# Accelerating Renewables Growth in ASEAN

## Challenges and policy suggestions

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# Abstract

Eight of the 11 member states of the Association of Southeast Asian Nations (ASEAN) have adopted net zero emissions targets, and recent national energy plans outline substantially higher ambitions for renewable capacity. Achieving these goals will require timely, sustained and strongly co-ordinated policy action to unlock the scale of renewable energy deployment needed by 2030 and beyond.

This report examines the key challenges hindering a faster capacity deployment of renewable power in ASEAN and outlines potential policy solutions informed by successful international experience. It also provides an assessment of renewable-energy auction design options, an increasingly important procurement mechanism that is expected to account for around 60% of global capacity growth by 2030 and is already utilised in several ASEAN countries.

# Acknowledgements, contributors and credits

This study was prepared by the Renewable Energy Division in the Directorate of Energy Markets and Security. The lead authors of the report were Vasilios Anatolitis-Pelka, Heymi Bahar and Piotr Bojek, who also co-ordinated the project.

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# Introduction

## Context

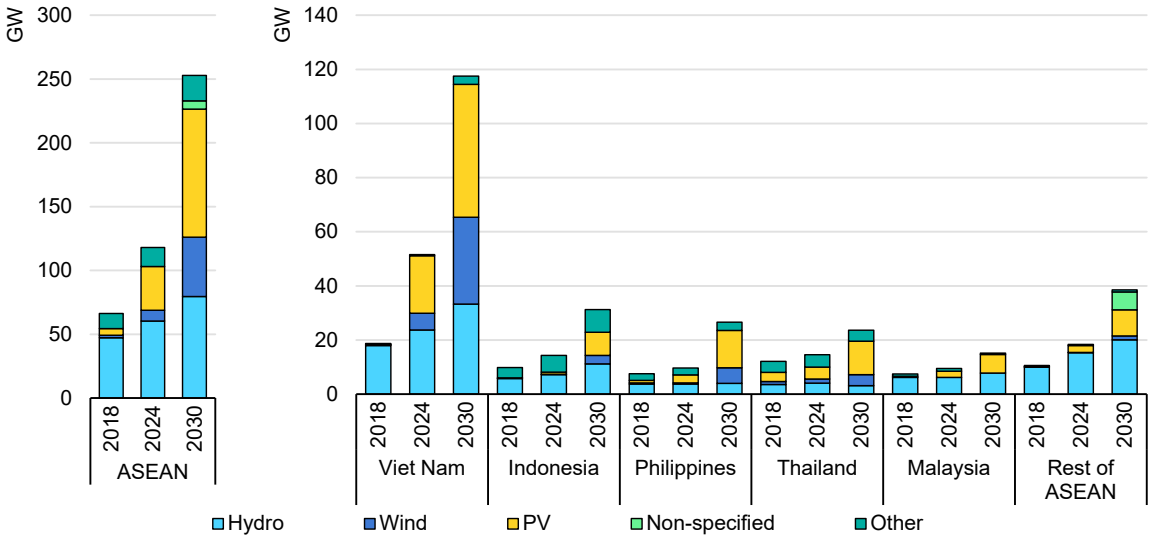
Electricity demand in the Association of Southeast Asian Nations (ASEAN) has tripled over the past two decades, driven by rapid economic growth, urbanisation, industrial expansion and rising living standards. Most countries have recorded annual electricity generation growth of more than 5% since 2000. Cambodia, Lao People's Democratic Republic (Lao PDR) and Viet Nam have surpassed 10% per year. Much of this rising demand has been met by coal-fired power plants, which supplied 47% of ASEAN's electricity in 2024 and remain relatively young, with an average age of around 15 years.

Renewable energy had significantly expanded in recent years, led by solar PV, whose installed capacity has increased sixfold since 2018 to nearly 35 GW. Still, hydropower continues to dominate renewable generation. Overall, renewables accounted for only 25% of ASEAN's total electricity supply in 2024. Variable renewable energy has played a very limited role so far. Solar PV and wind together contributed less than 5% of electricity generation in all ASEAN member states – except Viet Nam – highlighting significant untapped potential for these technologies.

ASEAN possesses vast renewable-energy resources, with around 20 terawatts of technical solar and wind potential – more than 55 times its current electricity generation capacity. With the sharp decline in the global cost of these technologies in recent years, tapping even a small share of this potential could significantly decrease the region's electricity supply costs, strengthening energy security and reducing exposure to fossil-fuel price volatility.

Considering the untapped potential and benefits, several ASEAN countries have announced more ambitious energy transition goals. Eight of the region's 11 member states have set net zero emissions targets. Recent national plans include significantly higher objectives for renewable capacity. For example, Indonesia's new Electricity Supply Business Plan 2025-2034 plans major solar and wind additions. Malaysia aims for 70% renewable capacity by 2050. Thailand's draft 2024 power development plan targets at least 50% renewable generation by 2037. Singapore plans up to 6 GW of low-emission electricity imports by 2035. Viet Nam's Revised Power Development Plan 8 sharply raises 2030 solar ambitions and outlines a pathway for renewables to reach up to 75% of generation by the middle of the century. Combined, these plans would more than double ASEAN's installed renewable capacity by 2030.

**Total installed renewable capacity (historical and 2030 ambitions) stated in government documents, 2018-2030**






Note: 2030 capacity deployment ambitions for renewables are based on following documents: Viet Nam – Revised Power Development Plan 8; Indonesia – Electricity Supply Business Plan 2025-2034; Philippines –- Energy Plan 2023-2050; Thailand – Draft Power Development Plan of Thailand 2024-2037; Malaysia – National Energy Transition Roadmap; rest of ASEAN – nationally determined contribution reports submitted to the registry of the United Nations Framework Convention on Climate Change.

Regional initiatives also play a growing role in shaping ASEAN's energy transition. The ASEAN Vision 2045 and associated regional targets strongly emphasise expanding renewable energy and strengthening system integration to ensure its cost-effective and secure deployment. Under the ASEAN Plan of Action on Energy Co-operation 2026-2030, member states aim to raise the share of renewables in their installed power capacity to 45% by 2030, up from around 35% today. Complementing these goals, the ASEAN Power Grid initiative seeks to enhance cross-border electricity trade and expand interconnections, supporting greater utilisation of renewable resources across the region.

Several ASEAN member states have already introduced important policy measures to accelerate renewable deployment. These include competitive auctions in Malaysia, the Philippines and Thailand; direct power purchase agreements (PPAs) in Singapore and Viet Nam; and net-metering schemes in Brunei Darussalam. Despite this progress, significant challenges persist, underscoring the need for timely and co-ordinated policy action to unlock the scale of renewable-energy growth required to meet ASEAN's 2030 ambitions.

# Objective of this paper

This paper identifies the most pressing challenges that continue to hamper faster capacity deployment of renewable power across many ASEAN member states. It aims to provide policymakers with potential policy solutions and priorities, drawing on successful international experience. The proposed measures can spur the renewable deployment needed to meet 2030 national ambitions.

The paper groups the challenges into three broad categories:

- Challenges related to elevated investment risk and higher renewable generation costs:
  - lack of implementation details in national plans
  - insufficient policy support to ensure long-term revenues and de-risk investments
  - elevated risk perception of PPAs with public utilities and administrative barriers to corporate PPAs
  - foreign-ownership restrictions and limited co-ordination between domestic-content requirements and deployment plans.
- Challenges related to power system and fossil fuel PPAs inflexibility:
  - inflexible PPAs with conventional generators
  - lack of remuneration for flexibility and ancillary services
  - insufficient incentives for distributed solar PV development.
- Challenges in permitting, community engagement and data availability:
  - lengthy and complicated permitting procedures
  - limited engagement with local communities
  - limited public data and high predevelopment risks for geothermal projects

The report also explores key design options for competitive auctions, which are the dominant procurement mechanism for renewables globally and implemented across ASEAN. The design options presented are relevant to both ASEAN member states with established mechanisms and those that are newly adopting auction systems.

The presence and types of challenges vary significantly across ASEAN countries. They reflect differences in power-market design, the generation mix, system flexibility, institutional capacity and deployment ambitions for renewables. Policymakers should consider these differences carefully when assessing the relevance and applicability of the proposed policy options to each national context.

# Key policy suggestions summary

## Policy suggestions for ASEAN member states to accelerate renewable capacity deployment, grouped by addressed challenge

| Policy recommendation | Policy priorities | International examples |
|---|---|---|
| **1. Key challenges and policy suggestions to accelerate renewable capacity deployment** | | |
| **1.1. Challenges related to elevated investment risk and higher renewable generation costs** | | |
| **Include implementation details in national plans** | Regularly publish and update national energy plans to reflect evolving market conditions, technological progress and changes in system needs. | In the European Union, National Energy and Climate Plans provide strong international examples of high-level, co-ordinated energy planning.<br><br>India offers another example of how consistent political commitment can provide investment clarity, even in the absence of a single consolidated plan. |
| | Embed energy plans in high-level legislation to increase policy certainty and minimise the risk of abrupt changes or reversals. | |
| | Ensure clear, consistent and frequent communication of government commitments to implementing the plan. | |
| **Increase the policy support to ensure long-term revenues and de-risk investments** | Establish large-scale and competitive renewable-procurement programmes, anchored in clear long-term strategies and implemented through fixed multi-year schedules. | Competitive auctions have become the primary mechanism globally for procuring utility-scale renewable energy, accounting for almost 60% of gross capacity additions expected in 2025-2030.<br>In India, large-scale auctions – led by central and state agencies and utilities – were introduced in 2013. They remain the backbone of utility-scale renewable deployment.<br>Thailand, Malaysia and the Philippines have all run successful renewable energy auctions.<br>In China, administratively set feed-in tariffs supported rapid PV and onshore wind growth before the transition to competitive auctions in 2025.<br>In Viet Nam, generous feed-in tariffs triggered boom-bust cycle across utility-scale solar PV (2019), distributed PV (2020) and wind (2021). |
| | Deploy targeted support for dispatchable renewable technologies such as bioenergy, hydropower and geothermal. | |
| | Avoid retroactive policy changes and stop-and-go measures. | |
| **Address the elevated risk perception of PPAs with public utilities and administrative barriers to corporate PPAs** | Strengthen the financial health of the main power-purchasing utilities. | In India, the government introduced a payment-guarantee mechanism for auctions conducted by the central agency, Solar Energy Corporation of India.<br>In Singapore, corporate buyers can sign PPAs with licensed retailers, enabling indirect procurement of renewable electricity via the grid. In Viet Nam, a corporate PPA scheme launched in 2024. In Malaysia, the Corporate Green Power Programme provides a financial PPA structure. Thailand has introduced a pilot corporate PPA |
| | Consider the creation of creditworthy, government-backed agencies or institutions that can serve as intermediaries. | |
| | Adopt internationally recognised standards for PPAs. | |

| Policy recommendation | Policy priorities | International examples |
|---|---|---|
| | Incorporate appropriate price-indexation mechanisms into standard contracts. | scheme of up to 2 GW, enabling large consumers to procure renewable electricity through a third-party grid- access framework.<br>Spain and France provide guarantees covering up to 80% of the PPA value in the event of buyer default. The European Investment Bank's Lending Envelope supports private financial intermediaries in underwriting riskier transactions. |
| | Remove regulatory and administrative barriers to corporate PPA. | |
| **Limit foreign ownership restrictions and increase co-ordination between domestic-content requirements and capacity deployment plans** | Minimise domestic-content requirements and align renewable-deployment strategies with supply-chain development. | In the European Union, competitive renewable-energy auctions in countries such as France, Germany, Italy and United Kingdom apply clear, non-discriminatory participation rules and use anonymous online bidding platforms.<br>India pursues a multi-step strategy to build a domestic solar PV supply chain. The strategy includes phased increases in import duties on modules and cells, targeted manufacturing subsidies through the "Production-Linked Incentive" scheme and a gradual requirement that systems benefiting from policy support use modules from an approved domestic manufacturers list. |
| | Avoid official and actual restrictions on foreign participation in renewable-energy projects. | |
| | Ensure equal treatment of domestic and international developers through transparent procurement processes. | |
| **1.2. Challenges related to power system and fossil fuel PPAs inflexibility** | | |
| **Increase the flexibility of PPAs with fossil-fuel generators** | Develop a comprehensive legal, regulatory and financing framework to enable renegotiating existing PPAs and fuel- supply contracts. | Indonesia plans to reduce its fleet of coal plants gradually starting in the mid-2030s. The Philippines has issued a moratorium on new coal-fired power plants and is exploring innovative options such as transition credits, which would allow issuing carbon credits for the early retirement of coal plants. Viet Nam prohibits new coal projects that are not already under construction and plans to retire or repurpose all existing coal plants by 2050. Brunei Darussalam, Cambodia and Malaysia have also announced that no new greenfield coal plants will be built.<br>In Poland, long-term PPAs signed in the 1990s to finance large fossil-fuel plants later proved incompatible with the liberalisation of the electricity market. The government terminated these contracts and introduced a dedicated stranded-cost mechanism that compensates generators based on the original PPA terms and actual operating costs and market revenues. |
| | Improve the design of PPAs for new fossil-fuel generators to better support system flexibility. | |
| | Accelerate electrification of end uses to absorb greater renewable generation. | |
| | Consider supporting the phasedown and repurposing of fossil fuel-fired plants. | |
| **Introduce the remuneration for flexibility and ancillary services** | Establish clear incentive mechanisms and update regulatory frameworks for flexibility services. | The Philippines launched its ancillary service market in 2024, complementing contracted reserves procured through the Ancillary Service Procurement Agreement.<br>In China, coal-fired plant retrofits are a key element of the national strategy to enhance system flexibility and facilitate higher deployment of variable renewable energy.<br>Many liberalised power markets – including the United Kingdom, France, Italy and several US markets (including PJM, MISO, NYISO) – operate capacity markets to reward dispatchability and ensure long-term adequacy.<br>In India, over half of the 60 GW awarded in renewable-energy auctions in 2024 consisted of hybrid projects combining technologies such as solar PV, wind, pumped-storage hydropower and batteries. |
| | Improve remuneration for flexibility and ancillary services. | |
| | Develop transparent procurement processes and market rules. | |
| | Introduce hybrid renewable-plus-storage auctions. | |
| | Set transparent and fair curtailment rules. | |
| | Incorporate locational pricing signals into renewable procurement. | |

| Policy recommendation | Policy priorities | International examples |
|---|---|---|
| **Increase incentives for the development of distributed solar PV** | Introduce long-term, market-based remuneration schemes for exported electricity. | In Viet Nam, attractive feed-in tariffs triggered a surge in distributed PV installations in 2020. However, the absence of a long-term remuneration framework led to an unsustainable pace of growth and increased grid congestion challenges.<br>Brunei Darussalam, Malaysia and the Philippines have implemented net-metering schemes enabling customers to offset their consumption with exports. Thailand applies net billing at rates below the retail tariff.<br>In India, deployment has accelerated since the launch of an enhanced residential investment subsidy programme in 2024, covering up to 40% of the system costs. The scheme is complemented by net-billing frameworks in most states. |
| | Promote real-time self-consumption models. | |
| | Provide targeted subsidies or preferential financing. | |
| | Align incentives for utilities. | |
| **1.3. Challenges of permitting, community engagement and data availability** | | |
| **Streamline permitting procedures** | Streamline permitting frameworks. | In India, government agencies secure land, obtain key permits and provide shared infrastructure (such as transmission access and roads) in advance under the Solar Parks scheme.<br>Germany has established a “one-stop shop” for onshore wind that serves as a single interface with numerous government bodies and local authorities. The government has also designated a central maritime authority as the single point of contact for all offshore wind permits.<br>Portugal has developed an online spatial-planning tool that identifies areas with lower environmental, land-use and cultural-heritage sensitivities.<br>Greece introduced in 2022 a simplified and fully digitalised licensing framework that reduced the number of permitting steps from seven to five and allowed authorities to process multiple applications steps in parallel. |
| | Establish one-stop shops to centralise permitting. | |
| | Introduce clear and enforceable deadlines for permitting decisions. | |
| | Digitalise permitting systems. | |
| | Improve the capacity of administrative offices. | |
| | Strengthen spatial planning by developing clear zoning guidelines. | |
| | Consider predeveloping priority sites. | |
| **Enhance the engagement with local communities** | Engage communities early in the project cycle. | In France, developers can earn additional points during the national solar PV auctions if they incorporate collective financing by citizens or local authorities or share governance with local residents.<br>Ireland mandates direct financial benefits through a Community Benefit Fund for offshore wind projects. Under the Renewable Energy Support Scheme, successful developers are required to establish a fund dedicated to supporting the economic, environmental, social and cultural well-being of local communities.<br>On the Spanish island of Gran Canaria, local television and radio stations were used to disseminate early information about planned renewable-energy developments. |
| | Enable community financial participation. | |
| | Implement transparent benefit-sharing frameworks. | |
| | Provide clear, consistent information. | |
| | Strengthen safeguards for affected communities. | |
| **Improve access to subsurface data and reduce predevelopment risks for geothermal projects** | Improve the availability of subsurface data. | Germany, the Netherlands, Italy, France and the United States have established public repositories for geothermal data and actively fund new data acquisition. At the regional level, the European Geological Data Infrastructure consolidates and standardises geothermal information for public use.<br>Türkiye and the Netherlands operate drilling-risk insurance schemes that compensate developers if wells fail to produce commercially viable resources. Kenya’s public |
| | Introduce measures to reduce exploration and early-stage risks. | |
| | Promote collaboration with the oil and gas industry. | |

| Policy recommendation | Policy priorities | International examples |
|---|---|---|
| | Define ready-to-develop geothermal areas and undertake early exploration activities. | Geothermal Development Company undertakes exploration and drilling. Indonesia uses public-private partnerships for exploration. Türkiye and Indonesia utilise risk mitigation schemes in collaboration with international donors, such as the World Bank. |
| **2. Key challenges and policy suggestions related to renewable auction design** | | |
| **2.1. Low participation in auctions** | | |
| **Simplify auction design** | Keep auction schemes as simple as possible, especially when first introducing auctions to reduce entry barriers. | All ASEAN member states apply capacity-based auction volumes. India and South Africa both conducted technology-specific, price-only auctions when they first started their auction schemes. Most countries in Europe similarly rely on technology-specific and price-only auctions. |
| **Ensure transparency to increase investor confidence** | Make tender documents freely accessible to ensure broad outreach. | To increase visibility regarding upcoming auctions, the Solar Energy Corporation of India has a dedicated tenders website, also featuring the relevant "request for selection" documents. Similarly, the European Union set up the RES Auctions Platform aggregating auctions by EU member states.<br>Malaysia and the Philippines used to publish detailed information on the respective auction results (bid prices and volumes). Thailand also provides extensive information on the awarded bidders. Germany publishes comprehensive auction results, including historic auction results. India, Italy and South Africa even publish results at the project level, encompassing both successful and unsuccessful bids. |
| | Publish national auction schedules (including planned volumes and indicative timelines) on a centralised platform. | |
| | Disclose auction results, such as average awarded prices and submitted and awarded volumes, to guide market expectations. | |
| **Minimise local-content requirements** | Avoid strict local-content requirements to increase competition in the auctions and avoid delays in project realisation. | Malaysia's LSS 5+ auction awards additional scoring points for earlier commissioning, leaving bidders to decide between an earlier commissioning (with a potentially higher bid price) or a later commissioning (with a potentially lower bid price). In Canada, Quebec includes local content in a weighted scoring system, while Nova Scotia assigns a score for (among others) local engagement. The European Union's Net-Zero Industry Act foresees minimum weightings in auctions for sustainability and resilience criteria. In South Africa, award criteria include minimum thresholds for local economic development. |
| | Consider using non-price award criteria to incorporate broader (economic) policy goals or alternatively, bid-correction amounts that adjust the submitted bid prices. | |
| **2.2. Delays in project realisation** | | |
| **Introduce material prequalification criteria** | Consider key project documents as a component of material prequalification before bid submission.<br>In addition, project realisation should always be safeguarded with financial prequalification, in the form of bid bonds and penalties. | Malaysia requires extensive documentation as part of the prequalification process, such as technical capability proven through experience and documents showing the right to use the specific land as the project site. India requires bidders to have a certain net worth and liquidity, as stipulated for instance in the guidelines for solar PV auctions. In Germany, bidders must usually have a permit under the Federal Emission Control Act, which already incorporates environmental approvals and land rights. |
| **Consider contract indexation** | Consider indexing contracts for renewable generators, linked to the consumer price index or relevant cost components (e.g. steel or labour) to reduce investors' risks and potential projects cancellations. | In 2025, the Philippines started indexing the auction-based Green energy tariff (allocated through the green energy auctions), with the price adjustment occurring between the award and the start of commercial operations. The European |

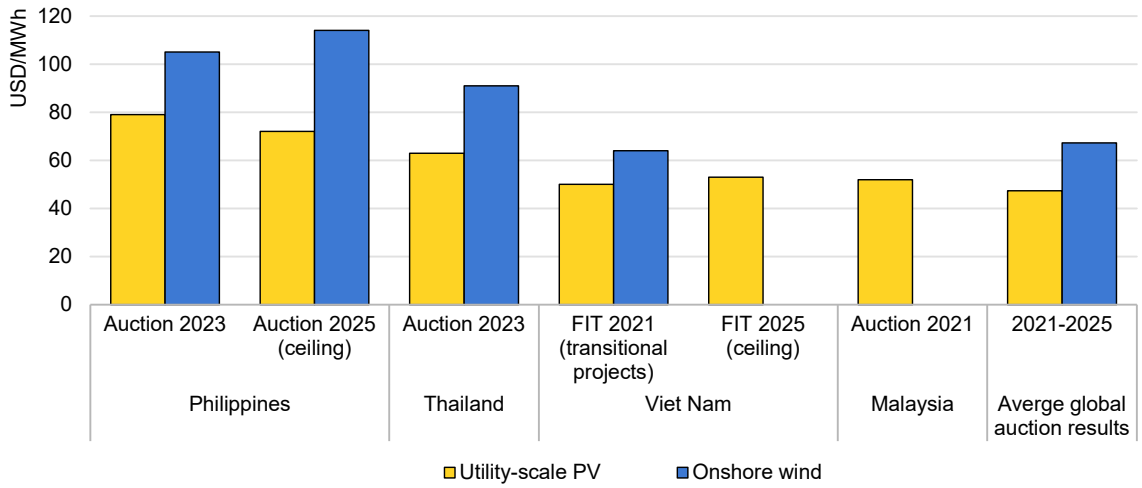
| Policy recommendation | Policy priorities | International examples |
|---|---|---|
| | | Commission recommends that EU member states index awarded contracts. Kazakhstan and the United Kingdom index their CfDs on the consumer price index over the entire contract duration. Several countries, including Argentina, Azerbaijan, Chile and Georgia, denominate contracts in US dollars. |
| **2.3. Lack of system integration** | | |
| **Organise dedicated auctions for dispatchable renewables to enhance system flexibility** | Consider including dispatchable renewables in future auction rounds to strengthen system flexibility. | The Philippines awarded almost 7 GW to pumped-storage hydropower in the third round of the Green Energy Auction programme. The Philippines and Thailand have also included combinations of solar PV and battery storage in their auctions, emphasising the need for dispatchable technologies. Argentina, Austria, Germany and Kazakhstan have implemented technology-specific auctions for biomass. Australia and Ontario have opted for auctions that include several dispatchable renewables. India has conducted several auction rounds for hybrid projects combining solar PV, onshore wind and often storage. |
| | Implement technology-specific or multi-technology auctions for dispatchable technologies and hybrid projects. | |
| **Use locational signals to improve system integration and reduce curtailment** | Consider implementing locational signals in auctions to reduce curtailment. | Thailand provides a bonus of around USD 14/MWh on the feed-in-tariff for projects in the Southern Border Provinces. Germany and Mexico introduced correction amounts on the submitted bid prices based on the projects' locations. Portugal mandated that participating projects be installed at specific grid-connection points. India's solar-park programme auctions predeveloped sites with completed permitting and grid access. Cambodia followed a similar design, with the government and the Asian Development Bank de-risking the solar PV projects. |
| | Consider introducing auctions for predeveloped sites to align projects' locations with power grid needs. | |
| **Utilise system-friendly contract design** | Consider introducing more system-friendly contract structures, including incentives to reduce forecasting errors and mechanisms rewarding flexibility. | In Malaysia, grid guidelines require utility-scale solar PV plants to submit generation forecasts, across various timeframes. India introduced the Deviation Settlement Mechanism, which requires renewable producers to submit accurate day-ahead and intra-day generation schedules. In the event of deviations, the generator faces financial penalties. In Germany, Spain, the United Kingdom and Denmark, wind and solar PV generators face balancing responsibilities to reduce system-integration costs. |
| | Consider gradually introducing balancing obligations for renewable generators to improve forecast accuracy and lower system costs. | |
| **Design transitional contracts in case of market-liberalisation plans** | Consider introducing transitional clauses into new PPAs signed with the government or feed-in tariffs when planning to establish or deepen wholesale electricity markets. | Albania's Law No. 24/2023 foresees transforming the awarded fixed-tariff PPA into a contract for difference once the market becomes liquid. The law also stipulates that the transformation should occur once the day-ahead market meets certain criteria on traded volumes and operationality. |
| | Define clear and transparent milestones for the full transition to contracts for difference to reduce uncertainty to investors. | |

# Chapter 1. Challenges and policy suggestions

## Challenges related to elevated investment risk and higher renewable generation costs

Despite recent declines, solar PV and onshore wind-generation costs in the Association of Southeast Asian Nations (ASEAN) countries remain above global averages. Based on recent auction outcomes and feed-in tariff reference levels, utility-scale PV costs typically range from USD 50/MWh to USD 80/MWh, while onshore wind projects fall between USD 65/MWh and USD 115/MWh. This is higher than the average global auction results, which ranged from USD 40/MWh to USD 55/MWh for PV and USD 60/MWh to USD 80/MWh for onshore wind in 2021-25. Viet Nam and Malaysia have the lowest costs in the region, with PV prices approaching global averages. In most other ASEAN member states, solar PV costs remain elevated (generally over USD 60/MWh) and significantly above the potential, considering the strong resource availability in the region.

**Solar PV and onshore wind tariffs in selected ASEAN support schemes and global average renewable-energy auction results, 2021-2025**






Note: FIT = feed-in-tariffs.

Sources: Department of Energy of Philippines; Energy Policy and Planning Office of Thailand; Ministry of Industry and Trade of Viet Nam; Sustainable Energy Development Authority of Malaysia; IEA (2025), Renewables 2025.

Two key drivers of solar PV and wind-generation costs are initial investment costs and financing costs, both of which are influenced by structural challenges in the region. Limited annual deployment has resulted in relatively small and fragmented markets, reducing competition among developers and suppliers and keeping investment costs elevated.

Higher financing costs represent a major barrier to lowering generation costs and scaling up investment in renewable energy. The lack of long-term visibility on government energy plans, schedules for renewable procurement and support mechanisms increases investor uncertainty, contributing to higher financing costs. Limited risk allocation in power purchase agreements (PPAs) between developers and utilities, alongside foreign-ownership restrictions in some markets, further amplify the perceived risks.

Addressing these challenges will require a co-ordinated policy approach that strengthens long-term planning; establishes clear and transparent policy support mechanisms; balances risk-sharing between developers, offtakers and governments; facilitates corporate PPAs; and reduces ownership and strict domestic-content barriers. Multiple successful policy examples, both from within ASEAN and in international markets, demonstrate that such policy actions can help reduce costs and accelerate renewable deployment.

## Lack of implementation details in national plans

The lack of detailed implementation measures in national energy plans continues to create uncertainty about government commitments to investing in renewable energy over the medium and long term. The absence of a long-term, clearly defined vision for energy-sector developers makes it difficult for national, regional and local authorities to align their actions. As a result, utilities, grid operators, developers, investors and supply-chain actors cannot confidently allocate investment capital. This uncertainty contributes to slower project development, higher financing costs and lower overall investment momentum.

Several countries have recently published new or updated energy plans. Among these are Viet Nam's Revised Power Development Plan 8, Indonesia's Electricity Supply Business Plan 2025-2034 and the Philippine Energy Plan 2023-2050. While these documents set out technology-specific capacity or generation targets for 2030 and beyond, they often lack clarity on implementation timelines, procurement schedules and policy instruments. In addition, stop-and-go policies and missed renewable-energy targets in several ASEAN countries have heightened investor concerns about long-term policy commitment and implementation.

Providing detailed, credible and stable implementation pathways will be essential for ASEAN countries to reduce uncertainty, lower financing costs and facilitate investment in renewable-energy projects.

## Policy priorities

- Regularly publish and update national energy plans to reflect evolving market conditions, technological progress and changes in system needs. Plans should include clear, technology-specific deployment targets based on either capacity or generation, along with indicative timelines and the policy measures required to achieve them. A concrete five-to-ten-year roadmap gives developers and investors the long-term visibility needed to commit capital and align project planning with national objectives.
- Embed energy plans in high-level legislation to increase policy certainty and minimise the risk of abrupt changes or reversals. Anchoring targets and key measures in law strengthens government accountability, enhances investor confidence and helps ensure continuity across political cycles.
- Ensure clear, consistent and frequent communication of government commitments to implementing the plan. Transparent updates on progress, timelines and upcoming policy actions help maintain market confidence, reduce misinformation, and enable all stakeholders to align their strategies and investment decisions.

## Selected policy examples

In the European Union, National Energy and Climate Plans provide strong international examples of high-level, co-ordinated energy planning. These legally mandated documents require every EU member state to set detailed renewable-energy targets for 2030 outlining the policies and measures needed to achieve climate and energy objectives. National Energy and Climate Plans take a comprehensive view of the energy system covering decarbonisation, energy efficiency, security of supply, regional market integration and innovation. They are prepared through broad consultations with citizens, businesses and regional authorities, aligning stakeholders around a common vision and strengthening confidence in long-term policy direction.

India offers another example of how consistent political commitment can provide investment clarity, even in the absence of a single consolidated plan. First announced by the prime minister at COP26 in 2021 and reaffirmed repeatedly since then, India's 2030 target of 500 GW of non-fossil electricity capacity has been backed by detailed technology allocations from the Central Electricity Authority, as well as directives on auction volumes. This steady and unified policy signal has strengthened investor confidence and underpinned a rapid acceleration of renewable-energy deployment over the past three years. It has also contributed

to India securing some of the world's lowest renewable-energy tariffs, with average solar PV auction prices falling below USD 30/MWh in the first half of 2025.

## Insufficient policy support to ensure long-term revenues and de-risk investments

Renewable-energy deployment in ASEAN is frequently constrained by policy frameworks that do not provide the long-term revenue certainty required to mobilise large-scale investment. Since most renewable technologies are capital-intensive, developers depend on predictable cash flows to secure financing at affordable rates. When support schemes (such as competitive auctions, standardised long-term contracts or clear tariff mechanisms) are absent or inconsistently applied, investors face higher perceived risks and thus expect higher returns. By contrast, clear and durable policy signals can significantly reduce financing costs, enabling renewable electricity tariffs to drop to levels that are competitive with conventional electricity generation.

Uncertain or irregular procurement schedules also limit the development of robust local supply chains. Without visibility on future project volumes, manufacturers and service providers are less willing to commit capital to expanding production capacity, power plant construction or maintenance services. They are also less willing to invest in new capabilities. This results in limited economies of scale, keeping project costs high even as equipment prices fall globally.

Recent experience across the ASEAN region illustrates these challenges. In Viet Nam, the expiry of feed-in tariffs in 2021 without a successor mechanism led to a near-standstill in new utility-scale investment. In Indonesia, limited procurement through the existing public-utility company framework, and tariff levels that are often too low to attract investors, have slowed capacity growth. Strengthening policy certainty, improving procurement design and ensuring predictable long-term revenue frameworks will be essential to reducing financing costs and accelerating renewable deployment across the region.

### Policy priorities

- Establish large-scale and competitive programmes for renewable procurement, anchored in clear long-term strategies and implemented through fixed multi-year schedules. Well-designed auctions have proven highly effective in expanding solar PV and wind deployment while reducing costs through competitive pressure.
- Deploy targeted support for dispatchable renewable technologies such as bioenergy, hydropower and geothermal. Given their site-specific nature and the value they bring to the power system, dedicated funding mechanisms and

procurement frameworks are needed to recognise their contribution to flexibility, reliability and resource adequacy.

- Avoid retroactive policy changes and stop-and-go measures. These can undermine investor confidence, create market interruptions and reduce project pipelines. Policy stability is essential to sustain developer participation and promote the emergence of local supply chains.

## Selected policy examples

Globally, competitive auctions have become the primary mechanism for procuring utility-scale renewable energy, accounting for almost 60% of the gross capacity additions expected between 2025 and 2030. Auctions now underpin deployment in major markets like China, India, the European Union and Latin America.

In India, large-scale auctions – led by central and state agencies and utilities – were introduced in 2013. They remain the backbone of utility-scale renewable deployment, with more than 60 GW of capacity awarded through auctions in 2024. Large procurement volumes, 25-year revenue certainty and strong payment guarantees from the central government have enabled some of the world's lowest prices, with the average standalone solar PV tariff decreasing from 135 USD/MWh in 2015 to about USD 30/MWh in 2024.

Several ASEAN member states are already harnessing competitive auctions to accelerate investment in renewables. Thailand, Malaysia and the Philippines have all run successful rounds. In the Philippines, the fourth Green Energy Auction conducted in 2025 awarded more than 10 GW of capacity for deployment by 2029, a major step toward achieving the country's 2030 targets. The ceiling tariff for standalone utility-scale solar PV was set at USD 72/MWh – well below the 2024 average wholesale electricity spot price of USD 94/MWh.

Feed-in tariffs have also played a significant role in earlier phases of market development. In China, administratively set feed-in tariffs supported rapid PV and onshore wind growth before the transition to competitive auctions in 2025. In Viet Nam, generous feed-in tariffs triggered deployment booms across utility-scale solar PV (2019), distributed PV (2020) and wind (2021). However, the absence of volume control led to a deployment boom in the short term and high costs for the government, straining grid infrastructure and contributing to high curtailment.

Other policy approaches include feed-in premiums and green certificate schemes. In Japan, a competitively set feed-in premium is now the main support mechanism. Korea relies on a renewable-portfolio standard and tradable green certificates. Many European countries (e.g. Germany, Denmark and the Netherlands) initially used administratively set feed-in premiums or green certificate systems (e.g. the United Kingdom, Poland and Sweden). However, most EU countries transitioned

to competitive procurement models – such as contracts for difference auctions – to improve cost efficiency and better manage deployment volumes.

## Elevated risk perception of PPAs with public utilities and administrative barriers to corporate PPAs

The financial health of state-owned utilities in several ASEAN member states remains weak, a significant concern for investors. In single-buyer markets, structural deficits or utilities' high debt levels are considered higher credit risks, increasing the cost of capital for renewable-energy projects. Standard PPAs often provide insufficient protection against payment delays, curtailment, changes in law or early termination. This reduces the projects' bankability, limiting participation by international financial institutions. Exposure to currency and inflation risks amplifies investor uncertainty.

Corporate PPAs  an increasingly important driver of renewable deployment worldwide, are also limited across many ASEAN countries. Creditworthiness requirements, regulatory/policy limitations on direct contracting and complex contract-approval processes restrict the ability of large commercial and industrial consumers to sign bilateral contracts with independent power producers. These barriers impede what could otherwise be a major source of long-term demand for renewable electricity. While uptake of corporate PPAs is growing in Malaysia, Singapore, Thailand and Viet Nam, overall activity remains modest in relation to the region's growing power demand.

As a result, both utility-led and corporate-led renewable deployment remains below its potential in many ASEAN member states. This requires policy action.

### Policy priorities:

- Strengthen the financial health of the main power-purchasing utilities, including through tariff reform, improved cost recovery and enhanced financial oversight.
- Consider the creation of creditworthy, government-backed agencies or institutions that can serve as intermediaries between independent power producers and utilities, reducing offtaker risk and improving project bankability.
- Adopt internationally recognised standards for PPAs that ensure guaranteed offtake and a balanced allocation of risks between generators and buyers, improving contract transparency and investor confidence.
- Incorporate appropriate price-indexation mechanisms into standard contracts to mitigate inflation and the risks facing developers and lenders with regard to commodity prices and exchange rates.
- Remove regulatory and administrative barriers to corporate PPAs, allowing large consumers to contract directly with renewable generators and diversifying offtake options beyond government-led procurement.

### Selected policy examples:

In India, payment delays by financially weak state-owned utilities led to persistent under-subscription in renewable-energy auctions in 2018-19. In response, the government introduced a payment-guarantee mechanism for auctions conducted by the central agency, Solar Energy Corporation of India. This measure substantially improved investor confidence, with average subscription rates increasing from 60% in 2019 to 90% in 2020.

Several ASEAN member states recently advanced corporate PPA frameworks to diversify offtake options. In Singapore, corporate buyers can sign PPAs with licensed retailers, enabling indirect procurement of renewable electricity via the grid. In Viet Nam, a corporate PPA scheme launched in 2024 allows both physical and virtual contracting. In Malaysia, the Corporate Green Power Programme provides a financial PPA structure whereby the TNB utility handles physical delivery, while corporate buyers receive renewable-energy certificates. Finally, Thailand has introduced a pilot corporate PPA scheme of up to 2 GW, enabling large consumers to procure renewable electricity through a third-party grid-access framework.

A key challenge for corporate PPAs remains the low credit rating of many potential offtakers and smaller developers. International examples demonstrate how targeted support can mitigate this constraint. Spain and France provide guarantees covering up to 80% of the PPA's value in the event of buyer default. The European Investment Bank's Lending Envelope, for its part, supports private financial intermediaries in underwriting riskier transactions. Such mechanisms can significantly enhance the bankability of corporate PPAs and facilitate broader market uptake.

## Foreign-ownership restrictions and limited co-ordination between domestic-content requirements and deployment plans

Foreign-ownership restrictions can constrain renewable-energy deployment by limiting access to international capital, technical expertise and international project developers. Such constraints reduce investor participation, slowing progress towards national and regional renewable-energy targets. While most ASEAN countries no longer impose formal ownership limits on renewable-energy projects (Cambodia, Indonesia and the Philippines removed their restrictions in 2021), Malaysia maintains a 49% foreign-equity cap for projects participating in government support schemes. Thailand's 2022 draft regulation proposing similar limits has also introduced additional uncertainty for investors. Even in markets that do not impose explicit restrictions, complex permitting processes and opaque procurement frameworks often require foreign developers to form joint ventures

with domestic firms. Such forced partnerships often increase governance and transaction risks, lengthen development timelines and raise overall project costs.

High domestic-content requirements have also negatively affected renewable deployment in parts of ASEAN, particularly when they have not been co-ordinated with broader industrial strategies or realistic assessments of local manufacturing capabilities. In Indonesia, stringent local-content rules for solar PV have significantly increased investment costs and reduced competition. In 2024, the government lowered domestic-content thresholds for solar PV (from over 40% to 20%), hydropower (from 48-71% to 23-45%, depending on project size) and geothermal (from 29-42% to 20-29%), facilitating investment. However, new requirements for wind (15%) and bioenergy (21-25%) could create new constraints if not accompanied by a development of the supply chain. While domestic-content policies can support job creation and industrial development, their effectiveness depends on their careful alignment with long-term deployment plans. If not well-designed, domestic-content policies risk creating supply bottlenecks, restricting technology choice and increasing overall project costs, ultimately slowing the deployment of renewable energy across the region.

## Policy priorities

- Minimise domestic-content requirements and align renewable-deployment strategies with supply-chain development to avoid potential manufacturing bottlenecks and resulting costs increases.
- Avoid official and actual restrictions on foreign participation in renewable-energy projects, to broaden the pool of investors and reduce financing costs.
- Ensure equal treatment of domestic and international developers thr**ough** transparent procurement processes featuring clearly defined, non-discriminatory selection criteria.

## Selected policy examples

In the European Union, competitive renewable-energy auctions in countries such as France, Germany, Italy and the United Kingdom apply clear, non-discriminatory participation rules and use anonymous online bidding platforms. Such measures ensure the equal treatment of domestic and foreign bidders, reducing the risk of preferential outcomes.

India provides an example of co-ordinated industrial and deployment policy. The government pursues a multi-step strategy to build a domestic solar PV supply chain. The strategy includes phased increases in import duties on modules and cells, targeted manufacturing subsidies through the “Production-Linked Incentive” scheme and a gradual requirement that systems benefiting from policy support use modules from an approved domestic manufacturers list. This approach links

supply-chain development to a predictable deployment pipeline, increasing investor certainty while supporting industrial growth. As a result, India's manufacturing capacity for PV modules is on track to increase from about 20 GW in 2022 to 100 GW in 2025.

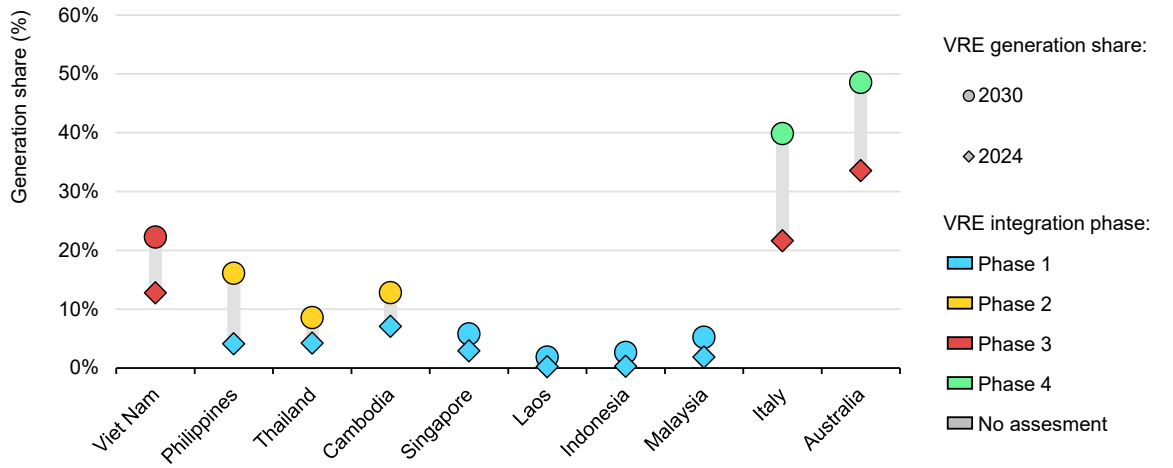
# Challenges related to power system and fossil fuel PPAs inflexibility

The growing deployment of solar PV and wind will increase flexibility needs across ASEAN power systems. The IEA's variable renewable energy integration framework classifies power systems in six phases, each reflecting the operational challenges associated with rising shares of variable generation. Phases 1-3 are considered low-integration stages, where variable renewable energy has a limited to moderate impact on system operations. Phases 4-6 represent advanced stages, in which variable renewable energy increasingly shapes system reliability and stability.

Today, all ASEAN member states except Viet Nam operate in phases 1-2, where variable renewable energy only has minor to moderate operational impacts. Most systems are expected to remain in these early phases through 2030. At this stage, managing integration challenges is generally straightforward. Key measures include enhancing the flexibility of existing thermal and hydropower plants, improving solar and wind forecasting, enabling more granular and near-real-time dispatch, updating grid codes for renewable connections, and modernising system monitoring and control capabilities. Importantly, these measures do not require major structural reforms or large capital investments, and can be implemented progressively as the shares of variable renewable energy rise.[1]

[1] A detailed assessment of renewables power-system integration challenges and potential solutions in ASEAN is available in the IEA report Integrating Solar and Wind in Southeast Asia.

**Variable renewable-energy generation shares and integration phases of selected countries, historical and Renewables 2025 forecast, 2024-2030**






Notes: VRE = variable renewable energy. Phase assessments are based on multiple parameters beyond VRE share in annual generation, including hourly generation and demand profiles, power grid configuration and installed dispatchable capacity.

Viet Nam had already reached Phase 3 in 2024 and is not expected to move to Phase 4 before 2030. In this phase, variable renewable energy starts to shape operational patterns more clearly, increasing variability and uncertainty in net load and requiring more significant changes in system operations. By 2035, some ASEAN countries could enter phases 3-4, with greater flexibility needs emerging as net-load patterns evolve. However, these conditions are expected to remain comparable with those already experienced in systems with high variable renewable energy, such as Italy, Spain and Australia, where multiple proven and cost-effective integration solutions are available.

ASEAN's power systems also face a structural challenge stemming from a large and relatively young coal fleet with an average age of around 15 years. These plants have an important technical role to play in providing operational flexibility. However, in several countries (including Indonesia, Thailand and Viet Nam), their ability to operate flexibly is constrained by long-term PPAs and fuel-supply contracts with minimum take-or-pay obligations. These contractual limitations reduce system flexibility at a time when it is increasingly valuable.

Addressing these flexibility barriers will be essential to support a cost-effective acceleration of renewable-energy deployment across ASEAN.

## Inflexible PPAs with fossil-fuel generators

PPAs in several ASEAN member states – including Indonesia, Thailand and Viet Nam – are often structured as firm, long-term commitments featuring minimum

offtake requirements and capacity payments which guarantee revenues for fossil-fuel generators. These provisions oblige utilities to purchase predetermined volumes of electricity, regardless of real-time demand. As a result, system operators have limited flexibility to reduce thermal output during periods of low net load. This leads to uneconomic dispatch, higher system costs and a reduced ability to contract new renewable capacity.

The challenge is especially acute in markets with significant thermal overcapacity, such as Indonesia and Thailand, where reserve margins have reached around 50%. In these systems, long-term fossil-fuel contracts often fully cover present (and in some cases projected) electricity demand, leaving utilities with little incentive or financial room to add new renewable capacity. These constraints are particularly problematic when utilities already face financial stress.

## Policy priorities:

- Develop a comprehensive legal, regulatory and financing framework to enable renegotiating existing PPAs and fuel-supply contracts, while providing new transition-aligned revenue streams that reward flexibility, firm capacity and system services.
- Improve the design of PPAs for new fossil-fuel generators to better support system flexibility, including by:
  - reducing minimum-take obligations to allow more economic dispatch
  - introducing flexibility requirements (lower minimum stable levels, faster startup times, higher ramp rates and frequent cycling capability)
  - diversifying fuel-supply portfolios through a mix of long- and short-term contracts, to improve procurement flexibility.
- Accelerate electrification of end uses to absorb greater renewable generation. This includes providing industrial heat via heat pumps and electric boilers, expanding electric mobility and adopting electric cooking.
- Consider supporting the phasedown and repurposing of fossil fuel-fired plants through clear, long-term system plans, the development of flexibility markets, and targeted financial support for early retirement and repurposing. Ensure transitions are people-centred, supporting workers and the affected communities.

## Selected policy examples

Indonesia plans to reduce its fleet of coal plants gradually starting in the mid-2030s. Its roadmap includes the early retirement of coal-fired power plants, conditional on international financial support and system reliability. While grid-

connected plants are targeted for phasedown, transitional measures such as co-firing with biomass, and potential retrofits with carbon capture and storage, are being considered.

The Philippines has issued a moratorium on new coal-fired power plants and is exploring innovative options such as transition credits, which would allow issuing carbon credits for the early retirement of coal plants. Viet Nam prohibits new coal projects that are not already under construction and plans to retire or repurpose all existing coal plants by 2050. Brunei Darussalam, Cambodia and Malaysia have also announced that no new greenfield coal plants will be built.

An international example comes from Poland, where long-term PPAs signed in the 1990s to finance large fossil-fuel plants later proved incompatible with the liberalisation of the electricity market. The government terminated these contracts and introduced a dedicated stranded-cost mechanism that compensates generators based on the original PPA terms, and actual operating costs and market revenues. Costs were recovered from consumers through a regulated transmission-tariff component, enabling a smooth transition without jeopardising system reliability.

## Lack of remuneration for flexibility and ancillary services

Power-sector structures in Southeast Asia range from vertically integrated utilities to partially or fully liberalised markets, with differing approaches to system operation and the procurement of ancillary services. The Philippines and Singapore operate competitive, market-based systems with dedicated mechanisms to procure ancillary services and short power-dispatch intervals. These designs provide clear price signals for flexible operation and create additional revenue streams for dispatchable generators.

Conversely, Indonesia, Thailand, Viet Nam, Malaysia and most other ASEAN member states retain single-buyer market structures without transparent, market-based procurement of ancillary services. These systems typically bundle ancillary services within long-term PPAs. In several countries (such as Thailand, Indonesia and Viet Nam), contractual obligations embedded in PPAs and fuel-supply agreements contribute to oversupply and limit operational flexibility, sometimes leading to uneconomic curtailment of variable renewable energy. In addition, the contracted operating characteristics often permit slow ramp rates and long startup times, and a limited number of startups and shutdowns. Under such conditions, generators face minimal incentives to operate flexibly. This raises overall system costs and makes it more difficult to integrate higher shares of solar PV and wind.

This lack of dedicated remuneration for flexibility also affects dispatchable renewable technologies such as hydropower, geothermal and bioenergy. Without

clear price signals for system services, their contribution to grid stability and flexibility remains undervalued. This reduces the competitiveness of dispatchable renewable technologies and limits their deployment, despite their potential to support the integration of variable renewable energy.

## Policy priorities

- Establish clear incentive mechanisms and update regulatory frameworks, to value appropriately and procure essential system services tailored to each country's market structure. This may include unbundling capacity, energy and ancillary services within contracts.
- Improve remuneration for flexibility and ancillary services, ensuring that price signals encourage greater provision of these services and enhance the system's operational flexibility.
- Develop transparent procurement processes and market rules, to enable fair competition among flexibility providers.
- Introduce hybrid renewable-plus-storage auctions, particularly in areas facing transmission constraints or high variable renewable-energy penetration.
- Set transparent, fair curtailment rules which are based on system security and applied consistently.
- Incorporate locational pricing signals into renewable procurement, to better reflect grid constraints and system needs.

## Selected policy examples

The Philippines launched its ancillary service market in 2024, complementing contracted reserves procured through the Ancillary Service Procurement Agreement. The reserve market co-optimises energy and reserve offers to determine the most cost-effective mix of services. It encourages private-sector participation and stimulates investment in flexibility resources, particularly battery storage.

International experience shows that targeted retrofits and operational adjustments can improve flexibility in conventional plants. In China, coal-fired plant retrofits are a key element of the national strategy to enhance system flexibility and facilitate higher deployment of variable renewable energy.

Many liberalised power markets – including the United Kingdom, France, Italy and several US markets (including PJM, MISO, NYISO) – operate capacity markets to reward dispatchability and ensure long-term adequacy. These markets also complement energy markets with transparent and competitive ancillary service mechanisms to procure frequency regulation, spinning and non-spinning reserves, black-start capability and voltage support.

In India, over half of the 60 GW awarded in renewable-energy auctions in 2024 consisted of hybrid projects combining technologies such as solar PV, wind, pumped-storage hydropower and batteries. These projects were procured with requirements for predefined generation profiles and capacity-utilisation factors to enhance system reliability.

## Insufficient incentives for the development of distributed solar PV

The deployment of distributed solar PV in ASEAN countries remains far below its technical and economic potential. As of 2024, the region only featured around 16 GW of installed capacity (including 12 GW in Viet Nam following the introduction of generous incentives). This means that total ASEAN capacity is lower than the capacity of the Netherlands alone. Policy uncertainties and limited remuneration for excess generation remain major barriers, particularly for residential and commercial and industrial consumers.

For most consumers – especially residential – the timing of solar PV generation does not align with their electricity demand profile, so that exporting excess electricity during peak generation hours is essential to project economics. In the absence of attractive and predictable remuneration mechanisms, distributed PV investments often fail to provide sufficient returns. In addition, incumbent utilities often express concerns about revenue loss from self-generation, which can slow policy progress and discourage the adoption of distributed solar PV.

As a result, the deployment of rooftop and commercial and industrial PV in Indonesia, Thailand, the Philippines and Malaysia remains significantly below its potential. This limits the potential contributions of distributed PV to enhancing system resilience and demand-side flexibility, reducing transmission-investment needs and lowering electricity costs.

### Policy priorities:

- Introduce long-term, market-based remuneration schemes for exported electricity reflecting installation costs, retail and wholesale electricity prices, and the desired pace of deployment. Remuneration should also take into account system-level benefits, including deferred grid investment.
- Promote real-time self-consumption models and phase out traditional net-metering approaches over time to improve the system friendliness of distributed PV.
- Provide targeted subsidies or preferential financing, especially for residential installations and projects supporting electrification in remote or underserved areas.

- Align incentives for utilities by linking regulatory rewards to their support for the deployment of distributed PV and timely grid connection to ensure their co-operation and engagement.

### Selected policy examples:

In Viet Nam, attractive feed-in tariffs triggered a surge in distributed PV installations in 2020. However, the absence of a long-term remuneration framework led to an unsustainable pace of growth and increased grid congestion challenges. Deployment in the commercial and industrial sector accelerated again in 2025 under the new direct PPA scheme allowing customers to sell excess electricity directly.

Brunei Darussalam, Malaysia and the Philippines have implemented net-metering schemes enabling customers to offset their consumption with exports. Thailand applies net billing at rates below the retail tariff. However, adoption has mostly remained slow, owing to limited economic attractiveness and uncertainty over long-term remuneration.

India has faced persistent delays in rooftop PV uptake. However, deployment has accelerated since the launch of an enhanced residential investment subsidy programme (PM-Surya Ghar Muft Bijli Yojana) in 2024 covering up to 40% of the system costs. The scheme is complemented by net-billing frameworks in most states.

## Challenges of permitting, community engagement and data availability

Complicated and lengthy permitting procedures, together with growing local opposition, are emerging as major challenges for the deployment of renewable energy worldwide. ASEAN is no exception. Complex administrative requirements, limited transparency, unenforceable deadlines, and overlapping responsibilities between central and local authorities significantly increase development risks. These factors contribute to cost overruns, delays and in some cases, project cancellations.

Limited community engagement compounds these challenges. In the absence of clear guidelines, early consultation and benefit-sharing mechanisms, renewable-energy projects – particularly those with larger land or environmental footprints, such as wind, hydropower and geothermal – often face local resistance. This can trigger lengthy legal processes and slow deployment, even in areas with strong resource potential.

ASEAN also holds some of the world's most promising geothermal resources. The region is expected to account for nearly 30% of global geothermal capacity additions by 2030, primarily in Indonesia and the Philippines. However, geothermal development carries uniquely high upfront risks, especially during resource assessment and exploration. The uncertainty associated with drilling success results in higher financing costs and often delays project timelines, leaving untapped the substantial system benefits from this dispatchable renewable technology.

Policymakers play a critical role in addressing these challenges. Strengthening permitting frameworks, improving administrative co-ordination, and establishing effective community engagement and benefit-sharing practices can significantly reduce development risks, attract a broader pool of developers and investors, and accelerate the deployment of renewable energy across the region.

## Lengthy and complicated permitting procedures

Lengthy and complex permitting procedures are a major barrier to the deployment of renewable energy in ASEAN. Project developers often face approval processes involving numerous steps across multiple national and local authorities, with unclear institutional responsibilities and non-standardised documentation requirements. Because many procedures lack enforceable timelines or service standards, applications can remain pending for long periods, creating significant uncertainty about project schedules and increasing development risks.

Administrative constraints compound these challenges. Limited digitalisation, insufficient staffing and gaps in technical expertise within local government offices frequently lead to processing delays. Developers typically have limited visibility on the status of their application or the reasons for bottlenecks. Overlapping or inconsistent regulations between agencies add to the administrative burden.

A lack of transparency in the permitting process can also heighten the risk of community objections, which may escalate into legal disputes and prolong approval timelines. These delays directly increase project costs, reducing the competitiveness of renewable-energy investments and slowing overall deployment.

Streamlining permitting procedures is therefore essential to lower development risks and accelerate the expansion of renewable energy in ASEAN.

### Policy priorities:

- Streamline permitting frameworks by simplifying rules, procedures and institutional responsibilities, to reduce the administrative burden and shorten project timelines.

- Establish one-stop shops to centralise planning, permitting and engagement with all relevant authorities, improving co-ordination and reducing uncertainty for developers.
- Introduce clear and enforceable deadlines for permitting decisions, including the use of positive administrative silence where appropriate, to avoid open-ended approval processes.
- Digitalise permitting systems to enhance transparency, enable real-time tracking of applications, and facilitate communication across national and local agencies.
- Improve the capacity of administrative offices through increased staffing, training and digitalisation to keep pace with the growing volume of project applications.
- Strengthen spatial planning by developing clear zoning guidelines, identifying go-to and no-go areas for renewable-energy development to accelerate site selection and reduce conflicts.
- Consider predeveloping priority sites, including by conducting resource assessments and securing permits and land rights in advance, to lower early-stage risks for developers and accelerate investment.

## Selected policy examples:

In India, government agencies secure land, obtain key permits and provide shared infrastructure (such as transmission access and roads) in advance under the Solar Parks scheme. By centralising these responsibilities, developers face fewer permitting steps, lower risks related to land acquisition and shorter lead times. This has helped accelerate large-scale solar deployment across the country.

Germany has established a “one-stop shop” for onshore wind which serves as a single interface with numerous government bodies and local authorities. The government has also designated a central maritime authority as the single point of contact for all offshore wind permits. This consolidation simplifies communication, clarifies institutional responsibilities, reduces the duplication of review processes and provides developers with greater visibility on timelines.

Portugal has developed an online spatial planning tool that identifies areas with lower environmental, land-use and cultural-heritage sensitivities. This publicly accessible platform allows developers and communities to assess potential project sites early in the planning process to avoid unsuitable or high-conflict zones. By increasing transparency and enabling better site selection, the tool reduces delays linked to environmental concerns and community opposition.

Greece introduced in 2022 a simplified and fully digitalised licensing framework that reduced the number of permitting steps from seven to five and allowed authorities to process multiple application steps in parallel. The reform also

introduced stricter deadlines for both administrators and investors, with the goal of cutting the total licensing time from 5 years to just 14 months. These changes have significantly improved predictability and speed, lowering development risks for renewable-energy projects.

## Limited engagement with local communities

Limited community engagement and the lack of structured benefit-sharing mechanisms often contribute to local opposition and project delays across ASEAN. In many cases, renewable-energy developers consult communities late in the planning process, provide limited information about the expected impacts or fail to establish clear channels for communication. This lack of early and meaningful participation can erode trust, particularly in areas where communities rely heavily on land and natural resources for their livelihoods.

Without transparent communication or tangible local benefits – such as employment opportunities, capacity-building, community development funds or shared revenue models – residents may perceive projects as externally imposed and offering limited advantages. These perceptions are amplified when land acquisition processes are unclear or compensation frameworks vary across regions, creating uncertainty and at times, a sense of inequity. Community resistance can intensify as a result, leading to protests, petitions or demands for additional assessments. In more contentious cases, disputes escalate into formal complaints or legal challenges, triggering lengthy reviews or permit suspensions. Such conflicts not only prolong permitting timelines but also generate reputational risks for developers, increasing project costs and delaying the delivery of planned capacity.

At a broader level, frequent community-related disputes undermine investor confidence in the sector, highlighting the need for more robust engagement practices and benefit-sharing frameworks across ASEAN.

### Policy priorities:

- Engage communities early in the project cycle. Involving local residents from the design phase onward helps build trust, increases public acceptance and reduces the likelihood of opposition later in the process. This engagement should continue throughout the development process.
- Enable community financial participation. Support mechanisms (e.g. crowdfunding schemes or dedicated savings and investment products) allow citizens to share in project revenues, enhancing local support.

- Implement transparent benefit-sharing frameworks. Policies that redistribute a portion of revenues from renewable projects (for example, through levies that feed into local development funds) can ensure that communities benefit directly from nearby projects.
- Provide clear, consistent information. Proactively communicating project details, including environmental impacts, visual changes and other considerations, and responding openly to community concerns builds trust with local communities and reduces the risk of opposition based on false information.
- Strengthen safeguards for affected communities. Introducing robust regulations that protect residents from unplanned adverse impacts and ensuring that developers provide compensation or remediation where necessary decreases risk perception by local residents.

## Selected policy examples:

On the Spanish island of Gran Canaria, local television and radio stations were used to disseminate early information about planned renewable-energy developments. This early outreach enabled residents to stay informed and voice their concerns before decisions were finalised. It enhanced transparency, reduced misinformation, and created trust between developers and the community. Importantly, this example also highlights the need for developers to adapt their communication strategies to different stakeholder groups, recognising their differing interests, technical understanding and preferred communication channels.

In France, developers can earn additional points during the national solar PV auctions if they incorporate collective financing by citizens or local authorities, or share governance with local residents. By rewarding community ownership and participatory project structures, the auction system ensures that projects with strong local engagement are not disadvantaged in a process typically dominated by cost considerations. This approach encourages more inclusive business models and helps distribute more broadly the economic benefits of renewable-energy deployment.

Ireland mandates direct financial benefits through a Community Benefit Fund for offshore wind projects. Under the Renewable Energy Support Scheme, successful developers are required to establish a fund dedicated to supporting the economic, environmental, social and cultural well-being of local communities. Developers must contribute approximately USD 2.3 for each megawatt-hour of electricity produced, creating a predictable and sustained revenue stream for community development initiatives. This requirement ensures that communities hosting offshore wind projects share in their long-term benefits, improving public acceptance and reducing the likelihood of local opposition.

# Limited public data and high predevelopment risks for geothermal projects

Access to reliable and standardised subsurface data is critical to reducing the high resource risks inherent to geothermal development. In most cases, however, the available geological information – such as reservoir characteristics, temperature profiles and fluid properties – remains incomplete, inconsistent or difficult to access. Data are often dispersed across multiple institutions, collected using varying methodologies, or locked behind opaque access procedures. The absence of centralised, comprehensive public-data platforms significantly limits developers' ability to evaluate geothermal potential, carry out preliminary modelling or accurately estimate resource uncertainty in the early phases of project development. These information gaps translate directly into higher financial risks and costs.

Geothermal projects also require substantial upfront capital for exploration activities (including geophysical surveys, test wells and initial drilling) that carry high uncertainty and represent a large share of total project costs. Without adequate risk-mitigation mechanisms (such as publicly funded exploration, resource risk insurance and cost-sharing schemes), these early-stage uncertainties undermine the economic attractiveness of geothermal power. They slow deployment of one of ASEAN's most promising dispatchable renewable-energy options, despite the region's exceptional resource potential.

Addressing challenges related to data availability and standardisation, and introducing early-stage risk-sharing mechanisms, are therefore essential steps towards unlocking greater private-sector participation and accelerating geothermal development across the region.[2]

## Policy priorities:

- Improve the availability of subsurface data by expanding geological surveys, and establishing national geothermal information platforms integrating data from government agencies and the oil and gas sector.
- Introduce measures to reduce exploration and early-stage risks for geothermal projects, including through government-supported exploration insurance schemes, public-private partnerships, concessional loans and grants to mitigate risks and support project bankability.
- Promote collaboration with the oil and gas industry to leverage subsurface expertise, drilling technologies and operational experience.

[2] The IEA report The Future of Geothermal Energy provides a detailed assessment of challenges to and potential policy solutions for accelerating the development of geothermal energy.

- Define ready-to-develop geothermal areas and undertake early exploration activities through state-owned entities to reduce private-sector exposure during the riskiest phases.

## Selected policy examples:

Several countries – including Germany, the Netherlands, Italy, France and the United States – have established public repositories for geothermal data and actively fund new data acquisition. At the regional level, the European Geological Data Infrastructure consolidates and standardises geothermal information for public use.

Türkiye and the Netherlands operate drilling-risk insurance schemes that compensate developers if wells fail to produce commercially viable resources. Kenya's Geothermal Development Company undertakes exploration and drilling and supplies steam to private developers, reducing early-stage risks for investors. Indonesia employs public-private partnerships for exploration. Türkiye and Indonesia introduced geothermal exploration risk sharing schemes in collaboration with international donors, such as the World Bank.

# Chapter 2. Auction design options for ASEAN member states

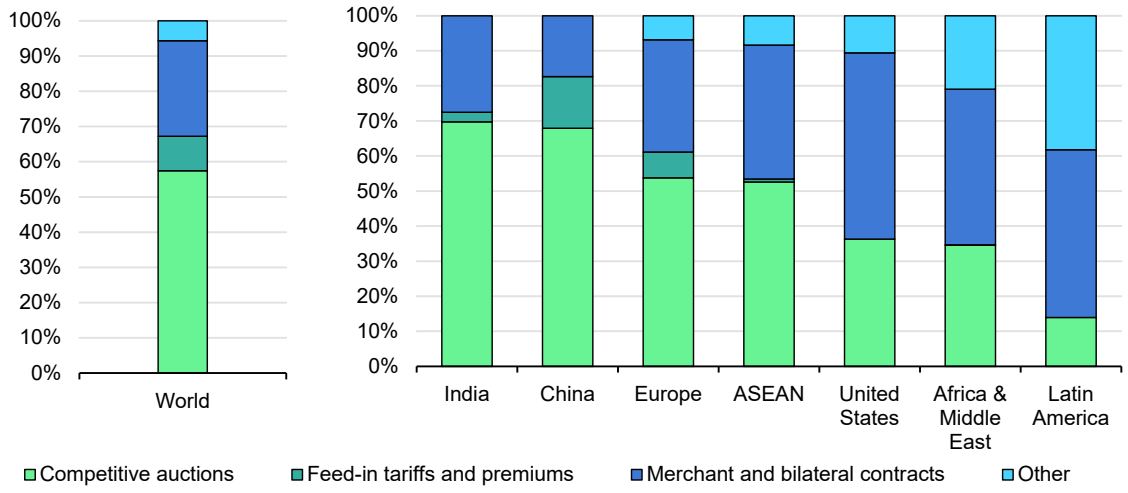
Competitive auctions are a key market-based instrument to scale up renewables. Unlike administratively set feed-in tariffs and premiums, where the government often sets offtake prices, competitive auctions let developers bid for the level of remuneration they receive. They can also address several of the challenges highlighted in the previous chapter, such as the higher costs of renewables, the need for long-term revenue certainty and the elevated risk perception of utility power purchase agreements (PPAs). Auctions have been implemented across the Association of Southeast Asian Nations (ASEAN). This chapter presents key design options relevant to both ASEAN member states with established mechanisms and those that are newly adopting auction systems.

## The role of competitive auctions in ASEAN

Auctions determine remuneration levels for renewables through competitive bidding and allocate support to generators on this basis. They can offer three main benefits compared to alternative instruments (such as fixed feed-in tariffs or green certificates): 1) efficient volume control over renewable deployment and visibility on policy costs for governments; 2) competitive price discovery, leading to cost reductions for governments and consumers; and 3) long-term revenue certainty for developers.

Globally, auctions are now the dominant procurement mechanism for utility-scale renewables, accounting for almost 60% of the gross capacity additions expected in 2025-30. In ASEAN, auctions are expected to drive over half of capacity growth in utility-scale renewables through 2030, similarly to Europe.

**Gross utility-scale renewable capacity additions by procurement type, 2025-2030**






Source: IEA (2025), Renewables 2025.

To date, seven ASEAN member states have implemented competitive renewable-energy auctions. The following analysis focuses on Cambodia, Malaysia, Myanmar, the Philippines and Thailand, where auctions have been conducted more recently and information on auction design is more readily available. Indonesia and Singapore have also held auctions. However, publicly available information on detailed auction design remains limited in Singapore, while Indonesia's auctions occurred earlier and are less representative of current practices.

Across the five countries in focus, several auction design features are broadly aligned. All ASEAN member states apply technology-specific auctions, often with regional or temporal differentiation of auction volumes; require material prequalification and bid bonds; and use pay-as-bid pricing[3]. Contract durations typically range between 20 and 25 years, and penalties for non-compliance or project delays are broadly comparable. In addition, four of the five countries do not index awarded contracts (a practice which the Philippines only introduced in 2025).

At the same time, important differences remain across key design parameters. Bidding windows range from one to four months, and the levels of bid and performance bonds vary significantly. Three countries denominate contracts in local currencies. Most notably, the time allowed for awarded projects to reach

[3] Thailand is an exception as the feed-in tariff level is set administratively and bidders compete for awards based on their technical-readiness scores, rather than price.

commercial operation differs substantially, ranging from 6 to 60 months. Ceiling prices also vary across countries, reflecting differences in local regulatory frameworks, cost structures and renewable-resource potential.

### Overview of auction design in selected ASEAN countries, 2019-2025

| Design element (latest auction) | Cambodia | Malaysia | Myanmar | Philippines | Thailand |
|---|---|---|---|---|---|
| Auction programme (latest auction round) | Development of a 60 MW and a 40 MW solar PV power plant | Large-scale solar programme (LSS 5+) | Bids for implementation of ground mounted solar power plant projects (EPGE PV 04/2022-2023) | Green Energy Auction programme (GEA-4) | Procurement of electricity from renewable energy sources 2022 - 2030 |
| Access to bid documents | To be purchased | To be purchased | To be purchased | Free of charge | Free of charge |
| Bidding window | 3 months | 1 month | 2 months | 4 months | 2 months |
| Technology-specific | Yes | Yes | Yes | Yes | Yes |
| Specific auction volumes | Site-specific (one site each round) | Regional | Site-specific (several sites) | Regional (per island) and per year | No specific locations, but per year |
| Prequalification – material | Yes | Yes (technical requirements, experience, use of land rights, connection approval) | | Yes (renewable energy service contract or a certificate of authority) | Yes (minimum scores in technical readiness, including land-use rights; also grid-connection confirmation) |
| Prequalification – financial | BB: USD 300-500 | BB: USD 79 000-1.2 million<br>PB: USD 225 000-3.5 million | | BB: USD 14 500/MW<br>PB: USD 26 600-75 000/MW | BB: USD 31 000/MW<br>PB: USD 31 000-250 000/MW |
| Pricing rule | Pay-as-bid | Pay-as-bid | Pay-as-bid | Pay-as-bid | n/a |
| Non-price criteria | No | Yes (more points for earlier SCOD) | No | No | Yes (technical readiness) |
| Contract type | PPA | PPA | PPA | FIT | FIT |
| Indexation | No | No | No | Yes* | No |
| Contract denomination | USD | MYR | USD (payments in MMK) | PHP | THB |

| Design element (latest auction) | Cambodia | Malaysia | Myanmar | Philippines | Thailand |
|---|---|---|---|---|---|
| Length (years) | 20 | 21 | 20 | 20 | 25 |
| Realisation period (months) | 18 | 27 | 6 | 15-51 | 12-60 |
| Penalties | | PB is retained in case of delay (1 month after SFCD); cancellation of award | | PB is partially retained in case of delay (less than 1 year after DCD); PB completely retained and cancellation of award (more than 1 year) | PB is partially retained in case of delay (less than 1 year after SCOD) ); PB completely retained and cancellation of award (more than 1 year) |
| Ceiling price (USD/MWh) | USD 76/MWh | USD 36/MWh and USD 43/MWh | | USD 78-106/MWh | n/a (FIT set at USD 62/MWh and USD 88/MWh) |

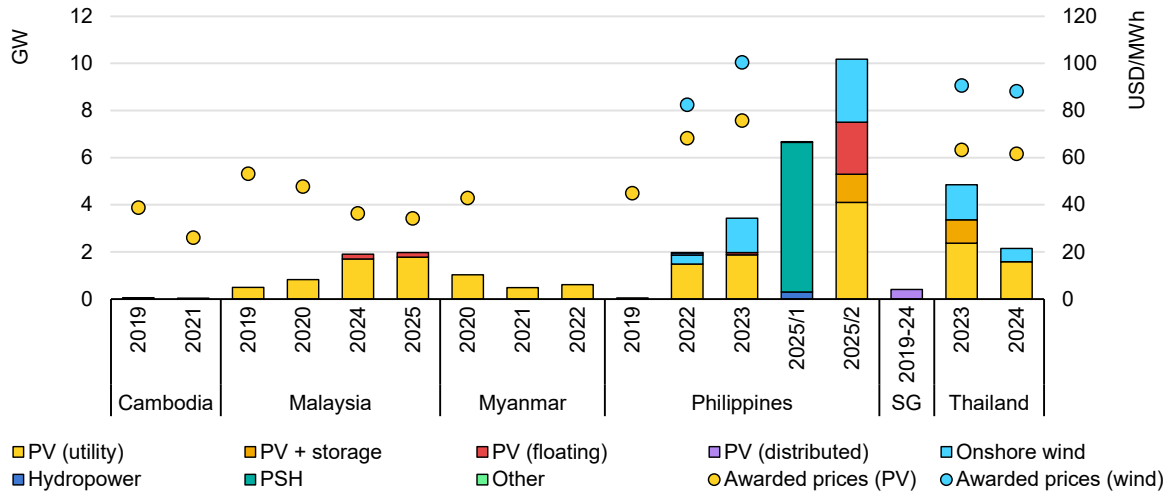
* Contract indexation was only introduced in the latest auction round in 2025 (GEA-4).

Notes: The design elements presented are based on the latest concluded auction round. Empty spaces indicate that the information was not publicly available. BB = bid bond. PB = performance bond. SCOD = scheduled commercial operation date. SFCD = scheduled financial close date. PPA = power-purchase agreement. FIT = feed-in tariff. MYR = Malaysian ringgit. MMK = Myanmar kyat. PHP = Philippine peso. THB = Thai baht.

Since 2019, more than 37 GW of renewables have been awarded in ASEAN. The Philippines accounts for over 60% (about 22 GW) of this awarded capacity. Malaysia (7 GW) and Thailand (5 GW) together represent roughly one-third of the region's awards. Myanmar awarded about 2 GW between 2020 and 2022. Singapore and Cambodia together awarded approximately 0.5 GW.

Solar PV represents the largest share of awarded capacity in ASEAN auctions, totalling about 24 GW – nearly two-thirds of all awarded capacity since 2019. Floating solar (3 GW) and solar PV with storage (2 GW) together make up almost one-fifth of this volume. Distributed PV contributes around 2% (0.4 GW). Hydropower is the second-largest technology, with nearly 7 GW awarded – almost all from pumped-storage projects in the Philippines. Onshore wind has reached close to 7 GW, mainly in the Philippines and Thailand. Geothermal and bioenergy have played only minor roles in competitive auctions.

**Awarded capacities and prices in renewable-energy auction rounds in ASEAN member states, 2019-2025**






Notes: PSH = pumped-storage hydropower. Other = bioenergy and geothermal. SG = Singapore. Each column represents one round with technology-specific auctions – except in Singapore, where five rounds of the SolarNova programme were aggregated. While all auctions from 2022 onwards in the Philippines were conducted under the Green Energy Auction Programme, the 2019 auction was organised by the Philippine utility Meralco.

Utility-scale solar PV achieved the lowest prices among renewable technologies in the ASEAN region, with awarded bids averaging around USD 56/MWh. Standalone projects, which represented the largest share of awarded capacity, cleared at roughly USD 55/MWh. Awarded solar-plus-storage projects totalled around USD 83/MWh. Cambodia recorded two of the lowest prices in the region (USD 26/MWh and USD 39/MWh for two standalone solar PV projects). This was supported by extensive de-risking measures, including site predevelopment and support from international financing institutions.

Floating solar PV achieved notably low average prices (below USD 50/MWh), largely reflecting competitive outcomes in Malaysia's LSS 5 and LSS 5+ auction rounds. In the Philippines, prices for more than 2 GW of floating PV under the GEA-4 round were not disclosed.

Onshore wind auctions resulted in average prices close to USD 94/MWh, around 70% higher than utility-scale solar PV. Prices were driven by auctions in the Philippines and Thailand, with awarded projects ranging from USD 80/MWh to USD 100/MWh.

Hydropower achieved competitive results in ASEAN auctions. Awarded prices averaged around USD 70/MWh, driven by more than 6 GW of pumped-storage hydropower at around USD 69/MWh in the Philippines.

# Key auction design options to increase participation

## Simple design

### Challenge:

Complex auction designs – such as multi-technology tenders, bid-correction amounts, extensive documentation or complicated scoring – can deter participation, especially in nascent markets. Lower competition often leads to higher auction prices.

### Policy priority:

Keep auction schemes as simple as possible, especially when first introducing auctions. Technology-specific and capacity-based auction volumes can provide higher visibility on the chances of being awarded, increasing investor confidence. Clear and simple selection criteria, such as price-only selection, can significantly reduce entry barriers. Static auction formats and pay-as-bid pricing also help bidders formulate and submit sufficiently high bids, preventing underbidding.

### Selected policy examples:

All ASEAN member states apply capacity-based auction volumes. India and South Africa both conducted technology-specific, price-only auctions when they first introduced their auction schemes. Most countries in Europe similarly rely on technology-specific and price-only auctions.

## Transparency

### Challenge:

Limited visibility on the auction and selection process lessens investor confidence. This can decrease participation and increase the cost of capital. In addition, low visibility about future auction volumes could deter investors from entering a market.

### Policy priorities:

- Make tender documents freely accessible to ensure broad outreach. This increases transparency not only for bidders, but also for interested stakeholders.

- Publish national auction schedules (including planned volumes and indicative timelines) on a centralised platform. These would provide project developers with an overview of upcoming opportunities, as well as helping member states better align and spread auction dates. Spreading auctions throughout the year would reduce the risk of bidders having to choose specific auctions, thus preventing low participation.

- Disclose auction results. Member states should consider publishing auction results, such as average awarded prices and submitted and awarded volumes, to guide market expectations.

### Selected policy examples:

To increase visibility regarding upcoming auctions, the Solar Energy Corporation of India (SECI) has a dedicated tenders website, also featuring the relevant "request for selection" documents. Similarly, the European Union set up the RES Auctions Platform aggregating auctions by EU member states.

Malaysia and the Philippines used to publish detailed information on the respective auction results (bid prices and volumes), although they stopped doing so in the recent auction rounds. Thailand also provides extensive information on the awarded bidders. Germany publishes comprehensive auction results, including historic auction results, both online and in a table format. India, Italy and South Africa even publish results at the project level, encompassing both successful and unsuccessful bids.

## Minimise local-content requirements

### Challenge:

Strict local-content requirements can decrease participation in competitive auctions. This can lead to higher prices and potential delays in renewable deployment, especially in nascent renewable markets.

### Policy priorities:

- Avoid strict local-content requirements. This will increase competition during auctions and avoid delays in project realisation. In general, strict requirements should be minimised if they are not targeting the ability of bidders to commission their projects.

- Consider using non-price award criteria to incorporate broader (economic) policy goals, avoiding excessive barriers. The award criteria applied when selecting the winning bids should reward higher performance on specific project characteristics (such as using more environmentally friendly

components or equipment, even at a higher bid price). Alternatively, bid-correction amounts that adjust the submitted bid prices could also be considered to pursue these policy objectives.

### Selected policy examples:

Malaysia's LSS 5+ auction awards additional scoring points for earlier commissioning, leaving bidders to decide between an earlier commissioning (with a potentially higher bid price) or a later commissioning (with a potentially lower bid price). In Canada, Quebec includes local content in a weighted scoring system, while Nova Scotia assigns a score for (among others) local engagement. The European Union's Net-Zero Industry Act foresees minimum weightings in auctions for sustainability and resilience criteria. In South Africa, award criteria include minimum thresholds for local economic development.

# Key auction design options to avoid delays in project realisation

## Material prequalification criteria

### Challenge:

Awarded projects in several ASEAN member states face commissioning issues and delays, mainly related to grid connection, permitting and land acquisition.

### Policy priority:

- Consider key project documents as a component of material prequalification before bid submission. These documents can include grid-connection agreements, land-use rights and essential permits. While this requirement may reduce the number of bidders, it significantly increases the likelihood of timely commissioning. In addition, project realisation should always be safeguarded with financial prequalification, in the form of bid bonds and penalties.

### Selected policy examples:

Malaysia requires extensive documentation as part of the prequalification process, such as proving technical capability through experience with commissioning and operating solar PV projects, and documents showing the right to use the specific land as the project site. India requires bidders to have a certain net worth and liquidity, as stipulated for instance in the guidelines for solar PV auctions. In Germany, according to the Renewable Energy Sources Act 2023, bidders must

usually have a permit under the Federal Immission Control Act, which already incorporates environmental approvals and land rights.

## Contract indexation

### Challenge:

High inflation and exchange-rate volatility can negatively impact project economics, increasing the risk of non-commissioning. This is especially challenging in markets with high costs of capital.

### Policy priority:

- Consider indexing contracts for renewable generators. Indexation can be linked to the consumer price index or relevant cost components (e.g. steel or labour). Indexation may apply only until commissioning, over the full contract period, or both. It can apply to contracts in both nascent (government PPA) and developed renewable markets (feed-in premiums/contracts for difference [CfDs]). Denominating contracts in foreign currencies could also reduce the risk of exchange-rate volatility, particularly in markets where long-term hedging instruments are limited.

### Selected policy examples:

In 2025, the Philippines started indexing the auction-based Green energy tariff (allocated through the green energy auctions), with the price adjustment occurring between the award and the start of commercial operations. The European Commission recommends that EU member states index awarded contracts. Kazakhstan and the United Kingdom index their CfDs on the consumer price index over the entire contract duration. Several countries, including Argentina, Azerbaijan, Chile and Georgia, denominate contracts in US dollars.

# Key auction design options to enhance system integration

## Dispatchable renewables

### Challenge:

Most competitive auctions in ASEAN member states focus on solar PV and onshore wind, which together account for more than 80% of total awarded capacity. While these technologies deliver low-cost generation, an overly narrow technological scope can create challenges for system integration as electricity

demand grows and the need for flexibility increases. Although member states are deploying and supporting dispatchable renewable technologies through other policy instruments, they have so far only used auctions to a limited extent to capture potential cost reductions for these technologies.

### Policy priorities:

- Consider including dispatchable renewables in future auction rounds to strengthen system flexibility. In line with national ambitions, ASEAN member states and implementing agencies could integrate dispatchable technologies into their auction schedules.
- Implement technology-specific or multi-technology auctions for dispatchable technologies and hybrid projects. Given their higher levelised cost of electricity, dispatchable renewables are unlikely to succeed in open auctions alongside solar PV and wind. Instead, dedicated or multi-technology dispatchable auctions could be organised.

### Selected policy examples:

The Philippines awarded almost 7 GW to pumped-storage hydropower in the third round of the Green Energy Auction programme (GEA-3). The Philippines and Thailand have also included combinations of solar PV and battery storage in their auctions, emphasising the need for dispatchable technologies. Argentina, Austria, Germany and Kazakhstan have implemented technology-specific auctions for biomass. Australia and Ontario have opted for auctions that include several dispatchable renewables (such as onshore wind or solar PV combined with battery storage, or pumped-storage hydropower), ensuring the deployment of flexible renewable capacity at least cost. India has conducted several auction rounds for hybrid projects combining solar PV, onshore wind and often storage.

## Locational signals

### Challenge:

Grid bottlenecks already contribute to renewable curtailment in several ASEAN markets. This is expected to intensify as deployment accelerates. Developers also face delays in securing grid connections, further slowing commissioning. Allowing project developers to choose their project sites freely can exacerbate the grid challenges.

### Policy priorities:

- Consider implementing locational signals in auctions to reduce curtailment. Locational signals can guide deployment toward areas with available grid capacity or lower system impacts. These signals include: 1) restricting projects to designated grid-connection points; 2) establishing geographic quotas (go-to or no-go zones); or 3) applying location-based price adjustments (bonuses or penalties) to bid prices.

- Consider introducing auctions for predeveloped sites. Under this model, governments identify suitable sites, assess resource potential and grid impacts, and secure key permits and grid-connection agreements before tendering the project. This reduces developer risk, accelerates deployment and helps align the project with grid needs.

### Selected policy examples:

Thailand provides a bonus of around USD 14/MWh on the feed-in-tariff for projects in the Southern Border Provinces (although not necessarily to address grid bottlenecks and curtailment challenges). Germany and Mexico introduced correction amounts on the submitted bid prices based on the projects' locations. Portugal mandated that participating projects be installed at specific grid-connection points. India's solar-park programme auctions predeveloped sites with completed permitting and grid access. Cambodia followed a similar design, with the government and the Asian Development Bank de-risking the solar PV projects awarded in 2019 and 2021. Several sub-Saharan African countries, including Zambia and Senegal, have adopted similar approaches.

## System-friendly contract design

### Challenge:

The current design of renewable contracts (mostly consisting of government PPAs) does not always incentivise system-friendly operation. Contracts in the ASEAN region are often designed as pay-as-produced, typically without balancing or forecasting obligations for the renewable producers.

### Policy priorities:

- Consider introducing more system-friendly contract structures, including incentives to reduce forecasting errors and mechanisms rewarding flexibility. In single-buyer markets, contracts with such technical requirements can improve alignment with system needs. If wholesale markets exist, consider moving to more system-friendly contracts, like feed-in premiums or CfDs.

- Consider gradually introducing balancing obligations for renewable generators to improve forecast accuracy and lower system costs. This typically entails forecasting responsibilities and exposure to imbalance costs when actual generation deviates from forecasts. These obligations support integrating variable renewables and promote more efficient system operation. Member states could consider gradually introducing similar obligations in PPAs going forward.

### Selected policy examples:

In Malaysia, the Guidelines On Large Scale Solar Photovoltaic Plant For Connection To Electricity Networks require utility-scale solar PV plants to submit generation forecasts to both the single buyer and the system operator. These requirements cover short- and medium-term forecasts, including day-ahead forecasts at 15-minute intervals, as well as long-term forecasts in the form of annual generation profiles. These forecasting obligations apply to PPAs under Malaysia's single-buyer model. India introduced the Deviation Settlement Mechanism, which requires renewable producers (under government PPAs) to submit accurate day-ahead and intra-day generation schedules. In the event of deviations, the generator faces financial penalties. In Germany, Spain, the United Kingdom and Denmark, wind and solar PV generators face balancing responsibilities to reduce system integration costs.

## Transitional contracts in case of market-liberalisation plans

### Challenge:

Awarded contracts – such as PPAs with the government – may create lock-in effects and limit flexibility. This is especially true during the transition to wholesale electricity markets. More market-based contract types (such as CfDs) support system integration, but retroactive modifications to existing contracts should be minimised and addressed comprehensively to retain investor confidence.

### Policy priorities:

- Consider introducing transitional clauses into new PPAs signed with the government or feed-in tariffs when planning to establish or deepen wholesale electricity markets. This could promote a shift towards a more system-friendly type of remuneration (like CfDs) once continuous spot-market operations have begun or liquidity has been reached in operational markets.

- Define clear and transparent milestones for the full transition to CfDs, to reduce uncertainty to investors. Milestones can be tied to market-liquidity indicators or the availability of balancing services.

## Selected policy examples:

Albania's Law No. 24/2023 foresees transforming the awarded fixed-tariff PPA into a contract for difference once the market becomes liquid. The law also stipulates that the transformation should occur once the day-ahead market meets certain criteria on traded volumes and operationality.

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