ASEAN Energy in 2025

Key Insights about ASEAN Energy Landscape and Predictions in 2025

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The analysis was curated based on data and information collected from various reliable sources: the official reports from the governments of the 10 ASEAN Member States, the private sector, and international organisations, as well as the 8th ASEAN Energy Outlook.

The main editor is Rika Safrina, with the authors for each insight as follows:

1. Energy-Climate Nexus : Indira Pradnyaswari, Muhammad Rizki Kresnawan
2. Market-Based Instruments for Leveraging Additional Financial Sources for ASEAN’s Energy Sector: Ambiyah Abdullah, Aldilla Noor Rakhiemah, Rio Jon Piter Silitonga, Muhammad Anis Zhafran Al Anwary, Veronica Ayu Pangestika
3. Tracking National Energy Policies : Afham Kilmi, Michael Petalio, Rully Hidayatullah, Marcel Nicky Arianto, Bayu Jamalullael
4. Charting Progress of Aspirational Energy Targets : Silvira Ayu Rosalia
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Insight 1

Energy-Climate Nexus

Written by Indira Pradnyaswari and Muhammad Rizki Kresnawan

Key Takeaways from COP29 and Mobilising Climate Finance in ASEAN

The Paris Agreement paved the way for a new era for a low-carbon future. In November 2024, the Conference of the Parties to the United Nations Framework Convention on Climate Change (UNFCCC), commonly referred to as COP, concluded its 29th edition in Baku, Azerbaijan. Leading to this COP, the ASEAN region is reaffirming its commitment to combat climate change through its annual Joint Statement on Climate Change [1]. The region reiterates its steadfast dedication to the UNFCCC and the Paris Agreement, stressing the principles of equity and common but differentiated responsibilities. The statement expresses growing concern over the rising levels of greenhouse gas emissions and the slow progress in climate financing by urging developed countries to provide necessary financial, technological, and capacity-building support, while also calling for the establishment of innovative financing mechanisms to address the pressing needs of the region. The statement also outlined several key priorities for the energy sector, including:

1. A call for swift and fair climate action and energy transition, emphasising the need for financial mechanisms to support these efforts.
2. A focus on the importance of developing and implementing low-emission technologies and enabling infrastructure to transition to a low-carbon regional economy.
3. An acknowledgment of the critical need to adopt best practices and advanced technologies to reduce emissions from upstream mineral extraction and processing, which are vital for clean energy technologies.
4. A strong emphasis on the importance of facilitating the transboundary flow of clean and renewable energy across the region.
5. A commitment to collaboration in developing low-emission technologies such as hydrogen and Carbon Capture, Utilisation, and Storage (CCUS).

Table 1 List of Energy-Related Initiatives in COP29 and Signatories Countries from ASEAN

Initiatives	Definition	Signatories in ASEAN
Global Energy Storage and Grids Pledge	Transform global energy infrastructure by deploying 1,500 GW of energy storage and 25 million kilometres of grid infrastructure by 2030.	Malaysia, Singapore
Green Energy Pledge: Green Energy Zones and Corridors	Develop Green Energy Zones and Corridors, combining renewable energy resources, infrastructure, and storage to optimise sustainable energy generation.	Malaysia, Singapore
Hydrogen Declaration	Scale up hydrogen production and use, especially in sectors where emissions are difficult to reduce while promoting mutual recognition of hydrogen certification schemes to create a global market for clean hydrogen.	Indonesia, Malaysia, Singapore

Sources: [3], [4], [5]

Several energy-focused initiatives introduced at COP29 received endorsement from a few ASEAN Member States (AMS) [2]. These include the Global Energy Storage and Grids Pledge, the Green Energy Pledge, and the Hydrogen Declaration (Table 1). Malaysia and Singapore have committed to all three pledges, whereas Indonesia has supported the Hydrogen Declaration. However, the other AMS opted not to sign the agreements. This highlights the region's varied approach to energy transition as it balances the complexities of shifting towards sustainable energy while seeking sufficient support and solutions to tackle climate challenges.

The COP29 session ended with a climate deal to mobilise USD 300 billion a year for climate finance from developed nations by 2035 under the New Collective Quantified Climate Finance Goal (NCQG), tripling from the previous goal of USD 100 billion annually, primarily designated for grants and low-interest loans [6]. It is part of the wider aspirational target of USD 1.3 trillion per year from all sources, including public and private sectors.

One notable shift in this initiative that should be appreciated is the contribution from developing countries and economies in transition who join the efforts. For example, China contributed approximately USD 24.5 billion in climate-related funding to support other developing nations from 2016 to 2023, which accounts for around 6% of the total climate finance provided by developed countries during the same timeframe [7]. This increased participation reflects the growing economic capabilities of these nations, aiming for a fairer distribution of the financial burden. While this broader involvement is a positive development, the gap between the ambitious climate finance goals and the actual financial situation underscores the ongoing challenges in securing sufficient funding to effectively address climate change.

As a centrepiece of climate finance, COP29 sheds light on optimising support between developed and developing countries [8]. The new finance goal aims to protect people and economies against climate disasters while bolstering clean energy deployments through climate funding. During 2021-2023, notable investment in the energy sector was made dominantly by local private investors, indicating the growing domestic capital market in some AMS [9]. Recently, the climate financing scheme in the ASEAN region has also experienced significant growth [10]. The funding source comes from a diverse array of channels, including private sector investments, public funding, dedicated climate funds, and blended financing schemes [11]. This multifaceted approach is expected to moderate risk levels and promote collaboration across sectors. Additionally, it will help to unlock capital for considerably unbankable projects, broadening access to larger and more varied funding pools.

Mobilising Climate Finance in ASEAN

AMS are actively exploring and adopting emerging low-carbon technologies which require a significant amount of funding. Although each AMS has its regulatory framework and policies on energy investment, the investors are still struggling to harmonise the regulation, including, foreign ownership, licensing, and environmental standards [9]. Therefore, prioritising regulatory schemes to shape a more concise and transparent financing path for investors is urgently required for ASEAN's climate journey.

To date, several initiatives have been implemented to serve pathways in mobilising international support. Just Energy Transition Partnership (JETP) and Energy Transition Mechanisms (ETM) are well-known for their long-term goal to realise the climate goals by providing financing schemes and engagement between investors and developing countries [12]. However, progress has been limited, indicating a need for more structured frameworks and actionable plans to meet the region's financing requirements. Table 2 provides information on existing financing mechanisms that have been applied in Southeast Asia.

Table 2 Energy and Climate-Related Financing Mechanisms in Southeast Asia

Mechanism	JETP		ETM		
	Indonesia	**Vietnam**	**Indonesia**	**Philippines**	**Vietnam**
Country Blueprint/Project	The Comprehensive Investment and Policy Plan (CIPP) 2023	Resource Mobilisation Plan	Preliminary Just Transition Assessment	Investment Plan for the Republic of the Philippines	Not established yet
Commenced Date	November 2022	December 2022	November 2022	November 2022	-
Financing Scheme	Blended Finance		Blended Finance		
Grant*	3%	4%	-	-	-
Debt**	97%	96%	-	-	-
Evaluation Tool	JETP Meta-Monitoring Platform	Exchange and Discussion Forums between Ministries and Agencies with IPG, GFANZ, and related stakeholders.	Relevant ADB policies and processes based on Preliminary Just Transition Assessment Document 2024, emphasising impact assessment	ACT IRF and ACT M&R Toolkit	-

**Grant: non-repayable funds provided to support specific projects or initiatives.*
***Debt: funds lent with the expectation of repayment, often with interest.*

Source: Author's compilation from multiple resources, in no particular order [13], [14], [15], [16], [17].

The varieties of ASEAN's financing mechanisms represent a strong recognition for establishing financing roadmaps in the region. Both schemes (JETP and ETM) utilise blended finance, a strategy that leverages public resources to improve the risk-return profile of investments, thereby encouraging private sector participation in sustainable development initiatives [18]. Indonesia and Vietnam's JETP schemes are heavily debt-driven, with 96-97% of financing coming from loans and only 3-4% from international grants. While the long-term objective is a green transition, this structure presents a double-edged sword for ASEAN's energy shift, as rising debt in developing nations could constrain fiscal flexibility [19].

Although JETP provides a transparent portion of capital structure, information on ETM remains limited. In supporting ETM activities, the Energy Transition Mechanism Partnership Trust Fund is established, receiving significant contributions from the governments of Japan, Germany, and New Zealand [20]. These funds are allocated for technical assistance projects and feasibility studies. While Indonesia and the Philippines have finished the pre-feasibility studies, no progress has been observed in Vietnam. These ongoing uncertainties and inconsistencies in funding mechanisms highlight the need for AMS to develop clear guidelines and a comprehensive climate finance roadmap.

An additional opportunity for ASEAN lies in optimising and utilising sovereign wealth funds to support carbon neutrality and fulfil global commitments to reducing greenhouse gas emissions. Sovereign wealth fund represents a national-owned investment fund that allocates capital towards applicable projects, in this case is climate-relevant project. For example, Singapore's sovereign wealth fund, Temasek, has invested USD 32 million in BeZero Carbon, reflecting a strategic effort to support the development of carbon markets essential for achieving net-zero emissions [21]. This approach exemplifies how sovereign wealth funds can play a crucial role in financing sustainable initiatives and driving the region's transition to a low-carbon economy. It is also emphasised the prominent role of government in supporting ongoing climate initiatives internally, in a structured and transparent way.

While domestic financing might be limited, indeed, ASEAN could explore other financing schemes and funding types beyond international grant. Diversifying financial sources is crucial whilst establishing a regional climate finance facility, expanding the issuance of green bonds, and leveraging Islamic green financing models, such as Malaysia's green sukuk, can provide stable funding. Additionally, Foreign Direct Investment (FDI) holds a crucial role in bolstering investment at the sectoral level. FDI refers to the investment made by a company in one country into projects in another country through a business collaboration with a local company. In 2022, the upstream-downstream process of the renewable energy supply chain was a major recipient of FDI in ASEAN [22], driven by energy transition goals and emerging investment opportunities. With effective policies in place, the region has the potential to become a key global manufacturing hub for clean energy, enhancing the integration between upstream and downstream sectors of the supply chain.

Sustaining ASEAN's Climate Goals Under a Shifting Geopolitical Landscape

However, this climate finance distribution might be worsened in 2025 due to the recent US short-noticed withdrawal from the Paris Agreement under Trump's Presidency. This mandate is translated from the *"Putting America First in International Environmental Agreements"* Executive Order, stating that the global environmental commitments were seen as unfair to the American economy, arguing that they burden American businesses while giving other countries more lenient terms. In specific, the order also instructs to immediately withdraw from any agreement, pact, accord, or similar commitment along with the purported financial commitments made by the US under the UNFCCC [23].

Concurrently, the "Reevaluating and Realigning United States Foreign Aid" Executive Order was also initiated to ensure that US taxpayer money was being used effectively and in line with American interests [24]. As a result, the US foreign aid shall be reviewed and reevaluated to ensure its alignment with national interest, global needs, and effectiveness. In coherence, a 90-day pause in US foreign development assistance shall immediately suspend new obligations and disbursement for foreign aid programs.

On its relevancies with ASEAN, this situation might lead to several issues on related projects that are funded by the US government due to general uncertainty over climate finance. Subsequently, at least significant funding allocated by the US Government for climate initiatives in developing countries will disappear. This might affect the continuity of climate mitigation and adaptation programs funded by the US in developing countries due to the emerging financial hole after the US departure, leading to delayed energy transition progress and loosening global climate commitment. For instance, this decision will affect the US co-leader role in Indonesia's JETP, transferring leadership responsibilities to Germany [25]. About USD 2.8 million disbursement from the United States Trade and Development Agency (USTDA) for Indonesia's JETP will be detained due to the 90-day pause period [26]. In response to the situation, a statement from the JETP Secretariat in Indonesia addressed that the reduced role of the US would not affect the energy transition in Indonesia. A similar atmosphere is possibly happening in other AMS [25].

Furthermore, the unexpected pull of the US from the Paris Agreement could also impact other existing climate pledges in other countries although it is still uncertain whether it will affect other participation on Paris Agreement or not. While the US accounts for the second largest share (13%) of global carbon emissions, its walkout potentially creates a dilemma and reconsideration on other climate initiatives made by developing countries with less contribution to carbon emission. Despite the ongoing geopolitical situation, it remains crucial for countries to strengthen regional and multilateral collaborations to sustain climate action and mitigate the long-term consequences of climate change.

Given geopolitical uncertainties, ASEAN must remain alert to risks in project implementation. Strengthening monitoring and evaluation is crucial, requiring collaboration between governments and the private sector for effective measurement, reporting, and verification. Funding challenges call for ASEAN to explore alternative sources to avoid disruptions from foreign aid volatility. Strengthening internal mechanisms, diversifying partnerships, and engaging global partners will help ensure sustainable development, climate resilience, and a robust regional climate strategy.

Insight 2

Market-Based Instruments for Leveraging Additional Financial Sources for ASEAN's Energy Sector

Written by Ambiyah Abdullah, Aldilla Noor Rakhiemah, Rio Jon Piter Silitonga, Muhammad Anis Zhafran Al Anwary, and Veronica Ayu Pangestika

Exploring the Carbon Market in ASEAN's Energy Sector

With the timing of the next cycle of Nationally Determined Contributions (NDCs) submission to the United Nations Framework Convention on Climate Change (UNFCCC) approaching, the attention on leveraging the carbon market to finance the national efforts to meet NDCs from all relevant stakeholders is greater than ever [27]. The 6th Assessment Report (AR6) published by the Intergovernmental Panel on Climate Change in 2023 stated that the current global efforts implied under the NDCs are more likely difficult to lower the temperature below 2 degrees by 2100 [28]. Moreover, the 2024 Emission Gap Report stated the emission gaps below 2°C in 2030 under the current policies and unconditional NDCs are estimated to be around 16 $GtCO_2e$ and 14 $GtCO_2e$, respectively [29]. The conditional global NDCs are estimated to lower the emissions gap by around 3 points from the unconditional NDC (11 $GtCO_2e$). The global emissions under the conditional NDCs and net zero targets are estimated to be around 19 $GtCO_2e$ in 2050 and would lower the emissions gap for the below 2°C target in 2050 and have emissions sink.

Among the key sectors under the NDCs, the total mitigation potential from the energy sector accounts for the largest share (nearly 40%) of the 31 $GtCO_2e$ of mitigation potential by 2030 [29]. The stronger efforts or targets for NDCs including strengthening the conditional NDC and net zero targets would be critical to meet the global temperature below 2°C in 2050. As a consequence, the financial need to accelerate the actions in closing the emission gap would also rise significantly. Thus, leveraging any financial means to finance the required climate actions would be unavoidable.

The annual global investment needed to finance NDCs is estimated to be USD 11.7 trillion by 2035 [29]. The additional annual investment amount is needed to finance the net zero target, which is around USD 0.9 trillion to USD 2.1 trillion from 2022 to 2050 [29]. The annual global climate finance in 2023 was estimated to be around USD 1.5 trillion to 1.6 trillion, which was increased significantly from the 2018 value, with around 19% from emerging market and developing economies (excluding China and less developing countries), around 90% of the total climate finance was spent for mitigation, and around 55% of climate mitigation finance was spent for the energy system [30]. Although the amount of annual climate finance increased, the current amount of climate finance is still far from meeting the USD 7 trillion of annual investment needed from 2024 to 2030 [30].

With a New Collective Quantified Goal (NCQG) agreed upon by the parties at the COP29, the leveraging carbon market to finance NDCs is promising with significant room for both public and private financial sources to cooperate in closing the climate finance [31]. A part of USD 300 billion will be expected from the developed countries' contribution in addition to multilateral development banks [31]. Albeit several key challenges occur in both international compliance and voluntary carbon markets including the environmental integrity issue, lack of robust and comprehensive carbon market infrastructure, and high investment risk along the carbon market value chain, the role of the carbon market and Article 6 (particularly Article 6.4) to close the climate finance in developing countries are getting more crucial than ever [32]. Taking into consideration ASEAN's position on the global energy supply chain and the region's efforts towards ASEAN carbon neutrality, the assessment of the potential implications of the global carbon market discussion on the ASEAN energy sector would help the region to design the comprehensive policy preparedness in responding to global carbon market movement on the energy sector in the region.

ASEAN's position in the global energy supply chain is crucial considering 35% of its energy share in global energy demand [33]. Most ASEAN Member States (AMS) have also submitted their national targets towards net zero or carbon neutrality by 2050 or 2060. Moreover, ASEAN also announced the regional strategy on ASEAN carbon neutrality, as the key starting guidance for the region on the efforts towards emissions reduction in ASEAN [34]. The energy sector (including power, transport, and industrial processes) accounts for more than half of the ASEAN total emissions, which urges decarbonisation in the energy sector as one of the keys to meeting carbon neutrality targets in ASEAN. To meet carbon neutrality in 2050, the region would need around USD 3.7-6.7 trillion of investment [34]. Moreover, the most recent 8th ASEAN Energy Outlook estimated about 5.1 $GtCO_2e$ greenhouse gas emissions will be produced by 2050 under the Baseline Scenario, and could be reduced to 1.1 $GtCO_2e$ in the most ambitious scenario, which required about USD 371 billion in the regional power sector [35]. Putting the huge amount of investment needed to finance carbon neutrality, the region accounted for only 2% of global clean energy investment in 2024 [36]. Although several AMS depend significantly on foreign direct investment than domestic financial sources in financing their energy infrastructure, about 60% of the regional clean energy investment came from public finance [39].

ASEAN absorbed around 5% of the total climate finance in Asia and Pacific in 2019, on which around 84% was spent on climate mitigation, and around 54% of the climate mitigation finance of ASEAN was spent on renewable energy [37]. Around 68% of it was financed through debts, including 26% from project market debt, 25% from low-cost project debt, and 17% from balance sheet debt [37]. Utilisation of the carbon market to provide additional financial sources for ASEAN has not yet been explored due to the early stage of carbon market development in ASEAN. The carbon market in ASEAN is projected to generate revenue of around USD 3 trillion and reduce around 1.1 $GtCO_2e$ by 2050 [38]. Taking into account of 50% share of the energy sector in the total ASEAN's emissions, the additional financial sources from the carbon market would bring significant impacts on mitigation efforts in the energy sector in the region [39].

However, the carbon market in ASEAN is still at an early development stage both in compliance and voluntary carbon markets. It requires more effort in setting a clear regulatory framework, scope, and compliance with the international standards applied to the global carbon market. Moreover, Article 6.2 and Article 6.4 on international carbon trading also require clearer and more transparency on the accounting of the potential carbon emission reduction to be eligible to be accounted for the internationally transferred mitigation outcomes at the global carbon market [40]. Thus, the re-assessment and realignment of the existing regulation and national standards applied for the carbon market in each of AMS including any existing carbon trading initiatives in the ASEAN energy sector would be the first step that needs to be implemented by the region.

For example, the existing Indonesian national standard on carbon credit accounting is based on the national standard on climate change mitigation set by the Ministry of Environment and Forestry of Indonesia needs to be adjusted with the new Paris Agreement Credit Mechanism to ensure environmental integrity inclusion and its compatibility with the international standard applied under Article 6. Other existing initiatives in the region include the potential of carbon trading in transboundary CO_2 transport and storage and energy efficiency carbon credit initiatives. Moreover, Renewable Energy Certificates (RECs) can also potentially complement the carbon market utilisation in the region.

Strengthening human capacity in ASEAN is essential to equip the region with the technical knowledge and expertise needed to participate effectively in the global carbon market. Currently, expertise in key areas such as carbon market monitoring, verification, accounting, and potential emissions reduction remains limited. Therefore, capacity-building initiatives should be prioritised and integrated into existing regional cooperation programs focused on human resource development in the energy sector.

Additionally, ASEAN must enhance regional collaboration to accelerate the development of carbon market infrastructure, including cross-sectoral partnerships related to carbon trading. Equally important is the establishment of interoperable data systems and a common carbon market framework, which will be crucial for fostering a well-structured and efficient ASEAN carbon market in the long term [41].

Linking ETS with Transboundary CO_2 Transport and Storage

The Southeast Asian region, characterised by its diverse energy landscape and significant industrial emissions, faces unique challenges in decarbonising its economy [42]. Carbon Capture and Storage (CCS) emerges as a crucial technology to meet the dual objectives of economic growth and emissions reduction [43]. However, the integration of CCS with Emissions Trading Systems (ETS) and transboundary CO_2 transport and storage infrastructure presents both opportunities and complexities that must be addressed to unlock its full potential. ETS provides a market-based mechanism to cap and trade greenhouse gas emissions, incentivising industries to invest in low-carbon technologies like CCS [44]. By assigning a monetary value to emissions reductions, ETS can directly enhance the economic viability of CCS projects. This is particularly relevant in Southeast Asia, where industrial sectors such as fossil fuels extraction and power generation dominate emissions profiles [45], [46].

To maximise CCS deployment in the region, establishing transboundary CO_2 transport and storage networks is essential. Many AMS face a shortage of domestic geological storage sites, making regional collaboration critical. Countries like Indonesia and Malaysia, with abundant storage potential, could serve as hubs for CO_2 storage, while others focus on capture and transport [47], [48]. However, transboundary CO_2 transport and storage is not necessarily applicable without first establishing a strong national foundation for CCS. A key challenge in building this foundation is ensuring the economic feasibility of CCS projects, which requires viable funding mechanisms, cost reductions, and supportive policies to drive investment. Integrating CCS with ETS could provide the necessary economic incentives and market-based solutions to accelerate its adoption and scalability.

Globally, the interaction between ETS and CCS remains nascent [49]. Of the 26 ETS in force, only five have any provisions on CCS, and just two (the EU ETS and UK ETS) include detailed guidelines. However, Indonesia has made significant progress in aligning ETS with CCS through several regulations. Presidential Regulation No. 14 of 2024 on CCS activities broadens the scope beyond the oil and gas sector, linking CCS outputs to carbon economic value (CEV) under Presidential Regulation No. 98 of 2021. While current regulations primarily cover the electricity sector through Ministry of Energy and Mineral Resources Regulation No. 16 of 2022, they lay the groundwork for broader applications. Policies for CCS generally follow one of two approaches: compliance-driven or incentive-based. The compliance-driven approach integrates CCS into regulatory frameworks, requiring industries to implement the technology to meet emissions reduction targets or adhere to performance standards. This is often achieved through mandates for specific sectors, such as power generation and extractive industries. In contrast, the incentive-based approach promotes CCS as an economic opportunity by providing financial support through subsidies, tax credits, result-based payments, or revenue from Enhanced Oil Recovery (EOR). In terms of CCS and ETS interaction, Indonesia's ETS aligns most closely with a system that interacts with fossil energy and industrial point-source capture applications [49]. As of now, it regulates emissions at the source, such as coal-fired power plants. Moreover, Indonesia's ETS aligns more closely with the compliance-driven approach, as regulations mandate that mitigation actions, including CCS, must be explicitly recognised by the government as contributing to the fulfilment of Indonesia's NDC. While emissions reductions achieved through CCS can be traded domestically or across borders under Indonesia's legal framework, all mitigation actions must be recorded and reported through the national registry. The government then considers these actions as part of its national efforts towards the NDC. As a result, traded emissions cannot be used by other parties to claim the credits, as this would constitute double counting. Thailand's voluntary program, T-VER, offers a contrasting approach by encouraging participation across all sectors without

imposing binding obligations [50]. Compared to Indonesia, T-VER is more advanced in terms of technical frameworks, as it includes specific methodologies for calculating emissions reductions achieved through CCS/CCUS [51]. This technical precision is a critical requirement for effectively integrating CCS with an ETS. However, the voluntary nature of T-VER contrasts with Indonesia's compliance-driven approach, highlighting different strengths and limitations. Each country thus demonstrates distinct advantages and challenges in balancing the technical requirements and economic feasibility of combining CCS with their broader climate policies. As transboundary CO_2 transport and storage is pivotal for regional CCS deployment, its economic feasibility hinges on robust ETS frameworks. Indonesia's progress in integrating CCS with ETS through CEV and Thailand's voluntary initiatives provides a foundation for expanding sectoral coverage and regional collaboration. Moving forward, ASEAN should prioritise harmonised legal frameworks to enhance the scalability of CCS, integrating it with CEV through its trade and non-trade mechanisms. This approach will enable CCS to contribute more effectively to global climate goals.

Energy Efficiency Carbon Credit Initiatives in ASEAN

To support ASEAN's energy efficiency growth, effective financing mechanisms and carbon pricing instruments are essential. While most governments have energy efficiency roadmaps, energy efficiency markets have lagged due to high due diligence costs and complex project financing. Even in mature markets like Europe, the sales cycle for energy efficiency projects typically takes 12-18 months. One of the measures being applied to tackle this market challenge is the application of carbon pricing policy on specific key industries thus encouraging the building and industries to reduce their energy consumption.

Such policies can create demand for standardised platforms that can be used to verify and monetise carbon reductions from energy efficiency projects (energy efficiency carbon credits). Thus, it can provide an incentivise to businesses while helping them comply with emissions regulations. However, deployment of energy efficiency technologies is commonly viewed as having high upfront capital costs which can be key barriers - particularly for small and medium enterprises and corporate clients who are hesitant to commit upfront costs for future benefits rather than immediate revenue gains. Energy Performance Contracts' complex legal and technical requirements further complicate the adoption of energy efficiency technologies. To bridge this gap, an online platform can be one option to provide third-party project valuation, performance insurance, certification, and connections to pre-qualified financing sources. This can create an integrated ecosystem supporting both energy efficiency implementation and carbon market development across ASEAN. To accommodate this, the ASEAN Centre for Energy, with support from IKI German and AFD, is developing an online platform designed to provide essential services such as third-party project valuation, performance insurance, project certification, and introductions to prequalified capital sources for energy reduction assets. This platform acts as a nexus for energy service companies and investors, fostering collaboration and enabling project financing for energy efficiency and renewable initiatives.

The Energy Efficiency Matching Platform will help streamline the financing process by facilitating expedited evaluations of energy efficiency projects in financial terms, enabling quicker deal closures with third-party finance providers. It automates and standardises the project pre-qualification processes by incorporating third-party valuation, insurance, and internationally recognised project certifications.

Despite these advancements, notable gaps still exist in the carbon credit trading mechanisms within the ASEAN region. While the energy efficiency investment and carbon platform present a vital opportunity to align sustainability aspirations with market mechanisms, its current static database for tracking emissions and facilitating project financing needs to evolve into a more dynamic trading ecosystem. The integration of blockchain-based carbon credit trading will allow for the transformation of static emission data into tradable digital assets. This transition promises to create immediate financial incentives for building owners to reduce emissions, while simultaneously providing investors with fresh opportunities for green investments.

Enabling a system that mirrors successful carbon markets, such as the EU ETS, equipped with modern technology, is crucial for ensuring transparent, efficient transactions. By enhancing these mechanisms, ASEAN can not only meet its ambitious goal of reducing energy intensity by 32% by 2025 under the ASEAN Plan of Action for Energy Cooperation (APAEC) but also accelerate its overall transition towards low-carbon and sustainable building

practices. Through targeted reforms and strategic partnerships, ASEAN stands poised to bolster its energy efficiency landscape, driving both economic growth and environmental responsibility.

Adding carbon credit trading functionality in the proposed online platform would create additional incentives for building owners, industry stakeholders, and investors, primarily by monetising emission reductions, creating market liquidity for carbon assets, and enabling better price discovery. This multi-faceted approach is not just a step towards achieving compliance with environmental targets but also a strategic maneuver to foster a competitive market that rewards sustainable practices, ultimately contributing to a greener future for the ASEAN region. Carbon pricing through taxes or cap-and-trade systems is a viable and cost-effective strategy for reducing greenhouse gas emissions [52]. However, the report also acknowledges the political challenges of implementing such measures, emphasising the need for supporting instruments to promote clean technology adoption. By creating a platform that transforms carbon credits into tradable assets, the initiative addresses these challenges, providing a market-driven mechanism that can overcome political barriers and incentivise meaningful environmental action across the ASEAN region.

Figure 1 Energy Efficiency Monetisation Mechanism

Renewable Energy Certificate: A Potential Game Changer for ASEAN Renewable Energy Financing

ASEAN countries' ambitious goal of achieving net-zero emissions entails substantial investments in clean energy. However, the financial gap for meeting the required investment needed for net-zero emission is still huge. ASEAN could venture into innovative financing schemes and instruments, as opposed to biding their time and seeing how Global North's pledges would be translated into a concrete investment mobilisation. Renewable Energy Certificate (REC), a market-based instrument that substantiates the environmental attributes and tracks the movement of clean electricity generation, emerges as the region's possible game changer. Its ability to provide credible verification makes it particularly attractive to private companies striving to meet their sustainability targets by addressing Scope 2 emissions, while carbon credits are utilised to offset Scope 1 and 3 emissions.

REC is commonly denominated in one-megawatt hour (MWh) and used to demonstrate proof of clean energy delivery from renewable sources. RECs play a crucial role in verifying end-users claims of renewable electricity consumption, as it is impossible to distinguish the source of electricity once electrons enter the grid. The purchase of RECs is driven either by **compliance** through a national energy regulation such as Renewable Portfolio Standards (RPS), or **voluntary** demands from private companies. RECs are typically transacted unbundled or bundled, in which the former denotes the purchase of certificates separately from the underlying physical electricity. On the other hand, bundled REC transactions refer to the procurement of clean electricity along with the associated RECs, via Power Purchase Agreements with renewable power plants, or various bundled green tariffs offered by utilities in Indonesia, Malaysia, Thailand, and Vietnam [53], [54]. The purchase of RECs generates supplementary revenue for utilities and Independent Power Producers, which can encourage the construction of new renewable energy assets.

A functioning voluntary REC market is evident in all ASEAN countries, some even have existing national guidelines on REC, such as Singapore with the *Singapore Standard (SS) 673: Code of Practice for Renewable Energy Certificates* and Malaysia with the upcoming REC Framework [55]. While RECs in Southeast Asia are being actively transacted within the confines of national boundaries, ASEAN may witness the proliferation of demands for cross-border RECs, especially with the increasing renewable penetration into the ASEAN Power Grid interconnections. However, global sustainability reporting standards with the likes of CDP and RE100 are yet to recognise the credibility of cross-border RECs in ASEAN— leaving the region with an array of regulatory gaps to address [55].

In the meantime, the full operationalisation of Article 6 at COP29 sets out a breakthrough for transnational carbon trading. While carbon credit is fundamentally different from REC, the establishment of a framework for the authorisation of Internationally Transferred Mitigation Outcomes offers an additional scheme for ASEAN in setting guidelines for RECs associated with cross-border clean electricity trade with some adjustments. The implementation of Article 6 hinges on the rigorous methodologies of carbon accounting, a process that trade parties of cross-border green power trade will need to adhere to by employing residual mix calculation [56], [57]. The main difference with the accounting method applied under the Article 6 is the residual mix calculation applied under RECs can be either transaction or issuance methods. Moreover, the Article 6 requires the corresponding adjustment after rechecking the emission accounting method applied is coherence with the global standard, which is not the case for RECs. While residual mix calculation is only one among the stipulated technical criteria, its implementation is imperative in ensuring the integrity, transparency, and robustness of environmental attribute claims.

There are several approaches that the AMS can pursue to advance the regional RECs from green power trading. National and bilateral efforts such as Singapore's plan to develop a global framework to recognise RECs from cross-border electricity trade are equally essential in amplifying shared visions of financing decarbonisation [58]. Moreover, as exemplified by the European *Association of Issuing Bodies*, the establishment of a dialogue platform that consolidates regional aspirations on RECs is one of the preliminary routes to achieve the acknowledgement of cross-border ASEAN RECs [59]. By virtue of learning from global best practices, ASEAN could enhance the credibility of its cross-border RECs, attract private investment, and therefore incentivise the growth of renewable energy in the region.

Insight 3

Tracking National Energy Policies

Written by Afham Kilmi, Michael Petalio, Rully Hidayatullah, Marcel Nicky Arianto, and Bayu Jamalullael

Brunei Darussalam

Brunei Darussalam has committed to reducing greenhouse gas emissions by at least 10% by 2035 and a further 20% by 2050 relative to Business-as-Usual, as outlined in the Brunei Darussalam National Climate Change Policy (BNCCP) [60]. The country has been consistently making efforts to implement the policies, including achieving a target of 30% renewable energy in the power mix by 2035 through solar capacity expansion to 200 MW by 2025. Currently, fossil fuel remains central to Brunei's energy sector, with renewables accounting for merely 0.14% of installed capacity, primarily from a 1.2 MW existing solar photovoltaic (PV) plant.

Since 2024, Brunei has committed to the pathways of decarbonising the transport sector by increasing the annual electric vehicle (EV) sales to 60% by 2035. To attain this goal, the Electric Vehicle Joint Task Force (EVJTF), co-led by the Ministry of Transport and Intercommunications along with the Ministry of Energy, has been implementing tax incentives, fuel price regulations, and charging infrastructure to support a wider adoption.

By 2025, decarbonisation initiatives across sectors will enter a new stage with more progressive national policies. Brunei has planned to introduce a carbon pricing mechanism to overcome industrial emissions, supported by stakeholder engagement and awareness. Moreover, the EVJTF will expand its focus to fuel efficiency standards, energy-efficient vehicles, public transport, and urban planning to promote mobility while also developing technical skills for EV adoption. Solar water heating, biofuels, and ocean-based energy technologies alongside plans to involve small and medium enterprises in renewable energy projects will be other areas that the Brunei government will focus on this year.

Cambodia

In 2024, Cambodia continued the implementation of its Power Development Masterplan 2022-2040 which performs as a strategic framework for clean energy transition with a focus on renewable energy integration and grid reliability [61]. The year saw notable progress in capacity development, for example, the installation of 350 MW of coal power and an addition of 60 MW solar PV capacity in two different provinces. Additionally, the country completed significant upgrades to the 230 kV and 115 kV transmission networks as a means to strengthen the national grid. Looking ahead to 2025, Cambodia aims to install solar PV plants in two other provinces totalling 190 MW. The plan also includes deploying a 20 MW Battery Energy Storage System and a 22 MW biomass plant in Phom Penh, expanding high voltage transmission lines, and finalising power purchase agreements with Lao PDR to add 250 MW and 300 MW of electricity imports. Off-grid solutions are anticipated to exceed a 98.27% village electrification rate.

Cambodia launched the National Policy on the Development of the Electric Vehicle Sector 2024-2030 [62]. The nation has set targets of 30,000 EVs, 720,000 electric motorbikes, and 20,000 electric tuk-tuks by 2030. In addition to this policy, the EV penetration target is set to be more ambitious, with a target of 70% of motorcycles electrified by 2050 along with the government's support for adding charging station facilities. This policy embodies a vision of a national decarbonisation pathway through the adoption of innovation and sustainability across the transport sector.

Furthermore, Cambodia entered a new phase of its energy transition efforts by incorporating the social, economic, and environmental aspects through the narrative of the Just Energy Transition Roadmap at the end of Quarter 3 in 2024 [63]. This forum will serve as the foundation of the importance of a fair and inclusive transition to renewable energy that focuses on ensuring equity and sustainability in the energy sector in Cambodia.

Indonesia

Indonesia is accelerating its energy transition with a series of policies introduced in 2024 and planned for 2025, aiming to meet a 23% renewable energy mix by 2025 and achieve net-zero emissions (NZE) by 2060. In supporting the targets, Indonesia is planning to release its new Power Development Plan (PDP) 2025-2034 in early 2025, with a strong target towards the addition of 71 GW of additional installed capacity, at least 70% of the addition will come from renewable energy [64]. Moreover, the government has implemented the Ministry of Energy and Mineral Resources (MEMR) Regulation No. 11 of 2024 which lowers the local content requirement for solar power plants from 40% to 20% [65]. This policy is expected to attract greater investment and expedite solar energy projects. To align with these policy initiatives, the government is converting diesel power plants to renewable energy and expanding its geothermal and hydropower capacity. With 10.6 GW of renewable energy capacity under development, these efforts are set to help Indonesia meet its 2025 targets [66].

Pathways to decarbonise the industrial, power, and transport sectors are underpinned by key regulations and infrastructure development. The introduction of MEMR Regulation No. 16 of 2024 provided a legal framework for Carbon Capture and Storage (CCS) [67]. This regulation enables industries to store and manage carbon emissions effectively, positioning Indonesia as a leader in CCS technology within Southeast Asia. Building on this progress, Presidential Regulation (PR) No. 14/2024, established a comprehensive framework for the implementation of CCS operations [68]. As the umbrella regulation for CCS, PR 14/2024 streamlines and expands the regulatory structure, extending its scope beyond upstream oil and gas working areas governed by MEMR Regulation No. 2/2023 and PTK-070 to also cover open and mining business licence areas. In support of this, the government has also introduced Gross Split Profit Sharing Contracts under MEMR Regulation No. 13/2024 and Decree No. 230.K/MG.01.MEM.M/2024, which outline specific regulations on Enhanced Oil Recovery (EOR) and CCS/Carbon Capture, Utilisation, and Storage (CCUS) activities [69]. These activities qualify for additional revenue-sharing arrangements, offering incentives for their adoption. Chapter 3 of the New Gross Split further elaborates on EOR and CCS/CCUS provisions, reinforcing their importance in improving resource recovery. Moreover, while coal-fired power plants (CFPPs) will continue operating to ensure domestic energy security, the government plans to gradually decommission and reutilise ageing CFPPs while integrating CCS technology and biomass co-firing into remaining active plants to align with national NZE targets [70]. On the other hand, in the transport sector, the government is focusing on the adoption of EVs, with a target of 2 million electric cars and 13 million electric motorcycles by 2030 [71]. By 2024, 1,299 Public Electric Vehicle Charging Stations were operational across 879 locations, ensuring robust support for EV users nationwide [72].

Indonesia is also prioritising energy security alongside its transition to cleaner alternatives. The B40 biodiesel mandate, which increases the palm oil content in biodiesel to 40%, was set to come into effect on 1 January 2025 [73]. This measure aims to reduce reliance on imported fossil fuels while strengthening domestic energy supply chains. Alternative to biofuels, Indonesia plans to install and operate a Nuclear Power Plant as a baseload plant by 2032, with the vision to achieve 14.2% of nuclear energy for electricity production, and potentially further increase to 15% considering nuclear energy

for electricity and green hydrogen production, in the national energy (electricity) mix by 2060 based on the recently released National General Electricity Plan (RUKN) 2024 [74]. These actions demonstrate Indonesia's commitment to balancing energy security with environmental sustainability while laying the groundwork for a resilient energy future.

Lao PDR

In 2024, the Ministry of Energy and Mines reviewed the progress of the 9th Five-Year Energy and Mining Development Plan (2021–2025) and initiated preparations for the 10th Five-Year Plan (2026–2030) [75]. As part of these initiatives, Lao PDR focused on expanding renewable energy projects and strengthening its domestic electricity grid. Policies prioritised hydropower, given its significant contribution to national energy generation, with updated frameworks to streamline investment and ensure environmental sustainability. These measures align with Lao PDR's strategy to utilise its hydropower potential for economic development and export opportunities.

Looking ahead, Lao PDR plans to achieve 98% electrification by the end of 2025, focusing on rural and remote areas [76]. The government is preparing new frameworks for solar mini-grids and off-grid electrification projects to support these goals. These efforts aim to improve energy access while reducing reliance on imported fossil fuels. Additionally, the Energy Efficiency and Conservation Strategy is set to promote energy savings across industrial, residential, and government sectors. By introducing technical standards and public awareness campaigns, this strategy seeks to achieve long-term energy efficiency targets.

The government is also exploring increased collaboration with neighbouring countries under the ASEAN Power Grid Initiative, with plans to expand cross-border electricity trade by 2025. These efforts are expected to endorse regional energy integration and strengthen Lao PDR's role as a major electricity exporter in Southeast Asia.

Malaysia

Malaysia launched key initiatives in 2024 to accelerate its energy transition. The National Energy Transition Roadmap (NETR) outlines the nation's commitment to achieving a 70% renewable energy share in the capacity mix by 2050, with intermediate targets of 31% by 2025 and 40% by 2035 [77]. This roadmap serves as a strategic guide for decarbonising Malaysia's energy system and transitioning from fossil fuels to cleaner energy sources. Specific measures include the introduction of the Solar for Rakyat Incentive Scheme (SolaRIS), which encourages residential solar installations, and the allocation of additional quotas under the Net Energy Metering (NEM) Rakyat programme to increase household adoption of solar PV systems [78], [79].

Additionally, the government enacted the Energy Efficiency and Conservation Act (EECA) in 2024, which mandates energy-efficient practices across industrial, commercial, and public sectors [80]. This act sets technical standards and monitoring systems to reduce energy waste, contributing to Malaysia's overall carbon neutrality target by 2050. Moreover, the Green Investment Strategy, launched under the New Industrial Master Plan 2030 (NIMP 2030), promotes investments in renewable energy, circular economy initiatives, and sustainable industrial growth [81].

Suruhanjaya Tenaga (ST) or the Energy Commission of Malaysia initiated two important initiatives in 2024, namely the Energy Exchange Malaysia (ENEGEM) and the Corporate Renewable Energy Supply Scheme (CRESS) [82], [83]. The Energy Exchange Malaysia facilitates the sales of renewable energy to neighbouring countries, namely Singapore and Thailand, through a market bidding mechanism operated by a Single Buyer (SB). Launched in 2024, the ENEGEM piloted its first auction process with cross-border sales of 100 MW RE capacity to Singapore. The other initiative is the CRESS, a mechanism that incentivises and enables renewable energy developers to supply corporate consumers by utilising the national grid assets. The system reliability is ensured through backup power arrangements and excess energy management which is regulated by the New Enhanced Dispatch Arrangement (NEDA) Guidelines. Such initiatives accelerate the endeavours of ASEAN Member States in realising Multilateral Power Trades within the region.

Building on its progress, Malaysia is planning significant initiatives for 2025 to reinforce its energy transition. The government will roll out the fifth round of the Large Scale Solar programme, further boosting solar energy capacity. This effort is part of Malaysia's broader renewable energy expansion, as detailed in the Malaysia Renewable Energy Roadmap (MyRER), which supports the development of solar, hydro, bioenergy, and emerging technologies to achieve decarbonisation targets [84]. By 2025, the NEM programme will also be extended to continue incentivising renewable energy adoption. Lastly, Malaysia's Circular Economy Policy Framework, introduced under NIMP 2030, aims to integrate circular economy principles into industries, encouraging waste reduction and resource optimisation [85].

In 2025, Malaysia will also encourage the region to focus on green energy markets and climate impact issues. Emerging as a hub for data centres in the region, digitalisation in the energy sector will allow operators to directly purchase energy from green power producers to meet the high energy demand for data centres [86]. As the pioneer of the Peer-to-Peer Energy Trading scheme in the region, Malaysia's leadership is expected to streamline the implementation of digital transformation in the ASEAN energy [87], [88]. Moreover, CCUS and carbon credit topics are planned to be included in the chairmanship prioritisation list.

Malaysia's policy on CCUS is advancing with a dedicated bill set to govern the entire value chain, from capture to storage, expected to be tabled by the end of 2024. On 21 May 2024, Minister of Economy Rafizi Ramli presented a memorandum for the standalone CCUS Bill to the Cabinet [89]. The legislation will be overseen by a federal governance body and a technically competent entity to ensure effective implementation, with initial CO_2 storage activities focused offshore and onshore feasibility studies to follow later. Malaysia is also pursuing bilateral agreements to establish itself as a regional CCS hub for integrated CCUS solutions in Asia-Pacific. The Ministry assures alignment with the Malaysia Agreement 1963 (MA63) discussions on state boundaries, following the Attorney General Chamber's guidance and existing laws such as the Continental Shelf Act (1966) and Territorial Sea Act (2012) [90].

Myanmar

Myanmar has introduced measures to strengthen its energy sector and improve service reliability, affordability, and access. In 2024, the Ministry of Electric Power (MOEP) announced a comprehensive plan to modernise power generation facilities, with a focus on maintaining stability during peak

demand periods [91]. These efforts aim to enhance energy stability while addressing rising electricity demand across the country. In addition to this, the MOEP implemented amendments to electricity tariff rates in August 2024 to address the sustainability of national electricity services amidst the increasing costs of power generation [92]. The country also shows its commitment to diversifying energy sources and promoting energy development through participation in the Belt and Road Green Energy Cooperation Action Plan (2024-2029) that emphasised the government's focus on securing a stable and sustainable energy future to achieve 100% electricity access by 2030 [93].

Philippines

The Philippines continues to advance its energy sector through new policies and strategic initiatives aimed at sustainability and energy security. One major milestone is the upcoming full operationalisation of the Renewable Energy Market (REM) launched in December 2024 which allows players to trade Renewable Energy Certificates (RECs) [94]. This market mechanism is expected to incentivise renewable energy investments and enable stakeholders to meet renewable portfolio standards while supporting the government's targets of 35% renewable energy share by 2030 and 50% by 2040.

The Department of Energy (DOE) has also introduced Department Circular No. DC2024-01-0001, which lies as the foundation of a national framework for hydrogen energy initiative [95]. This policy sets a roadmap for exploring hydrogen as an alternative energy source, including feasibility studies and infrastructure planning to support hydrogen adoption in the Philippines' energy mix. Along with this, DOE has mandated higher biodiesel blends, increasing the CME content in diesel fuel to 3% which has been commenced since October 2024, with plans to further increase it to 4% by 2025 and 5% by 2026 [96]. This policy is designed to support decarbonisation efforts and strengthen the local coconut industry.

In September 2024, during the 68th International Atomic Energy Agency (IAEA) General Conference, the Philippines unveiled the national nuclear roadmap highlighting the key target to be achieved from 2024 to 2050 [97]. Under the Philippine Energy Plan (PEP 2023-2050), the Philippines aims to have the first operational nuclear power plant in 2032 with 1.2 GW capacity and gradually increase to 4.8 GW in 2050 [98]. In December 2024, as part of the preparation for its nuclear energy programme, the Philippines in collaboration with the IAEA conducted the Integrated Nuclear Infrastructure Review (INIR) mission, a consultative review to track the progress and readiness of national infrastructure on nuclear energy development [99].

Singapore

Singapore has introduced significant energy policies in 2024 to strengthen its grid infrastructure, accelerate the energy transition, and integrate advanced technologies. Throughout 2024, the Energy Market Authority (EMA) launched the Future Grid Capabilities Roadmap to support the development of a resilient and sustainable power grid by incorporating distributed energy resources (DERs) such as rooftop solar PV, battery energy storage systems, and EVs charging networks [100]. To further optimise the use of this digital technology, EMA initiated a consultation on harnessing DERs through Virtual Power Plants which represents Singapore's proactive approach to addressing the challenges of integrating DERs and ensuring a reliable energy system [101].

Continuing the Pathfinder Project for multilateral power trade in ASEAN, Singapore doubled the power imports from Lao PDR under the Lao PDR-Thailand-Malaysia-Singapore Power Integration Project (LTMS-PIP) Phase II [102]. The 2nd phase continues the import of hydroelectric power with a maximum capacity of 100 MW, with an additional 100 MW coming from Malaysia for another two years to 2026. The LTMS-PIP Phase II emphasised the importance of multilateral power trade to diversify the energy supply, ensuring greater energy security in the future through multilateral and regional cooperation.

As part of its low-carbon transition, Singapore implemented additional measures to support clean energy adoption and enhanced grid reliability. These include adjustments to regulatory frameworks to encourage investments in emerging technologies and facilitate the use of alternative fuels like hydrogen [103]. The Energy Transition Measures, announced in 2024, also include support for infrastructure development and incentives for adopting advanced energy solutions.

Thailand

Thailand is accelerating its energy transition with ambitious policies aimed at reducing energy consumption and expanding clean energy initiatives. In 2024, the Ministry of Energy launched a comprehensive Energy Efficiency Plan (EEP2024), targeting a 36% reduction in energy intensity by 2037, equivalent to 35,497 ktoe in energy savings [104]. The government also unveiled a 2.9 trillion-baht (~USD 85.9 billion) clean energy plan, focusing on renewable energy expansion, grid improvements, and private sector investments under the National Energy Plan (NEP 2024) [105]. As part of this strategy, Thailand announced a pilot project for 2,000 MW of clean energy trading, designed to promote renewable adoption and attract foreign investment [106].

Furthermore, during the middle of 2024, Thailand held public hearings of its PDP 2024-2037 which yielded the plan to increase renewable energy's share to 51% by 2037 alongside a massive reduction in coal and gas [107]. It also includes the initiative to introduce nuclear energy and new technologies to enhance energy efficiency, security, and sustainability. To support clean energy adoption, Thailand has also revised its renewable energy framework to introduce Direct Power Purchase Agreements (DPPA) to expand the coverage of solar, wind, and energy storage investments among private sector entities.

In 2025, Thailand plans to implement critical measures to support clean energy and reduce carbon emissions. The government is preparing to introduce a carbon tax, calculated based on the carbon content of products [108]. To complement this, Thailand is extending its EV incentive programme where the ratio of local production should be 1.5 vehicles per imported vehicle by 2025 under the updated EV 3.5 package [109].

Vietnam

In 2024, Vietnam achieved key milestones in its energy policy which reflect the government's commitment to energy efficiency and sustainability. The Ministry of Industry and Trade (MOIT) implemented several approaches, including a review and update of the Energy Efficiency and Conservation Law, which emphasises stricter compliance for industrial and commercial energy users [110]. Efforts were also made to enhance the adoption of energy

management systems across various sectors to encourage more transparency and accountability in energy consumption. Secondly, the Renewable Energy Master Plan introduced the updated targets for wind and solar power capacity that are linked to the National Green Growth Strategy for 2021-2030. To support these policies, Vietnam expanded its financial incentives for businesses adopting renewable technologies and green practices. A notable achievement included scaling up rooftop solar initiatives, particularly in urban and rural areas, to decentralise power generation and enhance energy security.

The introduction of Vietnam's Decree No. 80/2024/ND-CP in 2024, which will be enacted by February 2025, also emphasised a strong commitment from the government to influence the growth of renewable energy in the industrial sector [111]. The DPPA Decree allows RE Generation Companies (GENCOs) to directly sell renewable energy to large consumers (>200 MWh of electricity consumption per month), using the national grid transmission assets or a private wire. The DPPA mechanism pushes the openness of national transmission assets while also incentivising the use of renewable energy, supporting the target of 11.9 – 13.4% of the renewable energy share in the total primary energy supply by 2030.

For 2025, Vietnam has outlined several progressive agendas focused on accelerating its transition to clean energy. According to the latest PDP VIII, the country is set to develop around 11-12 GW of wind power capacity by 2025 [46]. The amendment of the PDP VIII will prioritise LNG-fired power projects, promote waste-to-energy facilities, expand rooftop and floating solar power, and incorporate options for nuclear energy and hydrogen to diversify energy sources and enhance sustainability [112]. Another major initiative involves the introduction of the National Hydrogen Strategy under Decision No: 165/Qd-Ttg, which aims to explore hydrogen as a viable alternative energy source, particularly for industrial and transportation sectors [113]. Aside from hydrogen, nuclear energy has become one of the main priorities of Vietnam's journey to ensure energy security, following the release of Prime Minister's Decision No. 72/QD-TTg which set up the steering committee for the construction of Vietnam's first nuclear power plant project intending to commissioning by 2030 [114]. Smart grid development will also be a key priority, enhancing energy reliability and supporting the integration of renewable energy into the national grid. MOIT will play a central role in enforcing technical standards and creating financial incentives to support these initiatives. Efforts will also be directed toward enhancing Vietnam's international cooperation in the energy sector, particularly through collaborations with global partners to share expertise and attract foreign investment.

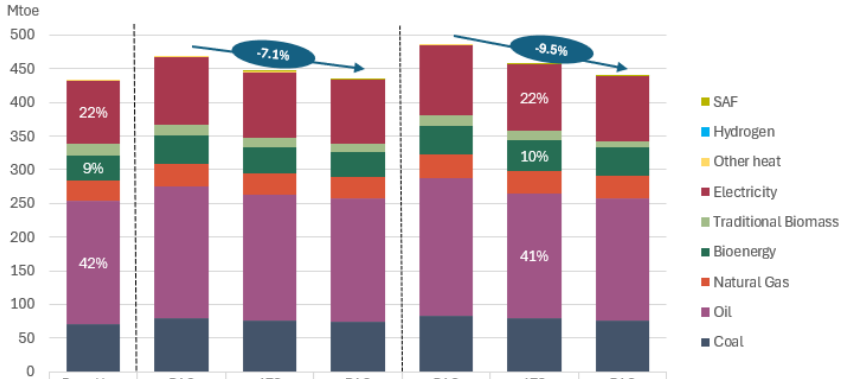
Insight 4

Charting Progress of Aspirational Energy Targets

Written by Silvira Ayu Rosalia

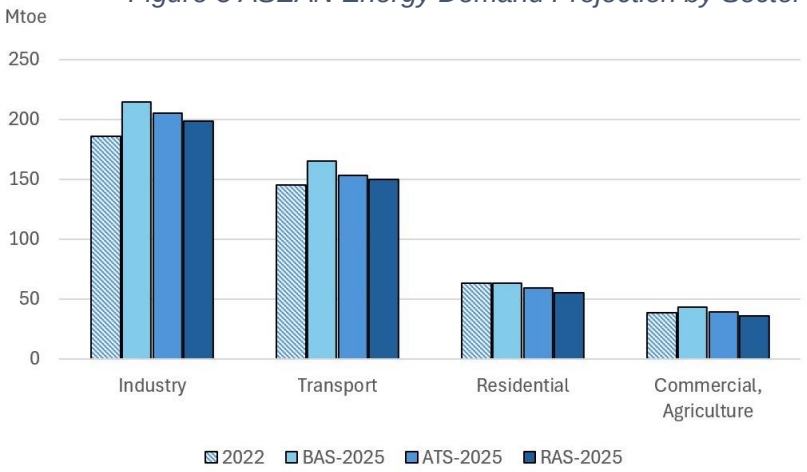
ASEAN Energy Demand

Figure 2 ASEAN Energy Demand Projection by Fuel[1]



	Base Year 2022	BAS 2024	ATS 2024	RAS 2024	BAS 2025	ATS 2025	RAS 2025
SAF	0.00	0.00	0.01	0.01	0.00	0.01	0.01
Hydrogen	0.00	0.00	0.03	0.03	0.00	0.05	0.05
Other heat	0.26	0.28	0.28	0.30	0.29	0.30	0.32

Figure 3 ASEAN Energy Demand Projection by Sector[1]

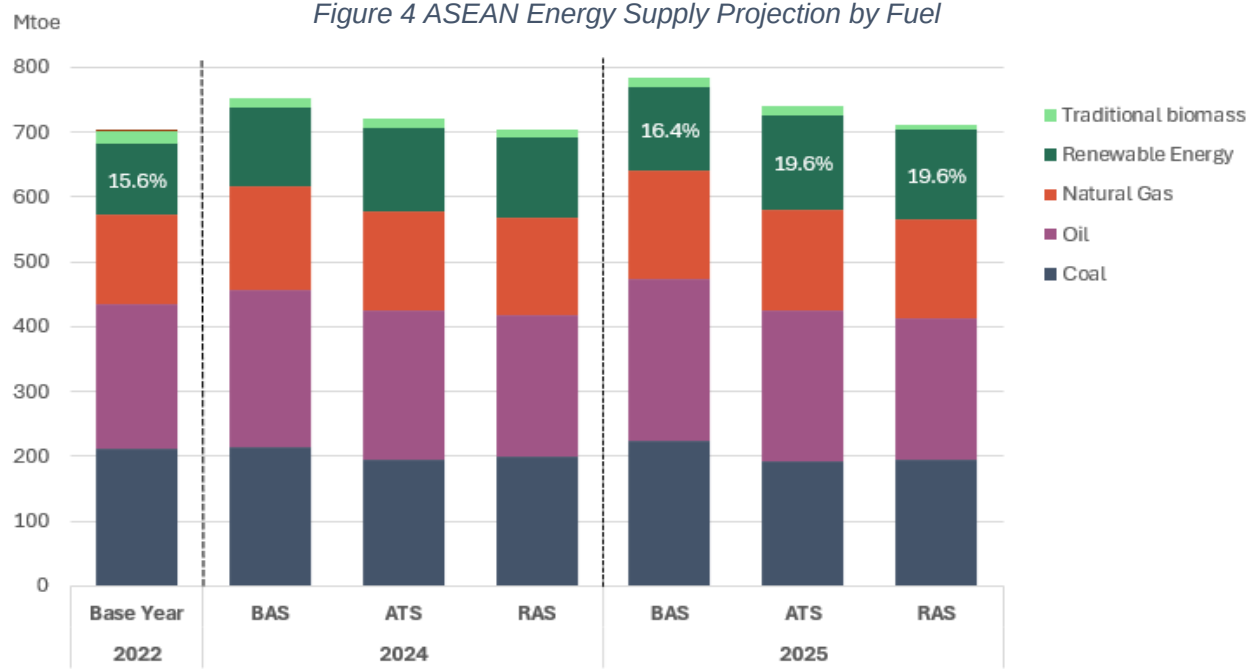


- Sectoral analysis shows that all end-use sectors see an increase in energy consumption driven by population and economic growth. Regional energy demand is expected to increase by 12.2% by 2025 from 2022 level with no policy intervention. Fossil fuels are projected to continue to dominate the energy sector, with oil still contributing the largest share of 41.4% of energy consumption.
- Observing future trends if countries implement national policies (ATS), fuel shifting will slightly raise the shares of electricity and bioenergy in ASEAN energy demand by 21.8% and 9.9% respectively in 2025, resulting from more stringent electric vehicle deployment and biofuel mandates in transportation. Improved policies also encourage clean cooking methods and electrification that reduce reliance on traditional biomass (wood, charcoal) in several ASEAN Member States (AMS).
- The use of more efficient and sustainable technologies throughout all end-user sectors will significantly reduce energy consumption and the fossil fuel portion. With energy-saving measures in national policies (ATS), avoided energy consumption could reach 5.8% in 2025, as compared to the BAS.
- In the transport sector as one of the sectors that makes a large contribution to sectoral energy demand besides industry, under RAS, through the implementation of ASEAN's commitment to increase vehicle efficiency within the ASEAN Fuel Economy Roadmap, the overall consumption will be reduced by 3% to 149 Mtoe by 2025.
- The use of Sustainable Aviation Fuel (SAF) and hydrogen as alternative fuels in the Industry and Transport sector are expected to have a contribution in 2025 although it is still in the early stage, thus stronger decarbonisation efforts are essential to increase utilisation of those alternative fuels to meet the region's energy demand.

[1]Notes: BAS = Baseline Scenario; ATS = AMS Targets Scenario; RAS = Regional Aspiration Scenario. Source: 8th ASEAN Energy Outlook (AEO8) [35].

ASEAN Energy Supply

Figure 4 ASEAN Energy Supply Projection by Fuel

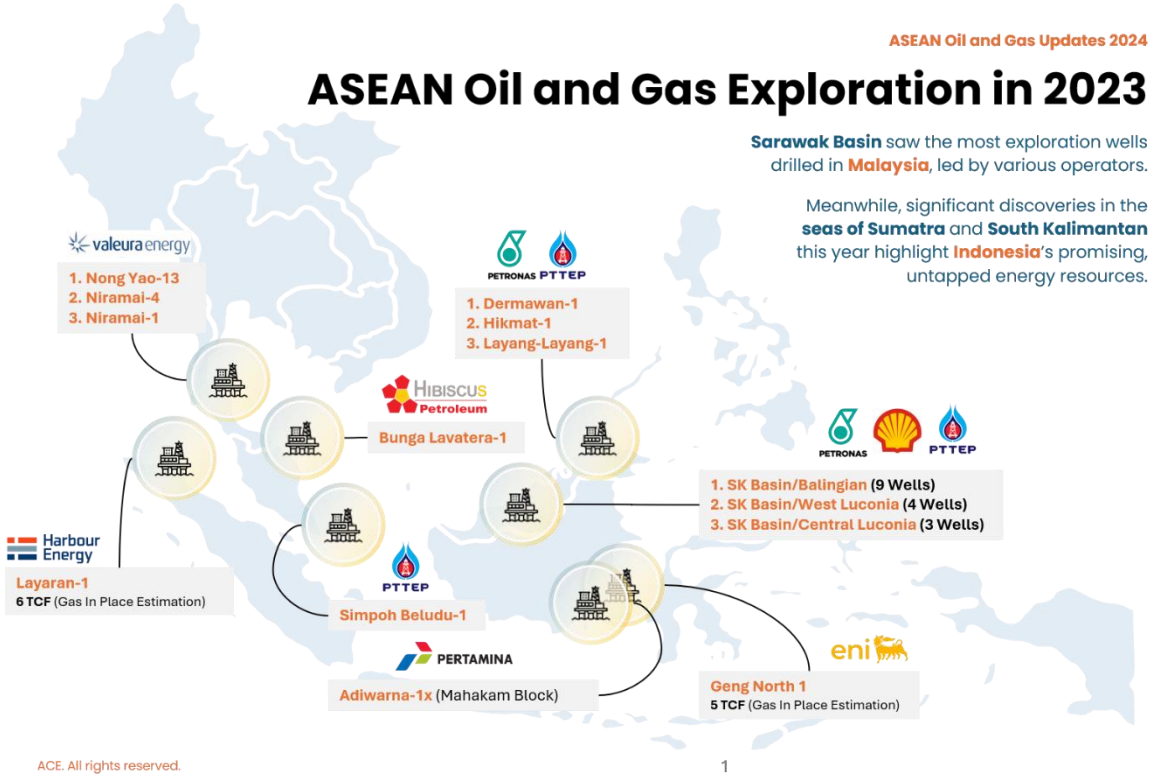


Source: AEO8 [35]

- The primary energy mix remained dominated by fossil fuels, with a 15.6% share of renewables in 2022. In 2025, the overall projection shows ASEAN will supply more energy by 12.2% compared to 2022.
- With existing ambitious policies to increase the supply of sustainable energy in 2025 especially solar and wind (ATS), the share of renewables is forecast to be increased by 33% at 145 Mtoe.
- By stronger policies and more ambitious efforts to pursue the regional target for the renewables share in energy supply (RAS), it could potentially reduce the portion of conventional fuel by 2.8% compared to ATS. These shifts are indicative of ASEAN's gradual transition towards cleaner energy while maintaining energy security.
- Addressing energy security during the transition to cleaner energy involves balancing the shift to renewable sources with the need for reliable, affordable, and stable energy supplies. Thus, diversifying the energy supply, particularly through renewable energy (RE), is crucial for reducing dependence on any single source and improving overall stability.

ASEAN Oil and Gas

Figure 5 ASEAN Oil and Gas Exploration



Source: ASEAN Oil and Gas Updates 2024 [45]

- Oil is still maintaining the largest total supply at about 221.6 Mtoe (32%) in 2022 followed by coal and natural gas. Furthermore, oil has emerged as the dominant source of imported energy in the ASEAN region.
- Several AMS had experienced a decline in oil production, largely due to the depletion of existing oil fields and insufficient levels of discoveries or investments in exploration and production. This decline diminished their capacity to satisfy regional demand through local production.
- Advanced production methods such as workover and enhanced oil recovery are needed to curb the decline [45]. The role of the government will become increasingly critical to ensure to encourage investment for production enhancement in mature fields, since the oil and gas demand is still expected to grow significantly in the next 15 years under the BAS.

ASEAN Electricity Sector

Figure 6 ASEAN Installed Capacity Projection

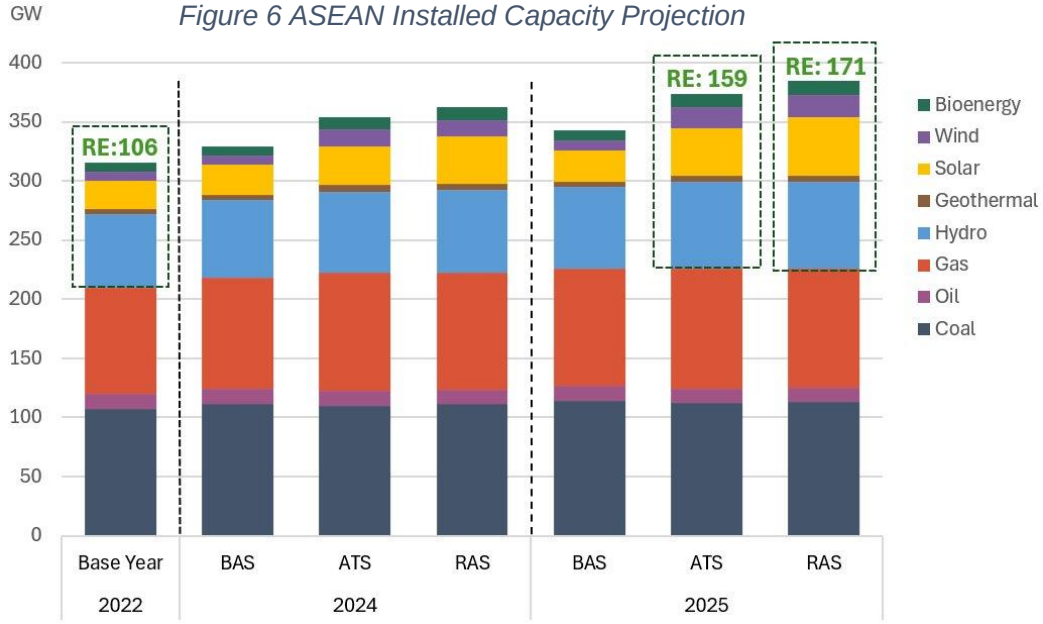
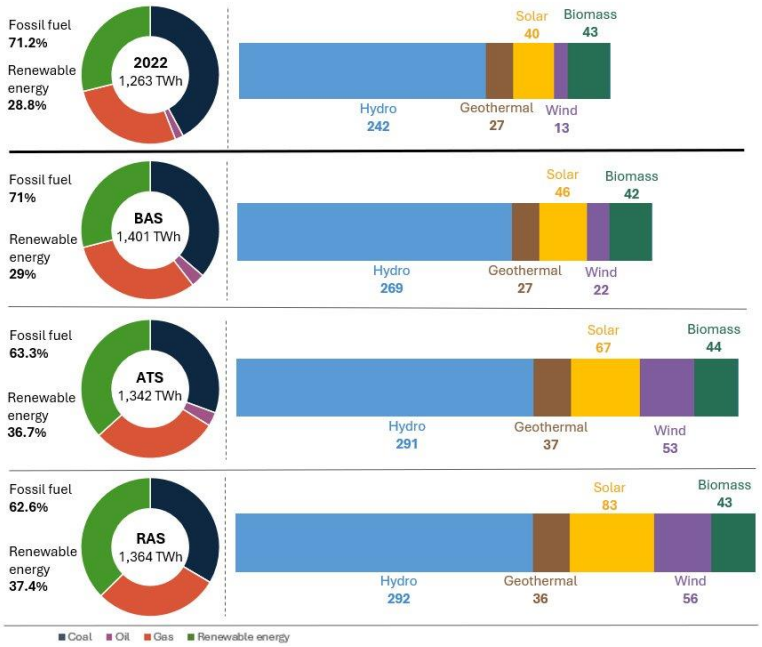


Figure 7 ASEAN Power Generation Projection 2025

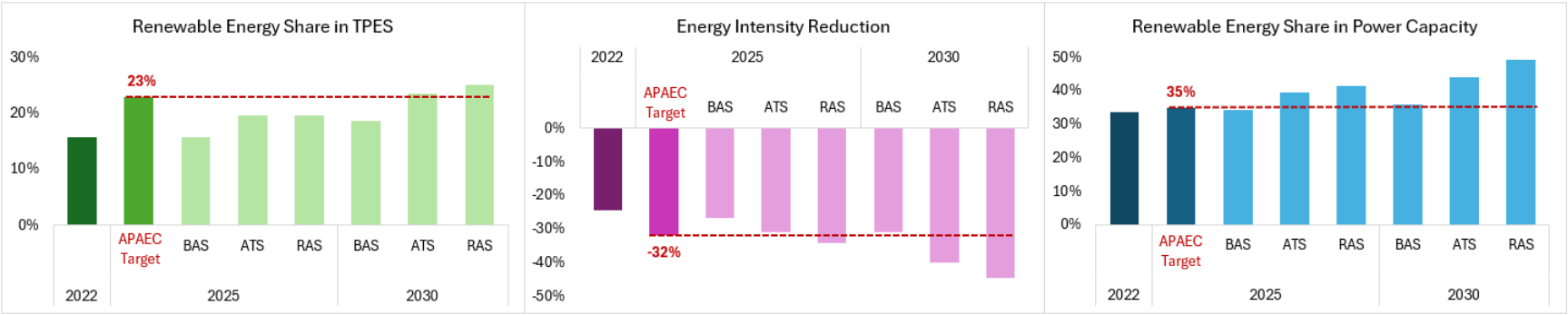


Source: AEO8 [35]

- The stability of the electricity supply has a prominent contribution to maintaining energy security, where ASEAN installed capacity still depends on fossil fuel at 66.4% in 2022, dominated by coal and natural gas. The total installed power capacity is expected to experience steady growth across scenarios, in 2025 it will increase by around 9% (BAS), 18% (ATS), and 22% (RAS) from 315.7 GW in 2022.
- By implementing policies based on the Power Development Plan, the share of RE in installed capacity in 2025 will increase by 39.2% from the 2022 level, which is still dominated by hydropower (19.6%) and solar (10.6%).
- In terms of power generation, there is an increase in total power generation across the given timeframe, reflecting growing energy demand driven by economic growth and population increases in the region.
- Electricity generation is reduced from BAS to ATS due to energy efficiency efforts but increases across the remaining scenarios. Such phenomena can be attributed to the increase in electrification policies and a marked shift towards renewable energy sources. The projections show that AMS will be required to generate power of 1,401 TWh in 2025. While ATS runs 4% less than BAS.
- Towards transition to clean energy, renewable generation in 2025 RAS will still be dominated by hydropower with a growth of 21% compared to 2022. Meanwhile, solar and wind will make quite a large contribution to the mix, reaching power generation of 82.7 TWh and 56.4 TWh, respectively.

ASEAN Energy Targets Assessment

Figure 8 ASEAN 2025 Energy Target Assessment



Source: AEO8 [35]

- Renewable energy is crucial for achieving a sustainable future, with ASEAN targeting a 23% **share of renewables in total primary energy supply (TPES)** by 2025 under the ASEAN Plan of Action for Energy Cooperation (APAEC) 2016-2025. As of 2022, the RE share stood at 15.6%, presenting a challenge to reach the target within three years. The projection shows a slight change in the BAS, and continuous growth in the other scenarios. The improvement in national renewables policies (ATS), will affect the growth of RE share by 19.6% in 2025. This effort needs to be strengthened by raising RE measurement in national policies to meet the regional target, where in the RAS 2025 RE share is predicted to have not reached the target of 23%. The ASEAN region is projected to meet the target by 2030 and the RAS by 2029, the significant increases in RE share driven by supportive policies and technological advancements. ASEAN RE growth is boosted by expanding hydropower, geothermal, solar, and wind.
- ASEAN aims for a 35% **RE share in installed capacity** by 2025. It reached 33.6% in 2022, and the ATS and RAS are on track to surpass this target, reaching 39.6% and 41.3%, respectively, while the BAS is expected to fall short at 34.2%. By 2030, RE shares in the ATS and RAS are projected to rise significantly, reaching 44.1% and 49.3%, driven by strong RE policies and a balanced approach to ambitious targets and cost optimisation.
- ASEAN aims for a 32% **reduction in energy intensity (EI)** by 2025 from the 2005 level. By 2022, a 24.5% reduction was achieved, indicating progress but still short of the target. Projections suggest that the ATS would reach 31% by 2025, slightly missing the target, while the RAS is on track to meet or exceed it with reductions of 34.2%, respectively. Achieving further EI reductions will require enhancing national efforts by implementing cost-effective measures in key sectors such as transportation, cooking, and cooling, accelerating the adoption of electric vehicles, improving fuel efficiency, and expanding mass transit. Financial incentives and public-private partnerships should also be leveraged to promote clean technologies and reduce financial risks in energy efficiency projects.

Insight 5

ASEAN Energy Priorities 2024–2025

Written by Afham Kilmi and Auliya Febriyanti

Unpacking Lao PDR's Chair Accomplishment in 2024

In 2024, Lao PDR led the ASEAN Chairmanship for the third time since becoming a Member State on 23 July 1997. Under the theme of 'ASEAN: Enhancing Connectivity and Resilience', the chairmanship was focused on strengthening regional collaboration and building resilience against global challenges, while upholding ASEAN Centrality [115]. The theme reflects on Lao PDR's role as a key player in shaping regional interconnectivity, positioning the country as 'The Battery of Southeast Asia'. With this ambitious strategy, Lao PDR has guided the region through a pivotal year of progress in the ASEAN Plan of Action for Energy Cooperation (APAEC) 2016-2025 Phase II: 2021-2025, from strengthening cross-border power trade to promoting innovative energy solutions which are pivotal in driving energy security, accessibility, affordability, and sustainability in ASEAN. Over the year, Lao PDR has delivered notable annual priorities:

- Finalised key agreements of APG and multilateral power trade through the Lao PDR-Thailand-Malaysia-Singapore Power Integration Project (LTMS-PIP) and Brunei Darussalam-Indonesia-Malaysia-the Philippines Power Integration Project (BIMP-PIP).
- Achieved substantive progress in finalising the draft of the successor agreement of the ASEAN Petroleum Security Agreement (APSA) and Term of Reference (ToR) for the ASEAN Petroleum Security Agreement (APSA) Institutional Framework and Operational Bodies to enhance AMS' petroleum security [116].
- Nearly all AMS have signed the Protocol to amend the Trans-ASEAN Gas Pipeline (TAGP) Memorandum of Understanding (MOU). TAGP coverage comprises 13 cross-border pipelines connecting 6 countries and 14 LNG regasification terminals across seven countries.
- Endorsed CCS Deployment Framework and Roadmap: 1) recommending policy improvements to strengthen investment and mitigate risks; 2) establishing ASEAN CCUS Working Group [43].
- Initiated the development of Energy Performance Benchmarks and Guidelines for Industry.
- Endorsed the 8th ASEAN Energy Outlook (AEO8) which contains key findings to guide regional future trends and serve as the foundation for developing the APAEC 2026-2030 [35].
- Enhanced monitoring for the APG projects and attracted more support from dialogue partners (DPs) and international organisations (IOs).
- Established ministerial-level working groups (Lao PDR-Cambodia-Singapore, Singapore-US-Vietnam, US-Singapore) to boost cross-border power trade and RE deployment, supporting APG interconnections via overland and subsea transmission [117], [118], [119].

The 42nd ASEAN Ministers on Energy Meeting (AMEM) held in September 2024 in Vientiane, Lao PDR emphasised ASEAN's commitment to sustainability through the integration of carbon neutrality strategies, circular economy principles, and the ASEAN Blue Economy Framework [120]. The theme for APAEC 2026-2030 was endorsed, "Advancing Regional Cooperation in Ensuring Energy Security and Accelerating Decarbonisation for a Just and Inclusive Energy Transition." Additionally, the ASEAN Energy Business Forum (AEBF) 2024 recognised 65 awardees for their contributions to energy efficiency, renewable energy, and energy management, reinforcing ASEAN commitment to capacity building, knowledge sharing, and international cooperation to support the region's role in the energy-climate nexus.

Updates on the APAEC 2021-2025 and Post-2025

The APAEC acts as the regional blueprint for fostering strong cooperation to enhance energy security, accessibility, affordability, and sustainability under the framework of the ASEAN Economic Community implementation [121]. Since its inception in 1999, APAEC has served as a cornerstone in setting a sustainable future of the ASEAN energy landscape to guide AMS in achieving collective energy goals, addressing regional challenges, and advancing the transition to low-emission energy. This document is renewed every five years with the current phase being from 2021 to 2025, carrying the sub-theme "Accelerating Energy Transition and Strengthening Energy Resilience through Greater Innovation and Cooperation" [122]. It outlines more ambitious and sustainable targets for advancing the energy transition. Key strategies of the seven Programme Areas, including its accomplishments are as follows:

ASEAN Power Grid	• As of 2022, 9 of the 18 interconnection projects defined in the ASEAN Interconnection Masterplan Study (AIMS) III are now fully operational. • The LTMS-PIP officially commenced on 23 June 2022, with approximately 266 GWh of electricity traded to date. • The implementation of APG has advanced as part of the ongoing AIMS III.
Trans-ASEAN Gas Pipeline	• A total of 13 cross-border pipelines, spanning 3,631 km, have been established, connecting six countries. • 12 regasification terminals across these countries have been developed, with a combined capacity of 49.5 Mtpa.
Coal & Clean Coal Technology	• By 2022, a total of 18.9 GW of combined cycle turbine installed power capacity has been achieved, alongside the operation of 13 coal-biomass co-firing plants with a combined capacity of 7.3 GW.
Energy Efficiency & Conservation	• A 24.5% reduction in energy intensity was achieved by 2022, with a projection to reach 26.9% under the Baseline Scenario and 31% under the AMS Targets Scenario by 2025.
Renewable Energy	• In 2022, the share of RE in Total Primary Energy Supply (TPES) was 15.6%, while the RE share in Installed Power Capacity stood at 33.6%. These figures are projected to increase to 19.6% in TPES and 39.6% in Installed Power Capacity by 2025.
Regional Energy Policy & Planning	• Regional energy policy and planning have been strengthened through enhanced collaboration with DPs/IOs, including the establishment of the first SOME-EU and SOME-ADB initiatives. • Published AEO7 in 2022 and AEO8 in 2024.
Civilian Nuclear Energy	• A total of 400 policymakers and relevant stakeholders have been trained through seven regional Nuclear Capacity Building and Training Programs.

ASEAN might face a time of uncertainty due to a shifting order from the newly elected US president, following the resurgence of an "America First" foreign policy. With this new policy, the US froze billions of dollars in foreign assistance, suspending ongoing projects such as those providing support to feasibility studies, stakeholder engagement, and capacity building on energy infrastructure in ASEAN [123]. For example, the United States Agency for International Development (USAID) has contributed to a five-year initiative to mobilise USD 3 million for clean energy infrastructure under Southeast

As the current phase of APAEC will end soon, the 10 AMS have agreed to the new theme of APAEC 2026-2030, **"Advancing Regional Cooperation in Ensuring Energy Security and Accelerating Decarbonisation for a Just and Inclusive Energy Transition**." This 5-year theme builds upon APAEC's 20 year-vision of "Secure, Resilient, and Interconnected Low-Carbon ASEAN Energy Future". This forward-looking agenda was reinforced by discussions on emerging energy technologies such as smart grids, advanced energy storage systems, hydrogen, ammonia, electric vehicles, bioenergy, artificial intelligence, and blockchain which are poised to strengthen ASEAN's energy resilience and sustainability. This blueprint is expected to be endorsed under Malaysia's Chairmanship and published this year in September 2025. The preparation of APAEC Post-2025 will take into consideration the various aspects of the implementation and progress of the current APAEC 2021-2025.

Welcoming Malaysia's ASEAN Chairmanship 2025

Malaysia has embarked on its fifth time leading the ASEAN region since becoming one of ASEAN's founding members in 1967. With previous chairmanships in 1977, 1997, 2005, and 2015, the 2025 ASEAN-Malaysia chairmanship handover from Lao PDR occurred during the Closing Ceremony of the 44th and 45th ASEAN Summits on 11 October 2024, symbolising Malaysia's readiness to guide the region into a new era of progress and resilience [126].

The theme **"Inclusivity and Sustainability"** was introduced by Malaysia's chairmanship to continue the efforts of Lao PDR's chairmanship that were focused on strengthening regional connectivity, sustainability, and cooperation to address ASEAN's economic, social, and environmental challenges. This theme seems to have a strong connection to the previous chairmanship theme in 2015 "Our People, Our Community, Our Vision" of which both themes consistently showcase Malaysia's commitment to fostering a united ASEAN that is prepared for a rapidly growing global economy [127].

To translate the theme into action, the chairmanship is focused on narrowing the development gap and inequalities, improving living standards, and mitigating the impacts of climate change. Therefore, Malaysia is set to enhance intra-ASEAN trade and investment by leveraging science, technology, and digital transformation across all pillars of regional cooperation.

Malaysia has launched an official website for its chairmanship to enhance accessibility and engagement at http://myasean2025.my/. The platform provides updates, resources, and key information related to its chairmanship initiatives.

Energy Agenda in Malaysia's Chairmanship 2025

Chairmanship theme on the energy sector: "Powering ASEAN: Bridging Boundaries, Building Prosperity"

ASEAN Power Grid	Trans-ASEAN Gas Pipeline	Energy Efficiency and Conservation
Signing of APG Enhanced MoU, developing ToR for subsea transmission cable framework, and mobilising financial resources for APG infrastructure expansion	Signing of APSA Successor Agreement	Launching of ASEAN Energy Efficiency Database and Investment Platform (Building)

Renewable Energy	Regional Energy Policy and Planning	Civilian Nuclear Energy
Finalisation of RE Long-term Roadmap and initiation of ASEAN REC Framework	Endorsement of the next cycle of APAEC 202602030	Initiation of Nuclear Power Plant Deployment (NPP) Framework

Malaysia stands as the backbone of the regional energy hub for sustainable development and energy innovation. Strategically positioned at the heart of the region, Malaysia leverages its seamless integration with neighbouring countries to solidify its role as a critical enabler of cross-border energy trade through APG and TAGP. Building upon its rich energy legacy, Malaysia's unique energy landscape, including natural gas, oil, and renewables, underpin its leadership in ASEAN's energy sector. As one of the world's top LNG exporters, Malaysia strengthens regional energy security with its cutting-edge infrastructure, comprising regasification terminals, pipelines, and storage facilities [129]. Beyond fossil fuels, Malaysia continues expanding its renewable energy capacity while spearheading electricity interconnection initiatives, such as LTMS-PIP and BIMP-PIP, further cementing its role as the centre for electricity interconnection and integration [130].

Under its chairmanship, Malaysia will continue to prioritise the APG to optimise energy use, by enhancing its MoU, scheduled at the end of 2025 [131]. APG is crucial in integrating RE sources and ensuring regional energy security. The MoU will focus on enhancing cross-border electricity transmission infrastructure capacity among AMS to facilitate electricity trade, especially from clean energy sources, such as hydropower, solar, and wind as well as promote digitalisation in the ASEAN energy sector. This aligns with Malaysia's National Energy Transition Roadmap, which targets 70% RE capacity by 2050. As ASEAN Chair, Malaysia is confident in promoting an ASEAN Carbon Credit Framework and presenting the ASEAN Joint Statement on Climate Change at COP30 in Brazil [132]. Malaysia's chairmanship will highlight the pathways for regional energy transition within the final implementation year of the APAEC 2021-2025 and the launching of APAEC 2026-2030.

Appendices

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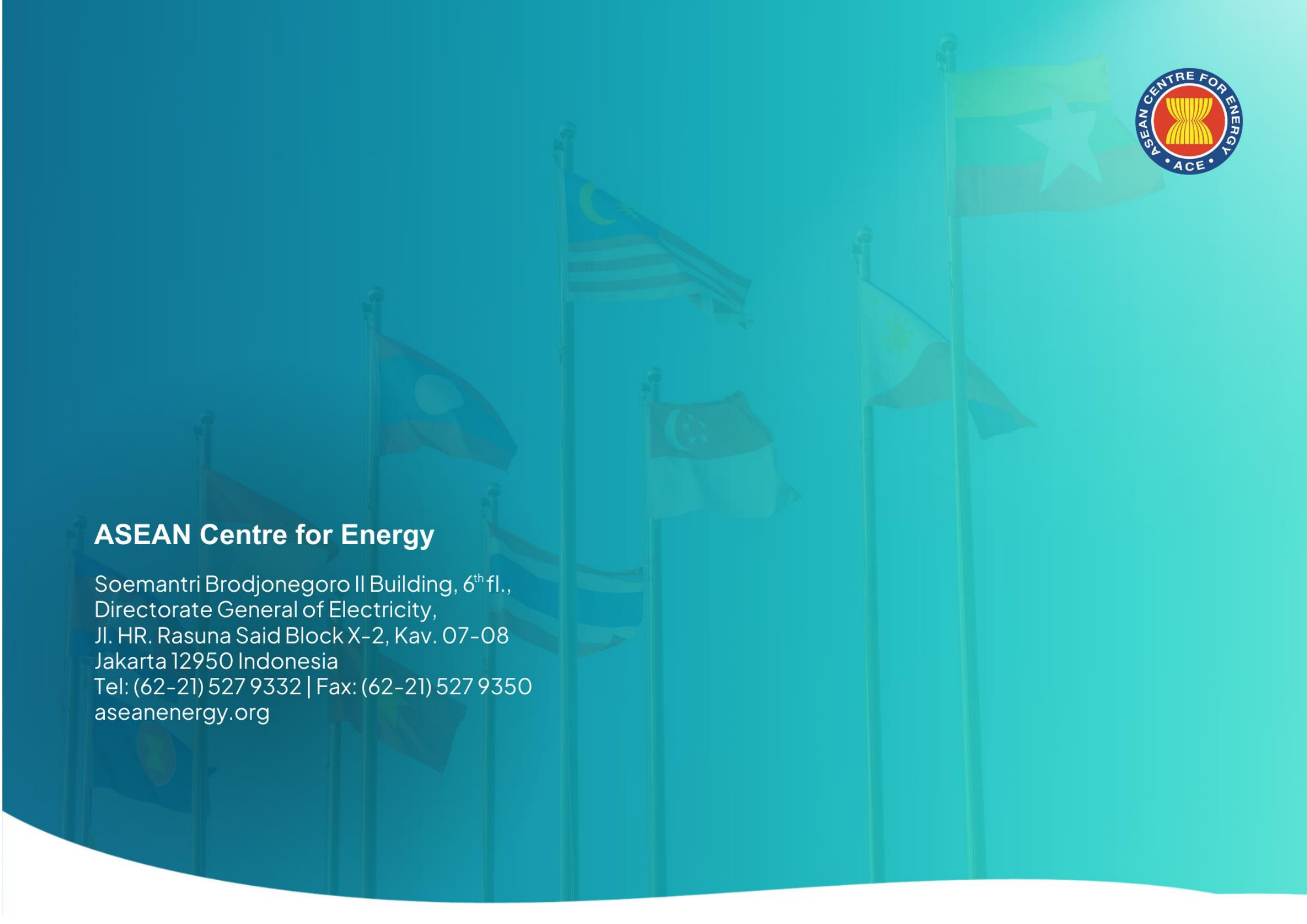
Abbreviation

ACE	ASEAN Centre for Energy
ADB	Asian Development Bank
AEO8	8th ASEAN Energy Outlook
AIMS	ASEAN Interconnection Masterplan Study
AMEM	ASEAN Ministers on Energy Meeting
AMS	ASEAN Member States
APAEC	ASEAN Plan of Action for Energy Cooperation
APG	ASEAN Power Grid
APSA	ASEAN Petroleum Security Agreement
ASEAN	Association of Southeast Asia Nations
ATS	AMS Targets Scenario
BAS	Baseline Scenario
BIMP-PIP	Brunei Darussalam-Indonesia-Malaysia-the Philippines Power Integration Project
BNCCP	Brunei Darussalam National Climate Change Policy
CBAM	Carbon Border Adjustment Mechanism
CCS	Carbon Capture and Storage
CCUS	Carbon Capture, Utilisation, and Storage
CDP	Carbon Disclosure Project
CEV	Carbon Economic Value
CO_2	Carbon dioxide
COP	Conference of the Parties
CRESS	Corporate Renewable Energy Supply Scheme
DER	Distributed Energy Resources
DOE	Department of Energy
DP	Dialogue Partner
DPPA	Direct Power Purchase Agreements
EECA	Energy Efficiency and Conservation Act
EI	Energy Intensity
EMA	Energy Market Authority
ENEGEM	Energy Exchange Malaysia
EOR	Enhanced Oil Recovery
ESCO	Energy Service Companies
ETM	Energy Transition Mechanism

ETS	Emissions Trading Systems
EU	European Union
EV	Electric Vehicle
EVJTF	Electric Vehicle Joint Task Force
FDI	Foreign Direct Investment
ktoe	Kilotonnes of oil equivalent
kV	Kilo Volt
LTMS-PIP	Lao PDR-Thailand-Malaysia-Singapore Power Integration Project
GFANZ	Glasgow Financial Alliance for Net Zero
$GtCO_2e$	Gigatonnes of carbon dioxide equivalent
GW	Gigawatt
IAEA	International Atomic Energy Agency
INIR	Integrated Nuclear Infrastructure Review
IO	International Organisation
IPG	International Partners Group
IPPs	Independent Power Producers
ITMOs	Internationally Mitigation Outcomes
JETP	Just Energy Transition Partnership
LNG	Liquefied Natural Gas
MEMR	Ministry of Energy and Mineral Resources
MOEP	Ministry of Electric Power
MOIT	Ministry of Industry and Trade
MoU	Memorandum of Understanding
MyRER	Malaysia Renewable Energy Roadmap
MW	Megawatt
NCQG	New Collective Quantified Goal
NDC	Nationally Determined Contribution
NEDA	New Enhanced Dispatch Arrangement
NEM	Net Energy Metering
NEP	National Energy Plan
NETR	National Energy Transition Roadmap
NIPM	New Industrial Master Plan
NZE	Net Zero Emissions
PDP	Power Development Plan
PEP	Philippine Energy Plan

PV	Photovoltaic
RAS	Regional Aspiration Scenario
RE	Renewable Energy
REC	Renewable Energy Certificate
RPS	Renewable Portfolio Standards
SAF	Sustainable Aviation Fuel
SGD	Singapore Dollar
SOME	Senior Officials Meeting on Energy
SPP	Southeast Asia Smart Power Program
ST	Suruhanjaya Tenaga
TAGP	Trans-ASEN Gas Pipeline
ToR	Terms of Reference
TPES	Total Primary Energy Supply
T-VER	Thailand Voluntary Emission Reduction Program
TWh	Terawatt hour
UNFCCC	United Nations Framework Convention on Climate Change
US	United States
USAID	United States Agency for International Development
USD	United States Dollar
USTDA	United States Trade and Development Agency



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