



ASEAN Centre for Energy
One Community for Sustainable Energy

ASEAN Power Grid

Updates 2025





Key Developments and Achievements on Power Interconnection



ASEAN Power Grid Capacity

Overview of the current and planned transmission capacity under the ASEAN Power Grid.



ASEAN Power Grid Impacts

A look into the ASEAN Power Grid's contribution to energy security, economic growth, and climate targets across the region.



ASEAN Power Trading Progress

Updates and milestones of the Lao PDR, Thailand, Malaysia, Singapore – Power Interconnection Project (LTMS-PIP) and the Brunei Darussalam, Indonesia, Malaysia, Philippines – PIP (BIMP-PIP).

ASEAN Power Grid Impacts: Driving Regional Energy Security and Green Growth

The ASEAN Power Grid (APG) plays a critical role in accelerating the region's renewable energy transition. Strengthened cross-border interconnections allow countries to tap into ASEAN's renewable potential **of 8,119 GW of solar and 342 GW of wind capacity**, supporting the **regional goal of 23% renewable energy share in TPES by 2025** and **progressing toward 52% by 2040**. Beyond its strategic contribution to ASEAN's clean energy transition, the APG delivers a range of measurable benefits that directly support the region's sustainable growth.



Social and Environmental Benefits

By improving cross-border connectivity, APG contributes beyond enabling cleaner energy but also protecting the environment and social well-being across the region.

1.45 M
jobs created

Direct and lifetime jobs form the majority (75%) of the green jobs created by the APG.

60 Mt

of fossil fuel consumption could be avoided by 2040 (ASEAN RE Target).

90.8 Gt
of CO₂
57 Mt
of N₂O

total emissions that could be avoided by 2040 (ASEAN RE Target).

Source: AIMS III Phase 1 and Phase 2 (2021)
and ASEAN Power Grid Project Profiles (2024)



Economic Benefits

Advancing energy interconnectivity is a key strategic part of the **ASEAN Economic Community (AEC) Strategic Plan** to advance our economy and safeguard our energy security.

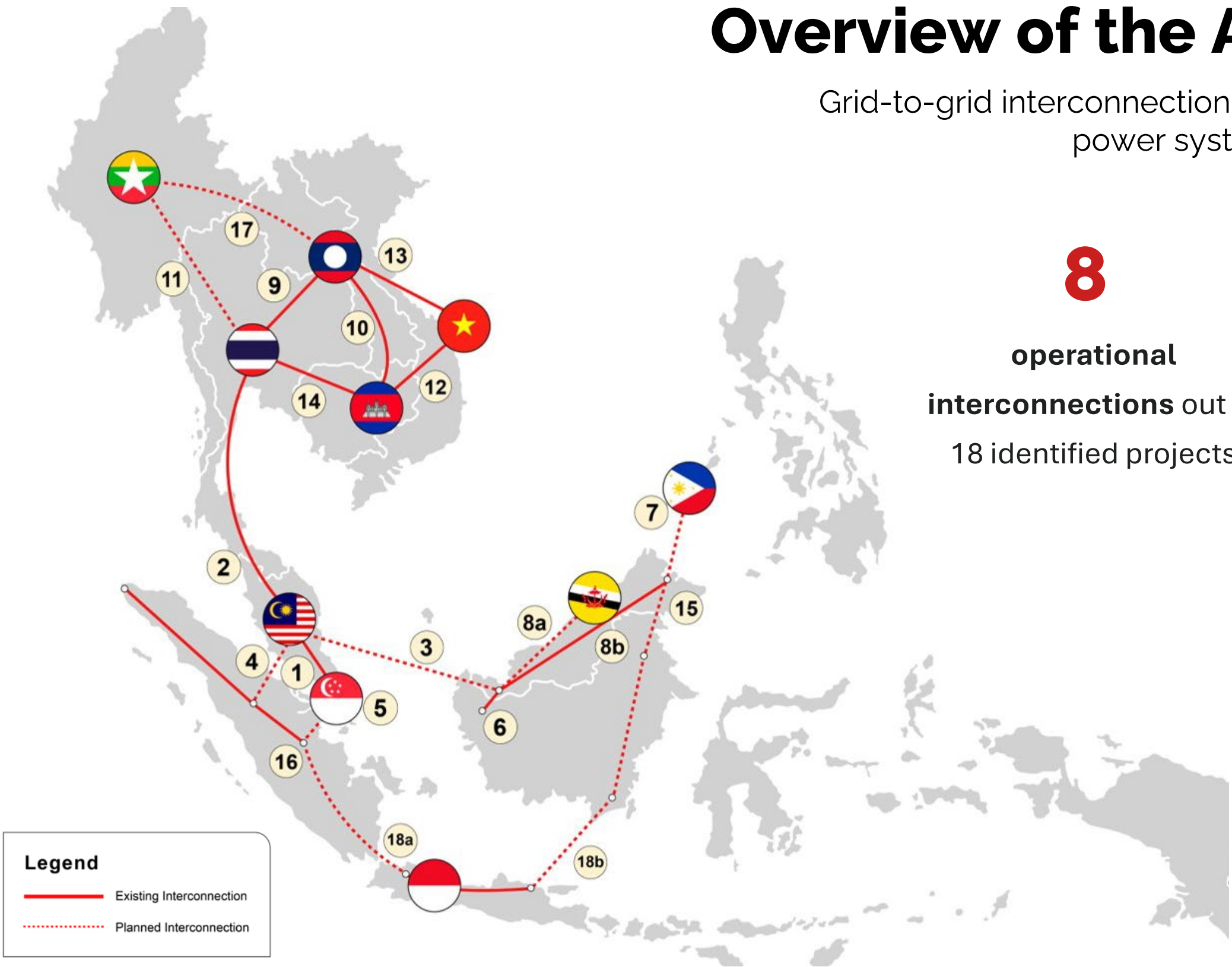
\$0.8 T
cost reduction

Saved **economic cost of decarbonization** in Southeast Asia by 2050.

Source: 8th ASEAN Energy Outlook (2024)

Overview of the ASEAN Power Grid Capacity

Grid-to-grid interconnection capacity across ASEAN continues to grow, enhancing power system reliability and supporting regional energy security.



8
operational
interconnections out of
18 identified projects

2.8 GW
operational grid-to-grid
capacity
(as of 2024)

7.5 GW
operational generation-
to-grid capacity
(as of 2024)

266 GWh
total of cross-
border power trade
through LTMS-PIP
(as of 2024)

13.7 GW
planned interconnection
capacity by 2040

6
future submarine
interconnections

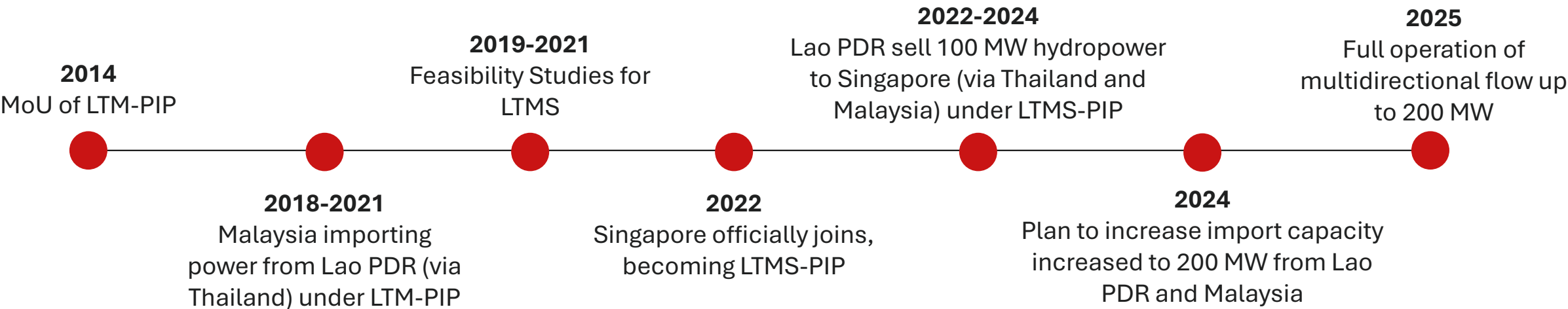
Source:

ASEAN Power Grid Interconnections Project Profiles (2024)

HAPUA Working Group 2 at the 41st HAPUA Working Committee Meeting (2025)

Updates from LTMS Power Interconnection Project:

The first multilateral cross-border electricity trade will see trade the capacity doubles in the next phase



Lao PDR-Thailand-Malaysia-Singapore Power Interconnection Project (LTMS PIP) is the first multilateral cross-border electricity trade project in ASEAN. The project started with unidirectional flow from Lao PDR to Malaysia under the Lao PDR-Thailand-Malaysia (LTM) initiative, then it extends to Singapore under the LTMS in 2022. Phase 1 of LTMS-PIP has completed in 2024 with a **total traded energy of 266 GWh through a capacity of up to 100 MW**.

LTMS-PIP Phase 2	2 power flows Lao PDR to Singapore, via Thailand and Malaysia, and from Malaysia to Singapore	200 MW Current maximum capacity, from initially 100 MW	14.99 GWh Cumulative total of purchased power from Malaysia to Singapore alone*
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Since September 2024, Lao PDR and Malaysia act as the supplier, while Singapore remains the purchaser. To facilitate Phase 2 of LTMS-PIP, Singapore’s Energy Market Authority (EMA) has extended Keppel’s electricity importer licence for an additional two years until 2026 and doubles the power import capacity to 200 MW.

*) Source: HAPUA Working Group 2 at the 41st HAPUA Working Committee Meeting (2025)

Updates from BIMP Power Interconnection Project:

Getting closer to unleash the Eastern Sub-region's interconnection potential

Inception

- The BIMP – EAGA was established on March 24, 1974, as a sub-regional cooperation framework designed to strengthen economic integration.
- The BIMP – Power Interconnection Project (PIP) was conceptualised in 2023 through a Joint Statement, set out to compliment regional power interconnection efforts of the APG.

Progress

- The 16th BIMP EAGA Summit reaffirmed member states commitment towards in energy cooperation.
- As of 2025 the PIP have successfully completed 60 domestic and cross border interconnection projects while 157 others are in progress.
- Final report of BIMP PIP Study in August 2025, that aims to assess technical and economic feasibility.

Next Actions

- Term of Reference (TOR) of BIMP-PIP
- Progress from the Sarawak-Brunei Darussalam and North Kalimantan-Sabah Interconnection Feasibility Studies, as well as the development of Sarawak-Sabah Interconnection
- Malaysia to assume the next BIMP-EAGA Chairmanship

5 Potential cross-border interconnections under BIMP-PIP

1,300 MW Total potential interconnection capacity

Source: AIMS III (2021)



The 16th Brunei Darussalam – Indonesia – Malaysia – Philippines East Asian Growth Area (BIMP-EAGA) Summit in Kuala Lumpur, 27 May 2025

Current Progress on Regional and National Power Initiatives



Regional Power Cooperations

Highlights from the Centre's activities during the APAEC 2021-2025, the 41st HAPUA Council Meetings and its Associated Meetings and the 43rd ASEAN Ministers on Energy Meeting (AMEM)



National Updates on Power

Status of ASEAN Member States national, bilateral and multilateral efforts on power initiatives to enhance energy security, expand infrastructure, and promote sustainable power development

Regional Power Cooperations:

Programme Area 1 focuses on continuous development of APG infrastructure and facilitating cross-border power trade

ASEAN Centre for Energy and the Heads of ASEAN Power Utilities/Authorities (HAPUA), as the responsible sectoral energy body, is cooperating with numbers of partners to implement Programme Area (PA) No. 1 under the APAEC 2016-2025 Phase II: 2021-2025 through provision of technical assistances.

Outcome-based Strategy (OBS) of PA1
in APAEC 2016-2025 Phase II: 2021-2025



1	Accelerate the progress of APG projects and initiate the expansion of multilateral electricity trading	- Supporting the Feasibility Studies for Indonesia-Malaysia Interconnection (under USTDA) - A Playbook for APG Interconnector Feasibility Studies	Study on the Roadmap for MPT in ASEAN				
2	Work on institutional framework and regulatory capacity as minimum requirements to advance multilateral electricity trading		Progressive Coordination: APG Stakeholders Coordination Meetings	Study on Intergovernmental Agreement to Advance MPT in ASEAN		Study on APG Financing Pathways	Study on GMS/ASEAN Regional Power Market Development and Shadow Trading
3	Work on harmonising the minimum technical requirements to advance multilateral electricity trading	- Data Sharing Guidelines and Framework 1st Pathfinder Data Sharing Project (now with UN ESCAP) - Workshops on Grid Code Harmonisation and on Wheeling Charge - Workshop on Available Transmission Capacity (taken over by NZ MFAT and ETP) - Workshop on Submarine Power Cables (taken over by Aus4ASEAN)	- Analytical Work of AIMS III Phase 3 - MPT Pilot Project Implementation		- Technical Exchange between Power System Operators, Regulators, and Policymakers in Southeast Asia - Workshop on Power Quality Assessment	Study on APG Financing Pathways	- Study on GMS/ASEAN Regional Power Market Development and Shadow Trading - Cross-border Trade and Interconnections Database
4	Explore integrating renewable energy and other digital developments into the ASEAN Power Grid	Workshops on: vRE Grid Integration (taken over by EU SCOPE IF)		Studies on: - Hydrogen and Ammonia - Emerging Technologies for APG	Workshops on: - Distributed Energy Resources - BESS - Smart Grid Technologies		

Regional Power Cooperations:

Collaborations with various partners to facilitate feasibility studies ahead of APG implementation

In addition to technical assistances under the first OBS of the PA1, the Centre and HAPUA have also been carrying out feasibility studies with Development Partners that cover, not only technical aspects, but including the economic, commercial, policy, environmental and social impacts, according to the needs of the involved Member States.



Project

**Feasibility Studies of Indonesia-Malaysia Interconnections:
Sumatra ID – Peninsular MY and North Kalimantan ID – Sabah MY**

ASEAN Power Grid Project Preparation Facility

Status

On-going: Resumption process

On-going: AMS Consultations through
High-Level Consultative Meetings and Focus Group Discussions

Highlights

Site Visit to Sumatra, Peninsular Malaysia, and Sabah (Oct 2024)



High-Level Policy Dialogue with Regulators and Policymakers (Oct 2024)



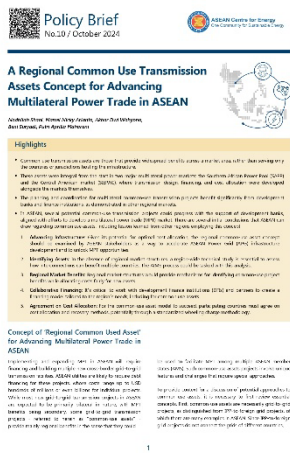
High-Level Consultative Meetings and Focus Group
Discussions (Aug-Sep 2025)



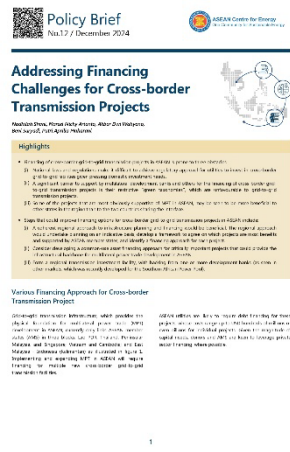
Regional Power Cooperations: The Centre's activities with partners have led to numerous publications that reflect the strategies of Programme Area 1

Publications under the ASEAN Power Grid Advancement Program (APG-AP)

2024



Policy Brief [A Regional Common Use Transmission Assets Concept for Advancing Multilateral Power Trade in ASEAN](#)



Policy Brief [Addressing Financing Challenges for Cross-border Transmission Projects](#)



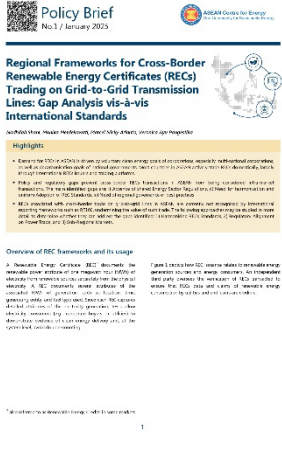
2025



Report [Study on the Roadmap for Multilateral Power Trade in ASEAN](#)



Policy Brief [Initiatives for Sub-Regional Power Trade in ASEAN: An Emerging Approach to Progress](#)



Policy Brief [Regional Frameworks for Cross-Border Renewable Energy Certificates \(RECs\) Trading on Grid-to-Grid Transmission Lines: Gap Analysis vis-à-vis International Standards](#)



Article [Malaysia's ASEAN Chairmanship: Catalyst for the ASEAN Power Grid's Breakthrough](#)



Regional Power Cooperations:

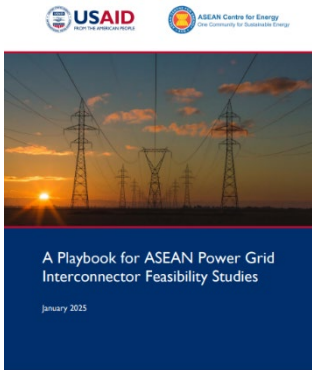
The Centre's activities with partners have led to numerous publications that reflect the strategies of Programme Area 1

Under the USTDA FS Project



Article
[Boosting RE through APG: Malaysia and Indonesia's next move in pursuing cross-border interconnection](#)

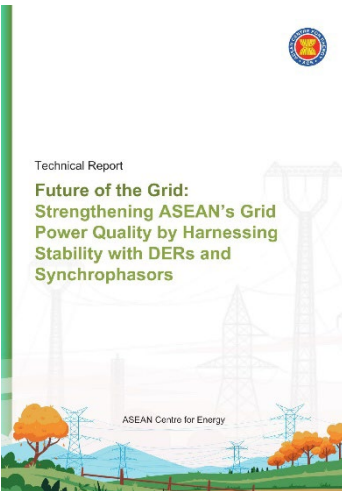
Under partnership with USAID SPP



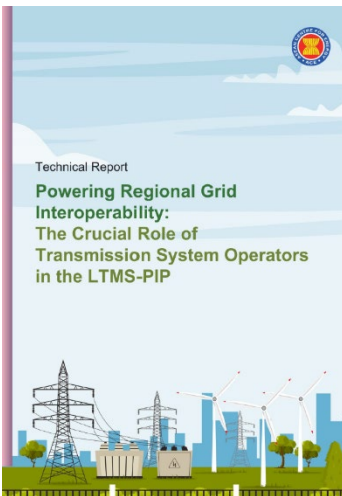
Report
[A Playbook for ASEAN Power Grid Interconnector Feasibility Studies](#)



Under partnership with G-PST and NREL



Technical Report
[Future of the Grid: Strengthening ASEAN's Grid Power Quality by Harnessing Stability with DERs and Synchrophasors](#)

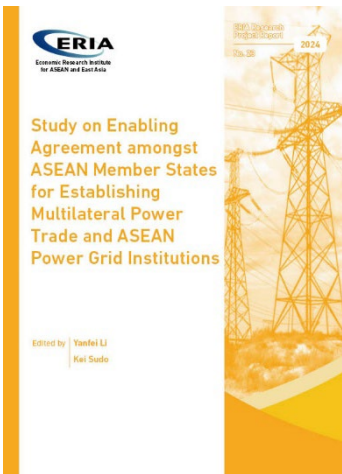


Technical Report
[Powering Regional Grid Interoperability: The Crucial Role of Transmission System Operators in the LTMS-PIP](#)



Under partnership with ERIA

2024



Report
[Study on an Enabling Agreement amongst ASEAN Member States for Establishing Multilateral Power Trade and ASEAN Power Grid Institutions](#)



2025



Report
[ASEAN Energy Booklet 2025 - Volume 2 Low-Carbon Hydrogen](#)

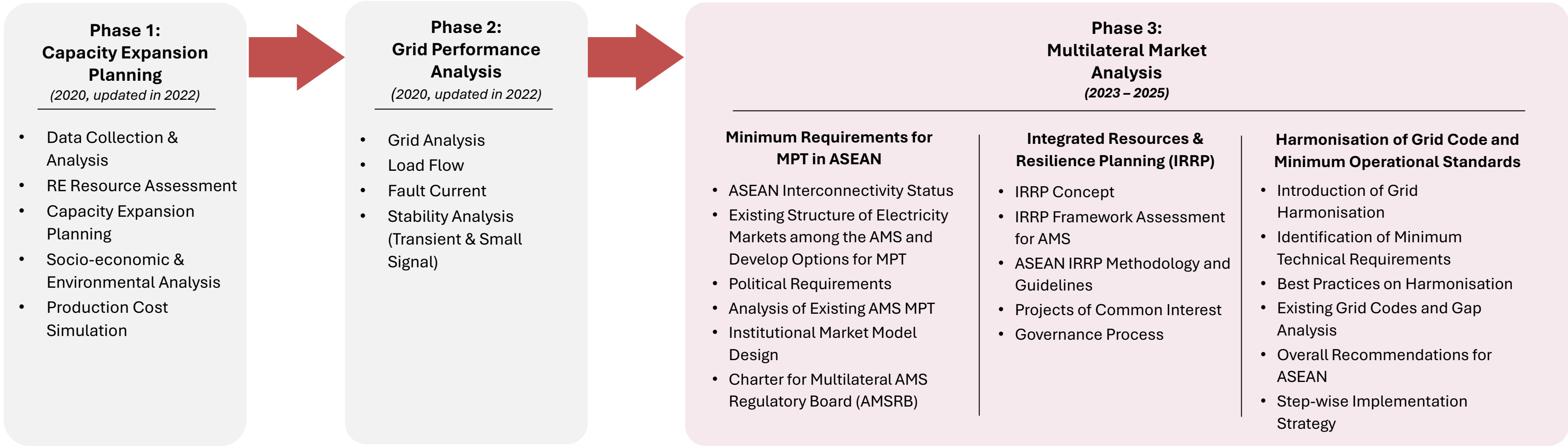


Regional Power Cooperations:

AIMS III Phase 3 as a technical reference for the Member States in enhancing MPT implementation

ASEAN Interconnections Masterplan Study (AIMS) serves as a regional planning reference for APG under the ASEAN cooperation framework. The first two phases focused on identification of potential cross-border interconnection and RE integration, while the third phase assesses the minimum requirements needed for market development under APG. The results of AIMS III Phase 3 serve as a foundation for the implementation of Programme Area 1: APG under the APAEC 2026-2030.

Development Phases of the AIMS III (2020 - 2025)



Regional Power Cooperations:

The 41st HAPUA Council Meeting focuses on regional energy security and connectivity through APG-related initiatives

This year's **41st HAPUA Council Meeting and its Associated Meetings** were held in Labuan Bajo, Indonesia. Bringing together all power utility companies across Southeast Asia, the meeting series addressed various regional initiatives throughout 2024 and 2025 and future programmes for the coming years following the APAEC 2026-2030. Alluding the [HAPUA Council Joint Statement 2025](#), HAPUA recognised the following regional initiatives:

1. Advancing the APAEC 2026-2030

Commitment to strengthening APG planning and implementation to enhance regional energy security and connectivity through infrastructure development including submarine power cables, advancement of market frameworks, and a coordinated regional cooperation framework.

2. Advancing the Enhanced APG Memorandum of Understanding (MoU)

Commitment to supporting the operationalisation of the APG through regional infrastructure planning, cross-border interconnection development, and project implementation under the ASEAN Interconnection Masterplan Study (AIMS).

3. Advancing Multilateral Power Trade through ASEAN Interconnection Masterplan Study (AIMS) III and Beyond

Commitment to the development of the 18 cross-border interconnections and recognised the findings and recommendation of AIMS III Phase 3 in advancing multilateral power trade including potential pilot projects.

4. Acknowledging the Development of Power Integration Projects

Acknowledgement on the successful implementation of LTMS-PIP and fully support the initiation of the BIMP-PIP, recognising their significance for future power integration initiatives within ASEAN.

5. Enhancing Cooperation among ASEAN Member States and Partners

Recognition on the necessity for collective support from all stakeholders, including development partners, international organisations, financial institutions, the private sector, and communities



The 41st HAPUA Council Meeting and its Associated Meetings were joined by the high-level executives of power utility companies across Southeast Asia

Regional Power Cooperations:

The 43rd AMEM marks firmer regional coordination to tackle energy and climate issues through APG

The 43rd ASEAN Ministers on Energy Meeting (AMEM) in Kuala Lumpur, Malaysia marks the launch of foundational regional cooperation initiatives for APG development, namely: **APG Enhanced Memorandum of Understanding (MoU)**, the **ASEAN Submarine Power Cable Development Framework**, **APG Financing Facility (APGF)**, and the **APG Secretariat**. Quoting the [Joint Media Statement](#), this momentum highlights the continued commitment of the ASEAN Member States (AMS) of regional coordination to address rising energy demand, volatility of global energy markets, and climate action.



Enhanced ASEAN Power Grid MoU

The ASEAN Power Grid Memorandum of Understanding (APG MoU) was first signed in 2007 and implemented in 2009. After its 15 years of validity, the MoU is now up for an extension with a brand-new title called the **Enhanced ASEAN Power Grid MoU (Enhanced APG MoU)**. Signed at the ASEAN Energy Business Forum 2025 (AEBF-25), the Enhanced APG MoU embodies the ASEAN Member States' renewed commitment on strengthening regional electricity connectivity through multilateral power trade, integration of renewable energy, and fostering investment in the energy sector.

Upon signing, the **ASEAN Power Grid Consultative Committee (APGCC)** will lead the operationalisation of the **Enhanced APG MoU** through the establishment of task force(s) focusing on technical, regulatory, and policy aspects, and their respective workplans.

The operationalisation will cover:

Institutional
Arrangements

Market
Arrangement

Regional Planning
and Operation



Aside from the Enhanced APG MoU, the AEBF-25 also sees the endorsement of the new ASEAN Plan of Action for Energy Cooperation (APAEC) 2026-2030 and the ASEAN Framework Agreement on Petroleum Security.

Regional Power Cooperations:

Notable regional APG initiatives launched in the 43rd AMEM and AEBF-25



APG Financing Initiative



MoU Exchange between ADB and the World Bank on APG Financing Initiative at the AEBF-25

AIMS III estimated **USD 764 billions of required investment** to build and operate well-connected electricity networks under high RE penetration. Building on this, the Asian Development Bank (ADB) and the World Bank, in cooperation with the ASEAN Secretariat and ASEAN Centre for Energy, launched the **APG Financing** initiative as a platform that gathers various financial institutions, donors, commercial banks, and philanthropies to support APG advancement.

ADB and the World Bank will provide the financial and technical assistances from capacity building, project preparation, and complete sets of financial instruments, including grants, concessional and regular loans, guarantees, political risk coverage, advisory services on public-private partnerships (PPP) and equity.



ASEAN Submarine Power Cable Development Framework

Realising the diverse geographical condition and to better connect RE supply to the demand's epicenters across ASEAN, submarine transmission becomes crucial. Addressing the pressing challenges of deploying submarine infrastructure requires a solid framework as a credible, transparent arrangement comprising technical, commercial, and financial components that is recognised by the Member States – as mandated during the 42nd AMEM in Lao PDR.

This year's AMEM endorsed the progress of **ASEAN Submarine Power Cable Development Framework** as a milestone towards a fully connected APG by 2045. The meeting also encouraged the Framework to be completed by the next AMEM or earlier, with SOME and ACE to update the progress to AMEM regularly.



ACE as the Secretariat of APG

The 43rd AMEM also recognised ACE's institutional capacity. Apart from being the region's energy think tank, catalyst, and knowledge hub, ACE will also be carrying out regional initiatives such as **the strategic role of APG Secretariat**. As the Secretariat, ACE will facilitate activities, documentation, and other related activities, including organising the necessary review and coordination, to ensure the successful completion of the MoU and the action plans.

National Updates on Power:

This year marks the most ambitious RE development planning to date from Cambodia, Indonesia and Viet Nam



Viet Nam

In April 2025, The Prime Minister of Viet Nam released Decision No. 768/QD-TTg to revise the eight installment of the Viet Nam's National Electricity Development Planning, also known as the **Revised PDP8**. Some of the highlights from the new PDP are as follows:

- Targeted maximum capacity in 2030 is **increased from 90.51 GW to 99.93 GW**.
- **RE sources is now planned at 28-36% by 2030 from 30.9%-39.2%** in the previous release. The share is dominated by solar and wind.
- The Revised PDP8 introduces **offshore wind (6.4 GW by 2035), nuclear (4-6.4 GW by 2035), and BESS (20 GW by 2035)**.
- The **Lao PDR-Viet Nam interconnection** is listed as one of the priority projects for the **2025-2030 timeline**.

More on Vietnam's Revised PDP8 and Indonesia's RUPTL 2025-2030:
[Policy Insight - Vietnam's Revised PDP8 and Indonesia's RUPTL 2025-2034](#)



Indonesia

In 2025, Indonesia released two of its important power development planning documents: the new **National General Electricity Plan (RUKN)** and the **National Electricity Business Plan (RUPTL) 2025-2034** which builds upon the former. Some of the key points from the documents are:

- The RUPTL plans a total of **69.6 GW capacity with 24% coming from vRE, hydro, nuclear and energy storage**.
- **A total of 500 MW from nuclear** is introduced in the new RUPTL, located in Sumatra and Kalimantan.
- The **Sumatra-Peninsular Malaysia and North Kalimantan-Sabah interconnections** are now included in the priority project list with **commercial operation date (COD) in 2034**.
- A total of **105 GW RE developments is expected by 2040**, according to the RUKN.



Cambodia

The Ministry of Mines and Energy of Cambodia issued the **Revision of Power Development Master Plan 2022-2040** document in 2024. Key highlights from the document are summarised below:

- Cambodia targets the total installed capacity to reach 12.2 GW by 2030 and 22 GW by 2040, **with RE share in 2030 is planned at 76% and will increase to 87% in 2040**.
- Among the planned RE technologies, **solar and hydro account the largest share with 26% and 23% targeted by 2030**, respectively.
- **Electricity imports from Lao PDR** is planned to reach **1 GW by 2030 and 6 GW by 2040**, coming mostly from hydropower, wind, energy storage and coal power plants.
- Additionally, the Cambodian Government has approved **24 power projects worth over USD 5 Billion** in 2024, comprising of solar, wind, and BESS.

National Updates on Power:

Recent bilateral initiatives between Member States signifies the continuous commitment in strengthening the APG

Viet Nam-Malaysia-Singapore Interconnection

During the ASEAN Summit in May 2025, MY Energy Consortium (a consortium between Tenaga Nasional Berhad (TNB) and Petroliam Nasional Berhad (Petronas)), PetroVietnam Technical Services Corporation (PTSC), and Sembcorp Utilities Pte Ltd [signed a Joint Development Agreement](#) to explore the feasibility of exporting RE-based electricity from Viet Nam to Malaysia and Singapore through a new submarine power cable. The exported electricity is expected to be from Viet Nam's offshore wind power and wheeled through the national grid of Peninsular Malaysia.

This initiative will support Singapore's ambitious target of 6 GW clean electricity imports by 2035 and is also in line with Viet Nam's Revised PDP8 which has included plans of a significant amount from offshore wind power for cross-border electricity transfer in their priority projects.

Sarawak-Peninsular Malaysia Interconnection

[TNB reported in AEBF-25 that the Sarawak-Peninsular Malaysia interconnection](#) is in the final step of forming a consortium for this joint development, following the completion of the pre-feasibility study in early 2025. The interconnection will allow a hydropower-based electricity transfer through a 700-kilometre undersea cable from Sampadi near Kuching, Sarawak to Johor, West Malaysia.

Sarawak-Singapore Interconnection

[A Conditional Approval \(CA\)](#) was granted by Singapore's EMA to Sembcorp Utilities Pte Ltd (SCU), in partnership with Sarawak Energy Berhad (SEB) for a 1 GW hydropower-based electricity import from Sarawak, Malaysia via submarine transmission. Preliminary technical and commercial feasibility studies are currently in its final approval process. The commercial operation date (COD) is expected to be around 2035.

Peninsular Malaysia-Singapore Interconnection

TNB announced the success of pre-feasibility of the new Peninsular Malaysia-Singapore interconnection during the AEBF-25. The new line expands the existing 1,000 MW interconnection capacity that links the two AMS since 1983.

The new interconnection line holds a potential capacity of up to 2,000 MW and is set for a bi-directional flow operating by 2030. Sidelining the 43rd AMEM, [a Joint Development Agreement \(JDA\) was also signed by TNB, SP Group, and Singapore Energy Interconnections \(SGEI\)](#) to conduct a full package feasibility study for this line.

Singapore-Indonesia Interconnection

June 2025 marks the new milestone of Singapore-Indonesia interconnection initiative. [A memorandum of understanding \(MoU\) on cross-border electricity trade](#) was signed by Singapore's Minister-in-charge of Energy and Science and Technology, and Indonesia's Minister of Energy and Mineral Resources.

National Updates on Power:

New policies and regulations from AMS reflecting regional connectivity and RE integration

Singapore's New Interconnection Company

As an effort to reach Singapore's low-carbon electricity import target by 2035, the Singapore Government recently appointed a new company to **handle Singapore's cross-border interconnection developments and operations** called the [Singapore Energy Interconnections Pte Ltd \(SGEI\)](#).

Malaysia's Guidelines for Corporate Renewable Energy Aggregation Mechanism (CREAM)

Published in March 2025, Suruhanjaya Tenaga provided a structured policy framework to enable community to contribute to the country's goal to reach 70% RE in the power mix by 2050. **Malaysian citizens can now generate revenue from selling excess RE in the RE supply market.**

More on Malaysia's Guidelines for CREAM: [Policy Insight - Malaysia: Guideline on Corporate Renewable Energy Aggregation Mechanism \(CREAM\)](#)

Indonesia's Guidelines on PPA from RE Sources

Indonesia, under the Ministry of Energy and Mineral Resources (MEMR), stipulated the Regulation No. 5 (2025) on RE Power Purchase Agreements (PPAs), which introduces **longer PPA durations, clearer provisions on carbon credits and RECs, refinancing mechanism, generation variability, and price adjustment for geothermal power plants.**

More on MEMR Regulation No. 5 (2025): [Policy Insight - Indonesia: Guidelines on Power Purchase Agreement from Renewable Energy Sources](#)

Thailand's Utility Green Tariff (UGT)

Thailand recently launched the new utility-led RE procurement called the [Utility Green Tariff \(UGT\)](#). The scheme allows **large power consumers to procure electricity from utility-scale RE plants along with the renewable energy certificates (REC)**. There are two procurement options: the user-unspecified RE scheme of UGT1 and the UGT2 with user-specified RE scheme.

Viet Nam's Corporate Direct PPA for RE Sources

Following the adoption of Viet Nam's New Electricity Law in 2024, [Vietnam issued Decree No. 57/2025 regarding direct PPA mechanism](#) for RE-based electricity procurement. This document defines **the framework for RE producers and large power consumers, as well as the arrangement should the two parties use private transmission line or the national grid** to transmit the electricity.

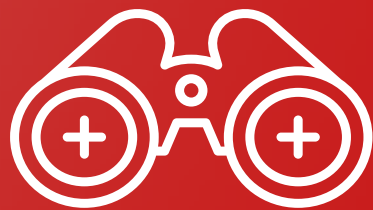
Malaysia's Guidelines for Corporate Renewable Energy Supply Scheme (CRESS)

In September 2024, Suruhanjaya Tenaga released the RE procurement guideline for large electricity consumers to purchase electricity from RE developers but using the national grid for the power wheeling.

More on Malaysia's Guidelines for CRESS: [Policy Insight - Malaysia: Corporate Renewable Energy Supply Scheme \(CRESS\)](#)



Path Forward: Next Steps and Outlook



Outlook on ASEAN Power System

Insights from the recently released ASEAN Renewable Energy (RE) Long-Term Roadmap, particularly on the Power Sector Transformation



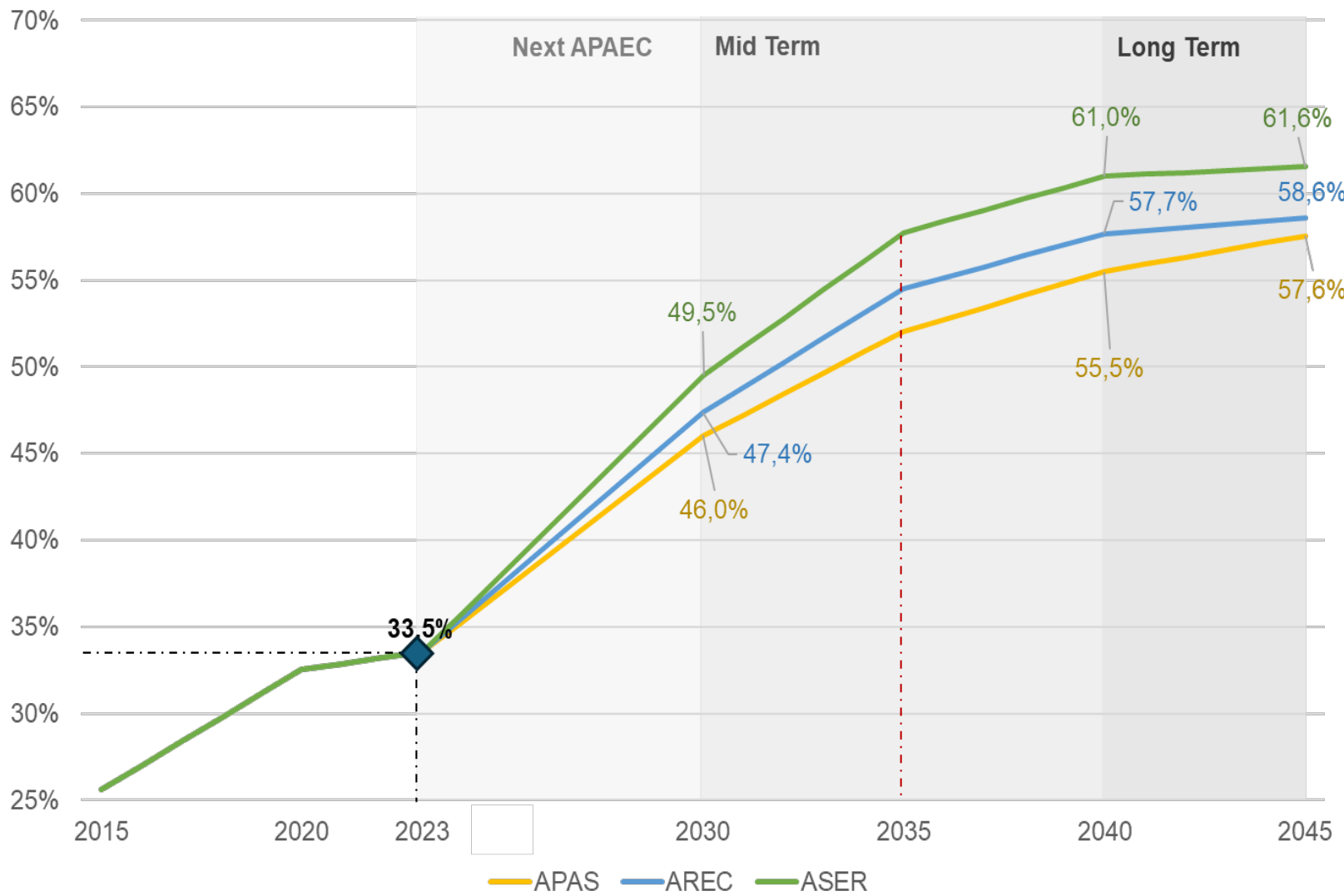
APAEC 2026-2030

Key strategies for Programme Area 1 (APG) under APAEC 2026-2030, including priority topic area and sub-topic, as well as the interests expressed by ASEAN Power Utilities

Insights from ASEAN RE Long-Term Roadmap:

RE capacity will exceed fossil fuel in the most capital-efficient pathway by 2030

RE Share of Installed Capacity in ASEAN (2015-2045)



APAEC (2026-2030): Critical Tipping Point

- The re-order of power system: vRE capacity surpassing conventional RE (e.g., hydropower) and overtakes coal.
- Milestone in 2030: Total RE capacity exceeding the total fossil fuel capacity.
- Regulatory frameworks and technical awareness for energy storage systems ensures the vRE growth in the first half of APAEC.

Mid-Term (2031-2040): vRE Takeover and Shift of the Flexibility Role from Gas to Storage

- vRE growth continues from 28.5% to 41.8%, dominating the grid’s system.
- 2031-2035: 5% reduction in coal’s share in the power system. Natural gas begins a steady decline.
- Strong increase of energy storage: doubling from 5.7% to 8.3%.

Long-Term (2041-2045): A Mature, vRE Dominant System

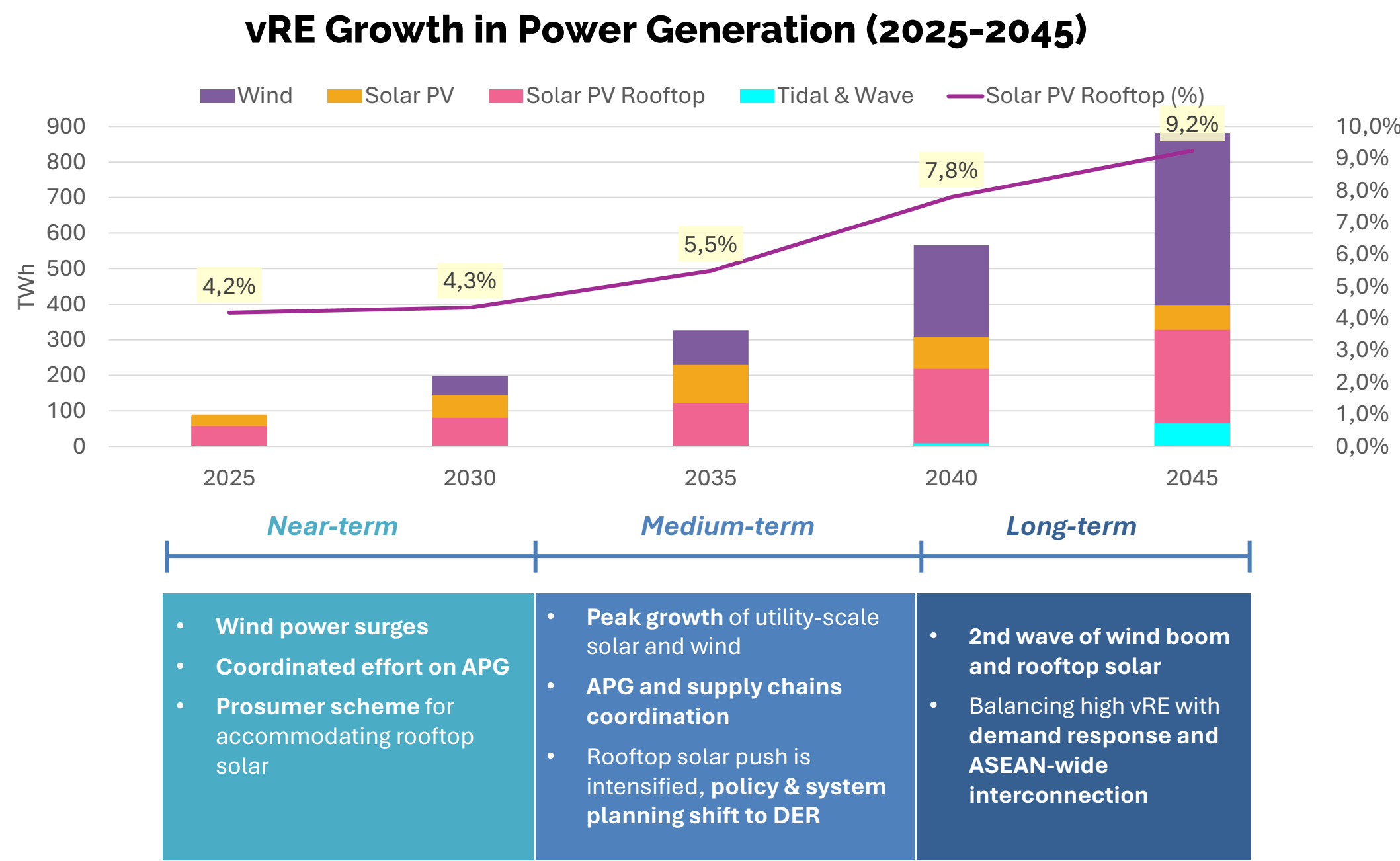
- vRE domination at 46.1%, while energy storage covers 10% of the grid system.
- Similar shares of conventional RE and coal (approx. 12.5%).
- Natural gas still acts as dispatchable capacity for grid stability. This slows down its decline compared to hydropower additions.



ASEAN RE
Long-Term
Roadmap

Insights from ASEAN RE Long-Term Roadmap:

Policymakers must prepare a policy planning on distributed energy resources to control the overwhelming vRE growth

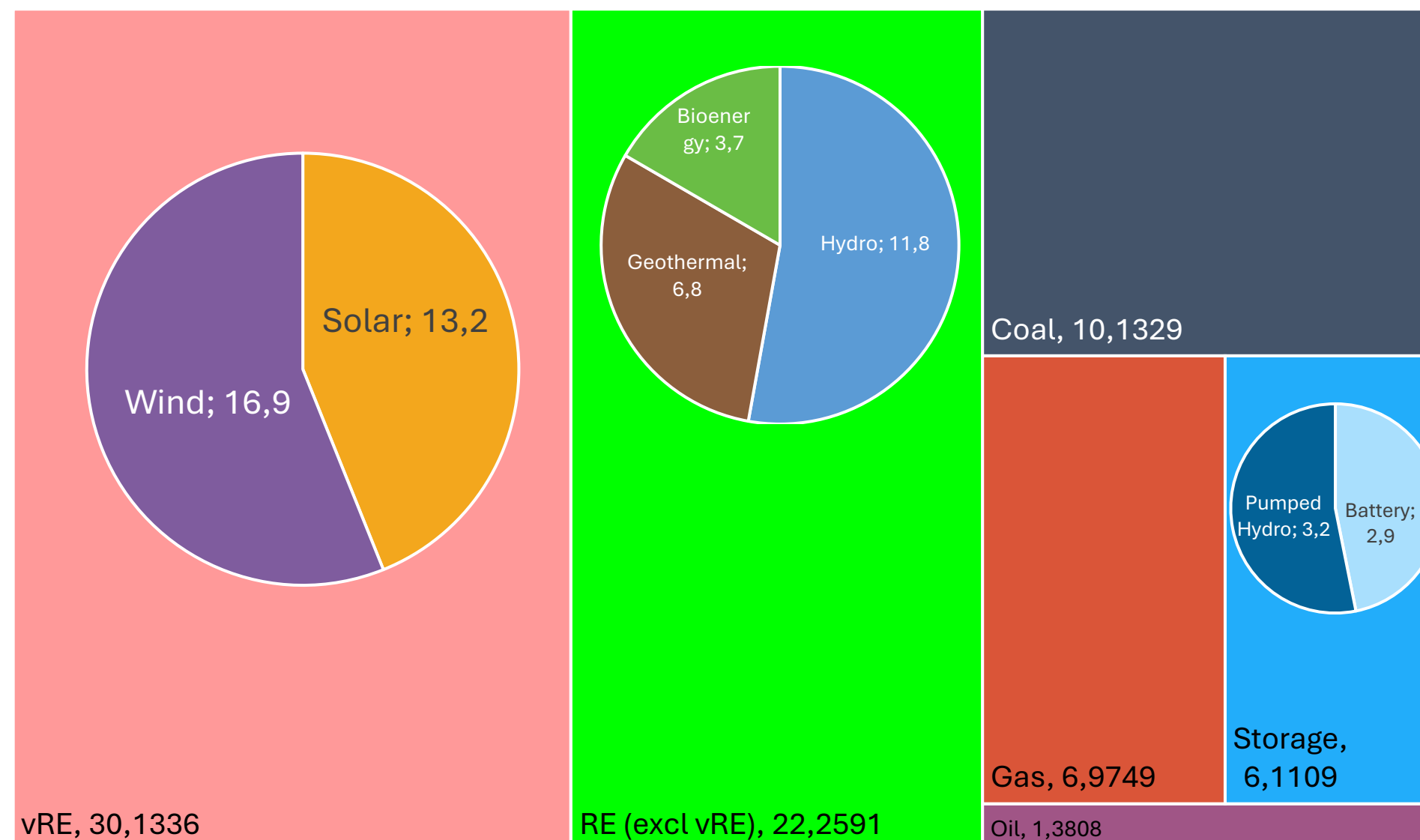


- The growth of rooftop solar PV in 2025-2030 term signifies the outset prosumer’s role in the power system.
- APG and supply chain coordination can help accommodate this vRE trend, albeit only during the medium to long-term.
- This necessitates **policy and power system planning shift that are laser-focused on managing distributed energy resources to better accommodate rooftop solar PV, energy storage, and flexible grids.**
- The power system must be ready to overcome the highly decentralised and prosumer-driven energy system.

Insights from ASEAN RE Long-Term Roadmap:

USD 77 Billion is required to reach RE target, but an effective APG implementation could help alleviate the burden

Investment Needs to reach RE target by 2030 (USD Billion)

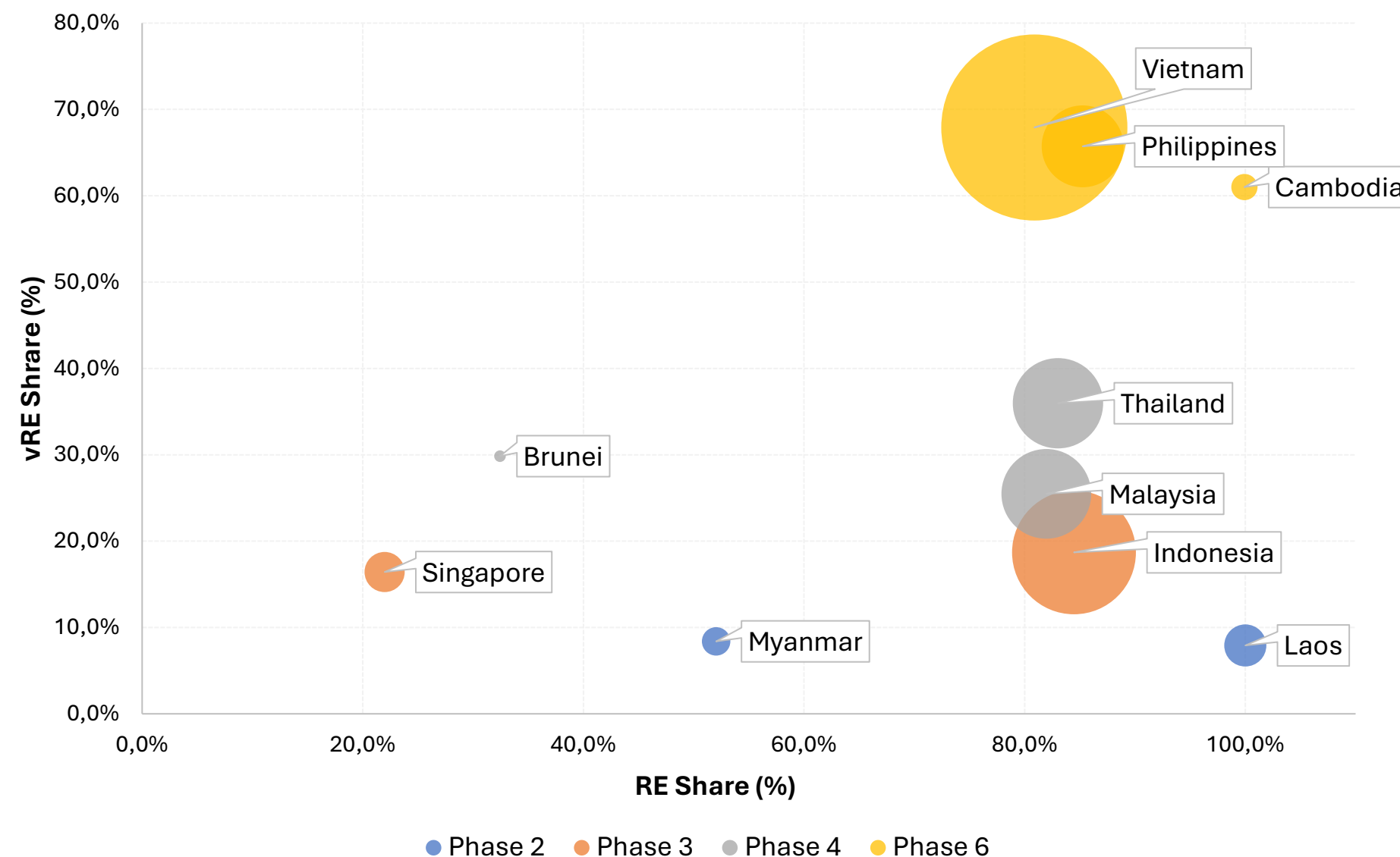


- A portion of 24% is still directed towards coal and gas; a forward-looking financial strategy that upholds the concept of transition finance must be put forward by ASEAN policymakers.
- Nevertheless, **cross-border resource sharing through APG significantly helps lowering down the required investment for coal and gas capacity**, at least until 2040 as the initial 18 APG interconnections might be reaching their maximum capacity past that timeframe. This demonstrates that maintaining decarbonisation efforts require continuous reinforcement of infrastructures, including that of APG.
- **The power system must be prepared for a 20% vRE penetration in the short term, 30-40% in the medium term, and ultimately aim for nearly 50% by 2045.** Regardless of the pathway scenario, investment in grid improvement and flexibility should be the utmost priority for the region to apply.

Insights from ASEAN RE Long-Term Roadmap:

Diverse realities and challenges across AMS in power system transformation highlights the need of a tailored approach

vRE and RE shares in each Member State's Power Generation by 2045



vRE Frontrunners: Viet Nam, Philippines, Cambodia

- Viet Nam, the Philippines, and Cambodia will face challenges in managing inverter-dominated system that lacks physical inertia of thermal power plants and ensuring energy security by bridging longer low-vRE periods.

The Balanced Transitioners: Thailand, Malaysia, Indonesia

- These Member States will be seeing challenges of managing large and frequent daily surpluses of vRE. Their system planning must be laser-focused on maximising all forms of flexibility to absorb a surplus of energy.

Diverse Development Needs: Brunei Darussalam, Lao PDR, Myanmar, Singapore

- Brunei's primary challenge is managing daily energy surplus.
- Myanmar's is more foundational, such as upgrading the grid to manage local congestion and accommodate the first significant wave of solar and wind projects.
- Singapore needs to secure reliable, clean energy imports through the APG.
- In contrast with others, the challenges in Lao PDR will be on leveraging its massive, dispatchable hydropower resources to act as the regional battery.

APAEC 2026-2030:

Programme

Area 1 focuses on firmer regional cooperation and stakeholder capacity ahead of wider APG implementation

PA 1 in the new APAEC brings the key strategy of **“Strengthen APG planning and implementation to enhance regional energy security and connectivity, through infrastructure development, advancing market frameworks, and a coordinated regional cooperation framework”** with the goals of:

- (1) firmer regional cooperation framework,
- (2) increasing capacity and preparedness of power sector stakeholders on energy security throughout the energy transition journey, and
- (3) increasing stakeholder capacity in enabling cross-border transmission infrastructure and multilateral power trade.

The new Outcome-based Strategies and Action Plans of PA 1 are outlined below:

Outcome-based Strategies (OBS)		Action Plans (APs)
1. Strengthen APG bodies' coordination	1.1	Operationalise the APG Enhanced MoU
	1.2	Strengthen coordination among APG bodies
	1.3	Strengthen the capacity of APG bodies
2. Enhance regional planning for the APG cross-border interconnections and Infrastructure	2.1	Establish AIMS, the ASEAN Subsea Power Cables Development Framework and other initiatives for enabling APG infrastructure
	2.2	Assess the feasibility of proposed cross-border interconnections under AIMS and APG Project Profiles
	2.3	Explore relevant technology advancement to strengthen grid systems and cross-border interconnectors
3. Expand cross-border power trading by accelerating development of APG infrastructure and enhancing regional market integration	3.1	Track the progress of APG development, including cross-border infrastructure and electricity trade
	3.2	Advance regulatory, policy, commercial and technical frameworks to support cross-border electricity trading and regional market integration
	3.3	Explore financing mechanisms and innovative business models for the development of APG interconnections and Infrastructure
4. Drive a low-carbon APG as a regional cooperation strategy to decarbonize the ASEAN energy system and support net zero emissions goals	4.1	Advance grid modernisation and digitalisation of ASEAN power system to ensure its capability towards energy transition
	4.2	Explore the integration of emerging technologies to accelerate grid decarbonisation
	4.3	Explore enabling policy and regulatory frameworks to accelerate cross-border clean and renewable electricity trading



APAEC
2026-2030

APAEC 2026-2030:
**Anticipating
ASEAN-wide
MPT, firmer
APG
cooperation,
and the overall
energy
transition
journey**

In line with the key strategy, this Programme Area 1 of the APAEC 2026-2030 will be seeing regional activities, ranging from studies and capacity building, that aim to prepare the AMS for the implementation and operationalisation of APG. The activities will touch upon various important topics and areas as follows:

Regional Institutional Framework

Operationalisation of APG MoU

Electricity Regulation, Market and Trade

Electricity Market Transformation for Energy Transition

Enablers of Cross-border Power Trade, e.g., Renewable Energy Certificate and Wheeling Charges

Power System Operation

Minimum Operating Standards for Cross-border Interconnection

Power System Transformation and Grid Modernisation for Energy Transition

Grid Infrastructure (Transmission and Distribution)

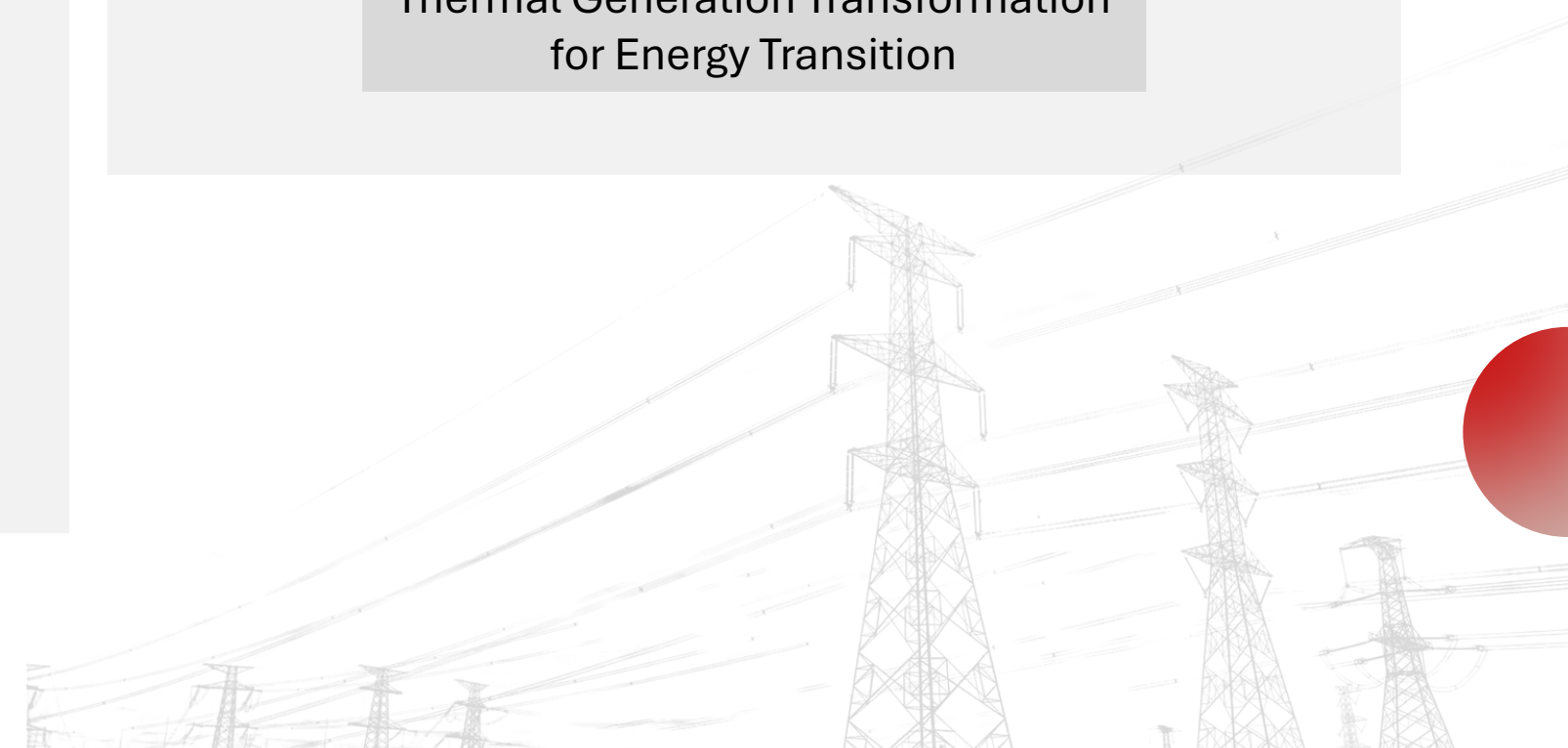
Regional Planning for Cross-border Infrastructure

Grid Technologies, e.g., Submarine Power Cable and HVDC

Financing of Grid Infrastructure

Power Generation

Thermal Generation Transformation for Energy Transition

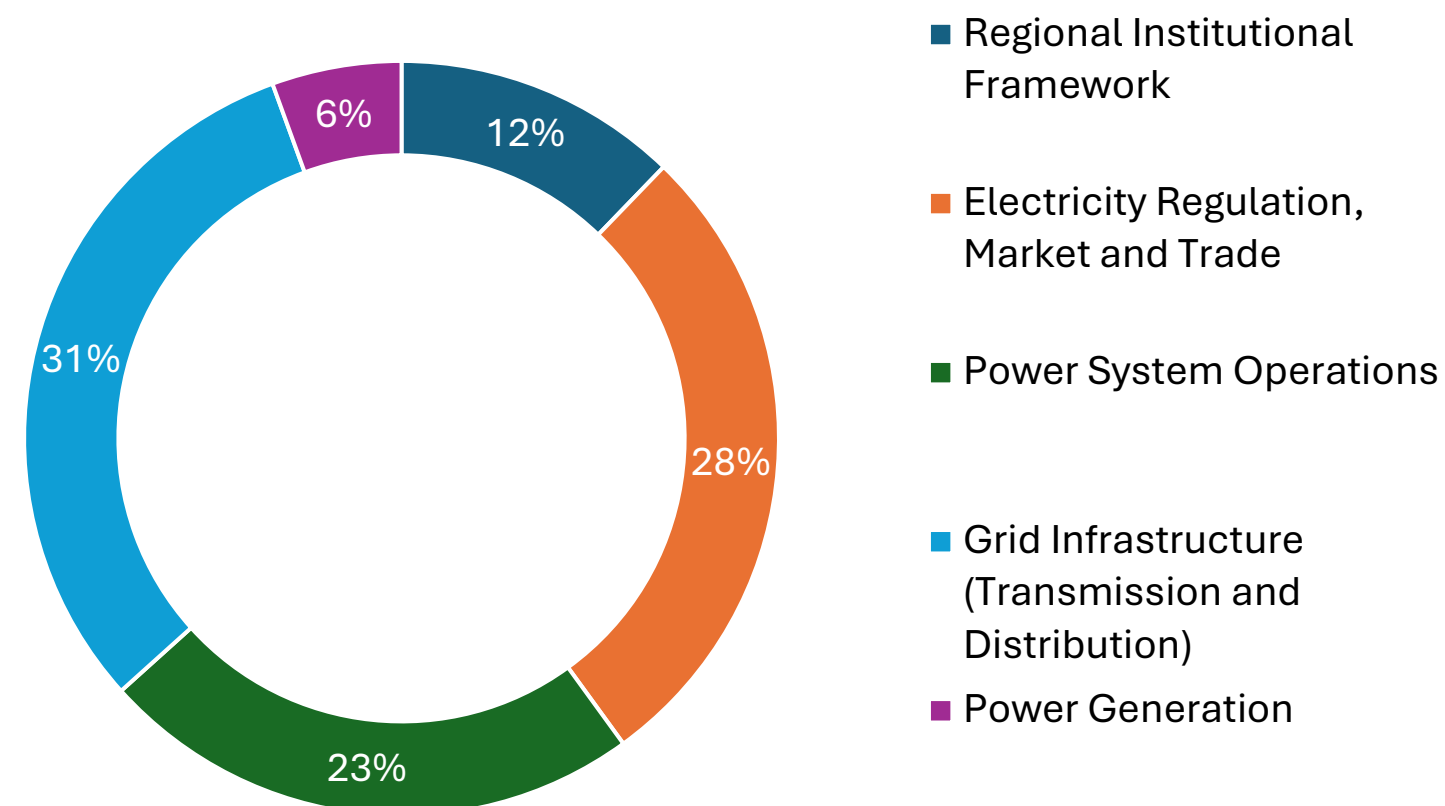


APAEC 2026-2030:

Interests from ASEAN Power Utilities align with the key strategy and priority topics under the new APAEC

During the 41st HAPUA Council and its Associated Meetings in Labuan Bajo, Indonesia, the Centre released a survey to HAPUA Working Groups (HWGs) to identify priority topic(s) and area(s) under the Programme Area No. 1 – APG of APAEC 2026-2030. The survey suggested that **Grid Infrastructure and Market Mechanism Development for supporting multilateral power trade (MPT) in ASEAN** should be prioritised in the next APAEC 2026-2030. Apart from that, the survey also presented other interests on exploring **Artificial Intelligence (AI) for Power System and Power Quality and Protection** as the most preferred topics.*

Important Topics to be Prioritised under APG in APAEC 2026-2030



Other Topics of Interest

PPA Guidelines
REC/Carbon Credits
Nuclear & Emerging Technologies
Artificial Intelligence
Electric Vehicle
Power Quality and Protection
Co-firing and Efficiency
Financing Interconnections
BESS

*) The survey respondents comprise of 9 representatives from HWG 1, 27 representatives from HWG 3, and 7 representatives from HWG 4.

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