ASEAN Centre for Energy
One Community for Sustainable Energy

Overview of Biomass Vision on ASEAN Power Decarbonisation

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The ASEAN Centre for Energy (ACE) is an intergovernmental organisation to advance the ASEAN energy cooperation under the high-level framework of the ASEAN Community

The purpose of the ASEAN Centre for Energy (ACE) ...

ACE as a **catalyst for economic growth and development** by initiating, coordinating, and facilitating national as well as joint and collective activities on energy

... to be met through our role for the ASEAN Member States ...

Catalyst

To unify and strengthen ASEAN energy cooperation through sharing platform, policy advisory, best practices assessment, and capacity building activities.

Knowledge hub

To provide knowledge repository and services through data management, periodic publication, and work dissemination.

Think tank

To assist AMS in research and practical solutions identification on policies, legal, and regulatory frameworks and innovative technological solutions.

... supported by ...

Dialogue Partners | Sectoral Dialogue Partners | Development Partners | International organisations

... based on ...

ASEAN Plan of Action for Energy Cooperation (APAEC) and guidance of the ASEAN Member States

Findings from the ASEAN RE Long-term Roadmap on

Biomass Needs for Power Decarbonisation

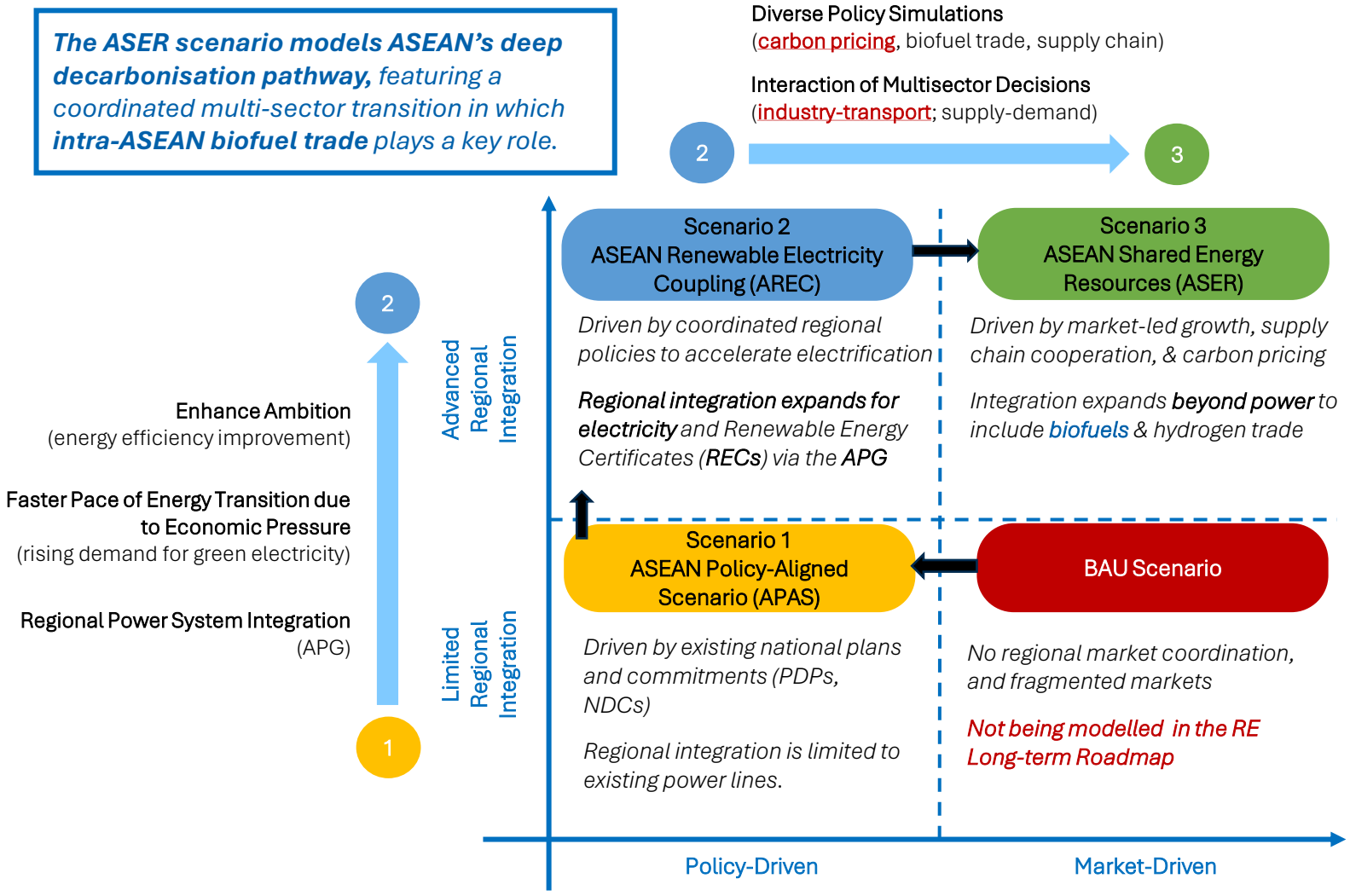
Introduction to the ASEAN RE Long-term Roadmap

The ASEAN RE Long-Term Roadmap is

ASEAN's evidence-based blueprint that translates the region's energy-transition vision under APAEC into clear choices, sequencing and actions.

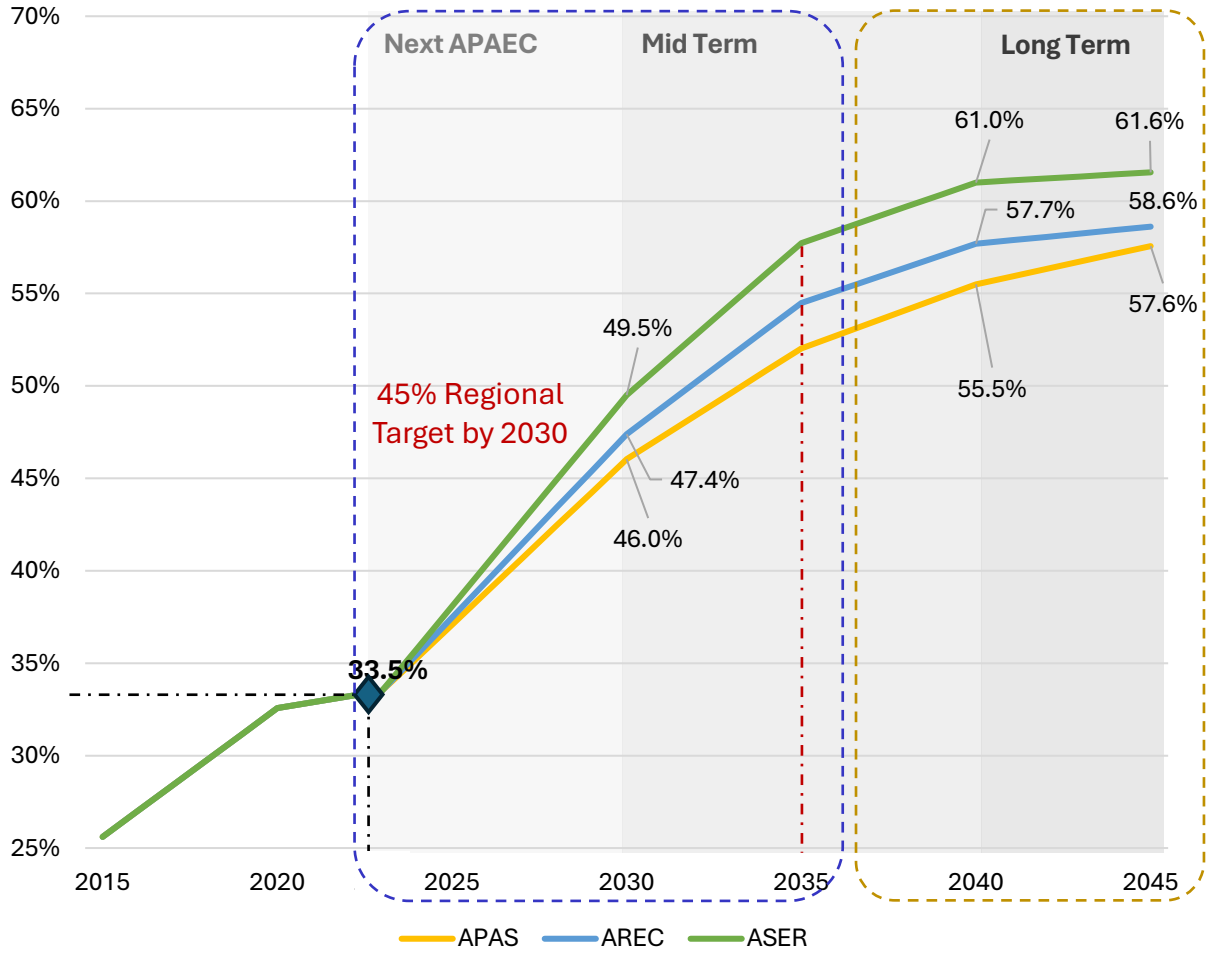
APAEC has adopted the Roadmap's results as its new targets, with the roadmap providing guidance across programme areas to align efforts toward the APAEC targets.

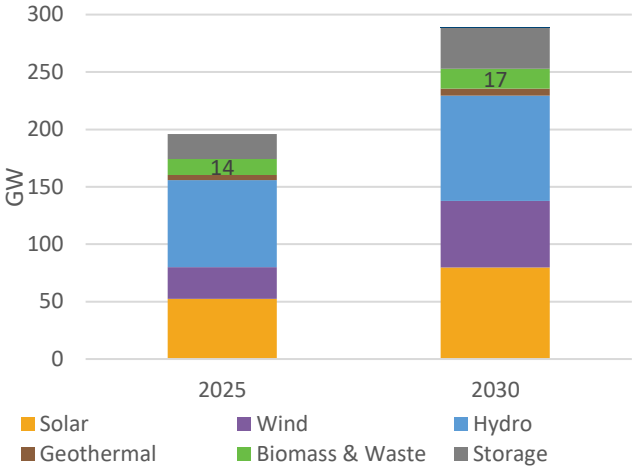
The ASER scenario models ASEAN's deep decarbonisation pathway, *featuring a coordinated multi-sector transition in which* ***intra-ASEAN biofuel trade*** *plays a key role.*



Power sector will play a dominating role in driving ASEAN's energy transition, with capacity surging to 2035; the focus now is on ensuring PDP implementation stays on track.

Renewable Capacity Share across Scenarios (2015-2045)





Reaching 2030 Target

- 45% RE installed capacity by 2030
- APAS - Reflection of PDP
- Depends on **Solar, Wind, and Hydropower**
- **Biomass & Waste** share is around 17 MW by 2030

2025 – 2035

- Member States show strong commitment and readiness to accelerate RE deployment – align with national PDP
- By 2035, most of the near-term gains from straightforward RE deployment are realised.

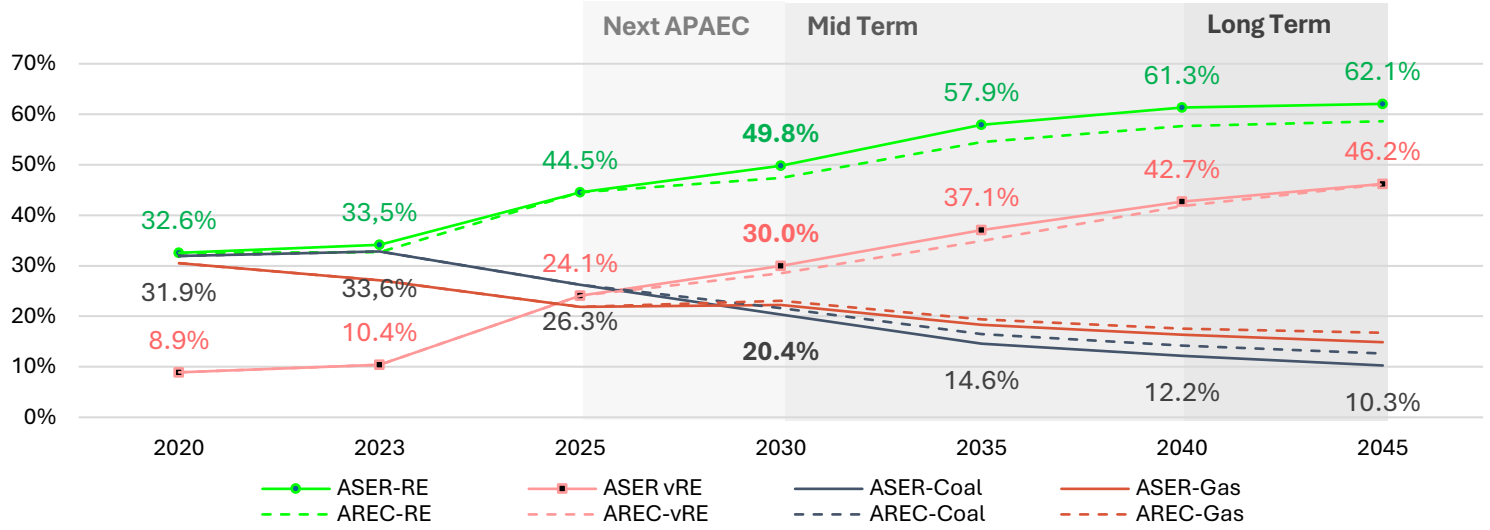
Post 2035

→ The projected flattening of capacity growth signals the onset of deeper integration and system-level challenges.

→ Addressing policy and flexibility gaps becomes critical to sustain momentum.

A critical tipping point emerges around 2030, when total renewable capacity surpasses fossil fuels, marking ASEAN's structural shift toward a cleaner power system.

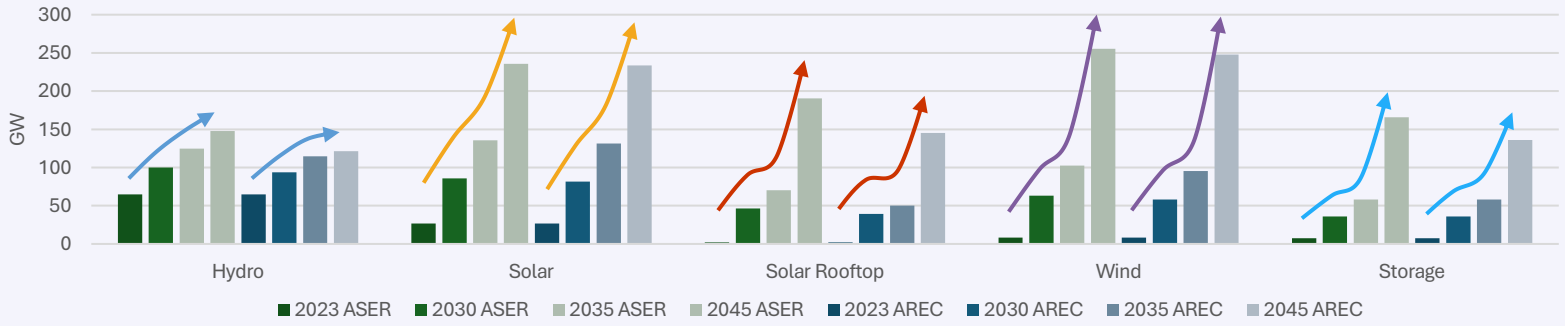
Installed capacity share of renewables, vRE, and fossil fuels (coal and gas) across ASEAN (2020-2045)



Key Tipping Points within APAEC 2026-2030

- ASEAN's power system will undergo a fundamental reoderding during the next APAEC period, with RE and vRE emerging as the dominant sources on the grid.
- vRE overtakes coal to become the single largest source of installed capacity.
- Total renewable capacity surpasses fossil fuels for the first time.
- Redefining coal and gas power plants as the flexible support for RE-oriented power system

*This growth is not driven by one technology alone, but through **simultaneous scaling of multiple clean energy fleets**...*

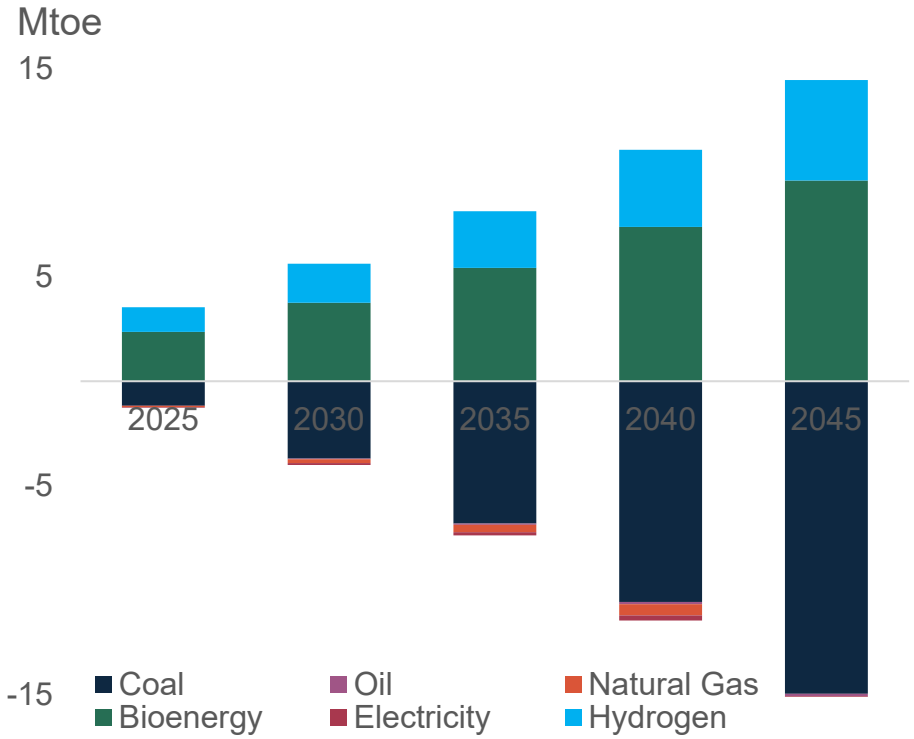


The transition is driven by the simultaneous scale-up of clean energy fleets, with:

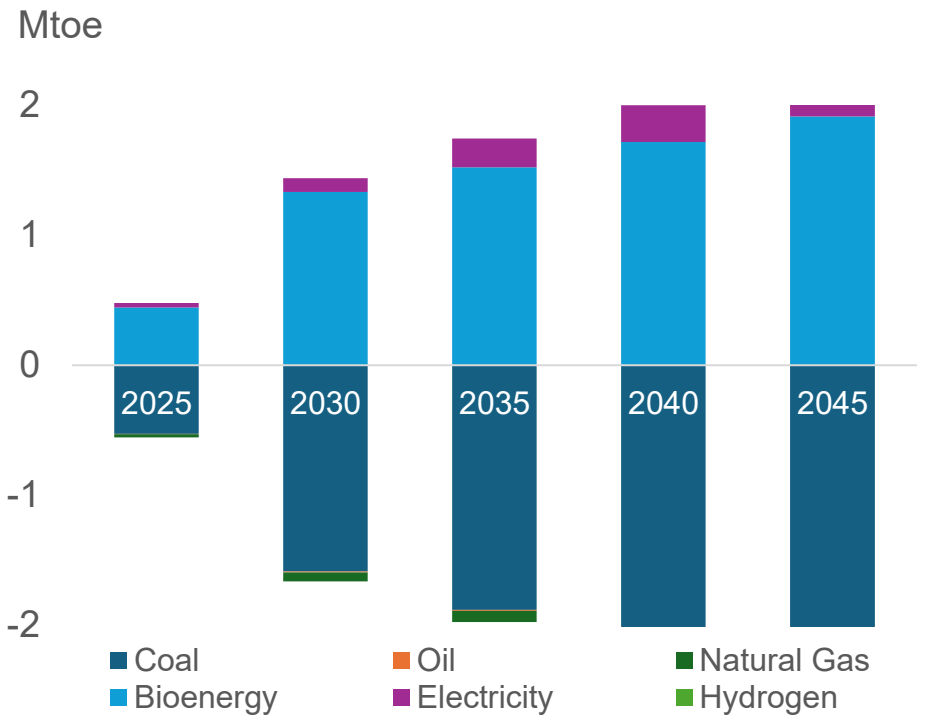
- **hydro (and geothermal)** providing firm capacity;
- **solar and wind** driving rapid decentralisation;
- And **storage** growing in parallel with vRE, confirming its essential role in enabling the power system transition.

High-heat sectors such as iron & steel depend on biomass and hydrogen in the long term, while low-heat sectors like pulp & paper lean more on electrification and bioenergy

Fuel Shifting in Iron & Steel Industry Demand
ASER vs. APAS



Fuel Shifting in Pulp & Paper Industry Demand
ASER vs. APAS



High heat (Cement, Steel, & Ceramics) fuel shifting to Hydrogen/ CCUS/ Biomass

Efficiency improvement is not enough, electrification solution is still long-term

Low heat (Pulp & Paper) switching to Electrification and Bioenergy

Low-hanging technologies: industrial heat pumps & electric boilers

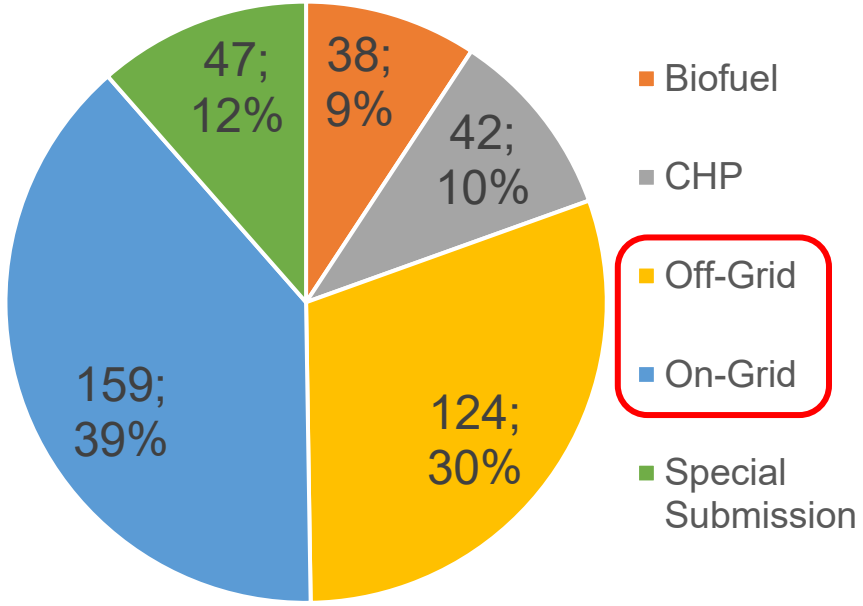
Reflections from the ASEAN Renewable Energy Awards

Status Quo of Biomass-Project Development

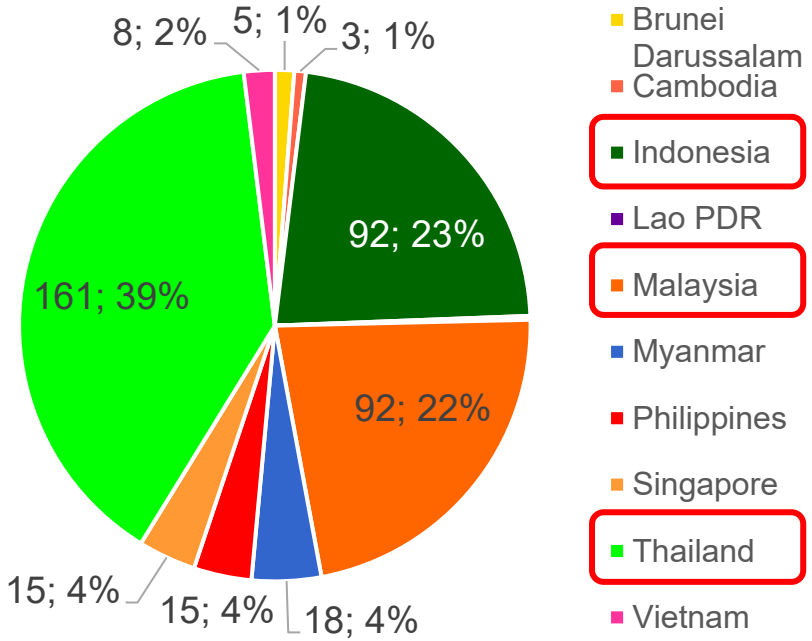
ASEAN Renewable Energy Awards Submission Trends

Awards' Database provides Project-Level Financial Intelligence from **Indonesia, Malaysia, and Thailand**, on **Utility-scale Power Projects, Decentralised RE, and Biofuel**

Total Submissions (2010-2025) = 410



Submissions (2010-2025) by Category

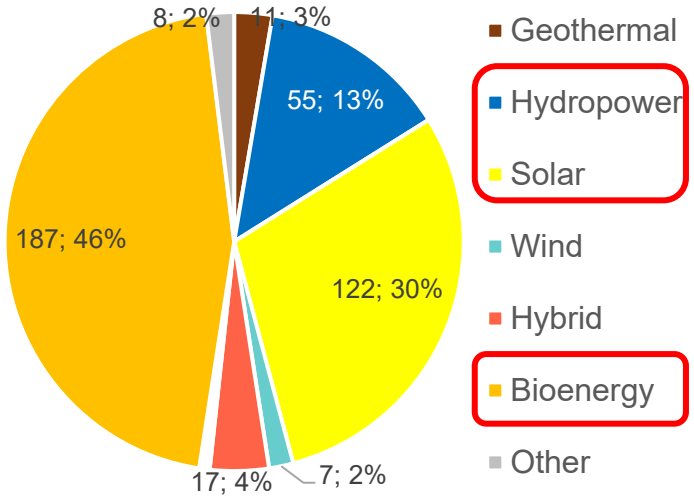


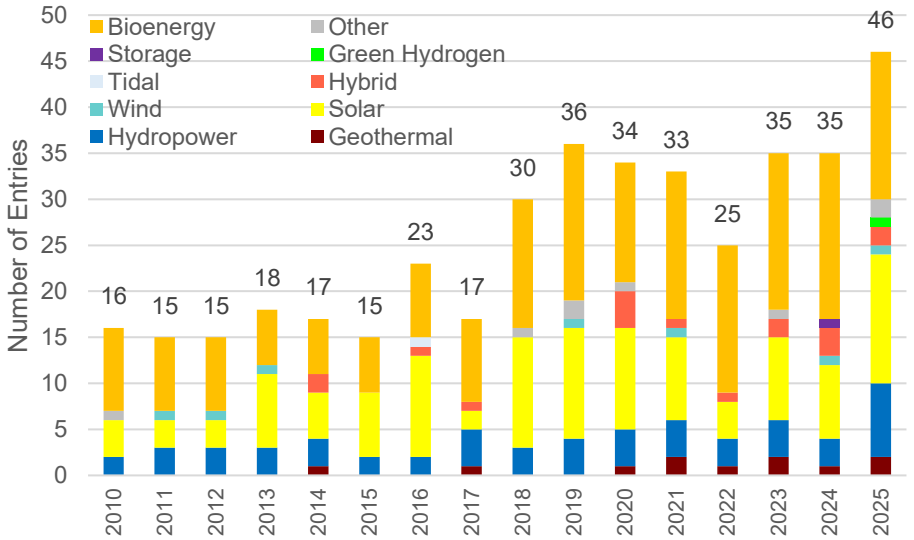
Submissions (2010-2025) by Country

1. **On-grid (39%)** provides rich pool of ***utility-scale and grid-connected*** RE's financial metrics (IRR, ROI, CAPEX)
2. **Off-grid (30%)** ***unique insights*** align with RE LTRM insight to ***increase rooftop solar by 27x*** fdsa
3. **CHP (10%) and Biofuel (9%)** offer critical data on ***feedstock, thermal efficiency, and industrial cost structures***

Deep-dive on Awards' Database

410 Entries provides **Reliable CAPEX and ROI Metrics** (and more) for Core ASEAN RE Assets such as **Bioenergy, Solar, and Hydropower**





1. ***Bioenergy, Solar, and Hydropower*** are the top three technologies captured in the Awards' Database

2. ***Hybrid, Geothermal, Wind, Storage, and Green Hydrogen*** represents the growing diversification and innovation with ***38 submissions***

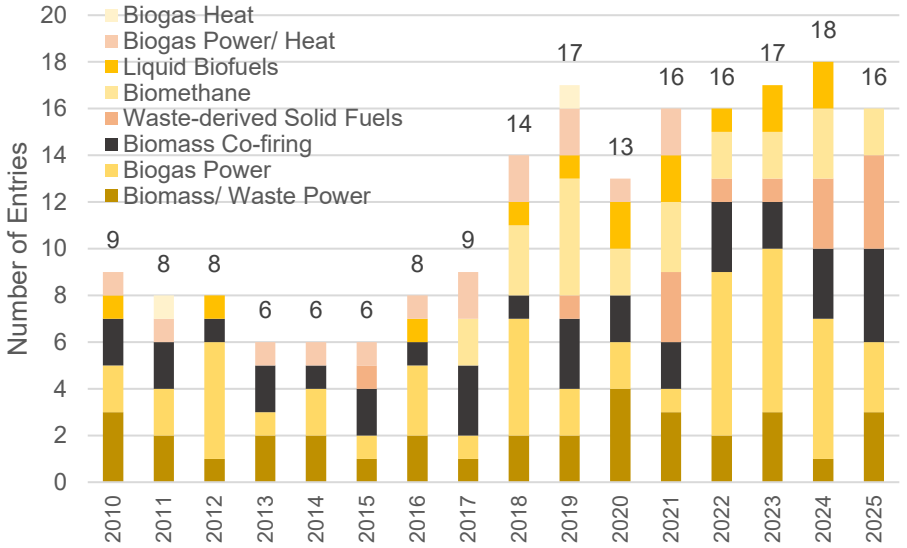
Trends over the years

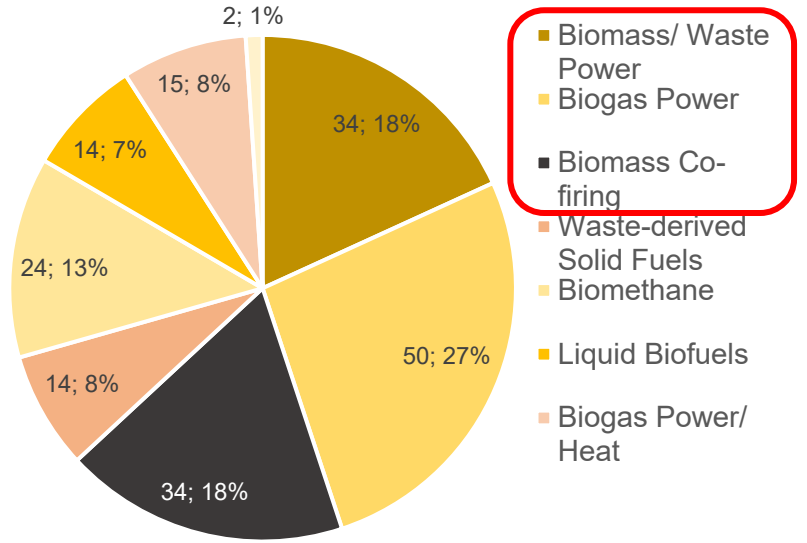
- ✓ ***Bioenergy submissions*** is consistently strong over the years → ***rich pool of different bioenergy technology***
- ✓ ***Solar*** is the primary driver of submissions ***after 2018***, including the richer business model pool under ***Hybrid category***
- ✓ ***Hydropower*** maintains a steady presence, offering ***long term CAPEX and ROI data*** (***including Geothermal*** with noticeable increase in 2023 – 2025)

Further Deep Dive on Bioenergy-related Submissions

Diverse portfolio confirms **High-Value Financial Insights** for **waste management, blending mandates, and industrial heat**

1. ***Biogas Power, Biomass/ Waste Power, and Biomass Co-firing*** are the top three also represents 66% of 187 entries (bioenergy)
2. Biogas: ***liquid waste streams (POME, industrial wastewater)***
3. Biomass: ***rice husk, bagasse and other variant feedstocks***





Trends over the years

- ✓ ***Biomethane and Liquid Biofuels*** submissions grow after 2017 → insights on ***national blending ratios*** and ***who are the off-takers***
- ✓ ***Biomass co-firing*** entries are consistent with average 2-3 submissions annually → ***true cost of transition for incumbent utilities***
- ✓ ***Waste-derived Solid Fuels*** increase significantly since 2021 → growing focus on ***circular economy*** and ***waste-to-energy*** technology development and finance ability

Overview of Biomass-related Projects in Awards (2025 & 2024)

Negeri Sembilan

2025 Special Submission Winner

Cenviro Scheduled Waste to Energy

Commission: 27 January 2018

Waste type: mixture of MSW, ISW, Medical, including solid, sludge, liquids

Technology: Hybrid combustion (rotary kiln + stoker) with Rankine Cycle steam turbine

Waste Operational Capacity: 100 tonnes per day

Surat Thani

2024 On Grid – National Winner

Bangsawan Green Biopower

Commission: 20 March 2018

Waste type: Agricultural residues (para rubber wood residue & palm oil residue)

Technology: Direct combustion using Multi-fuel step grate boiler & steam turbine

Waste Operational Capacity: 75,7 ktons per year or 10,4 tons per hour

Palembang

2025 Special Submission Winner

Comestoarra Community-based WtE

Commission: 2 November 2020

Waste type: MSW (Organic & Biomass), specifically organic waste (dry leaves, twigs, wood)

Technology: Fixed Bed Downdraft Gasification (Syngas to Power)

Waste Operational Capacity: 50-100 kg/ hour (~ 1.2 – 2.4 tons/day)

Duri, Riau

2025 Combined Heat Power Winner

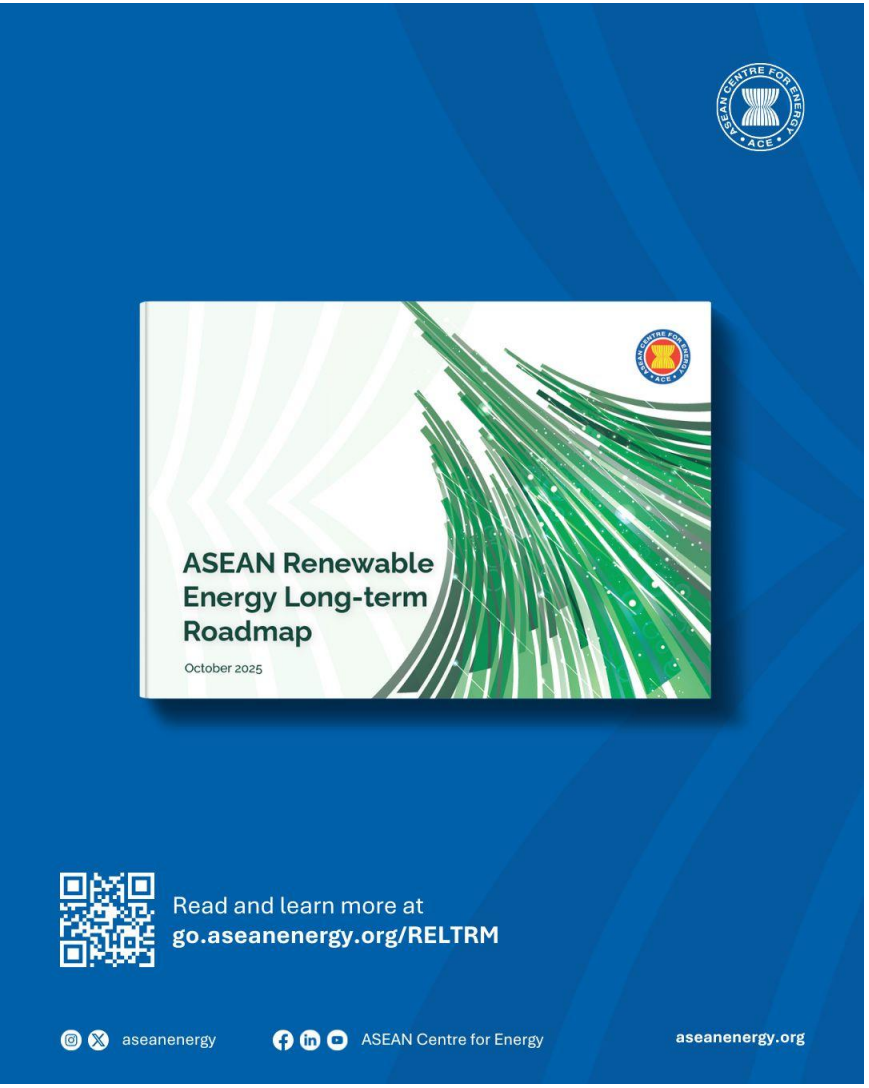
Pelita Agung Biomass Power Generation

Commission: 2007

Waste type: Palm Kernel Shell and Fiber (Solid waste from Palm Oil Mill)

Technology: Biomass CHP – Steam Boiler & Turbine

Waste Operational Capacity: 91.2 ktons per year



The ASEAN Renewable Energy Long-term Roadmap (RE LTRM) has officially been endorsed at the 43rd ASEAN Ministers on Energy Meeting (AMEM) on 16 October 2025 in Kuala Lumpur, Malaysia. To read more, please visit *go.aseanenergy.org/RELTRM*

The Biofuel Market Potential for Regional Cooperation in ASEAN, developed by ACE in collaboration with ERIA, explores how regional cooperation can unlock ASEAN's biofuel market.

The study serves as a key foundation for future initiatives, including the ASEAN RE Long-term Roadmap, and recommends establishing an ASEAN Biofuel Taskforce to harmonise standards and create a shared sustainability certification framework.

Read more through:
https://www.eria.org/research/biofuel-market-potential-for-regional-cooperation-in-asean

Thank you.

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