



Scene Setting Presentation: Scenarios of Energy Transformation: Case of Southeast Asia

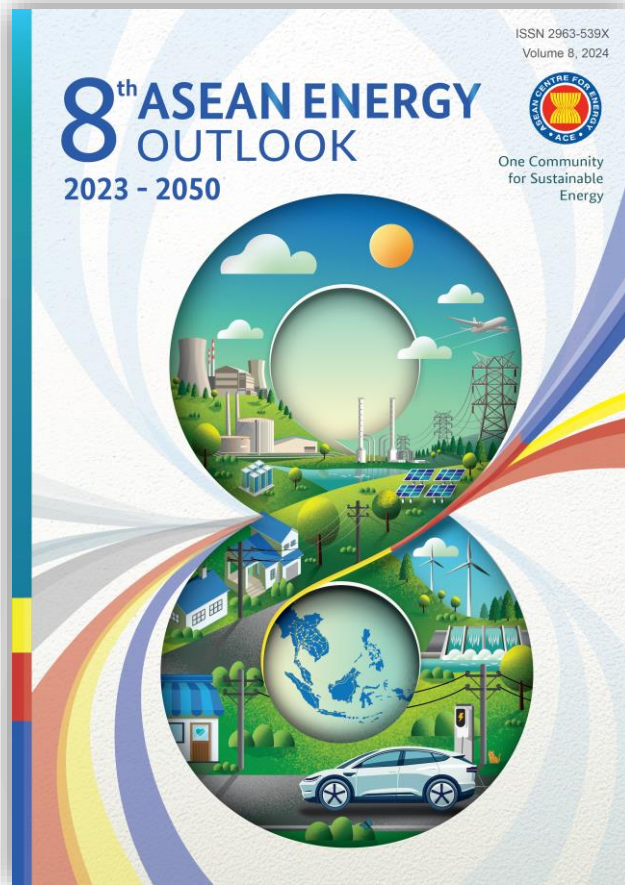
**Key findings of
the 8th ASEAN Energy Outlook (AEO8)**

Decarbonising Asia: Energy Transformation

SIEW Thinktank Roundtables
Singapore, 25 October 2024

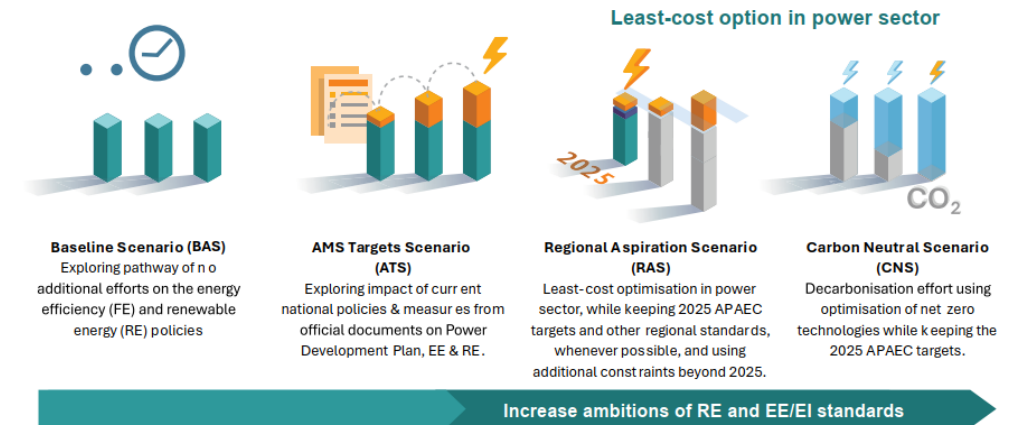


8th ASEAN Energy Outlook



- This 8th edition presents a comprehensive analysis of the current state of ASEAN's energy landscape and offers projections for several plausible future scenarios, namely: the **Baseline Scenario (BAS)**, the **AMS Target Scenario (ATS)**, the **Regional Aspiration Scenario (RAS)** and the **Carbon Neutrality Scenario (CNS)**.

Historical data from 2005 – 2022 are projected out to 2023 – 2050 in four scenarios.



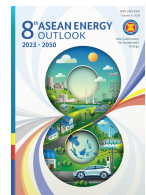
- The AEO8 serves a critical reference, gearing up towards the final year of **ASEAN Plan of Action for Energy Cooperation (APAEC) 2016-2025** Phase II (2021-2025), guiding the development of the new phase of APAEC 2026-2030, and monitoring the region's energy ambitions.



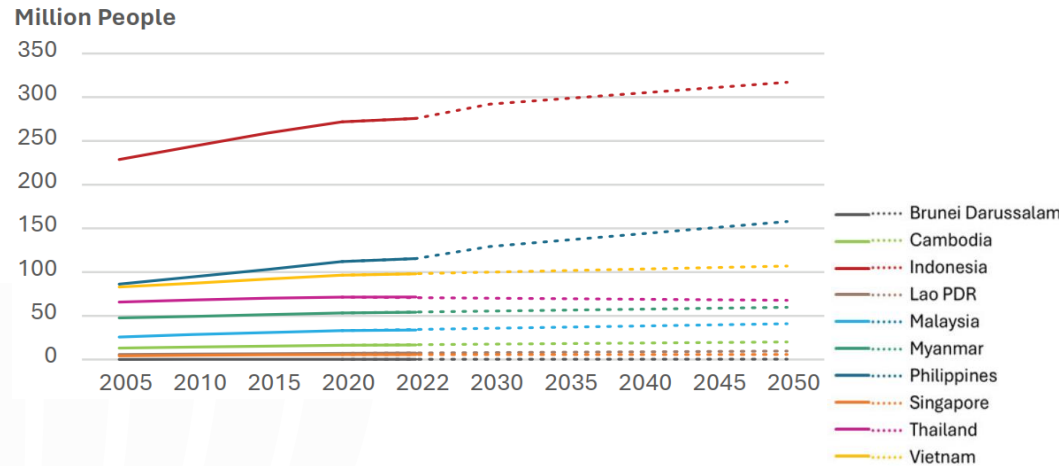
AEO8 is poised to serve not only as a guiding compass but also as a catalyst for the formulation of visionary regional targets and driving strategic energy policy development for the APAEC 2026-2030 and also for a coming transformative decade.



The Driving Factors of ASEAN Energy Consumption

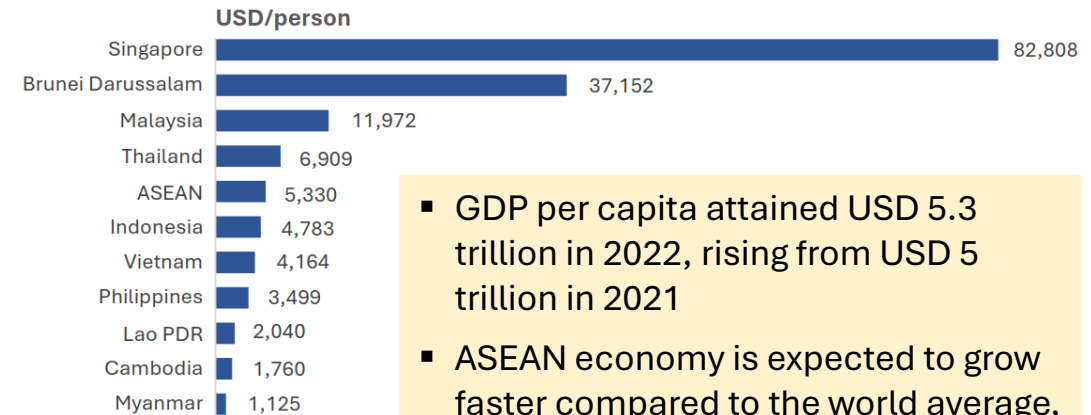


Population of ASEAN Member States, 2005-2050



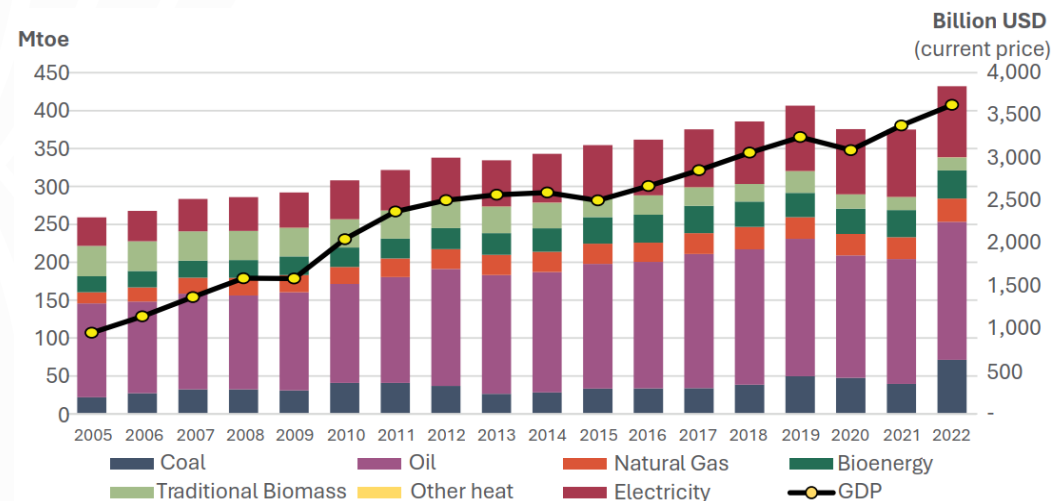
Total ASEAN population increased 1.2 times in 2022 compared to 2005 level.

AMS' GDP per Capita in 2022



- GDP per capita attained USD 5.3 trillion in 2022, rising from USD 5 trillion in 2021
- ASEAN economy is expected to grow faster compared to the world average, with an expected average growth rate of 4% between 2023 and 2050.

Energy Demand by Fuel and GDP in ASEAN, 2005-2022



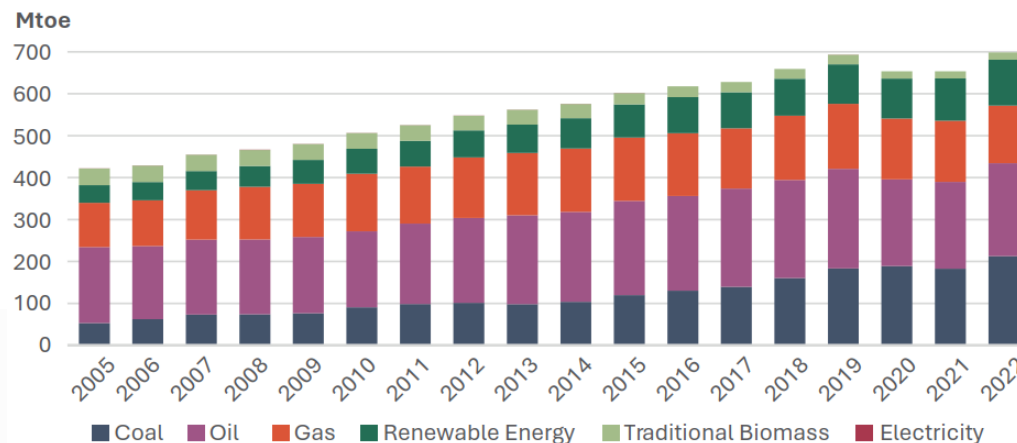
- After the plunges in ASEAN energy consumption by 7.6% in 2020 and 0.2% in 2021, 2022 recorded a significant increase in energy demand by 15.2%, returning the value to above the pre-pandemic level.
- The growth of energy consumption in 2022 is 67% from 2005 level. This surging growth in demand was caused by the impacts of positive GDP growth in 2022.

Safeguarding Energy Security and Resilience



Entering the post-pandemic era, ASEAN's TPES gradually increased in just over two years, with rising dependency on oil imports.

ASEAN Total Primary Energy Supply by Fuel, 2005-2022



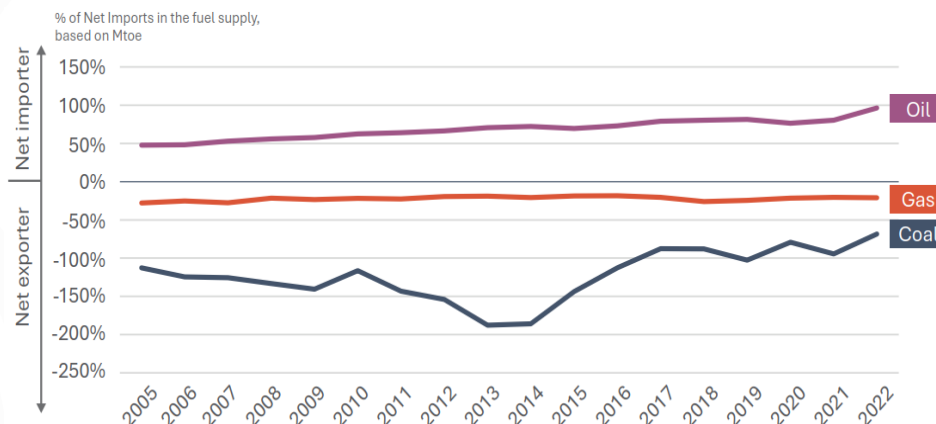
Note: Renewable Energy includes hydro, geothermal, biomass, solar, wind, tidal and wave, excluding traditional biomass used by households.

- ❑ ASEAN's total primary energy supply (TPES) demonstrated a strong recovery in 2022, closely mirroring the growth observed in TFEC.
- ❑ However, this recovery **remains heavily reliant on fossil fuels**, with coal experiencing a particularly significant increase of 16.5%, as compared to 2021 levels. Coal dominated the region's energy mix, accounting for 31.5% in 2022.

ASEAN Energy Export-Import Status Quo

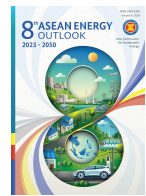
Net-importer of oil since before 2005
ASEAN is a net exporter of coal and gas of global trade

ASEAN Fossil Fuel Dependency, 2005-2022



- ❑ Oil emerged as the dominant imported energy source in ASEAN. Several AMS had experienced a decline in oil production, Consequently, the AMS had increasingly turned to oil imports to bridge the gap, with an annual growth rate of 16%.
- ❑ The ASEAN region is a net exporter of coal, reaching 68% of net export in 2022. Coal export patterns varied sharply several times throughout the historical examined years.
- ❑ The net export of natural gas is much more stable than coal. The annual variations of growth or decline were relatively low, but the 2005 number (28%) decreased to 21% by 2022.

Achieving Carbon Neutrality



AMS Net Zero and NDC Targets in Mitigating Greenhouse Gas Emissions

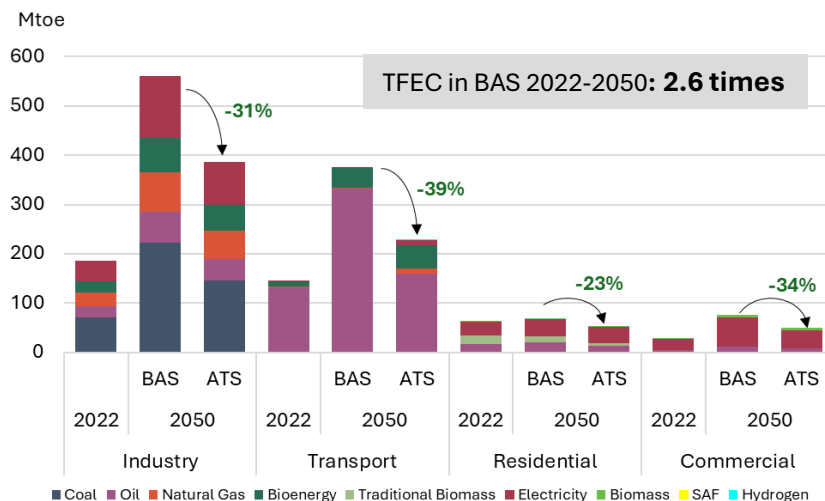
Country	Net Zero/Carbon Neutrality Target	NDC Target (Reduction of GHG Emission)	
		Unconditional	Conditional
Brunei Darussalam	Net Zero by 2050	-20% from 2030 Business-as-Usual (BAU) scenario	-
Cambodia	Net Zero and Carbon Neutrality by 2050	-	-41.7% from 2030 BAU scenario
Indonesia	Net Zero by 2060 or sooner	-31.89% from 2030 BAU scenario	-43.20% from 2030 BAU scenario
Lao PDR	Net Zero by 2050, conditionally	-60% from 2030 BAU scenario	-45.69 MtCO ₂ -eq/yr in 2030-2030
Malaysia	Net Zero by 2050	-45% of carbon intensity from 2005 levels	-
Myanmar	Net Zero from forestry and other land use by 2040	-244.52 MtCO ₂ -eq (sectoral targets)	-414.75 MtCO ₂ -eq (sectoral targets)
Philippines	No specific target	-2.71% from 2020 to 2030 cumulative BAU scenario	-75% from 2020 to 2030 cumulative BAU scenario
Singapore	Net Zero by 2050	Peak absolute emissions at 65 MtCO ₂ -eq	-
Thailand	Carbon Neutrality by 2050; Net Zero by 2065	-30% from 2030 BAU scenario	-40% from 2030 BAU scenario
Vietnam	Net Zero by 2050	-15.8% from 2030 BAU scenario	-43.5% from 2030 BAU scenario

- ❑ ASEAN, as one of the region's most vulnerable to the impacts of climate change, is actively working to contribute to global commitments which required to develop and implement Nationally Determined Contributions (NDCs).
- ❑ The **energy and climate sectors are inextricably linked** and mutually dependent and integrating this energy-climate nexus is vital for **enhancing long-term energy security, affordability, accessibility, and sustainability**.
- ❑ Integrating energy and climate efforts will further support national and regional renewable energy policies, helping **ASEAN to move toward low-carbon economies and achieve carbon neutrality**.
- ❑ The data indicates that 77% of GHG emissions in ASEAN are primarily generated from the energy, industrial processes, and land use, including land-use change and forestry. With **the energy sector being the largest contributor to CO₂ emissions**.
- ❑ Achieving carbon neutrality and environmental sustainability in ASEAN **requires a comprehensive approach that integrates socio-economic, technological, and governance strategies**.

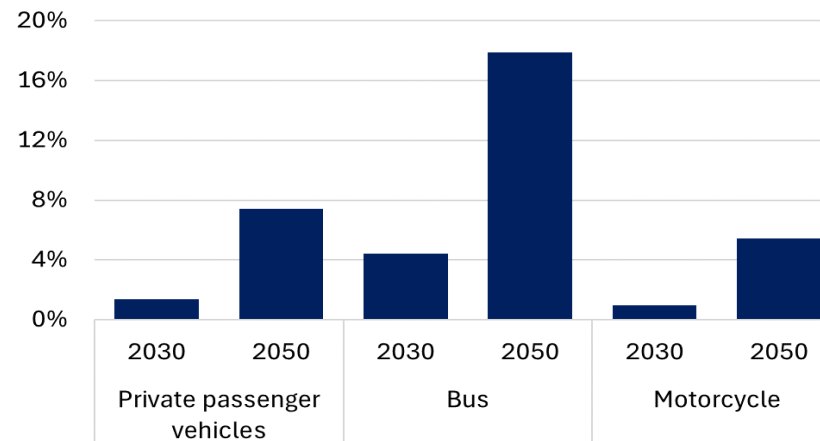
Charting Multiple Pathways - ASEAN Energy Demand



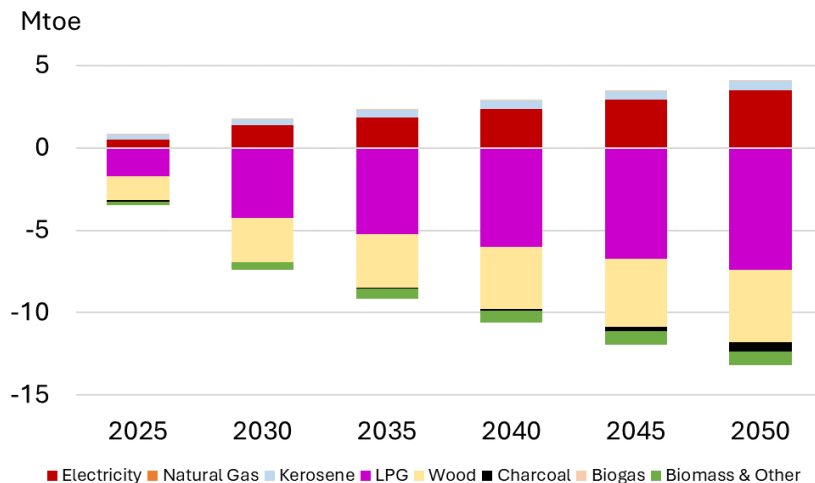
Final Energy Demand in 2050



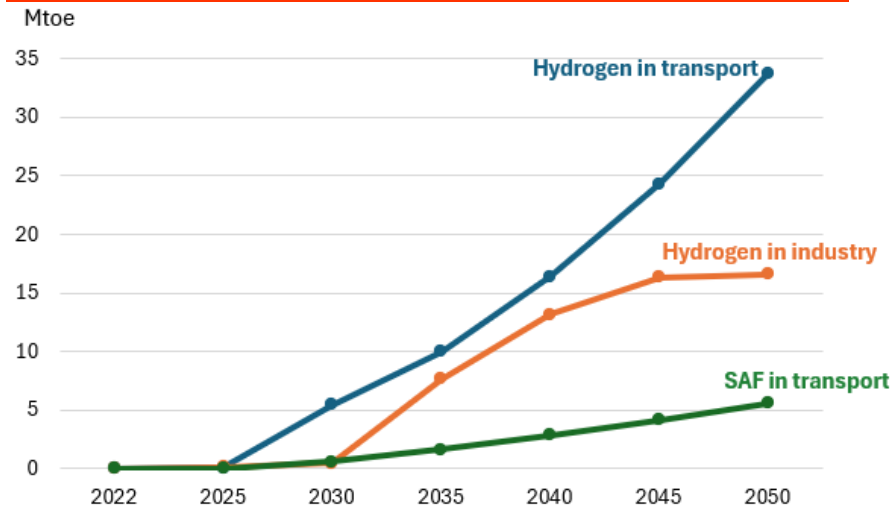
EV Penetration in Road Transport, ATS



Fuel Shift in Residential (Clean cooking), ATS



Emerging Technologies in Demand, CNS



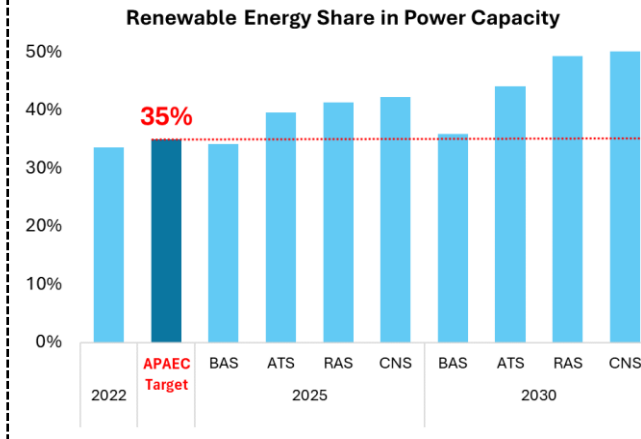
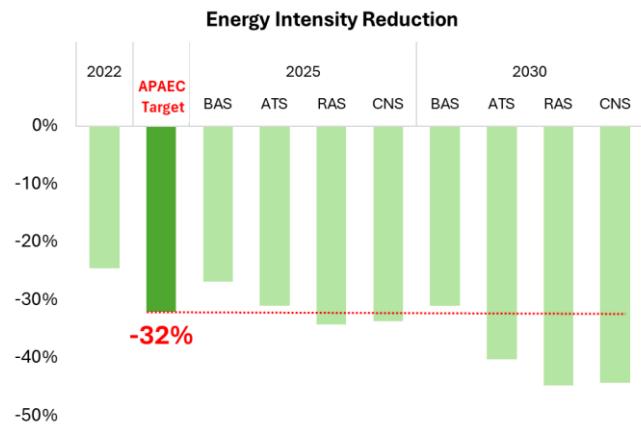
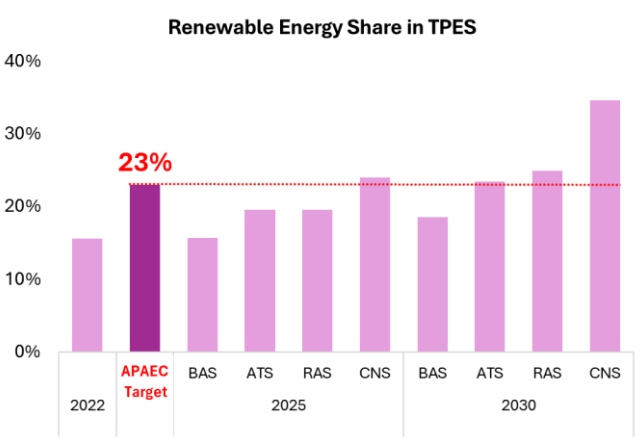
- Energy demand in 2050 is **2.6 times** higher than 2022 (BAS)
- Industry** and **Transport** are the highest energy-consuming sectors, dominated by **coal and oil**
- Potential reductions of 33% (ATS) are driven by **efficient appliances and fuel economy**
- The need for **fuel shifting** to cleaner energy sources like **electricity, bioenergy, and hydrogen**.
- In road transport, **buses** leading the **EV penetration** in road transport (ATS)
- In residential, phase out of **traditional biomass** (wood and charcoal) and LPG to **electricity** by 2050 (ATS)
- Hydrogen in transport** grows exponentially

Notes: BAS = Baseline Scenario; ATS = AMS Targets Scenario; CNS = Carbon Neutrality Scenario

Charting Multiple Pathways - ASEAN Energy Supply



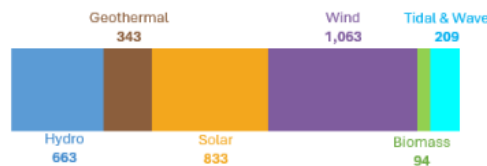
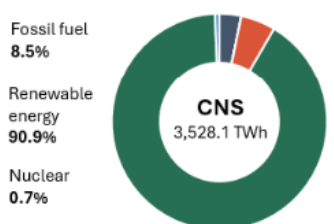
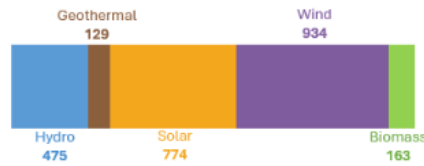
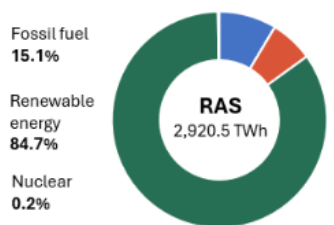
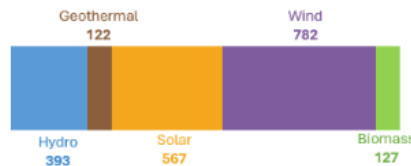
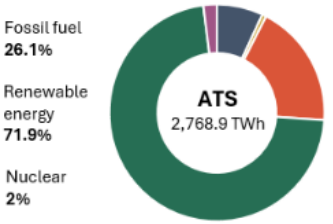
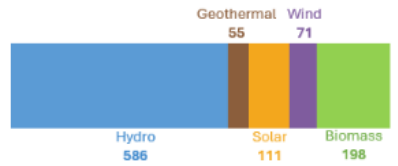
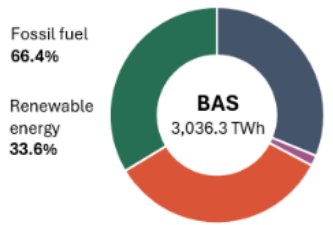
APAEC Targets, 2025 and 2030 Projections



APAEC targets for 2025 are projected to be **met** or **exceeded** under specific scenarios by **2030**, with particularly strong outcomes under ATS, RAS and CNS

Electricity Generation in 2050 Across Scenarios

Electricity generation is **reduced** from Baseline 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 marked **shift** towards **renewable energy** sources under more ambitious scenarios.

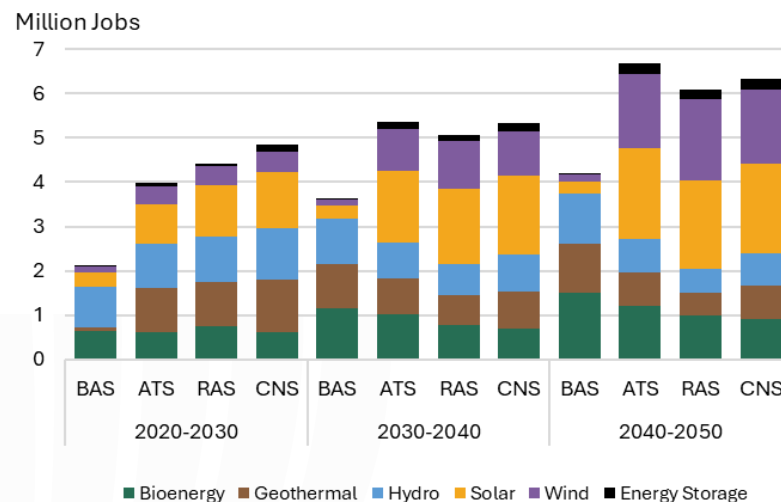


■ Coal ■ Oil ■ Gas ■ Renewable energy

Notes: BAS = Baseline Scenario; ATS = AMS Targets Scenario; RAS = Regional Aspiration Scenario; CNS = Carbon Neutrality Scenario

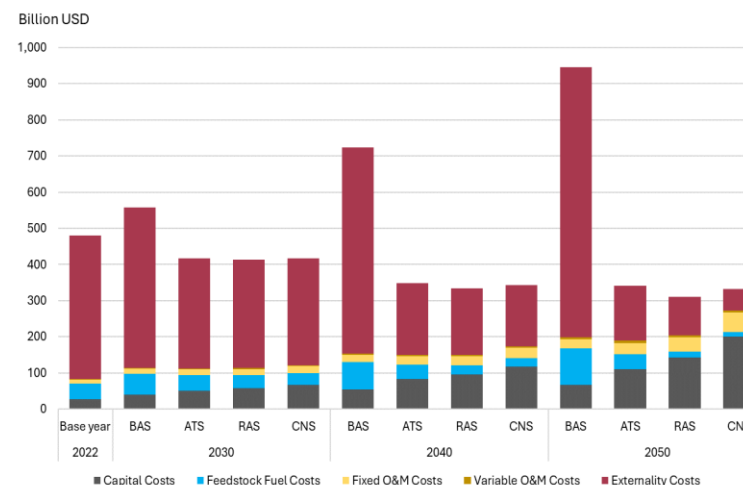
Charting Multiple Pathways - Secondary Analysis

Renewable Energy Employment



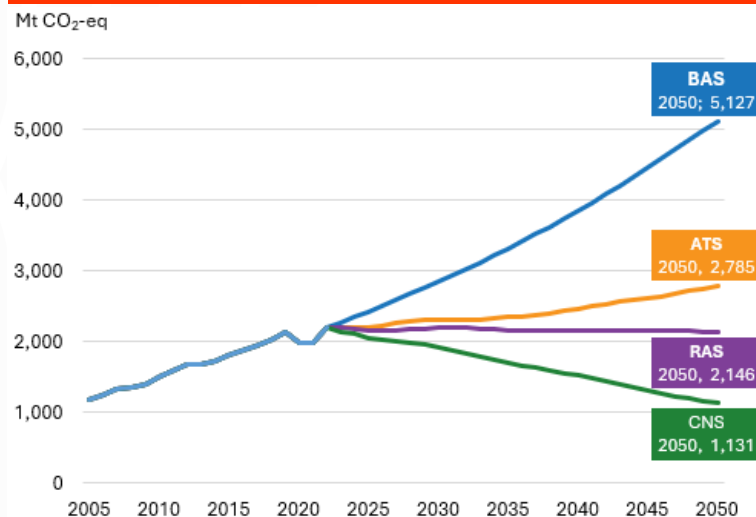
- ❑ CNS projects to create over **6 million new RE jobs 2040-2050**
- ❑ Over **3.2 million job losses by 2050** due to fossil fuel plant decommissioning (CNS)
- ❑ The need for managing **workforce transitions** through retraining programmes and workers' support

Electricity Production Cost



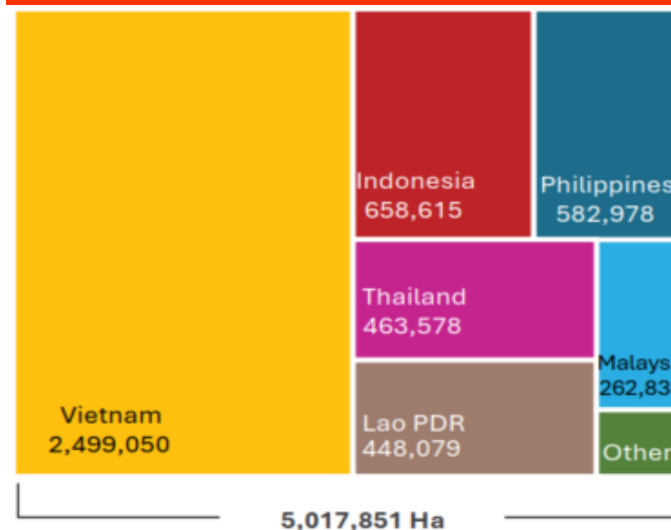
- ❑ **Large investment costs** are required to promote greener and more sustainable technologies
- ❑ As more efficient and cleaner options become available, **externality costs** and fuel costs decrease.

GHG Emissions in All Sectors



- ❑ The **ATS** will cut emissions by **46%** in 2050. Emissions in the **RAS** were further decreased by **23%**.
- ❑ The avoided emissions mostly come from **electricity generation**, due to the shift from fossil fuels to cleaner power sources

Land-use for Solar PV & Wind by 2050, RAS



- ❑ The land required for **VRE** can reach **5 million Ha**, or **1.1% of ASEAN land**, by 2050 (RAS)—mostly in **Vietnam**, followed by **Indonesia** and the **Philippines**.
- ❑ The need for **integrated land-use policies** that balance RE expansion with environmental sustainability.

Policy Recommendation



Maximise energy efficiency

Demand Side

- ❑ **Enhance energy efficiency standards** for buildings, appliances, and industrial processes
- ❑ **Invest in efficient technologies** to lower energy intensity and operational costs
- ❑ **Encourage energy diversification** for long-term decarbonization
- ❑ **Smart demand response** through power sector energy use and RE integration for grid efficiency improvement



Ensure energy diversification and security

Supply Side

- ❑ **Renewable energy sources diversification** for greater energy security
- ❑ **Modernise electrical grids** for handling renewable inputs and improving grid reliability
- ❑ **Balance clean energy with security** for a secure energy shift (natural gas and CCS utilisation)
- ❑ **Ensure community inclusion** in renewable energy projects
- ❑ **Expand rural electrification efforts** to ensure equitable access to energy
- ❑ **Implement carbon pricing strategies** to accelerate decarbonisation

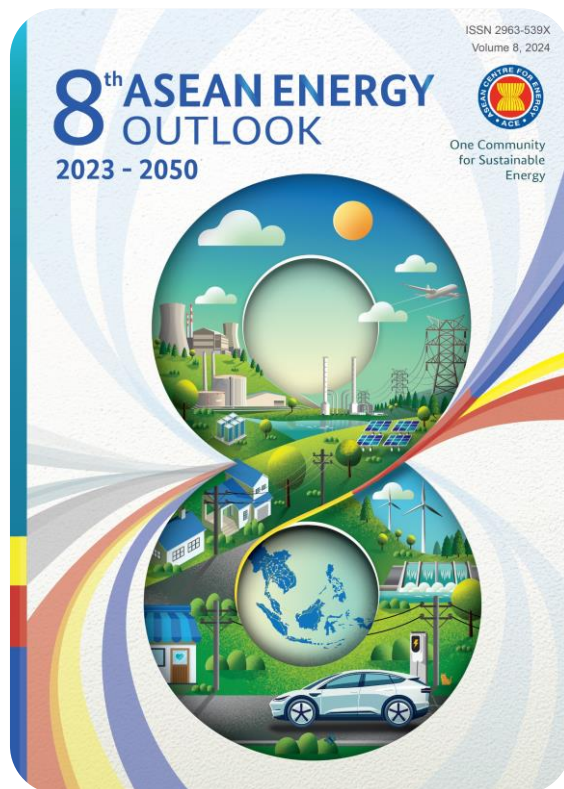


Promote multistakeholder collaboration

Regional Cooperation

- ❑ **Promote interconnectivity**, including ASEAN Power Grid and cross-border gas pipelines for energy flexibility
- ❑ **Develop supportive policies**, including clean energy investment incentives while ensuring energy security and affordability
- ❑ **Foster international cooperation** to accelerate the transition
- ❑ **Engage with various stakeholders** to ensure broad support and address concerns





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