage or debt burden, debt-service capacity, tariff cost recovery, subsidy or sovereign-support dependence, and financial transparency. Since transmission investment in ASEAN remains closely tied to state utilities, regulated tariffs, or public payment arrangements, weak utility or counterparty finances can undermine bankability even where external financing is available.

**The third factor is project delivery capacity.** This refers to the ability of institutions and utilities to prepare, approve, procure, coordinate, and implement transmission projects. It includes project pipeline quality, permitting and right-of-way processes, procurement and contract management capacity, institutional coordination, and delivery track record. This matters because delays in approvals, land acquisition, procurement, or execution can raise costs, increase risks, and weaken investor confidence even where financing and credible counterparties are available.

**Table 3:** Factors assessed under the financing and delivery capacity pillar.

| FACTORS                                                                                                                      | CORE QUESTION                                         | KEY ASSESSMENT CRITERIA                                                                                                                                                                 |
|------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  <b>Financing ecosystem</b>               | Can projects access suitable long-term finance?       | Public budgets; utility or sovereign borrowing; MDB/DFI and concessional finance; commercial lending; domestic capital markets; green finance; blended or private capital availability. |
|  <b>Utility and counterparty strength</b> | Are utilities or counterparties financially credible? | Earnings strength; leverage or debt burden; debt-service capacity; tariff cost recovery; subsidy or sovereign-support dependence; financial transparency.                               |
|  <b>Project delivery capacity</b>         | Can planned projects be delivered?                    | Project pipeline quality; permitting and right-of-way processes; procurement and contract management; institutional coordination; delivery track record.                                |

## BOX 1



### Assigning factors that overlap across pillars

*Some factors naturally cut across more than one dimension of bankability. The framework, however, assigns each factor according to its primary function in shaping transmission bankability. For example, tariff frameworks are shaped by policy objectives and regulatory capacity; it also affects utility finances. In this paper, they are treated under market and regulatory structure because they determine cost recovery through predictable revenues. Likewise, instruments such as PPP laws, third-party access rules, wheeling arrangements, or direct procurement mechanisms also affect financing prospects, but they are assigned to policy and implementation readiness pillar because they create pathways for project entry and execution. Utility financial strength is itself influenced by tariff design and policy support, yet it is assessed under financing and delivery capacity because it most directly affects whether projects can attract finance to reach implementation.*

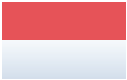
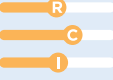
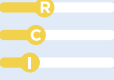
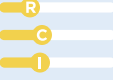
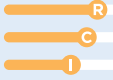
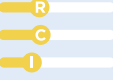
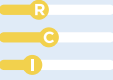
*Taken together, these three pillars provide a structured qualitative basis for comparing transmission investment readiness across ASEAN. The framework does not seek to produce a mechanical score. Rather, it offers a comparative lens for understanding how differences in institutional structure, implementation readiness, and financing conditions shape the scope for domestic transmission investment and private participation across national systems. Simultaneously, it is also recognised that cross-border interconnectors require an additional layer of analysis beyond country-level readiness alone, to consider the complications that arise at the interface between participating jurisdictions. This is further discussed in Box 2 in later part of the paper.*

## 2.2. Mapping transmission investment readiness across ASEAN

Applying the framework across ASEAN reveals wide variation in transmission investment readiness. The need for grid expansion is increasingly clear, but the conditions for turning that need into bankable projects differ substantially. In most ASEAN systems, transmission remains regulated and state-led, even where generation has been partially opened to private participation. Policy ambition around renewable integration and regional interconnection is widespread, but implementation instruments, financing capacity, utility strength, and delivery capability remain uneven. The following mapping therefore assesses ASEAN systems across the three dimensions of the framework, rather than treating grid ambition alone as evidence of readiness.

### Market and regulatory structure

Across ASEAN, transmission remains overwhelmingly organised as a regulated monopoly function. Private participation has advanced much further in generation than in transmission, where ownership and operation remain largely concentrated in state-controlled utilities. This creates a common regional pattern: even where independent power producers play a major role in generation, transmission is usually planned, financed, operated, and expanded through public utility-led structures (Figure 3).

| Market & Regulatory Structure                                  |                                                                                               |                                                                                                |                                                                                                |                                                                                                 |                                                                                                    |                                                                                                  |                                                                                                 |                                                                                                |
|----------------------------------------------------------------|-----------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|
|                                                                | <br>CAMBODIA | <br>INDONESIA | <br>LAOS PDR | <br>MALAYSIA | <br>PHILIPPINES | <br>SINGAPORE | <br>THAILAND | <br>VIETNAM |
| GENERATION                                                     |              |               |               |              |                 |               |              |             |
| TRANSMISSION                                                   | State Owned                                                                                   | State Owned                                                                                    | Joint Venture                                                                                  | State Owned                                                                                     | Private Concession                                                                                 | State Owned                                                                                      | State Owned                                                                                     | State Owned                                                                                    |
| RETAIL<br>Open Market (OM)<br>Single Buyer (SB)                |              |               |               |              |                 |               |              |             |
| INDEPENDENT<br>REGULATOR                                       | ✓                                                                                             | —                                                                                              | —                                                                                              | ✓                                                                                               | ✓                                                                                                  | ✓                                                                                                | ✓                                                                                               | ✓                                                                                              |
| TARIFS<br>(USD/kWh)<br>Residential<br>Commercial<br>Industrial |             |              |              |             |                |              |             |            |

**Figure 3:** Market and regulatory structures across ASEAN power systems. Private participation in ASEAN power systems is concentrated mainly in generation, while transmission and distribution remain largely state controlled. The main exceptions are the Philippines, where transmission is privately operated under concession, and Lao PDR, which uses a joint-venture model for high-voltage transmission. Singapore and the Philippines show the greatest degree of market opening. Tariff structures vary widely, from Singapore's more cost-reflective pricing to the higher import-linked tariffs seen in the Philippines and Cambodia reflecting cost recovery constraints, while most other systems retain tightly regulated, often subsidized tariffs. (Note: Malaysia represents Peninsular Malaysia in the figure above and rest of the paper; Brunei and Myanmar having vertically integrated structures are excluded). Abbreviations used: IPP- Independent Power Producer; EDC, PLN, ED, TNB, EGAT are state utilities of respective member countries.

Market opening varies significantly across ASEAN. Singapore and the Philippines are the region's most open power markets, but in different ways. Singapore has a liberalised, cost-reflective market and a credible regulatory environment, while transmission remains tightly regulated as critical infrastructure<sup>xvi</sup>. The Philippines provides the clearest example of private transmission participation through the National Grid Corporation of the Philippines (NGCP) concession, where a private concessionaire operates, maintains, and expands the grid while ownership remains with the state<sup>xvii</sup>. These cases show that market openness can create clearer entry points for private participation, but it does not necessarily remove delivery, affordability, or regulatory risks.

A larger group of ASEAN systems continues to operate variants of the single-buyer or state-led model. Indonesia, Thailand, Vietnam, Cambodia, Lao PDR, and Peninsular Malaysia all retain significant state control over transmission and system operation, although their regulatory and tariff environments differ considerably. In Malaysia<sup>xviii</sup> and Thailand<sup>xix</sup>, relatively stronger institutions and ongoing tariff or market-access reforms provide a more predictable environment than in more constrained systems. Vietnam<sup>xx</sup> has moved toward greater reform in generation procurement and grid-linked renewable access, but transmission remains closely shaped by state-led planning and EVN's financial position. Indonesia<sup>xxi</sup> remains highly centralised around PLN, with tariff regulation and legal constraints limiting the scope for private transmission participation.

The transmission operating model is also uneven. In most systems, transmission is owned and operated by state utilities or state-linked entities. The Philippines is the main whole-of-grid concession example. Lao PDR<sup>xxii</sup> presents a different hybrid model through EDL-T, a joint venture between Electricité du Laos and China Southern Power Grid for high-voltage transmission. This demonstrates that non-traditional transmission structures are possible in more constrained systems, but it should be characterised carefully as a strategic state-linked partnership rather than straightforward private capital mobilisation. Cambodia also has examples of project-specific BOT-type (Build, Operate, Transfer) transmission investments, but these remain selective and highly structured rather than evidence of a standardised private transmission market <sup>xxiii</sup>.

Regulatory oversight and cost recovery are central to transmission bankability, but high electricity prices do not necessarily mean tariffs are cost-reflective or bankable. Singapore's higher tariffs sit within a credible, cost-reflective regulatory regime. In Cambodia <sup>xxiv</sup> and the Philippines<sup>xxv</sup>, by contrast, high prices partly reflect fuel-import dependence and exposure to volatile generation costs rather than strong transmission revenue recovery. In Indonesia<sup>xxvi</sup>, Lao PDR<sup>xxvii</sup>, and to some extent Vietnam<sup>xxviii</sup>, tariffs remain more state-directed or politically constrained, while utility financial stress weakens confidence in long-term revenue arrangements. The key bankability issue is therefore not tariff level alone, but whether revenues are predictable, adequate, and enforceable enough to support long-tenor transmission finance.

Overall, the market and regulatory landscape show that ASEAN's transmission systems are not simply "open" or "closed." Rather, they sit along a spectrum. At one end are systems with clearer regulatory credibility and more developed private-entry precedents; at the other are systems where transmission remains deeply embedded in state-utility structures, with limited standardised pathways for private or blended capital.

## Policy and implementation readiness

ASEAN countries increasingly recognise the importance of grid expansion, renewable integration, and regional electricity trade in their long-term energy strategies. The main distinction is no longer whether countries have articulated energy-transition or grid-expansion ambitions, but whether those ambitions are supported by implementation instruments that can create credible project pipelines and enable investment (Figure 4).

In the more advanced systems, policy ambition is increasingly backed by market-access reforms and grid-enabling instruments. Singapore has linked its decarbonisation strategy to electricity imports, grid digitalisation, and future interconnection<sup>1</sup> planning. Malaysia has introduced policy instruments such as CRESS and ENEGEM<sup>2</sup>, alongside tariff reforms (IBR RP4)<sup>3</sup> and enhanced solar-with-storage programs (LSS6<sup>4</sup>), to support renewables capacity, access and cross-border electricity trade. Thailand<sup>5</sup> too has begun to develop instruments such as a draft third-party access code, a direct PPA pilot, and the Utility Green Tariff, indicating a gradual shift toward more flexible grid access for renewable energy users. These systems show relatively stronger policy and implementation readiness, although delivery still depends on timely project preparation, approvals, and coordination.

1 [Future Grid Capabilities Roadmap](#); [Demand-Side Flexibility Roadmap](#); The [Four Switches Strategy](#); government-backed [Singapore Energy Interconnections \(SGEI\) Pte Ltd.](#) to develop cross-border interconnectors.

2 [CRESS](#) (Corporate Renewable Energy Supply Scheme)- Launched in September 2024 by the Ministry of Energy Transition and Water Transformation (PETRA), CRESS establishes a third-party open grid access framework in Peninsular Malaysia. It enables private corporate consumers to bypass traditional monopolies and contract physical power purchase agreements (PPAs) directly with independent renewable energy developers. Developers access the national grid infrastructure by paying a standardized System Access Charge (SAC), providing corporations a streamlined path to fulfil their environmental, social, and governance (ESG) goals.

[ENEGEM \(Energy Exchange Malaysia\)](#)- Established in April 2024 under the Cross-Border Electricity Sales for Renewable Energy (CBES RE) scheme, ENEGEM serves as the country's central trading hub for cross-border green power. The platform employs a competitive, transparent auction mechanism allowing licensed foreign utility entities—primarily in Singapore and Thailand—to bid on and purchase excess Malaysian renewable energy.

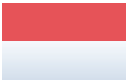
3 [The Incentive-Based Regulation Regulatory Period 4 \(IBR RP4\)](#) is Malaysia's latest electricity tariff determination framework, taking effect from July 1, 2025, to December 31, 2027, to drive the nation's energy transition while rationalising subsidies.

4 [LSS6](#)- Sixth round competitive bidding round for Large Scale Solar and Storage projects, with a total quota of 2,500MW of solar capacity paired with 1,250MW of Battery Energy Storage System (BESS). With TNB as the key off-taker, the programme incorporates fixed tariffs awarded through competitive bidding, under a long-term PPA and grid connection agreement. It primarily aims to boost the country's solar generation and export capacity.

5 [Thailand's](#) Energy Regulatory Commission (ERC) has introduced a series of landmark market-liberalisation policies to dismantle its traditional state-utility monopoly, addressing the rising clean energy demands from multinational corporations and data centres.

[Third-party access \(TPA\)](#) gives eligible parties the right to use the existing grid to transmit electricity with standardised wheeling charges. This enables [direct power purchase agreements](#) (DPPAs), under which large consumers can contract directly with private generators, often for renewable electricity. DPPA is under pilot phase having entered implementation in early 2026.

Utility Green Tariff (UGT)- For companies that choose not to or cannot contract a Direct PPA, the Utility Green Tariff (UGT) offers a bundled green power service directly through state utilities. It itemizes standard electricity alongside Renewable Energy Certificates (RECs) directly on a single bill.

| Policy & Implementation Readiness                                                                                                                                                                                                  |                                                                                               |                                                                                                |                                                                                                |                                                                                                 |                                                                                                    |                                                                                                  |                                                                                                 |                                                                                                |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|
|                                                                                                                                                                                                                                    | <br>CAMBODIA | <br>INDONESIA | <br>LAOS PDR | <br>MALAYSIA | <br>PHILIPPINES | <br>SINGAPORE | <br>THAILAND | <br>VIETNAM |
| LONG TERM ENERGY & TRANSMISSION PLANNING                                                                                                                                                                                           | PDP 2022 - 40                                                                                 | RUKN 2025 - 60<br>RUPTL 2025 - 34                                                              | NSEDP 2026 - 30                                                                                | 13th MYS Plan<br>NETR 2023                                                                      | Energy Plan 2023-50<br>TDP 2025-50                                                                 | SG Plan 2030<br>FGCR 2024                                                                        | PDP 2024-37                                                                                     | PDP 8 2025<br>Grid first transition                                                            |
| PRIVATE PARTICIPATION INSTRUMENTS                                                                                                                                                                                                  | PPP Law 2021                                                                                  | PR 38/2015 PPP/Concession Laws<br>IIGF                                                         | PPP Decree 2021                                                                                | CRESS<br>ENEGEM<br>IBR RP4                                                                      | Private Concession                                                                                 | TPA (imports only)<br>FAST-P                                                                     | DPPA Pilot<br>UGT Scheme<br>TPA Code (Draft)                                                    | PPP Law 2020<br>Electricity Law 2024<br>DPPA Tariff Reform<br>Green Taxonomy Code              |
| CROSS-BORDER FACILITATION<br> Domestic<br> Domestic+Cross-Border |              |               |               |              |                 |               |              |             |

**Figure 4:** Policy and implementation readiness in ASEAN. Grid Development Policy Landscape in ASEAN. Most ASEAN member states now have long-term energy plans that recognize the need for grid expansion, renewable integration, and, increasingly, cross-border trade. The main difference lies in implementation readiness: Singapore, Peninsular Malaysia, and Thailand are supported by more developed grid-enabling instruments, while Vietnam, Indonesia, and the Philippines combine strong policy ambition with more uneven execution capacity. Cambodia and Lao PDR have also introduced legal pathways for private participation, but implementation remains more selective and project specific.

Abbreviations used in figure 4: PDP: Power Development Plan; RUKN: Rencana Umum Ketenagalistrikan Nasional (National Electricity Master Plan); RUPTL: Rencana Umum Penyediaan Tenaga Listrik (Electricity Supply Business Plan); NSEDP: National Socio-Economic Development Plan, MYS Plan: Malaysia Plan, NETR: National Energy Transition Roadmap; TDP: Transmission Development Plan; FGCR: Future Grids Capabilities Roadmap; PPP: Public Private Partnership; IIGF: Indonesia Infrastructure Guarantee Fund; CRESS: Corporate Renewable Energy Supply Scheme; ENEGEM: Energy Exchange Malaysia; IBR RP4: Incentive-Based Regulation Regulatory Period 4; TPA: Third-Party Access; FAST-P: Financing Asia's Transition Partnership; DPPA: Direct Power Purchase Agreement; UGT: Utility Green Tariff.

Vietnam and the Philippines illustrate a second group of systems where policy ambition is strong, but implementation readiness remains uneven. Vietnam's PDP8 and recent legal reforms (Electricity Law 2025, PPP Law 2020)<sup>6</sup> signal a clearer grid-first orientation, including direct power purchase arrangements and provisions for selected private grid-linked (sub-500 kV) infrastructure. However, many instruments remain at an early stage of operationalisation, while implementation will depend on tariff reform, EVN's financial position, and project execution capacity.

The Philippines presents a different but related case: it already has the region's clearest example of private participation in transmission through the NGCP concession, and its broader policy framework supports grid expansion and renewable targets. Yet persistent bottlenecks in permitting, right-of-way acquisition, and grid-generation coordination continue to weaken implementation effectiveness. Together, Vietnam and the Philippines show that policy ambition and formal reform instruments are not sufficient unless they are matched by project execution capacity, timely approvals, and coordinated grid planning.

Indonesia presents a more structurally constrained intermediate case. It has strengthened its formal policy and planning architecture through RUPTL 2025-34, PR 112/2022 and MEMR Reg 10/2025<sup>7</sup>, PPP rules, government-backed guarantee mechanisms (IIGF<sup>8</sup>). The country's long-term energy policies prioritise domestic grid expansion, especially inter-island transmission and renewable integration, while leaving space for cross-border power trade where it supports national objectives. However, the practical scope for independent private transmission investment remains constrained by PLN's dominant role, politically regulated tariffs, and legal restrictions on electricity-sector unbundling. Indonesia is therefore best understood as a high-need, reform-oriented system where policy ambition exists, but transmission bankability remains limited by the underlying regulatory model and the difficulty of creating clear, ring-fenced private-entry pathways.

In the more constrained systems, policy frameworks increasingly signal openness but remain more dependent on project-level structured arrangements. Cambodia has adopted a PPP law (2021) and hosts selective private transmission BOT examples<sup>9</sup>, suggesting that legal pathways exist. However, these have not yet developed into standardised and scalable project structures.

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6 Vietnam's recent reforms signal a more grid-oriented and market-opening power-sector framework. The revised [PDP8](#) (effective April 2025), raises renewable capacity ambitions while covering transmission development and cross-border grid connections. The [2024 Electricity Law](#) (effective February 2025) broadens the legal basis for renewable and new-energy development, tariff mechanisms, investor selection, and electricity-service charges, while [Decree 57/2025](#) establishes the framework for direct power purchase agreements (alongside TPA) between renewable generators and large electricity users. [Vietnam's PPP Law](#), effective January 2021, provides a general legal framework for private participation in infrastructure, including power grids and power plants.

7 Indonesia's electricity planning framework is anchored by RUKN 2025–2060 and PLN's [RUPTL 2025–2034](#), which guide long-term power-sector development, procurement, and grid expansion. [RUPTL 2025–2034](#) places stronger emphasis on domestic grid expansion, renewable integration, industrial electrification, and inter-island transmission, while PR 112/2022 and MEMR Regulation 10/2025 provide the regulatory basis for renewable-energy acceleration and the power-sector transition roadmap. These instruments signal stronger formal planning, but transmission bankability remains shaped by PLN's dominant role, tariff regulation, and constraints on unbundling.

8 The [Indonesia Infrastructure Guarantee Fund](#) (IIGF) is a state-owned enterprise under Indonesia's Ministry of Finance that provides government guarantees for infrastructure PPP projects. It acts as a single-window platform for appraising, structuring, processing claims, and issuing guarantees to improve project bankability and reduce risks for commercial lenders and private investors.

9 [Cambodian Transmission Limited](#) (CTL), backed by Malaysia's HNG Capital, has operated a 110 km double-circuit 230 kV line under a 25-year build-own-transfer arrangement since 2013. A successor entity, CTL II, is extending this model north-eastward backed by MIGA political risk guarantees to cover loans provided by Japan's Mizuho Bank.

[Cambodia Power Transmission Lines Co., Ltd.](#) (CPTL) developed a 221 km, 115 kV private transmission line to import electricity from Thailand into northwestern Cambodia under a 30-year BOT arrangement with the Government of Cambodia. Supported by ADB non-sovereign lending, the project illustrates a customised, project-level private transmission precedent rather than a standardised market model.

Lao PDR similarly combines strong electricity export ambitions with its PPP decree, the EDL-T joint-venture model and participation in regional power trade initiatives (LTMS-PIP). Simultaneously, project-specific private participation has also emerged in generation-to-grid investments such as Theun-Hinboun<sup>10</sup> and Monsoon Wind<sup>11</sup>. Nevertheless, domestic implementation conditions continue to be shaped by weak utility finances, governance constraints, and reliance on external partners.

Policy and implementation readiness across ASEAN is improving but remains uneven. Several countries have introduced tools such as third-party access, wheeling, direct procurement, PPP frameworks, or cross-border trading mechanisms, yet these instruments do not automatically create bankable transmission projects. The key test is whether they are operational, predictable, and able to support repeatable investment. Corporate renewable procurement or wheeling rules may enable generation-linked grid access, for example, but do not necessarily provide a bankable framework for regulated transmission expansion. Similarly, PPP laws still require credible revenue recovery, payment security, and risk allocation to become financeable. Overall, the region is moving beyond broad transition ambition, but many systems still lack the operational instruments needed to translate grid plans into standardised and financeable projects.

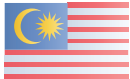
Cross-border facilitation remains the least developed part of the policy landscape. Singapore, Malaysia, Lao PDR, and increasingly Vietnam show stronger engagement with cross-border power trade through import strategies, bilateral arrangements, or trading platforms. However, cross-border readiness cannot be inferred from domestic policy ambition alone. Interconnectors require workable arrangements for import and export permissions, wheeling, settlement, operating responsibility, and dispute resolution. LTMS-PIP shows that multilateral trade is possible in ASEAN, but as a government-led arrangement using existing interconnections, it offers limited guidance for financing new standalone interconnector assets.

## Financing and delivery capacity

The sharpest differences across ASEAN appear in financing and delivery capacity. Nearly all member states continue to rely heavily on state-led delivery for transmission, but the strength of financing ecosystems, utility balance sheets, and project delivery capability differ substantially (Figure 5). Access to capital does not automatically translate into bankable transmission projects: even where domestic capital markets, MDB finance, or green-finance instruments are available, weak cost recovery, debt stress, or limited payment credibility can still constrain investment.

<sup>10</sup> [Theun-Hinboun](#) is a 520 MW Lao PDR hydropower project operated by THPC, with EDL-GEN holding 60% GSM (Thailand) 20%, and Scatec 20%. It is an independent power producer, aligning with the generation-linked transmission model as it exports electricity to Thailand, supported by associated [230 kV transmission lines](#).

<sup>11</sup> The [Monsoon Wind Power Project](#) is a 600 MW utility-scale wind facility located in southern Laos, commencing full commercial operation on August 22, 2025. The project is operated by Monsoon Wind Power Company and transmits 100% of its generated capacity via a dedicated 500 kV cross-border line directly to Vietnam Electricity (EVN).

| Financing & Delivery Capacity                                      |                                                                                               |                                                                                                |                                                                                                |                                                                                                 |                                                                                                    |                                                                                                  |                                                                                                             |                                                                                                |
|--------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|
|                                                                    | <br>CAMBODIA | <br>INDONESIA | <br>LAOS PDR | <br>MALAYSIA | <br>PHILIPPINES | <br>SINGAPORE | <br>THAILAND             | <br>VIETNAM |
| ECOSYSTEM                                                          | Public funds<br>• Sovereign Borrowing<br>• State Equity<br>Project Linked Funds               | Public funds<br>• Sovereign Borrowing<br>• State Equity<br>JETP                                | JV Funding<br>Project Linked Funds                                                             | Public funds (RM 43B)<br>• Sovereign Borrowing<br>• State Equity<br>• Islamic Bonds             | Private Concession (NGCP)<br>Sovereign Wealth Fund                                                 | Public funds<br>• Future Energy Fund (S\$10B)<br>FAST-P (US\$1.3B)                               | Public funds (THB 3B)<br>• Sovereign Borrowing<br>• State Equity<br>• Sovereign Sustainability Linked Bonds | Public funds<br>• Sovereign Borrowing<br>• State Equity<br>JETP (€ 67M)                        |
| UTILITY FINANCIAL STRENGTH<br>Power Utilities<br>Moody's S&P Fitch | EDC<br>NA                                                                                     | PLN<br>Baa2/Negative<br>BBB/Negative                                                           | EDL<br>NA                                                                                      | TNB<br>A3/Stable<br>A-/Stable                                                                   | NGCP<br>NA                                                                                         | SP GROUP<br>Aa1/Stable<br>AA+/Stable                                                             | EGAT<br>BBB+/Negative                                                                                       | EVN<br>B2/Stable<br>BB+/Stable                                                                 |
| SOVEREIGN CREDIT RATING (Moody's)                                  | B2/Stable (2026)                                                                              | Baa2/Negative (2026)                                                                           | Caa2/Stable (2026)                                                                             | A3/Stable (2025)                                                                                | Baa2/Stable (2026)                                                                                 | Aaa/Stable (2026)                                                                                | Baa1/Stable (2026)                                                                                          | Ba2/Positive (2026)                                                                            |

**Figure 5:** Financing and delivery capacity landscape in ASEAN. Grid financing across ASEAN remains predominantly state-led, with more advanced systems beginning to diversify through green, blended, and concession-based financing, while weaker markets continue to rely on concessional and tailored project-level structure<sup>xxix</sup>.

In the more mature systems, grid investment remains largely utility-led but is supported by stronger capital-market access, more credible cost recovery, and deeper financing ecosystems. Singapore benefits from strong public finance capacity<sup>12</sup>, robust regulatory credibility, and access to regional finance markets, including blended-finance platforms<sup>13</sup>. Peninsular Malaysia benefits from TNB's access to corporate borrowing, green finance<sup>14</sup>, and sukuk instruments<sup>15</sup>, supported by a relatively mature domestic capital market. Thailand also has stronger domestic financing capacity, supported by sovereign and utility borrowing, MDB engagement, and sustainability-linked financing instruments<sup>16</sup>.

However, it is important to distinguish financing capacity from actual private participation in transmission assets. Utility bond issuance or access to capital markets indicates that an incumbent can raise finance, but it does not necessarily mean that private capital is entering transmission as an asset class or assuming transmission project risk. This distinction is particularly important in Malaysia and Thailand, where financing conditions are relatively strong, but transmission development remains primarily utility led.

In intermediate systems, financing channels are broader but still constrained by counterparty strength, tariff frameworks, and implementation risk. The Philippines has a more diversified transmission-financing model because of the NGCP concession, which allows the concessionaire to fund grid upgrades through regulated revenues and capital-market access and more recently, sovereign wealth participation<sup>17</sup>. Yet persistent issues around permitting, right-of-way, regulatory oversight, and grid-generation coordination continue to affect project delivery.

Vietnam relies heavily on EVN, state budgets, commercial borrowing, and on-lent development finance. Recent reforms efforts (including recent JETP<sup>18</sup> support) may expand financing options, but EVN's financial condition and tariff constraints remain central to bankability<sup>xxx</sup>. Indonesia faces a particularly large financing and delivery challenge: although PPP and guarantee mechanisms exist, PLN's balance sheet, regulated tariffs, legal constraints, and the complexity of an archipelagic system limit the pace and structure of private transmission investment<sup>xxxi</sup>.

In the more constrained systems, transmission finance remains closely tied to concessional lending, sovereign support, bilateral finance, and project-specific arrangements. Cambodia relies heavily on concessional and bilateral support, with some project-specific

12 Singapore's [Future Energy Fund](#) was established with an initial S\$5 billion injection to support Singapore's adoption of low-carbon energy sources, which will likely involve nascent technologies, higher capital expenditures, and exposure to significant commercial and geopolitical risks.

13 Financing Asia's Transition Partnership ([FAST-P](#)), launched by MAS in 2023, is a Singapore-led blended-finance platform aiming to mobilise up to US\$5 billion for Asia's green transition, supported by up to US\$500 million in Singapore Government concessional capital to help de-risk marginally bankable projects.

14 Malaysia's [Green Technology Financing Scheme](#) (GTFS), managed by MGTC, supports green-technology projects by providing a 60–80% government guarantee on eligible financing from participating financial institutions.

15 Malaysia's Sustainable and Responsible Investment (SRI) [Sukuk Framework](#), introduced by the Securities Commission Malaysia in 2014, provides a regulatory basis for green, social, and sustainable sukuk issuance, enabling capital-market financing for eligible sustainable infrastructure and energy-transition projects.

16 Thailand's landmark THB 30 billion (~\$880 million) sovereign [sustainability-linked bond](#) (SLB, backed by ADB) focuses broadly on national emission reductions, with renewable and EV integration through smart grid transition as key components.

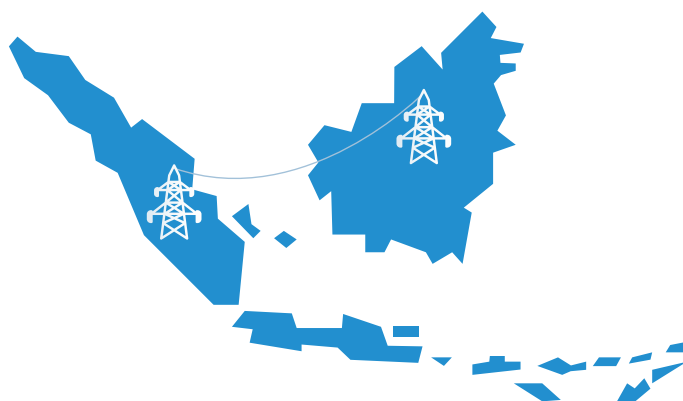
17 The [Maharlika Investment Corporation](#) (MIC), the Philippines' sovereign wealth fund, has acquired a 20% stake in the National Grid Corporation of the Philippines (NGCP), buying into the 60% stake of the grid operator's largest shareholder-Synergy Grid and Development Philippines Inc. (SGP).

18 A landmark [€67 million](#) loan agreement was signed in 2025, between France and EVN to build two massive 500 kV substations and associated transmission lines in the key southern industrial hubs of the country.

private participation. Lao PDR has mobilised capital through the EDL-T joint venture and export-linked power projects, but these structures are highly specific and not easily replicable without stronger standardisation, credit enhancement, and governance safeguards. In both countries, weak utility financial strength and limited domestic capital-market depth continue to restrict scalable private participation.

Project delivery capacity also varies across the region. Even where finance is available, transmission projects can be delayed by land acquisition, right-of-way issues, permitting, procurement bottlenecks, and weak coordination between generation and grid planning. These delivery risks are particularly important because they directly affect bankability: delays raise costs, increase uncertainty, and make long-tenor investors less willing to commit capital without stronger guarantees or public support.

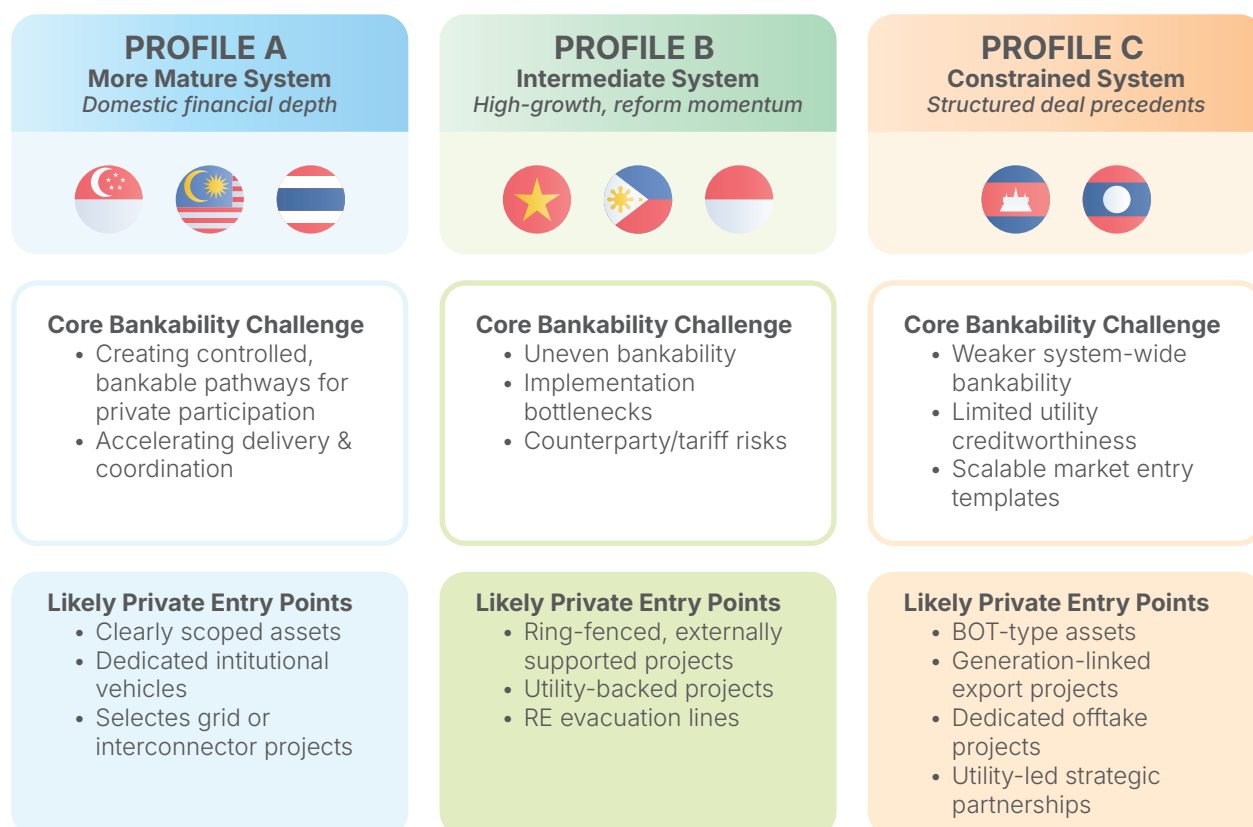
Taken together, financing and delivery conditions show that ASEAN's challenge is not simply one of capital scarcity. Rather, it is a challenge of financing maturity and project bankability. In stronger systems, the issue is how to channel available capital into timely transmission delivery. In intermediate systems, the challenge is to strengthen revenue certainty, counter-party credibility, and implementation capacity. In more constrained systems, concessional finance, guarantees, and structured risk-sharing structures remain necessary to establish bankable precedents.



## 2.3. A typology of transmission bankability profiles in ASEAN

The country mapping above points to a differentiated transmission bankability landscape across ASEAN. While most member states recognise the need for accelerated grid investment, they vary significantly in the regulatory, policy, financing, and delivery conditions needed to turn grid plans into bankable projects. These differences show that ASEAN's transmission challenge is not constrained by capital availability alone, but by the interaction of regulatory predictability, implementation readiness, utility financial strength, cost-recovery credibility, and project delivery capacity.

These differences can be synthesised into three broad transmission bankability profiles (Figure 6). The profiles are not a ranking. Rather, they identify the type of bankability problem each country context presents and the broad entry points through which private participation may become feasible.



**Figure 6:** A typology of transmission bankability profile in ASEAN (developed by authors). Note: Profiles indicate different bankability problems, not country rankings.

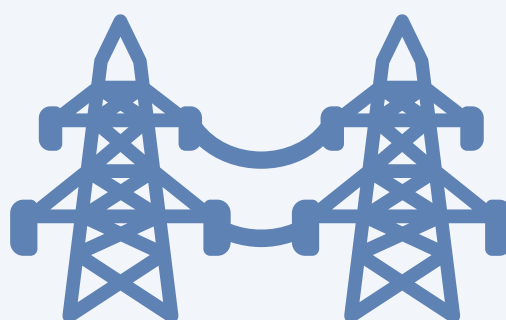
**Profile A** systems have relatively stronger implementation readiness foundations in ASEAN. Singapore, Peninsular Malaysia, and Thailand generally benefit from stronger regulatory credibility, institutional capacity, utility balance sheets, and access to finance. Their challenge is less about basic financing access and more about project delivery speed, coordination, and controlled entry pathways. Singapore's grid bankability challenge increasingly shifts outside its domestic system because long-term decarbonisation depends on electricity imports and interconnection. In Malaysia and Thailand, transmission remains largely under incumbent utilities, despite stronger institutions and emerging market-access tools.

**Profile B** systems combine large investment needs and reform momentum with uneven bankability. Vietnam's reforms remain at an early stage of operationalisation; the Philippines has a private transmission concession but still faces planning, permitting, right-of-way, and grid-generation coordination bottlenecks; and Indonesia's private transmission scope remains constrained by PLN's dominance, tariff regulation, and constitutional limits on electricity-sector unbundling. These systems may offer major medium-term opportunities, but only if policy reform is translated into bankable project pipelines with credible revenue recovery, payment security, and delivery capacity.

**Profile C** systems face weaker system-wide bankability, including lower utility creditworthiness, limited financing depth, and greater reliance on concessional or bilateral support. Yet Cambodia and Lao PDR show that private or quasi-private participation can still emerge through highly structured, project-level arrangements, such as BOT-type transmission assets, strategic partnerships, or export-linked infrastructure. These precedents are useful, but they remain heavily structured and de-risked. They are proof points, but not yet scalable market templates.

The typology highlights an important asymmetry. Profile A and B systems may have stronger or improving regulatory and financing foundations, but this does not automatically make them ready for broad-based private participation in transmission. Conversely, Profile C systems demonstrate actual private participation precedents, but usually through customised and externally supported transactions. The central question is therefore not which countries are “more” or “less” investable, but what bankability problem must be solved in each context. This sets up the discussion for the next section, which examines the private participation models that may be relevant under different country and project conditions.

## BOX 2



### Cross-border transmission: Where country readiness stops being enough

*The typology introduced above is designed primarily to assess national transmission investment readiness. It helps explain why some ASEAN systems are better positioned than others to finance and deliver domestic grid expansion, renewable evacuation corridors, and selected transmission assets. Cross-border transmission, however, introduces a different kind of bankability problem.*

*A cross-border interconnector is not bankable simply because one or both participating countries have stronger domestic readiness. Its viability depends on the interface between jurisdictions: the legal basis for electricity trade, import and export permissions, interconnector ownership and operating arrangements, revenue recovery, wheeling and settlement rules, cost and benefit allocation, foreign-exchange treatment, dispute resolution, and political commitment across governments.*

*The Lao PDR–Thailand–Malaysia–Singapore Power Integration Project (LTMS-PIP) provides an important first precedent<sup>xxxii</sup>. It demonstrates that multilateral cross-border electricity trade is possible in ASEAN, initially enabling up to 100 MW of renewable hydropower exports from Lao PDR to Singapore via Thailand and Malaysia using existing interconnections. It has since expanded to up to 200 MW and introduced multidirectional trade, including additional supply from Malaysia to Singapore. However, LTMS-PIP is best understood as a government-enabled trading arrangement supported by utilities, system operators, and commercial counterparties, rather than a financing template for new standalone interconnector assets.*

*The next wave of scheduled cross-border projects is likely to be more complex. For example, Singapore-linked import proposals from Sarawak, Indonesia, and Vietnam involve long-distance and, in several cases, subsea cable infrastructure<sup>xxxiii</sup>. These projects require arrangements that go beyond a bilateral buyer–seller transaction. They raise questions around technical grid codes, safety standards, cable-laying and repair protocols, maritime permitting, wheeling-charge methodology, settlement, payment security, dispute resolution, and allocation of costs and benefits across jurisdictions.*

## BOX 2

*In this context, the Malaysia–Singapore interconnection illustrates the shift from legacy system support to fuller cross-border trade. Having existed since 1983, it was upgraded in 2022 to support bidirectional flows of around 1,000 MW under LTMS-PIP<sup>xxxiv</sup>. A second interconnector of up to 2,000 MW is now under consideration for operation by 2030<sup>xxxv</sup>. This shows that existing links can provide a technical foundation for trade, but scaling them requires updated commercial, regulatory, technical, and settlement frameworks.*

*Early national-level responses are also beginning to emerge. Singapore’s establishment of Singapore Energy Interconnections (SGEI) Pte Ltd illustrates one approach: as a government-appointed entity to develop and operate cross-border electricity interconnections, SGEI<sup>xxxvi</sup> creates a dedicated vehicle for interconnector development and private-sector collaboration outside the ordinary domestic transmission model. Malaysia’s ENEGEM provides a related market-platform response under the Cross-Border Electricity Sales for Renewable Energy scheme, enabling renewable electricity exports to neighbouring countries through structured trading and bidding framework. These initiatives suggest that cross-border bankability will require not only stronger domestic readiness but also dedicated institutions and platforms that can manage project interfaces across jurisdictions.*

*Recent ASEAN developments suggest movement in the same direction at the regional level. At the 43rd ASEAN Ministers on Energy Meeting in October 2025, ASEAN endorsed the Enhanced ASEAN Power Grid MoU, the Submarine Power Cable Development Framework Terms of Reference<sup>xxxvii</sup>, and the ASEAN Power Grid Financing Initiative<sup>xxxviii</sup>. These developments are promising, but their impact will depend on credible follow-through: time-bound implementation, operational guidelines, and fast-tracked progress on the rules that determine cross-border bankability. Without these, ASEAN risks continuing to rely on project-level cross-border projects rather than developing a scalable framework for APG infrastructure.*

## 2.4 Private participation models for grid development and modernisation

The preceding section shows that ASEAN transmission systems differ not only in investment need, but in the type of bankability problem they face. More mature systems may require faster project delivery and stronger coordination mechanisms; intermediate systems may need clearer revenue recovery, payment security, and implementation capacity; more constrained systems often depend on tightly structured, externally supported transactions. These differences mean that no single private participation model will be suitable across ASEAN, and no model is bankable without credible revenue recovery, counterparties, and risk allocation.

Private participation should therefore be understood as a spectrum of arrangements through which governments can selectively mobilise private capital, technical capability, and delivery capacity while retaining strategic control over grid planning and system operation<sup>xxxix</sup>. Unlike generation, transmission is usually a regulated monopoly function, so private participation generally depends on clear project scope, predictable revenue recovery, credible counterparties, and enforceable long-term contracts. This section reviews the main private participation models relevant to transmission investment (Table 4) and assesses the conditions under which each may be applicable in ASEAN.

**Table 4: Private Participation Models for Grid Infrastructure<sup>x1</sup>.** [Note: Transmission business models vary by jurisdiction, the table therefore describes typical structures; IPP refer to Independent Power Producers; BOT is Build Operate Transfer, BOOT is Build Own Operate Transfer, BOOM is Build Own Operate Manage; SPV refer to Special-Purpose Vehicle]

| MODELS                                                                                                                                          | KEY FEATURES                                                                                                                                               | ASSET OWNERSHIP                                                                                                                 | RISK ALLOCATION                                                                                                                                                                                 | FINANCING STRUCTURE                                                                                                            | REVENUE SOURCES                                                                                 | EXAMPLES                                                                                                                                                                 |
|-------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  <b>Independent Transmission Project (ITP) (BOT/BOOT/BOOM)</b> | Competitively tendered transmission project or package. Private SPV typically designs, finances, builds and operates/maintains under a long-term contract. | Private during contract term; BOT/BOOT assets transfer to public party at expiry; BOOM may remain private.                      | <b>Private:</b> construction, financing, O&M.<br><b>Public/system operator:</b> planning, dispatch and regulation. Land/permitting allocation may vary.                                         | Project finance: sponsor equity + commercial debt; MDB/DFI loans, guarantees, blended finance structures may reduce cost/risk. | Regulated or bid transmission-service payments, often availability-based.                       | <ul style="list-style-type: none"> <li>India: competitively bid Inter-State Transmission System projects</li> <li>Brazil: auctioned transmission concessions.</li> </ul> |
|  <b>Generation-linked transmission (IPP-associated)</b>        | Dedicated facilities connect a generation project to the grid/offtaker; common for remote renewables or export projects.                                   | Usually generator/project SPV; transfer arrangements vary.                                                                      | <b>Private Developer:</b> construction/performance.<br><b>Generator/offtaker/grid entity:</b> interface, curtailment and connection risks as contracted                                         | Often financed with generation projects; climate/MDB/DFI and political-risk instruments may support bankability.               | Usually recovered through PPA/offtake revenues; dedicated transmission charges may also apply.  | Monsoon Wind (Lao PDR-Viet Nam): 600 MW wind project with associated 500 kV cross-border transmission and 25-year EVN PPA.                                               |
|  <b>Utility-developer joint venture (JV)</b>                   | Public utility/state entity and private developer co-invest through a project SPV.                                                                         | Co-owned through partner equity stakes.                                                                                         | Shared as per contract;<br><b>Private partner:</b> often significant execution/technology responsibilities<br><b>Public partner</b> supports system integration, approvals and local interface. | Partner equity + project/corporate debt; MDB/DFI or commercial-bank debt may be used.                                          | Regulated tariffs or contracted transmission-service payments; returns follow equity interests. | Powerlinks Transmission Ltd (India): Tata Power 51%; POWERGRID 49%.                                                                                                      |
|  <b>Whole-of-grid concession</b>                             | Private concessionaire operates, maintains and expands an existing national/regional transmission network.                                                 | Legacy assets may remain public; concessionaire receives operating rights and may finance expansion under concession agreement. | <b>Private:</b> O&M, expansion and performance.<br><b>Public/regulator:</b> policy, tariff regulation and residual asset responsibilities.                                                      | Equity and debt supported by regulated transmission revenues; structure varies by jurisdiction.                                | Regulated transmission tariffs/charges.                                                         | NGCP (Philippines): operates, maintains and expands the national grid under a 25-year concession; legacy assets remain with TransCo.                                     |
|  <b>Merchant transmission</b>                                | Privately financed transmission/interconnector relying primarily on market-based revenues.                                                                 | Private                                                                                                                         | <b>Private investor</b> bears construction, operating and substantial market/revenue risk; exemptions or contracts may mitigate risk.                                                           | Primarily commercial finance; long-term capacity sales/contracts may support bankability.                                      | Primarily congestion/capacity-allocation revenues; ancillary-service revenues may apply.        | <ul style="list-style-type: none"> <li>ElecLink (UK-France);</li> <li>Hudson Transmission Project (USA).</li> </ul>                                                      |

## Independent Transmission Projects

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Independent Transmission Projects<sup>xli</sup> are asset-specific structures where a dedicated project company finances, builds, and operates a defined transmission asset, such as a transmission line, substation package, renewable evacuation corridor, or selected interconnector. The public sector typically retains responsibility for system planning, dispatch, and network coordination, while the private partner takes on defined construction, financing, and operational responsibilities.

ITPs are commonly structured through BOOT (Build, Own, Operate, Transfer) or BOO (Build, Own, Operate), usually under a long-term transmission service agreement (TSA). Revenues are usually linked to availability or regulated transmission charges rather than actual electricity volumes, which helps reduce demand risk. A structured variant of this model is tariff-based competitive bidding (TBCB), most prominently used in India's transmission sector. Under TBCB, transmission projects are identified through public planning and competitively tendered. Developers bid on the levelised transmission charge required to build operate and maintain the asset under a long-term contract. The India Green Energy Corridor case study later in the paper discusses this approach in greater detail.

### **What bankability problem does it solve?**

The ITP model helps make transmission bankable by ring-fencing a specific asset from the broader utility balance sheet and anchoring revenues through a predictable contractual or regulated framework. TBCB adds a competitive procurement layer, improving price discovery, standardising contracts, and creating a more repeatable pathway for private participation.

This model is most useful where the project scope is clear, the counterparty is credible, and revenue recovery can be made predictable over a long tenor.

### **What are its limits in ASEAN?**

ITPs require strong project preparation, clear procurement rules, enforceable contracts, and credible payment arrangements. In many ASEAN systems, transmission remains deeply embedded in state-utility structures, making it difficult to separate assets, revenues, and risks cleanly. Where tariff recovery is uncertain or utility creditworthiness is weak, ITPs may require guarantees, MDB participation, payment-security mechanisms, or other de-risking support.

For cross-border interconnectors, ITPs face additional complications, including multi-jurisdiction approvals, settlement rules, cost allocation, and dispute resolution.

## BOX 3

**Hybrid annuity-type structures as a potential adaptation**

Hybrid annuity-type structures<sup>xliii</sup> combine public funding with private delivery and financing. Under a typical arrangement, the public sector funds part of the capital cost during construction (around 40%), while the private developer finances the remainder and is repaid over time through fixed annuity or availability-linked payments. This reduces demand and revenue-collection risk for the private partner while allowing the state to retain strategic control over key infrastructure planning and ownership.

In transmission, this could be considered as a potential adaptation approach, though not a widely proven model yet. HAM has been used more extensively in sectors such as roads and water, while transmission sector has more commonly relied on regulated returns, availability-based concessions, or competitive bidding models such as TBCB (India).

For ASEAN, the relevance of hybrid annuity-type structures lies in their structuring logic. They may be useful in systems where investment needs are large, utility balance sheets are constrained, and governments want to bring in private delivery capacity without transferring broader transmission ownership or market risk. However, these structures require careful fiscal assessment, since annuity payments, guarantees, and termination obligations can create contingent liabilities for governments.

**Generation-linked structures**

Generation-linked transmission<sup>xliiii</sup> refers to transmission assets developed to connect a specific generation project, cluster of projects, or export-oriented power facility to the grid or to a dedicated off-taker. The transmission asset may be developed on the generator's balance sheet, through a dedicated project vehicle, or as part of the generation project's contractual framework.

This model is common where the transmission asset is closely tied to renewable-energy evacuation or cross-border power export. The Monsoon Wind project is a relevant example: the transmission component is linked to a specific generation project and long-term offtake arrangement with Vietnam's utility EVN.

**What bankability problem does it solve?**

Generation-linked structures solve the "generation plus evacuation" problem. Renewable projects are often bankable only if grid connection risk is addressed. By bundling or closely coordinating transmission with generation, the model reduces the risk that a viable renewable project becomes stranded because the network is not ready.

It can also support first-mover projects in weaker systems by anchoring the transmission asset to a dedicated revenue source, such as a PPA or export contract.

**What are its limits in ASEAN?**

This model is useful for specific projects, but less suitable for wider network expansion. It does not necessarily support open-access, multi-user transmission infrastructure, system-strengthening investments, or meshed regional grids. It can also create risks if dedicated lines are optimised for a single project rather than broader system needs.

For ASEAN, generation-linked transmission may be useful as an entry point, especially in Profile B and C contexts, but it is not a substitute for planned, scalable grid development.

## Utility–developer joint ventures (JV)

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Utility–developer joint ventures<sup>xliv</sup> involve a public utility or state-linked entity partnering with a private, strategic, or foreign investor to finance, develop, operate, or upgrade transmission assets. The public party often contributes system knowledge, permissions, land access, and political legitimacy, while the partner brings capital, technology, engineering capability, or project-delivery expertise.

Lao PDR's EDL-T structure<sup>19</sup> illustrates this type of arrangement, although it is better characterised as a strategic state-linked partnership than as straightforward private capital mobilisation.

### What bankability problem does it solve?

JVs can help overcome constraints where fully independent private transmission is difficult, but where the state utility alone lacks capital or technical capacity. They can provide a controlled route for external participation while preserving public involvement in strategic grid assets.

This can be especially useful in systems where political sensitivities around transmission ownership are high.

### What are its limits in ASEAN?

JVs are often heavily structured and dependent on the terms of the concession, shareholder agreement, and revenue framework. They may raise concerns about transparency, governance, tariff-setting, and long-term control over strategic infrastructure.



## Whole-of-grid transmission concessions

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Under a whole-of-grid concession<sup>xlv</sup>, a private concessionaire is granted responsibility to operate, maintain, and expand a national or regional transmission network under a regulated revenue framework. Asset ownership may remain with the state, while the concessionaire assumes responsibility for network performance and investment delivery.

The Philippines' NGCP concession is the clearest ASEAN example of this model.

### What bankability problem does it solve?

A whole-of-grid concession can mobilise private capital and managerial capability at system scale, rather than project by project. It can create incentives for network performance, maintenance, and investment planning, while reducing the fiscal burden on the state.

### What are its limits in ASEAN?

This model requires very strong regulatory oversight. Because the concessionaire's revenues depend on tariff approvals, regulatory resets, and investment allowances, weak or

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<sup>19</sup> Lao PDR illustrates this model through [EDL-T led joint venture](#) with China Southern Power Grid, which formalized its concession arrangement in 2021 and entered full operation in January 2024.

unpredictable regulation can undermine bankability. It also requires careful management of public accountability, national security concerns, right-of-way challenges, and grid-development obligations.

For most ASEAN countries, whole-of-grid concessions are unlikely to be the first option because they require mature regulation and a political-legal environment that permits system-wide private operation.

## Merchant lines

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Merchant transmission<sup>xlvi</sup> is the most market-exposed model. A private developer builds and operates a transmission line without guaranteed regulated returns, relying instead on congestion rents, usage fees, or price arbitrage between markets.

### **What bankability problem does it solve?**

In theory, merchant transmission can mobilise private capital without relying on regulated tariffs or public balance sheets. It may be suitable where there are liquid electricity markets, transparent nodal or zonal price differences, and clear rules for congestion revenues.

### **What are its limits in ASEAN?**

In the ASEAN context, merchant transmission is unlikely to be the dominant pathway for grid expansion. Most power systems in the region remain state-led or heavily regulated, and revenue certainty is still central to project bankability. As a result, merchant models are more likely to remain niche instruments for selected interconnectors or specialised opportunities, rather than scalable solutions for broader grid modernisation.





CHAPTER

# 3

## Financing Grid Infrastructure through Blended Structures

The preceding sections show that private participation models are not automatically bankable. Many priority grid investments are economically necessary, but face barriers such as weak utility creditworthiness, tariff affordability limits, high upfront capital costs, foreign-exchange exposure, political and regulatory risk, delivery uncertainty, or the absence of long-tenor revenue arrangements. Whether an ITP, concession, generation-linked structure, joint venture, or hybrid arrangement reaches financial close depends on how these risks are allocated and mitigated.

The same model may require different risk-mitigation layers depending on the country context, project type, counterparty strength, and geopolitical setting. A clearly scoped transmission project in a more mature system may need little beyond predictable availability payments and clear procurement, while a similar project in an intermediate or constrained system may require combination of guarantees, concessional finance, MDB anchoring, or payment-security mechanisms. The model defines the entry point; de-risking determines whether that entry point becomes financeable. This is where blended finance becomes relevant<sup>xlvii</sup>.

Blended finance is a structuring approach combining public, concessional, philanthropic, or development finance with commercially oriented capital to make projects bankable where market finance alone is insufficient<sup>xlviii</sup>. Its purpose is not simply to lower financing costs, but to improve the project's risk–return profile and mobilise private investment for infrastructure with clear development or climate benefits<sup>xlix</sup>.

Blended finance is therefore best understood as an enabling layer, not as a private participation model in itself<sup>l</sup>. It can be combined with different structures, including independent transmission projects, availability-based concessions, generation-linked transmission, utility–developer joint ventures, or hybrid public-private arrangements.

### 3.1. Structuring blended finance around bankability gaps

A disciplined blended finance structure begins by identifying the specific risk or constraint that prevents a project from reaching financial close. De-risking instruments and finance structuring should then be selected to address that constraint directly<sup>li</sup>. For example, weak utility creditworthiness may require payment guarantees or liquidity facilities; tariff affordability constraints may require concessional debt or viability-gap support; and first-mover cross-border projects may require project-preparation grants, political risk insurance, or regional guarantee mechanisms. The relevant question is therefore not whether blended finance is employed, but whether the instrument used is matched to the actual bankability gap in question<sup>lii</sup>.

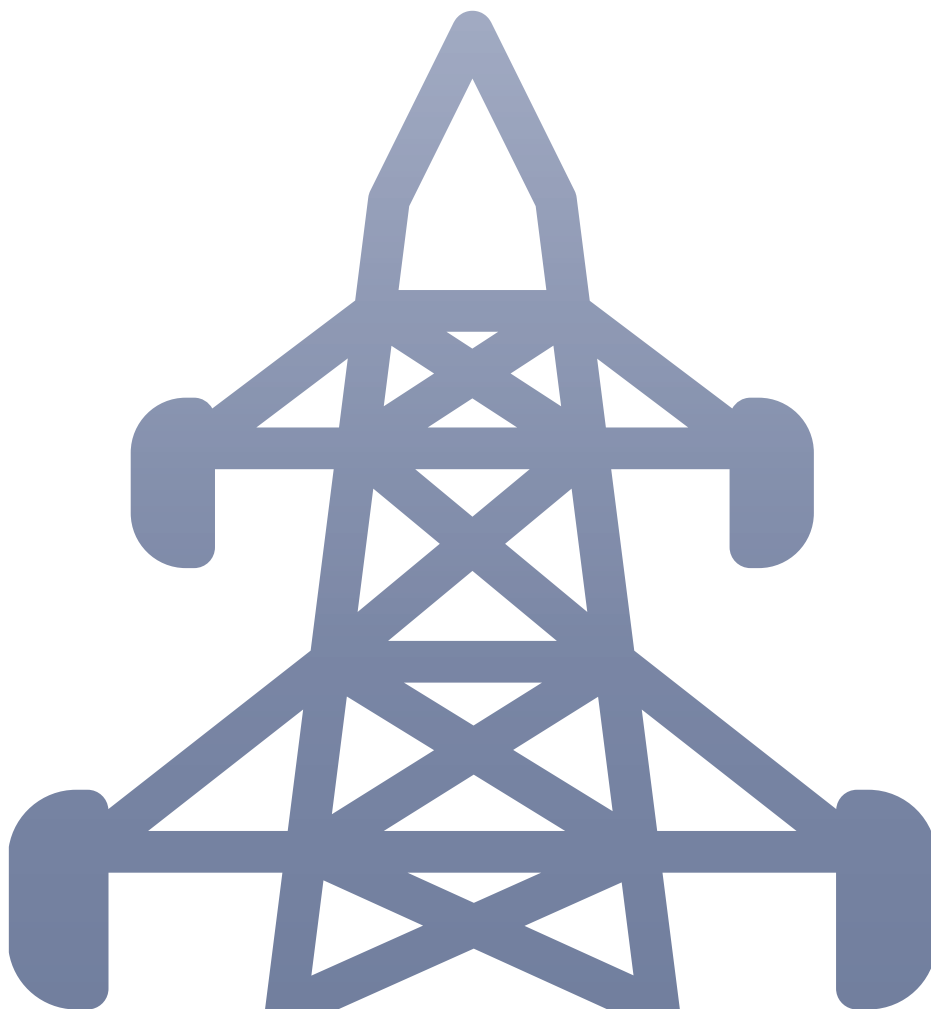
Table 5 below maps key bankability gaps in ASEAN transmission investment to relevant de-risking instruments while structuring blended finance. Payment risk, tariff affordability, FX exposure, construction delays, political risk, and cross-border settlement uncertainty each require different instruments. The table also reinforces that de-risking intensity varies by profile: limited and targeted in stronger systems, more structural in intermediate and constrained systems.

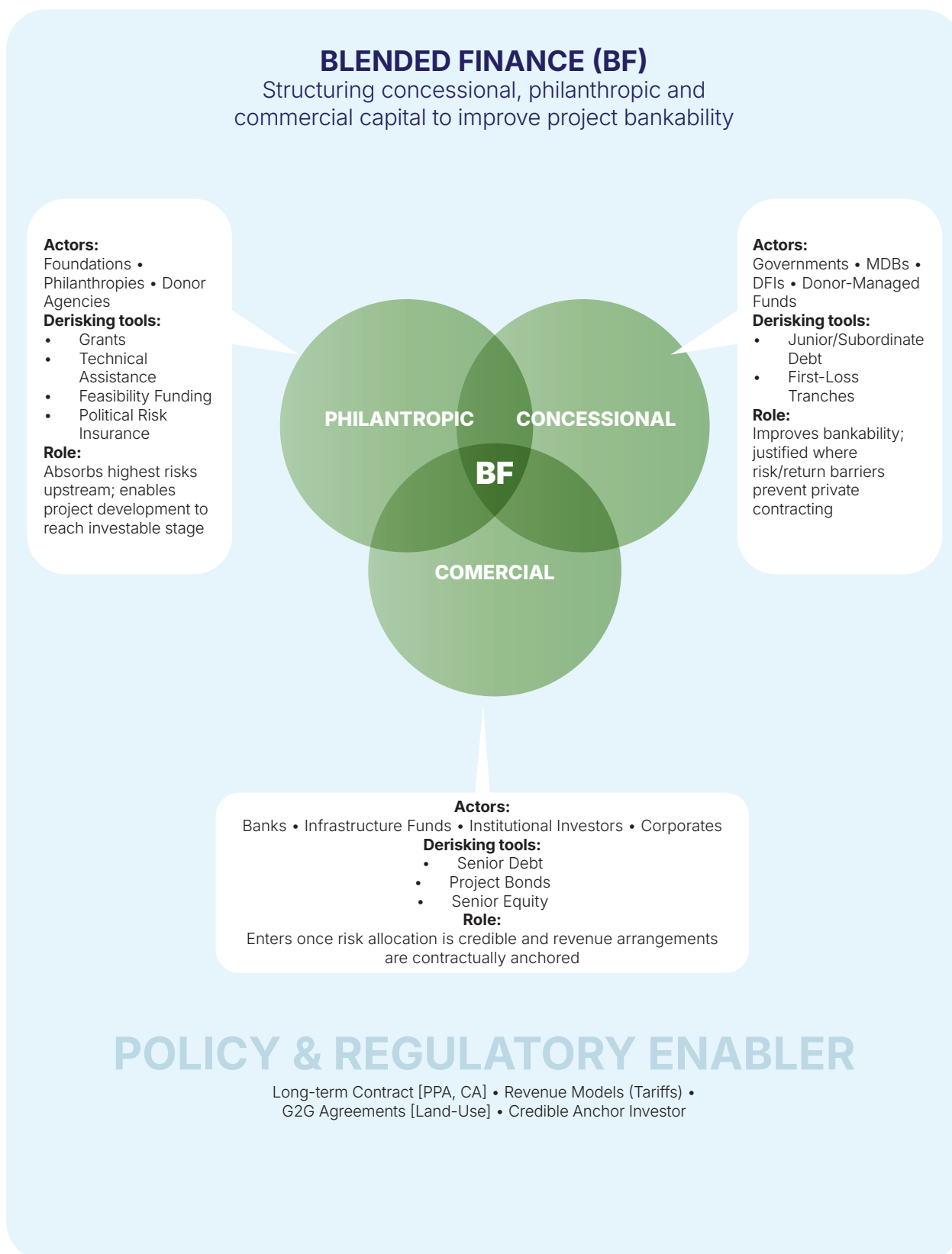
**Table 5:** Matching transmission bankability gaps with de-risking instruments. The listed instruments are indicative rather than prescriptive. In practice, several tools may need to be combined, and their suitability depends on project structure, counterparty strength, regulatory treatment, fiscal risk exposure and other factors.

| Bankability gaps                                            | Why it matters for transmission                                                                                                | Possible de-risking tools                                                                                                                   | Relevant systems                     |
|-------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------|
| <b>Weak utility or off-taker creditworthiness</b>           | Transmission revenues often depend on regulated public counterparties. Weak creditworthiness status reduces lender confidence. | Payment guarantees, partial risk guarantees, liquidity facilities, escrow accounts, MDB anchor lending, sovereign undertakings              | Profiles B, C                        |
| <b>Tariff affordability or cost-recovery gap</b>            | Projects may be economically justified but difficult to recover fully through tariffs without affordability concerns.          | Viability-gap funding, concessional debt, subordinated debt, tariff-smoothing mechanisms, output-based support                              | Profiles B, C                        |
| <b>Foreign exchange and convertibility risk</b>             | Financing may be in hard currency while revenues are in local currency.                                                        | Local-currency lending, FX hedging facilities, convertibility guarantees, concessional FX buffers                                           | Profiles B, C; Cross-border projects |
| <b>Construction and completion risk</b>                     | Transmission projects face land, permitting, right-of-way, EPC, and interface risks.                                           | Project-preparation grants, construction guarantees, contingent credit lines, MDB due diligence, government support for land and permitting | All profiles                         |
| <b>Political, regulatory, or change-in-law risk</b>         | Long-tenor assets depend on stable tariff, licensing, and regulatory treatment.                                                | Political risk insurance, partial risk guarantees, government support agreements, change-in-law protection                                  | Profiles B, C; cross-border projects |
| <b>First-mover or cross-border risk</b>                     | New interconnectors lack precedents and require coordination across jurisdictions.                                             | Project-preparation facilities, concessional anchor finance, MDB coordination, political risk insurance, regional guarantee mechanisms      | Cross-border projects                |
| <b>Settlement and payment risk in cross-border projects</b> | Cross-border assets depend on wheeling, settlement, and payment flows across multiple parties.                                 | Escrow accounts, payment waterfalls, settlement platforms, MDB-backed guarantees, regional settlement mechanisms                            | Cross-border projects                |

Blended finance works primarily through capital-stack structuring: different sources of capital are layered according to risk tolerance, return expectations, and their role in making the project investable. Grants and technical assistance can support early project preparation; concessional or subordinated debt can lower financing costs or absorb risks commercial lenders cannot price; first-loss capital can protect senior investors; and commercial debt or equity can enter once revenue arrangements and risk allocation are credible. However, capital structuring alone is not sufficient. It must be supported by matching policy and regulatory conditions, including long-term contracts, tariff or availability-payment frameworks, government-to-government agreements, guarantees, settlement mechanisms, and credible anchor investors. Figure 7 illustrates how these capital layers and enabling policy conditions work together.

At the same time, blended finance is difficult to structure and replicate. Projects differ in their readiness levels, institutional settings, revenue models, and risk profiles. Blended structures may also involve high transaction costs and limited transparency around pricing, concessionality, risk-sharing, and performance outcomes. For this reason, blended finance should be applied with discipline. It should address a clearly identified bankability gap, demonstrate additionality, avoid crowding out commercial capital, and manage public risk transparently. Guarantees, annuity payments, termination payments, minimum-revenue undertakings, and sovereign support can improve bankability, but may also create contingent liabilities for governments and utilities. A disciplined structure should therefore disclose and monitor fiscal exposure, price risksharing transparently, and include sunset or step-down mechanisms where risks decline over time<sup>liii</sup>.





**Figure 7:** An illustrative representation of blended finance structuring (developed by authors).

## 3.2. Implications for ASEAN bankability profiles

The role of blended finance would differ across the three ASEAN bankability profiles.

In Profile A systems, blended finance should be used selectively. These systems generally have stronger regulatory credibility and financing capacity, so concessional support need not be a default. Its most useful role may be in project preparation, first-mover interconnectors, complex subsea cable development, or regional coordination where commercial investors still face uncertainty.

In Profile B systems, blended finance can play a more active role in converting reform momentum into bankable project pipelines. These systems often have strong investment needs and improving policy frameworks, but projects may still face tariff uncertainty, utility credit risk, permitting delays, or payment-security concerns. Guarantees, liquidity facilities, MDB participation, and concessional tranches can help bridge these gaps, but should be linked to reforms that improve procurement quality, tariff credibility, and delivery capacity.

In Profile C systems, blended finance is often foundational. Projects may require concessional anchor debt, MDB structuring, political risk insurance, sovereign support, and strong contractual ring-fencing before private capital can participate. The objective should not only be to close individual transactions, but to create transparent precedents that gradually reduce perceived risk and move the market beyond one-off project-specific arrangements.

## 3.3. Blended finance and cross-border transmission.

Cross-border transmission presents a distinct case for blended finance. Interconnectors may generate regional benefits that are not fully captured by project revenues: improved energy security, lower system costs, reduced curtailment, better renewable integration, and greater regional resilience. However, costs and benefits are often distributed unevenly across jurisdictions. One country may host the line, another may consume the power, and a third may provide transit services.

This creates bankability gaps that are not only financial, but institutional and political. Blended finance can reduce first-mover risk, support project preparation, improve payment security, and crowd in long-term capital. However, it cannot substitute for credible regional rules on wheeling charges, settlement, cost allocation, technical standards, payment security, and dispute resolution.

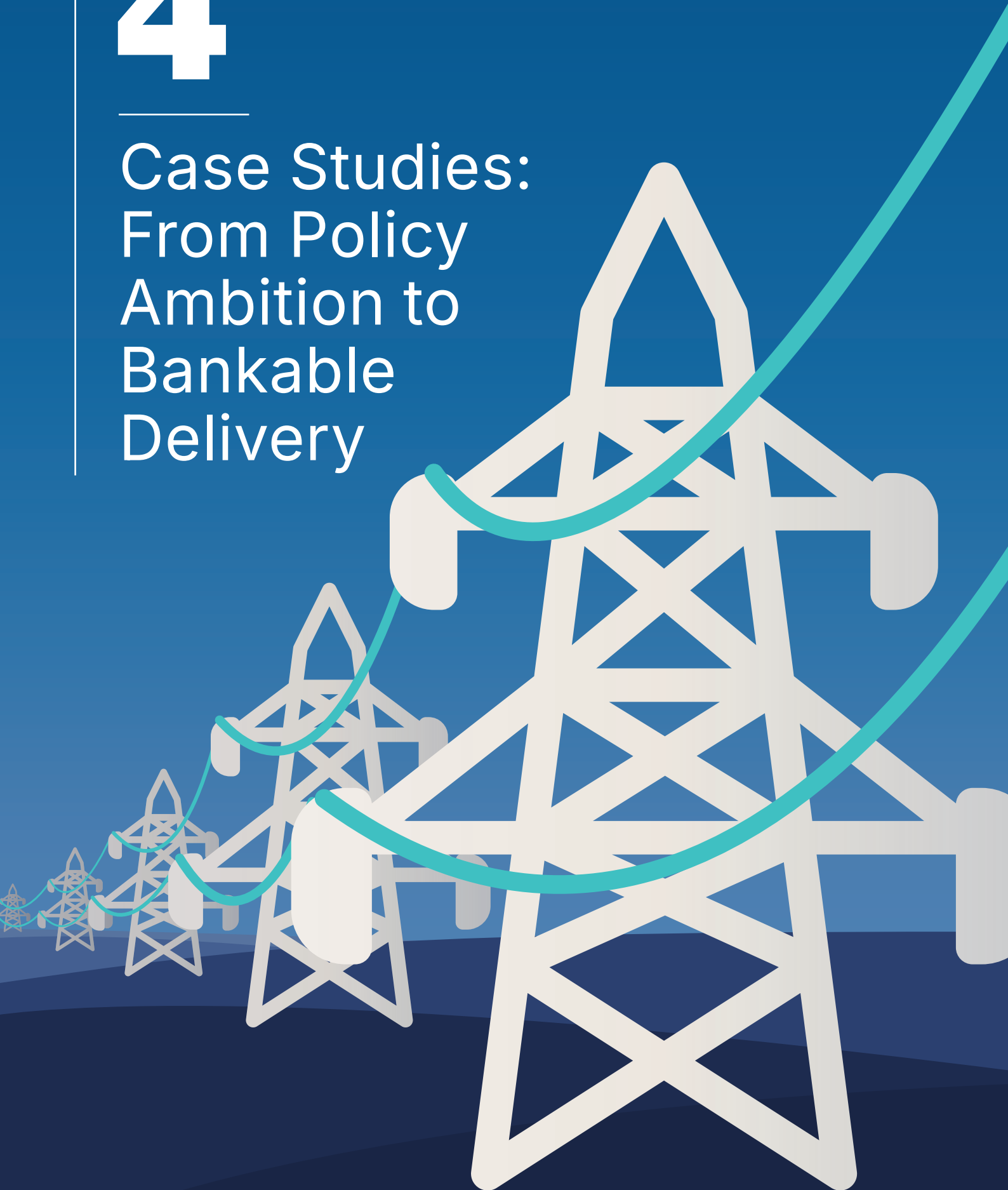
The emerging ASEAN Power Grid agenda is therefore important. The Enhanced APG MoU, Submarine Power Cable Development Framework Terms of Reference, and ASEAN Power Grid Financing Initiative point toward a more coordinated regional architecture for interconnector development. Their effectiveness will depend on whether they move from high-level commitment to operational tools that reduce uncertainty for investors, lenders, utilities, and governments.

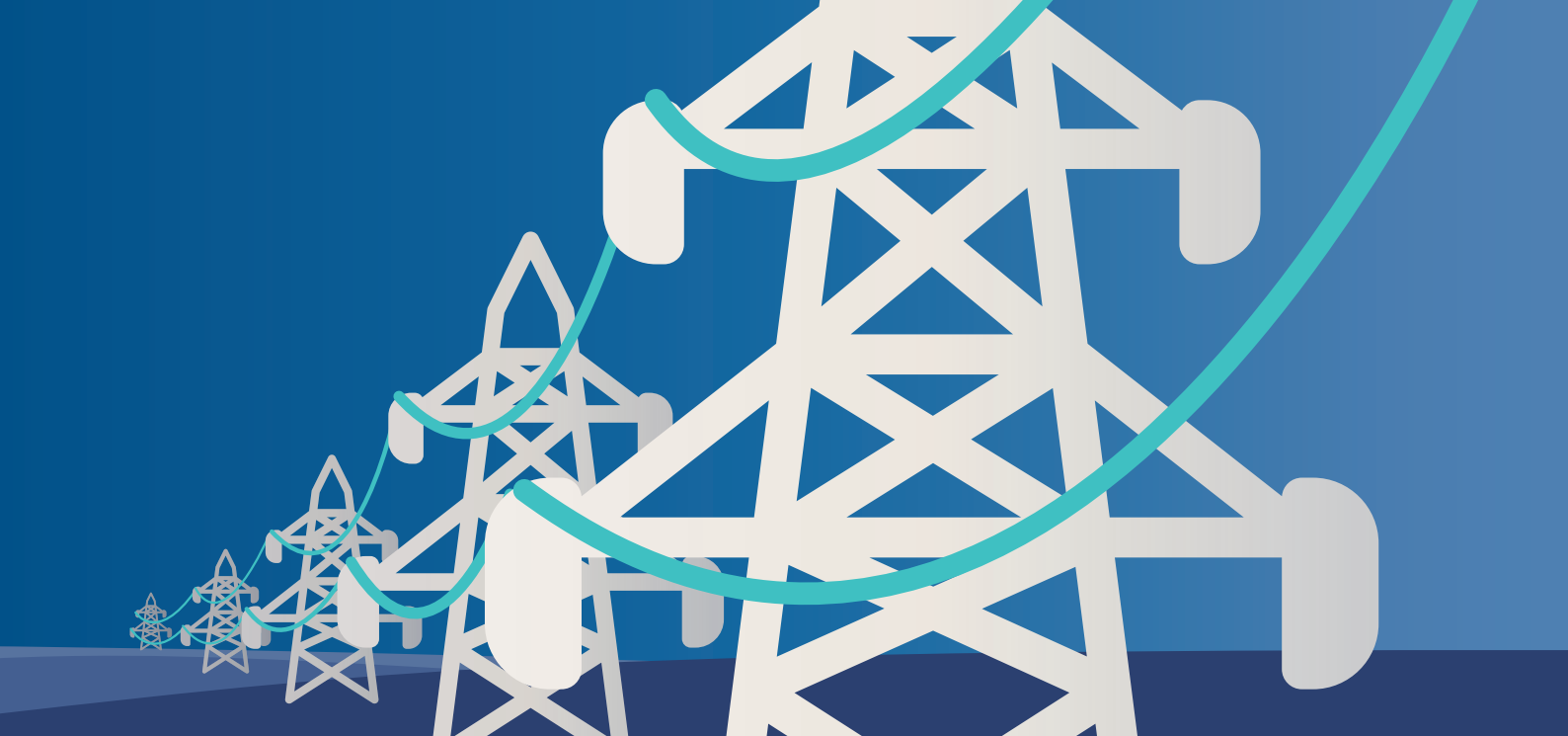
In sum, blended finance can help close specific bankability gaps in ASEAN grid financing but should be deployed with discipline. Used strategically, it can close specific bankability gaps and help ASEAN move from project-specific transmission deals toward more standardised, transparent, and replicable investment structures. Used poorly, it can also obscure fiscal risks and shift excessive liabilities onto public institutions without building a scalable market.

CHAPTER

# 4

## Case Studies: From Policy Ambition to Bankable Delivery





**T**he previous sections developed a typology of ASEAN transmission bankability profiles, reviewed the private participation and blended-finance structures that may be relevant under different conditions. The following case studies shift from framework to practice. They examine how specific grid-related investments have been structured to overcome common delivery, financing, and risk-allocation barriers. The cases are used to identify transferable lessons for ASEAN, while also clarifying what is context-specific and should not be treated as a direct template.

India's Green Energy Corridor illustrates how large-scale domestic transmission expansion for renewable integration can be supported through coordinated planning, targeted public finance, and long-term revenue certainty. The Lao PDR–Vietnam Monsoon Wind project illustrates how a first-mover, generation-linked cross-border project can become financeable through a dedicated offtake structure, MDB anchoring, and tailored contractual risk allocation.

## **4.1. India's Green Energy Corridor (GEC) — Making Domestic Grid Expansion Bankable for Renewable Integration**

India's Green Energy Corridor was launched to address a specific system challenge: renewable energy deployment was accelerating faster than the grid's ability to evacuate and manage variable power. The programme therefore focused on building dedicated inter-state and intrastate transmission infrastructure to connect renewable-rich regions with demand centres, while also strengthening system-operation capabilities through Renewable Energy Management Centres (REMCs)<sup>liv</sup>.

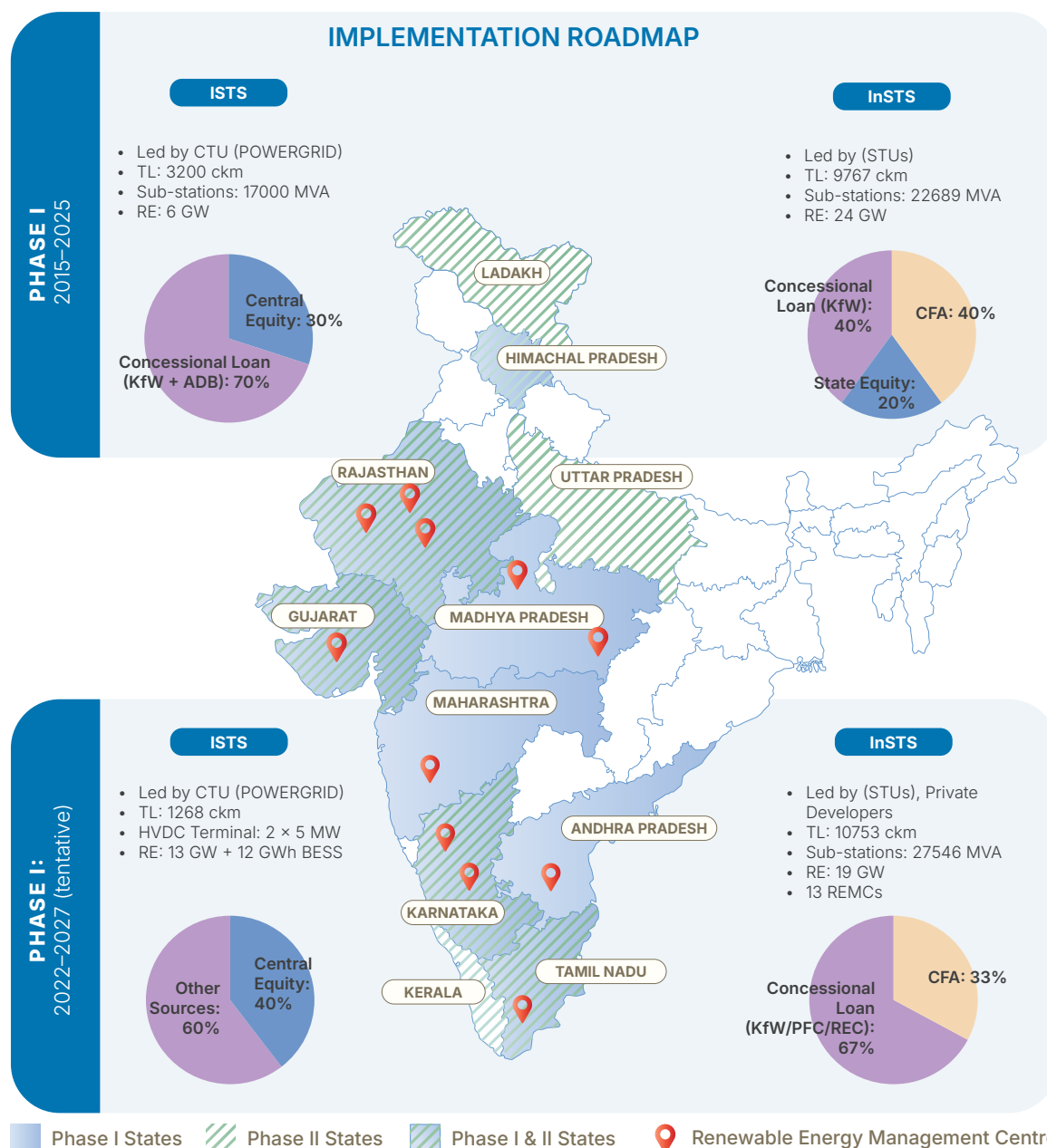
Across its phases, the programme has combined physical grid expansion with institutional coordination, public finance support, and market-based procurement (Figure 8). Its relevance for ASEAN lies less in direct replication and more in the way it shows how domestic transmission expansion can be made bankable when project pipelines, revenue recovery, and risk allocation are clarified in advance.

# GREEN ENERGY CORRIDOR PROGRAMME, INDIA

## INSTITUTIONAL FRAMEWORK



## IMPLEMENTATION ROADMAP



**Figure 8:** India's Green Energy Corridor in a snapshot. The figure summarises the programme's institutional framework, phased implementation roadmap, and financing structure across inter-state (ISTS) and intra-state (InSTS) transmission systems for renewable-energy evacuation.

**Abbreviations used in figure 8:** MNRE: Ministry of New and Renewable Energy; MoP: Ministry of Power; CFA: Central Financial Assistance; CEA: Central Electricity Authority; CERC: Central Electricity Regulatory Authority; ISTS: Inter State Transmission System; InSTS: Intra State Transmission System; CTU: Central Transmission Utility; STU: State Transmission Utility.

## Key bankability features



### a. Coordinated planning and institutional alignment

A core strength of the Green Energy Corridor is the alignment between renewable-energy targets and transmission planning. The programme is coordinated across central and state-level institutions: the Ministry of New and Renewable Energy (MNRE) drives policy, sets renewable integration targets and deploys central grant or Central Financial Assistance (CFA), while the Ministry of Power (MoP), Central Electricity Authority (CEA), and Central Electricity Regulatory Commission (CERC) ensure technical and regulatory coherence<sup>lv</sup>. Table 6 compares the institutional arrangements for standard transmission development with those under the GEC programme.

**Table 6:** Comparing the institutional arrangements for standard power transmission development and the specialised Green Energy Corridor (GEC) programme in India.

| Feature           | Standard Power Transmission                 | Green Energy Corridor                                                                |
|-------------------|---------------------------------------------|--------------------------------------------------------------------------------------|
| Primary authority | Ministry of Power (MoP)                     | Jointly by Ministry of New and Renewable Energy (MNRE) and MoP                       |
| Key objectives    | National grid expansion and reliability     | To synchronise RE evacuation with deployment                                         |
| Technical focus   | Conventional grid expansion and reliability | Renewable evacuation, grid integration, forecasting, and system stability.           |
| Funding sources   | Commercial banks, internal accruals         | Grant supported (CFA 33%–40%) + concessional multilateral loans (e.g., KfW and ADB). |

Implementation followed a bifurcated model: State Transmission Utilities (STUs) delivered intrastate transmission systems (InSTS), leveraging local capabilities for routing, land acquisition and permitting, while inter-state transmission systems (ISTS) were executed by Power Grid Corporation of India (PGCIL, Central Transmission Utility), whose stronger balance sheet enabled delivery of complex, capital-intensive multi-state national backbone infrastructure<sup>lvi</sup>.

Through a phased rollout, GEC strengthened policy credibility and scalability by first establishing core evacuation infrastructure across renewable-rich states, then expanding into new geographies and higher-risk corridors<sup>lvii</sup>. It adopted a strategic “overbuild” approach developing transmission capacity ahead of generation to reduce curtailment, avoid stranded renewable assets, and signal long-term system readiness. Key risks, such as land acquisition, permitting delays, multi-agency coordination, and technical challenges in difficult terrains, were mitigated through strong central oversight, programme-level monitoring, and clear institutional roles.

The coordinated institutional alignment reduced uncertainty over project planning and implementation responsibility. The key takeaway is that transmission was not treated as an afterthought to renewable generation. It was planned as enabling infrastructure, with a phased pipeline linked to renewable deployment.



## **b. Targeted public and concessional support**

GEC used public and concessional support selectively to address bankability constraints, especially for intra-state transmission systems where State Transmission Utilities faced weaker balance sheets or affordability limits. Central Financial Assistance covered around 33–40% of intra-state project costs, lowering upfront capital requirements and enabling projects to combine central grants, state equity, and concessional loans. For inter-state transmission projects, financing followed a more corporate-style 70:30 debt–equity model backed by PowerGrid, with additional central support reserved for higher-risk corridors<sup>lviii</sup>.

Development-finance support, including KfW and ADB-backed financing for selected components, also contributed to grid-strengthening investments, project preparation, environmental and social due diligence<sup>lix</sup>. As the programme progressed, phase II demonstrated reduced grant dependence and greater reliance on domestic financing signalling growing market maturity.

For ASEAN, the lesson is that public and concessional support can close specific viability gaps without fully replacing private or utility financing.



## **c. Long-term revenue certainty through regulated and competitive procurement**

India's transmission procurement has provided long-term revenue certainty through a mix of regulated and competitive approaches. Earlier projects, especially in Phase I, were often developed under the Regulated Tariff Mechanism, a cost-plus framework based on actual capital expenditure, operating costs, and a regulated return on equity. As the sector matured, suitable projects increasingly moved toward Tariff-Based Competitive Bidding, where pre-structured transmission assets are competitively tendered under long-term Transmission Service Agreements, often structured around 35 years<sup>lx</sup> concession periods.

Under TBCB, transmission projects are identified through public planning processes and competitively tendered. Developers bid on the levelised transmission charge required to build and operate the asset under long-term transmission service arrangements. Revenue is generally linked to asset availability rather than electricity volume, reducing demand risk while supporting long-tenor finance.

This is one of the key transferable features for ASEAN. It shows how governments can preserve public planning control while using competition to improve cost discovery and attract private participation into clearly scoped transmission assets.



#### d. System-operation capability as part of bankability

The Green Energy Corridor also invested in Renewable Energy Management Centres to improve forecasting, scheduling, and dispatch of variable renewable energy. This matters because transmission bankability is not only about financing the line. It also depends on whether the system can operate the asset effectively and reduce curtailment, congestion, and integration risks.

For ASEAN systems with growing solar, wind, and cross-border trade ambitions, this lesson is highly relevant. Grid investment needs to be paired with operational capabilities that make renewable integration reliable and commercially credible.

## 4.2. Monsoon Wind: Structuring a Bankable Cross-Border Renewable Export Project.

The Monsoon Wind Power Project<sup>lxi</sup> is a 600 MW wind farm in southern Lao PDR exporting electricity to Vietnam under a long-term power purchase agreement (PPA) with Vietnam Electricity. It is Lao PDR's first utility-scale wind project and one of Southeast Asia's largest wind projects. The project is significant because it demonstrates how a first-mover cross-border renewable export project can reach financial close in a relatively constrained market through a dedicated contractual structure, MDB anchoring, and clear allocation of cross-border risks.

Monsoon Wind is best understood as a generation-linked cross-border project, rather than a standard open-access interconnector. Its transmission component is tied to a specific generation asset and long-term offtake arrangement. This makes the case highly relevant for renewable export projects, but less directly transferable to multi-user ASEAN Power Grid interconnectors.

### Key bankability features



#### a. Policy alignment and export permissions

Monsoon Wind was supported by strong bilateral policy alignment. Lao PDR benefits from diversifying its electricity export base beyond hydro-power, while Vietnam gains access to clean electricity to support rising demand and decarbonisation objectives. The project's inclusion within Vietnam's power planning framework (PDP8)<sup>lxii</sup> and Lao PDR's 28 years export permissions helped establish the legal and policy basis for cross-border electricity sales.

This is key because cross-border projects require more than commercial agreement between buyer and seller. They need host-country approvals, importing-country recognition, export rights, and alignment with national power-sector planning.



### b. Dedicated long-term revenue anchor

The central bankability feature of Monsoon Wind is its 25-year PPA with Vietnam Electricity (EVN). This provides a dedicated revenue anchor for the project. The PPA reduces uncertainty around demand, offtake, and repayment capacity, boosting lender confidence. By linking generation, export infrastructure, and long-term offtake within a single project structure, the project reduces the risk that transmission investment becomes stranded or underutilised<sup>lxiii</sup>.



### c. MDB anchoring and lender confidence

The project reached financial close with a US\$692.5 million non-recourse financing package anchored by ADBI<sup>lxiv</sup>, which was designed to address first-mover and cross-border risks while mobilising a diverse pool of capital. The financing structure combined ADB-led blended funding (including concessional and commercial tranches) with parallel loans from institutions such as AIIB, JICA, and commercial banks, creating a layered capital stack that balanced risk with returns (Figure 9).

MDB participation helped reduce perceived political, regulatory, environmental, and social risks. It also provided confidence to commercial lenders that the project had undergone robust project preparation and risk assessment.



### d. Cross-border risk allocation

The project's bankability depended on allocating cross-border risks clearly. These included responsibilities for project development in Lao PDR, grid integration in Vietnam, USD denominated payment arrangements, force majeure provisions, dispute resolution, and transmission interface risks. International arbitration provisions and carefully structured contractual protections helped reduce concerns around enforceability across jurisdictions<sup>lxv</sup>.

Additionally, curtailment risk—critical for intermittent renewables—was managed through concessional financing features and reserve mechanisms to protect debt servicing under adverse scenarios.

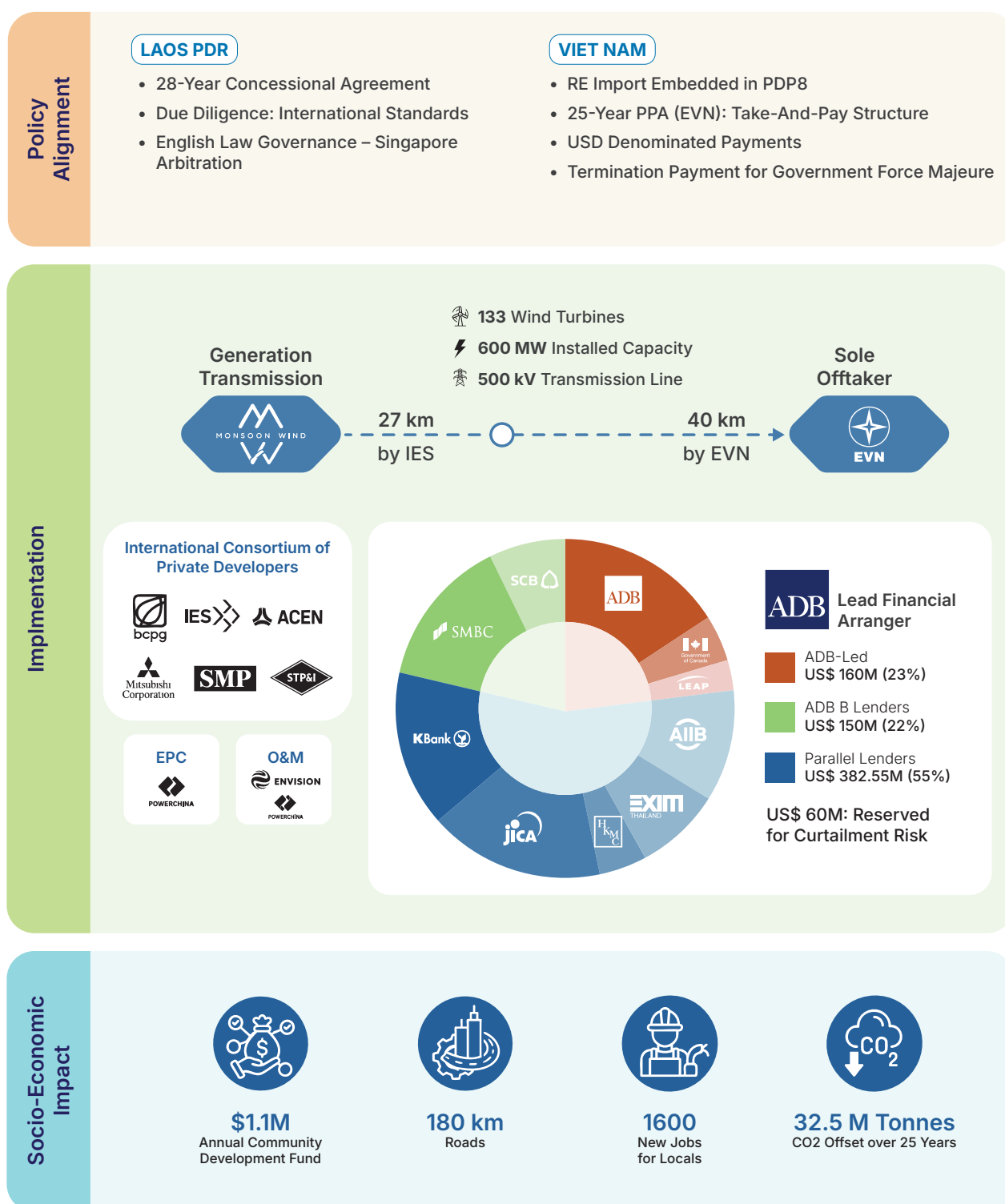
This is particularly relevant for ASEAN because cross-border projects often fail not because the resource is unattractive, but because responsibilities across jurisdictions are unclear. Monsoon Wind shows how a tightly structured bilateral project can overcome this problem.



### e. Safeguards as part of bankability

Social and environmental safeguards were also central to bankability. For large transmission linked renewable projects, land access, community acceptance, biodiversity concerns, and grievance mechanisms can materially affect construction timelines and lender confidence. In Monsoon Wind, safeguard due diligence, continued community engagement, environmental and social management formed part of the project's bankability architecture, not simply a compliance requirement<sup>lxvi</sup>.

# MONSOON WIND POWER PROJECT



**Figure 9:** Monsoon Power Wind Project in a snapshot. The figure summarises the project's bilateral policy alignment, generation-linked transmission structure, MDB-anchored financing package, implementation arrangements, and socio-economic impacts.

## BOX 4

## From open-access transmission to bankable cross-border interconnectors

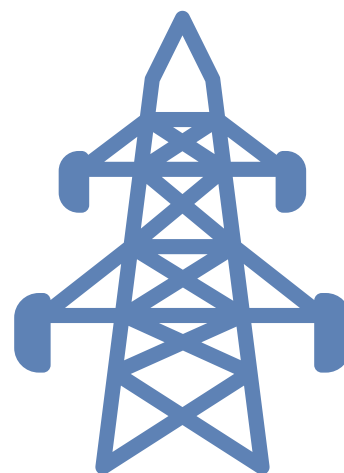
*The India Green Energy Corridor and Monsoon Wind case studies illustrate important but bounded lessons. India shows how domestic renewable-evacuation infrastructure can be scaled through coordinated planning, long-term revenue certainty, and competitive procurement. Monsoon Wind shows how a bilateral, generation-linked export project can reach financial close through a dedicated PPA, MDB anchoring, and structured risk allocation. Neither case fully tests the challenge of open-access, multi-user transmission, especially where cross-border infrastructure must serve multiple market participants rather than a single generator-off-taker pair.*

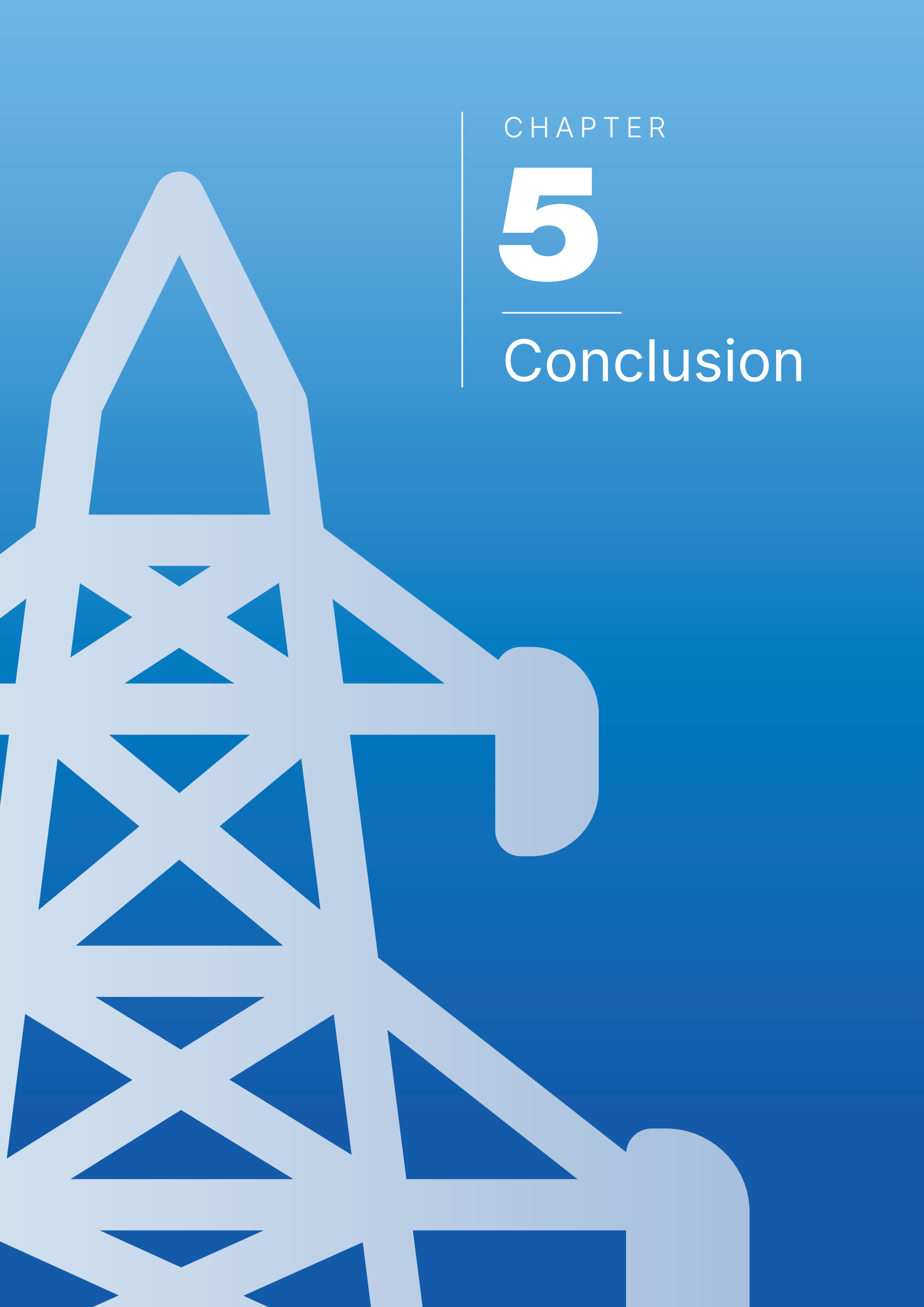
*Brazil provides a useful national precursor. While India's Green Energy Corridor demonstrates how domestic renewable-evacuation infrastructure can be scaled, Brazil shows how open-access, multi-user transmission can operate as a repeatable concession market<sup>lxvii</sup>. Projects are centrally planned, competitively tendered, and remunerated through regulated availability-linked revenues. Because revenue is regulated and linked to asset availability rather than electricity volume, the model reduces demand risk while preserving open-access network principles<sup>lxviii</sup>. The relevance of the Brazil model for ASEAN is not that it offers a cross-border template, but that it identifies the domestic building blocks — planning, access rules, concession design, procurement, and revenue recovery — that would need to be standardised for multi-user grid infrastructure.*

*In contrast, the Ireland-Great Britain interconnector, Greenlink provides a closer cross-border comparator. It is a privately sponsored, standalone interconnector whose capacity is available to multiple market participants rather than tied to a single PPA<sup>lxix</sup>. Its bankability rests on a 25-year period cap-and-floor regime<sup>lxx</sup>: that is, the project can earn market revenues within a defined band, while downside risk is limited by a regulated revenue floor and revenues above the cap are returned to consumers. This mechanism preserves merchant incentives while providing enough revenue stability to support long-tenor, non-recourse project finance.*

*For ASEAN, the combined lesson is that open-access, multi-user interconnectors require more than project-specific offtake contracts. They need standardised rules for access, revenue recovery, cost allocation, wheeling and settlement, technical standards, and dispute resolution.*

*Brazil illustrates the domestic building blocks of investable open-access transmission; Greenlink shows how revenue-stabilisation mechanisms can support privately financed cross-border assets.*





CHAPTER

# 5

Conclusion

The paper's findings show that ASEAN's grid-financing challenge is not simply a shortage of capital; it is a bankability and delivery challenge. Countries differ in their regulatory foundations, policy readiness, financing capacity, and project delivery capability, while cross-border project add risks that national readiness alone cannot resolve. The policy task is therefore to convert the region's grid ambition into bankable project pipelines, supported by credible long-term revenue arrangements, targeted de-risking, disciplined blended finance, and standardised transaction frameworks.

## Policy recommendations



### 1. Convert policy ambition into bankable project pipelines

ASEAN has begun moving from regional grid ambition toward implementation through national grid plans, the Enhanced APG MoU, the Submarine Power Cable Development Framework, and the APG Financing Initiative. The next task is to convert this momentum into prepared, sequenced, and financeable transmission projects. This means defining not only what needs to be built, but how each project will recover revenue, allocate risks, secure permits, identify counterparties, and reach procurement or financial close.

A key bankability bottleneck in some planned projects is the absence of durable long-term revenue arrangements. Transmission assets require long-tenor finance, and investors need predictable cash flows over the asset life. India's transmission projects under tariff-based competitive bidding rely on long-term Transmission Service Agreements, often structured around 35-year concession periods, while Monsoon Wind reached financial close with a 25-year PPA with EVN. Such arrangements reduce demand and payment uncertainty, support debt repayment, and limit exposure to short-term policies or market shifts.



### 2. Match de-risking tools to specific bankability challenges

Bankability challenges differ across ASEAN member states and project types. Private participation should therefore be matched to the specific risks that prevent projects from reaching financial close. In more mature systems, the priority may be delivery speed, coordination, and controlled entry pathways. In intermediate systems, projects may require payment security, tariff clarity, project preparation, and implementation support. In more constrained systems, private entry is likely to depend on ring-fenced project-specific structures with stronger public or MDB anchoring.

The policy objective should not be broad liberalisation, but targeted private participation where it can improve delivery, financing, or technical capability without weakening public control over strategic grid planning.



### 3. Use blended finance selectively and with discipline

Blended finance should address specific bankability gaps rather than subsidise grid investment generally. It is most useful where projects are economically justified but not commercially financeable because of weak utility creditworthiness, tariff affordability limits, FX exposure, firstmover risk, political or regulatory uncertainty, or cross-border settlement risk.

Blended finance should be structured prudently: public or concessional support must be additional, proportionate, and transparent. Instruments such as guarantees, annuity payments, termination clauses, minimum-revenue commitments, and sovereign support can make projects more bankable, but they also create obligations for governments and utilities that may not appear as upfront costs. These risks should be clearly priced, disclosed, and monitored so that derisking private investment does not simply transfer excessive contingent liabilities to public balance sheets.



### 4. Transferable lessons toward open-access, multi-user transmission

The case studies point to transferable principles rather than models that can be copied wholesale. India's Green Energy Corridor shows how domestic renewable-evacuation infrastructure can be scaled through coordinated planning, availability-linked revenues, competitive procurement, targeted public support, and enhanced system-operation capabilities. Monsoon Wind illustrates how a generation-linked cross-border project can reach financial close through a dedicated PPA, export permissions, MDB anchoring, and structured contractual risk allocation.

For ASEAN, the next step is to move from ambition to realisation by structuring bankable transmission projects that can progressively build toward open-access, multi-user regional infrastructure. Brazil's transmission auction model illustrates how open-access network expansion can become a repeatable investment architecture when planning, concession design, procurement, and regulated revenues are standardised. Greenlink shows how a privately financed interconnector can remain available to multiple market participants through a cap-and-floor regime that balances market exposure with revenue stability.

The broader implication is that ASEAN Power Grid infrastructure cannot rely only on one-off bilateral offtake arrangements. Domestic renewable evacuation, generation-linked exports, and open-access interconnectors each require different bankability structures, but they should support a common regional direction: multi-user transmission systems governed by clearer rules on access, revenue recovery, wheeling, settlement, technical standards, cost allocation, and dispute resolution.

Ultimately, ASEAN's grid transition will depend less on finding a single optimal financing model than on building the institutional architecture that makes transmission investment bankable, repeatable and scalable. The region now has growing policy momentum, emerging private-participation precedents, and new APG-related platforms. The priority is to convert this momentum into bankable project pipelines, disciplined risk-sharing structures, and regional rules that allow domestic grid expansion and cross-border interconnection to reinforce one another.

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