ACE at SIEW Think Tank Roundtable 2022

Charting Energy Security and Resiliency in ASEAN

Presented by:
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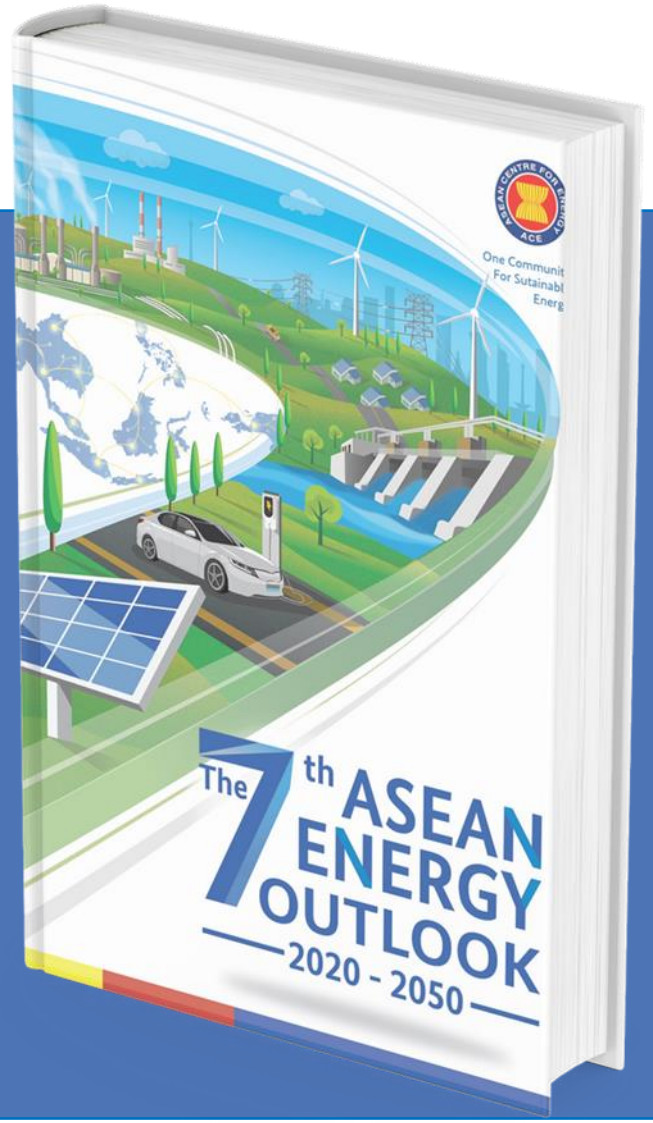
on behalf of AEO7 Team



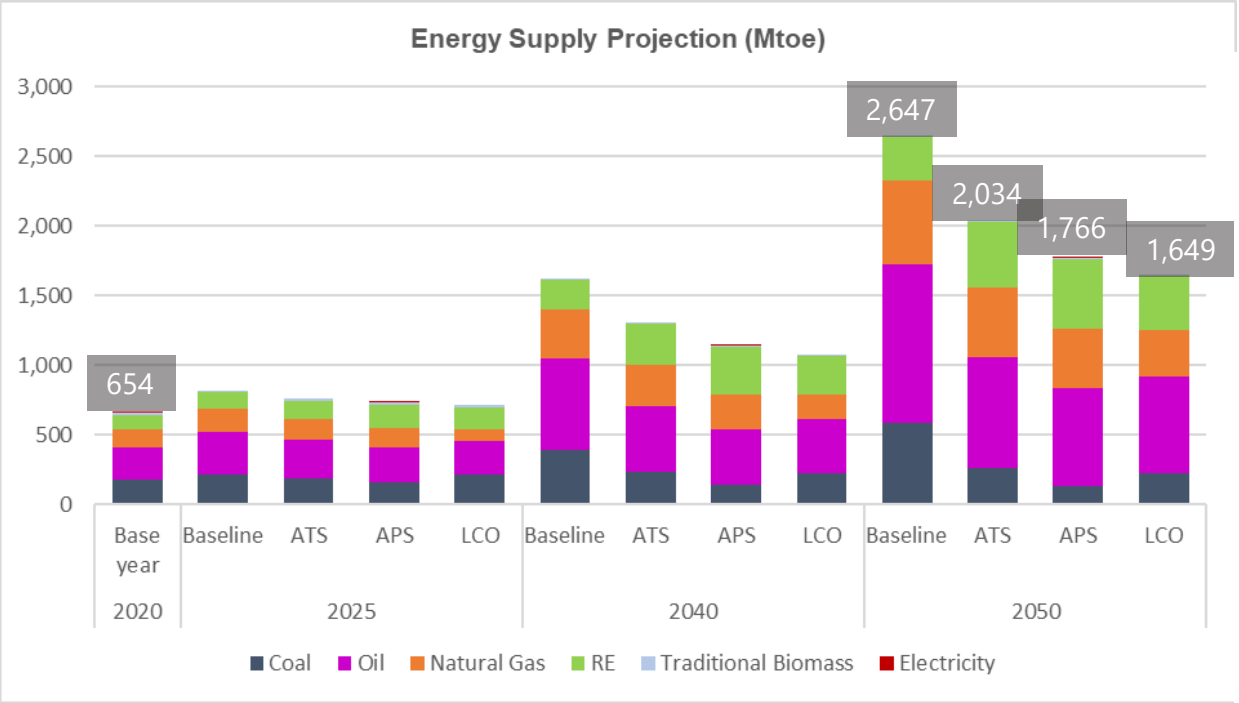
The 7th ASEAN Energy Outlook (AEO7)

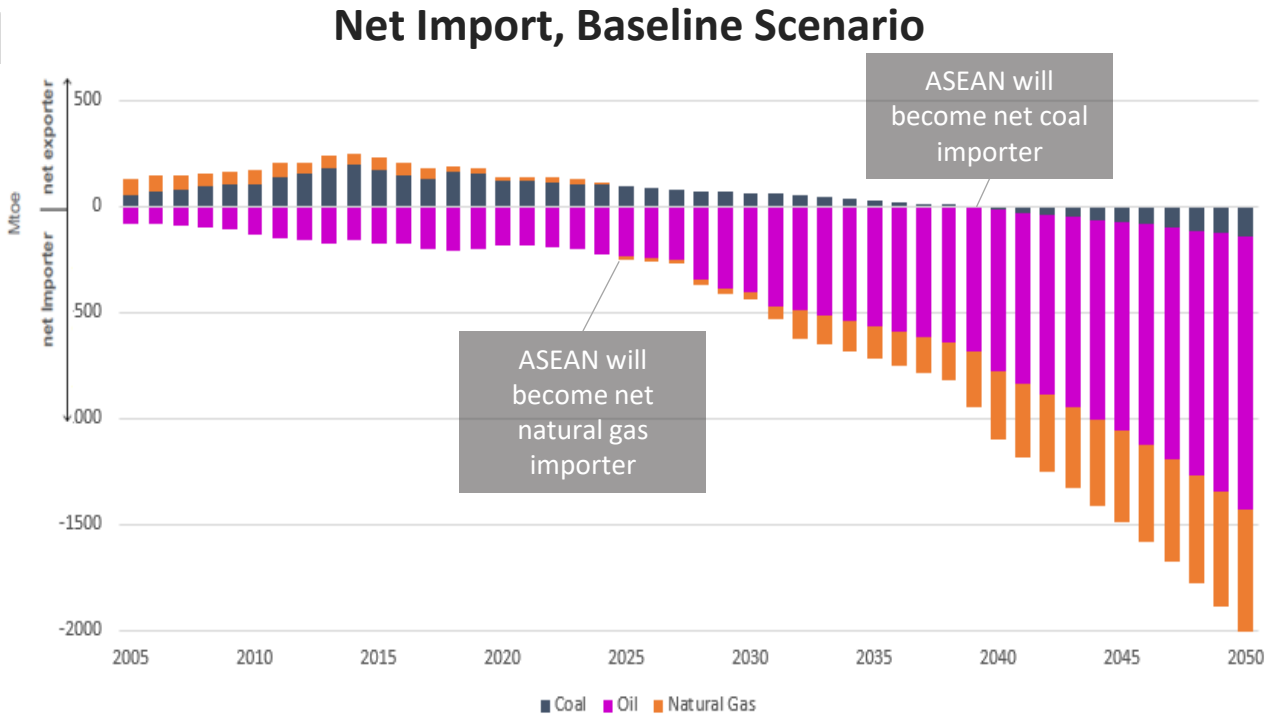
Least Cost Optimisation [LCO] Scenario	**Least-cost optimisation** using technology-neutral approach — Introducing optimisation to AEO from all viable technologies in **power sector**, while keeping the **APAEC target**.
APAEC Target Scenario [APS]	Efforts to meet **2025 APAEC Targets** — Exploring measures required to reach regional RE & EE targets, expanding from national targets, based on ASEAN Member States (**AMS) inputs**.
AMS Target Scenario [ATS]	Achievement of **existing AMS policies and targets** — Exploring impact of existing national policies and measures from **official documents** especially on RE, EE, and PDP.
Baseline Scenario	**Historical achievement** excluding any policy interventions — Exploring pathway of **no additional efforts on the RE and EE policies**.

- ❑ Covering 2021-2050 projection period
- ❑ Launched in 40th ASEAN Ministers on Energy Meeting in Cambodia
- ❑ APAEC = ASEAN Plan of Action for Energy Cooperation

Supported by: Implemented by Technical Support:

Pathways of ASEAN energy system and energy security

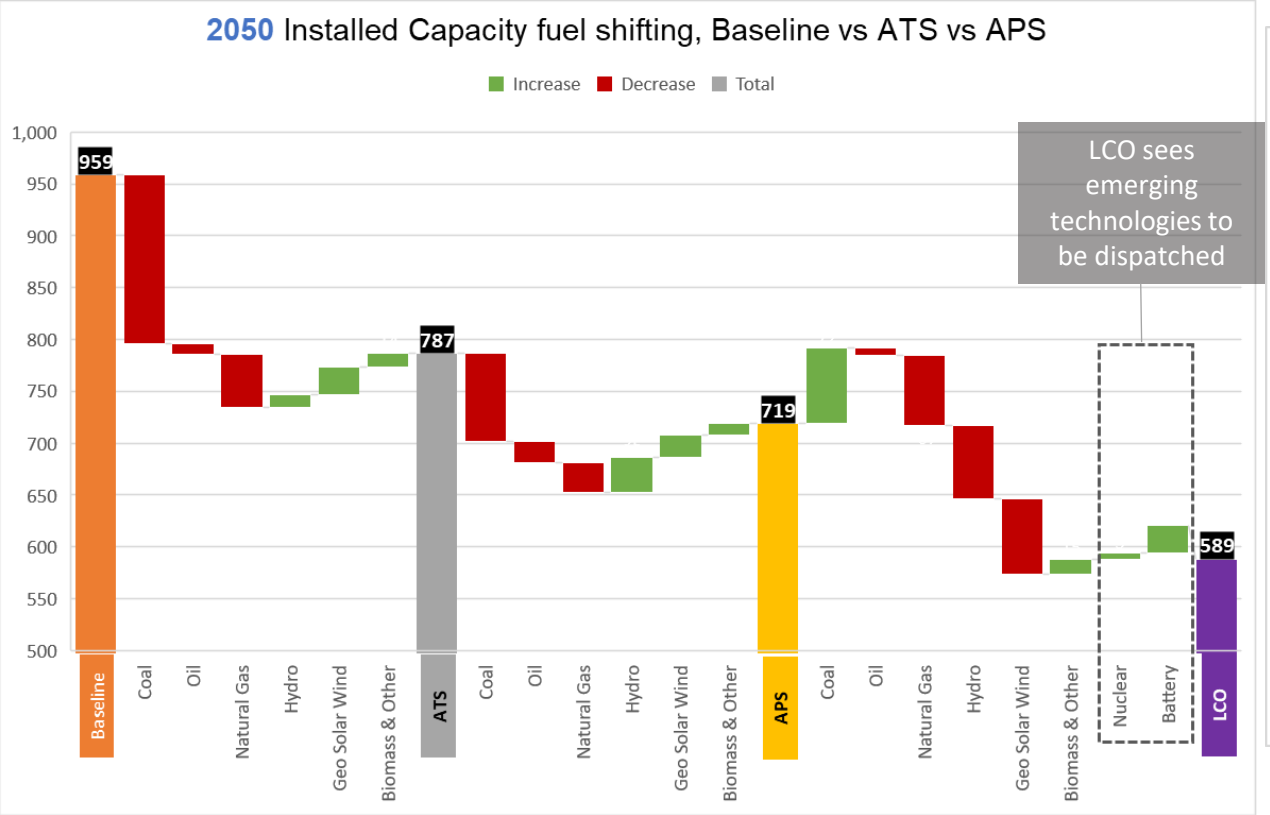


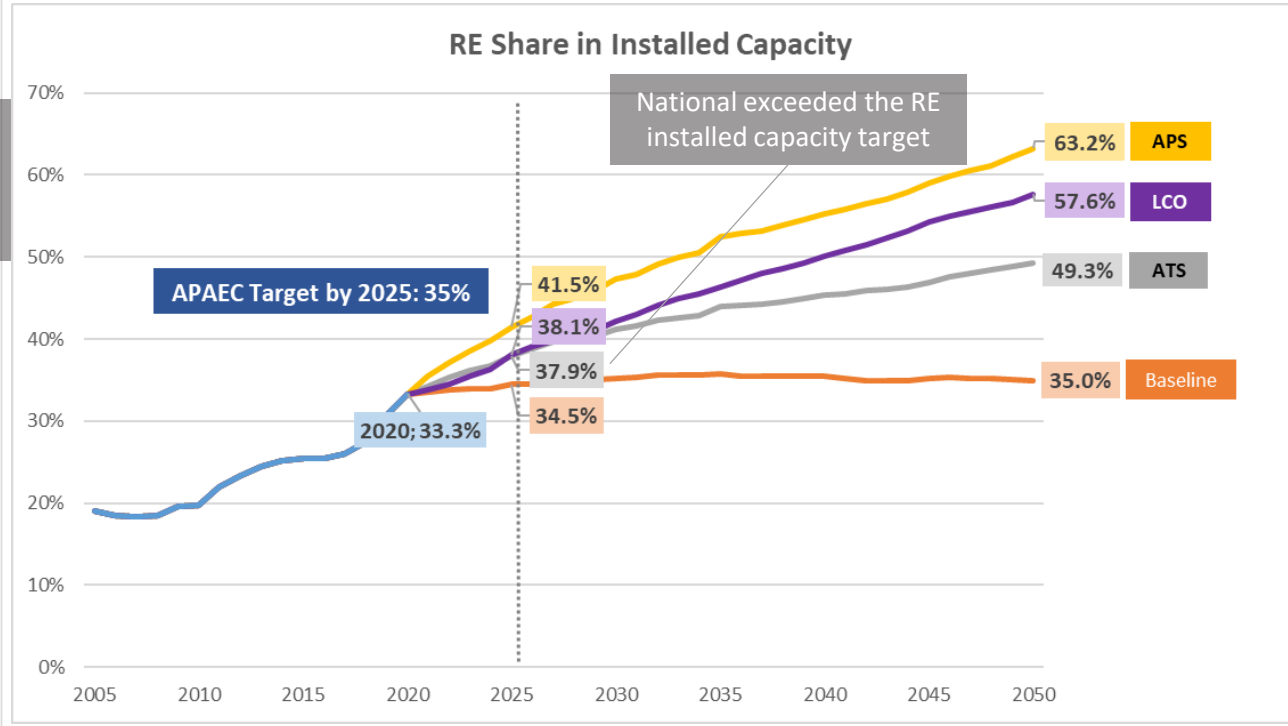


- Baseline Scenario projected a 4x of energy required to fuel the economic growth from 2020 to 2050. Energy efficiency measures reduce the need of energy to 3x and 2.7x in ATS and APS.
- LCO Scenario reduces the demand further to 2.5x of 2020.
- In all scenarios, fossil fuels remain the largest component.

- In Baseline Scenario, without significant discoveries and/or additions to existing production infrastructures, and with continuous utilisation of fossil fuels, ASEAN would become net importer of natural gas and coal starting from 2025 and 2039, respectively.
- Previously, AEO6 projected the years to be 2024 and 2035.

The evolving electricity generation system – capacity





- As the needs of installed capacity decrease due to energy efficiency, clean energy penetrates the power system.
- Even with the same level of electricity need in APS, lower installed capacity is required in LCO Scenario. Coal, bioenergy, & nuclear replaces natural gas, hydro, solar & wind with battery penetration.

- In term of installed capacity, continuing national efforts would lead to the achievement of regional target, 37.9% of RE.
- In APS, 41.5% share can be achieved in 2025
- In the long term, a maximum of 63.2% RE share can be achieved in 2050. The LCO Scenario is set to maintain the regional targets.

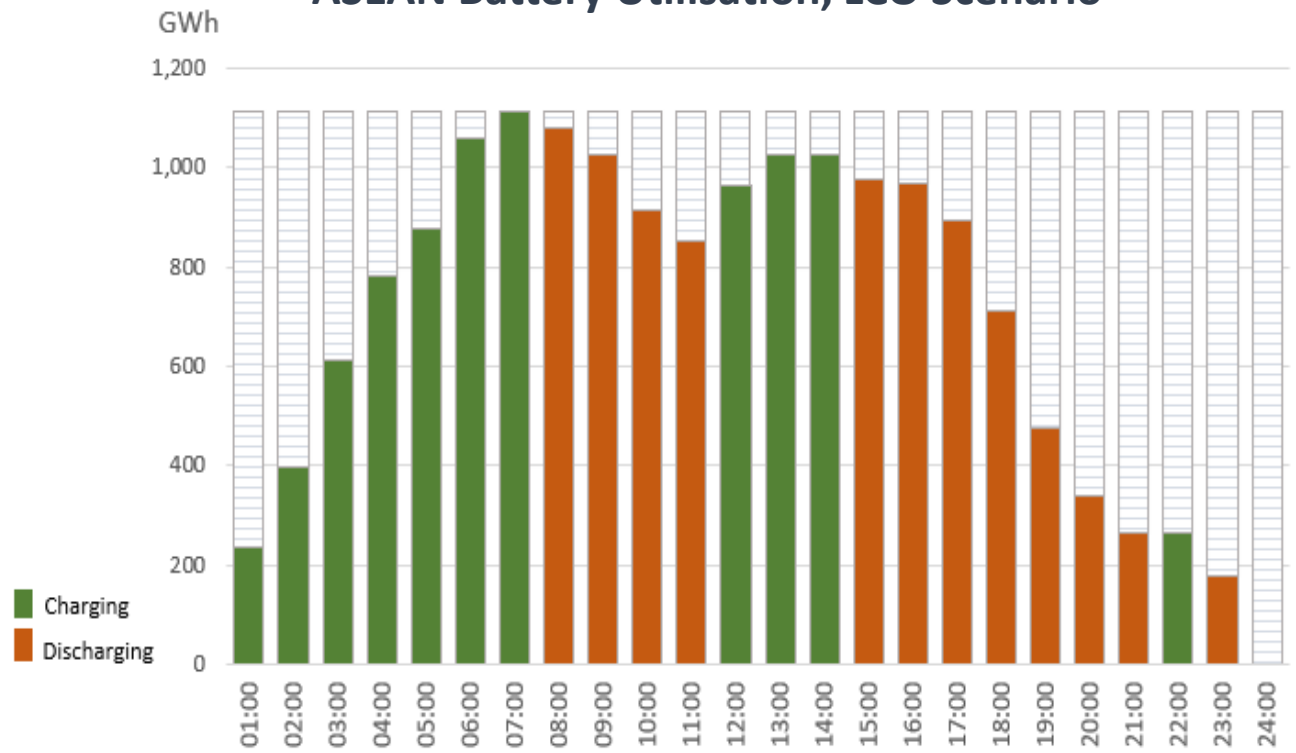
Technologies: Interconnection and Energy storage

ASEAN Interconnection Project Expansion Plan, LCO Scenario

Future Projects	Construction Year (Capacity)	Total Construction Capacity (MW)
Thailand – Peninsular Malaysia	2025	400
Peninsular Malaysia – Sumatra	2025	600
The Philippines – Sabah	2030 (70 MW) 2031 (230 MW) 2032 (200 MW)	500
Sarawak – Brunei Darussalam	2025 (180 MW) 2026 (120 MW)	300
Lao PDR – Vietnam	2025	4462
Thailand – Myanmar	2025	1104
Thailand – Cambodia	2025 (590 MW) 2036 - 2043 (1604 MW)	2200

- In LCO Scenario, shows a high preference for utilising existing and ongoing interconnections, particularly in neighbouring AMS.

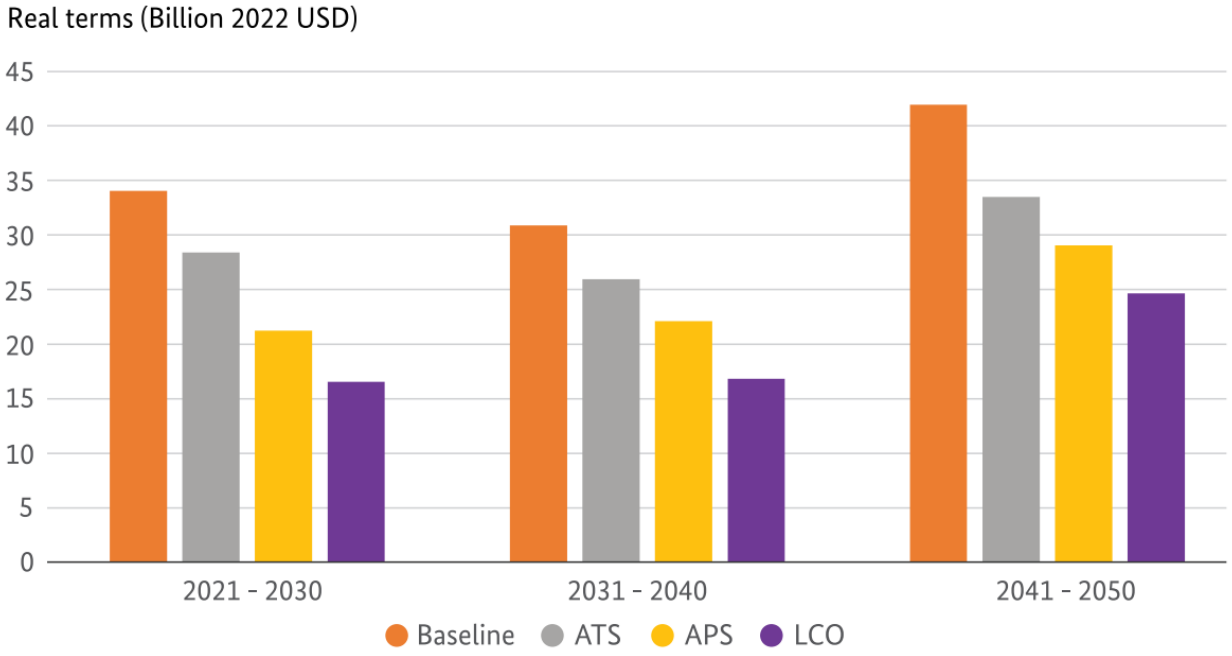
ASEAN Battery Utilisation, LCO Scenario



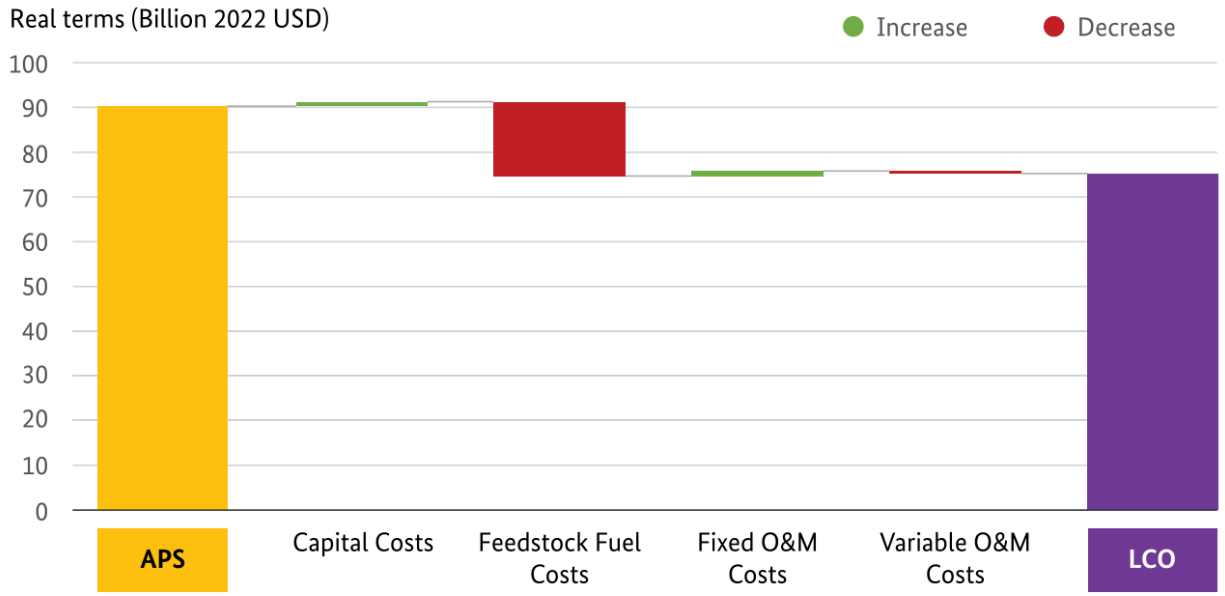
- Batteries can be used to provide stored power during peak hours. Crucial in enabling higher penetration of RE and maintaining the power grid's stability.
- In the LCO Scenario, the region is expected to require 26.6 GW of capacity to store about 1,100 GWh of electricity by 2050.

Cost characteristics of power generation system

Annual Power Investment Cost



Power System Cost Shifting in 2025, APS vs LCO Scenario

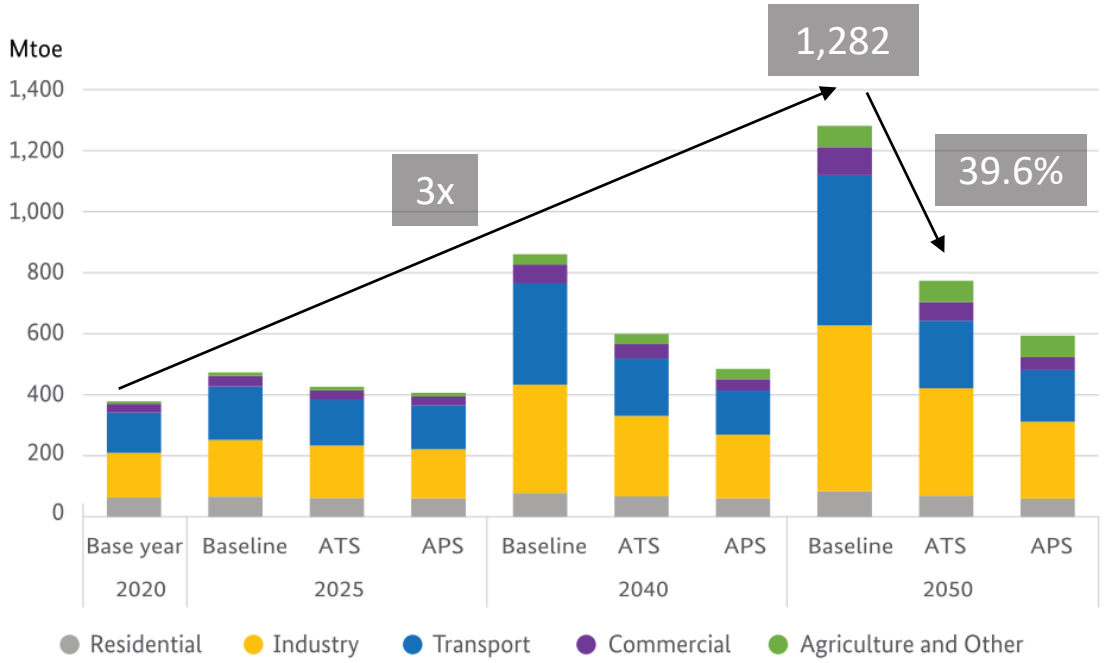


- In the short term, investment cost gets higher from Baseline to ATS and APS due to higher penetration of RE. But in the long term, energy efficiency measures reduce the investment cost.
- Cumulative investment in 2021-2050 – Baseline: USD 1,070 billion; ATS: USD 879 billion, APS: USD 726 billion, LCO: USD 582 billion.

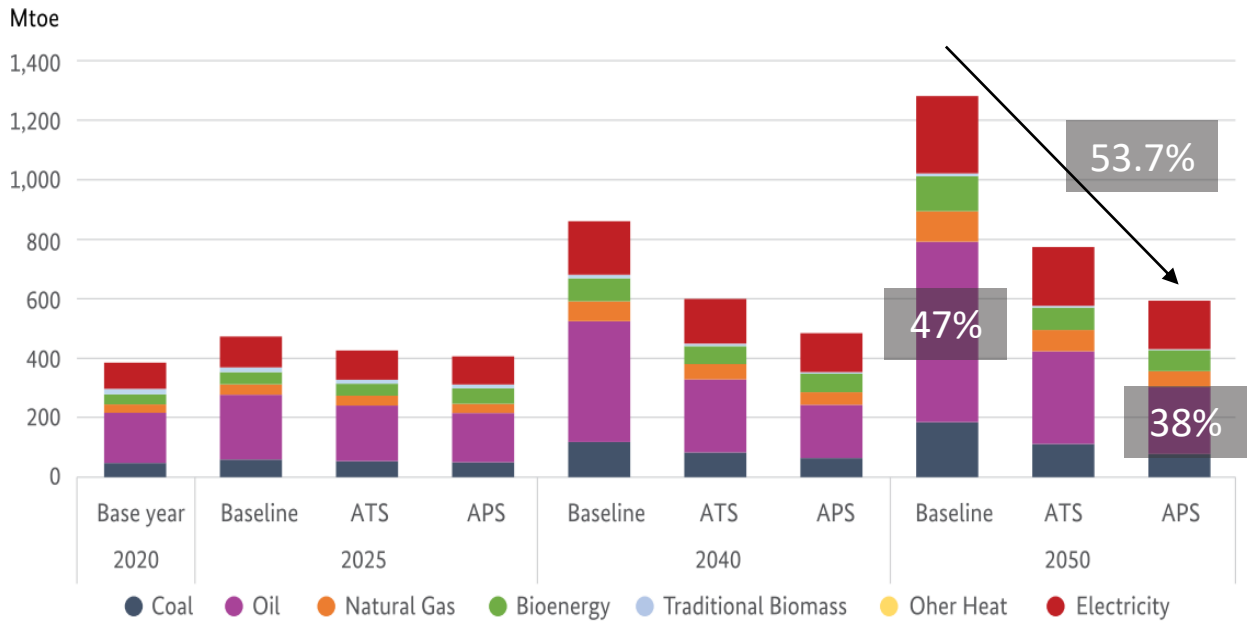
- Throughout the projection period, LCO Scenario cumulatively saves 80%, compared to APS. Note that this is while keeping APAEC target of 23% RE share in TPES.
- Highest reduction in term of production cost comes from the saving in fuel cost, followed by capital cost.

ASEAN energy demand: Industry-Transport and Oil

By Sector



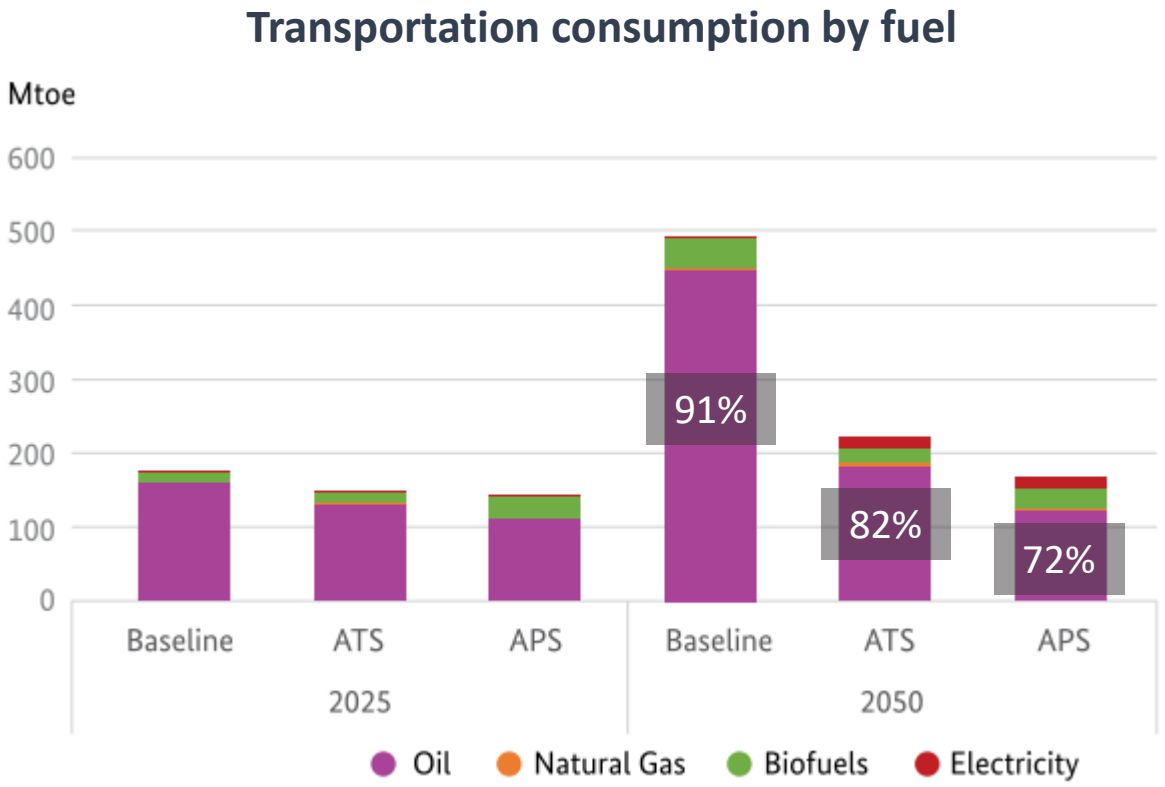
By Fuel

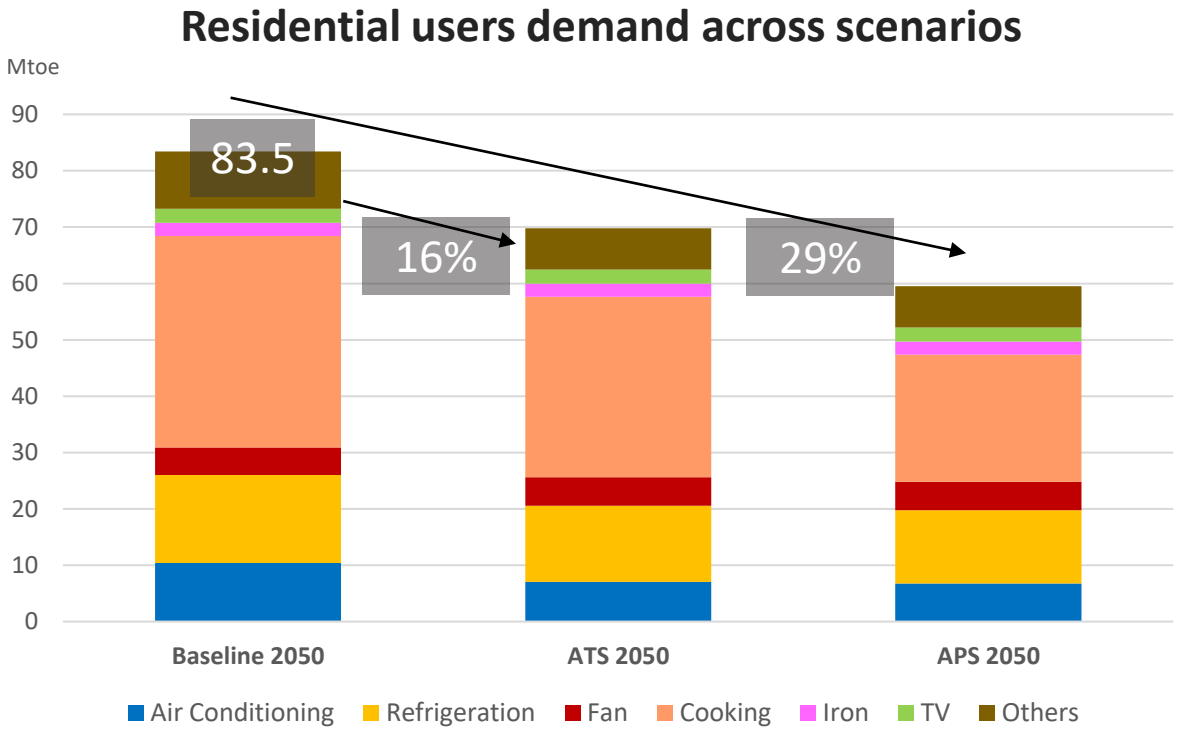


Industry and transport sectors continue to be the highest energy consuming sectors in the region

Oil products remain the largest to be consumed, with 47% share in 2050 Baseline Scenario, and reduced to 38% in APS for the same year

Some strategies: sustainable transport and cooking



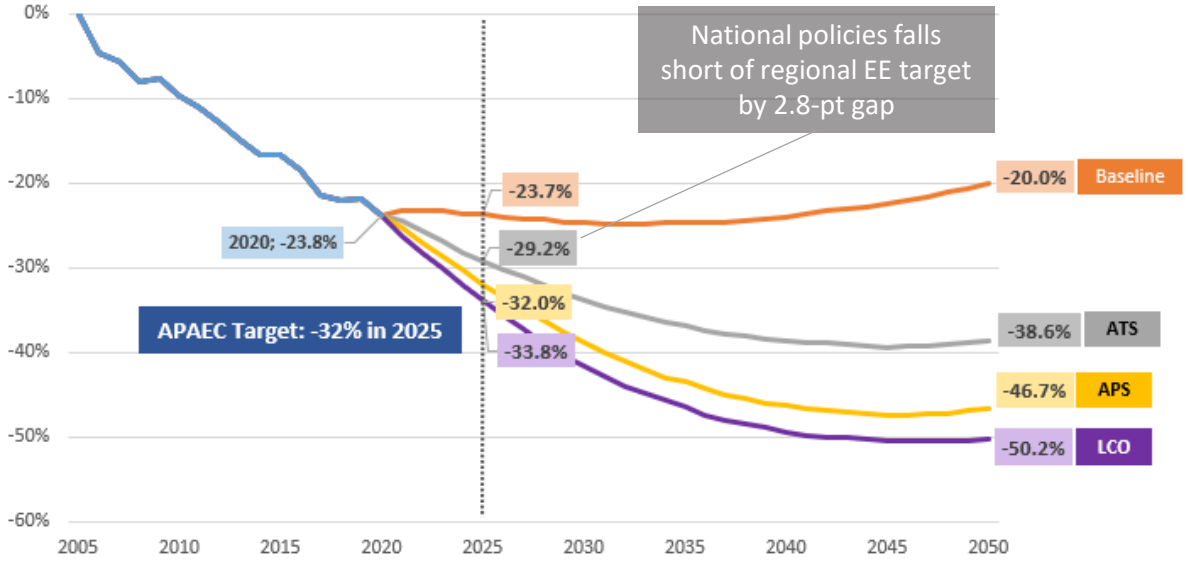


Oil products remain the largest fuel in transport sector, about 91% of the energy consumption of the vehicle fleet in 2050 under Baseline Scenario

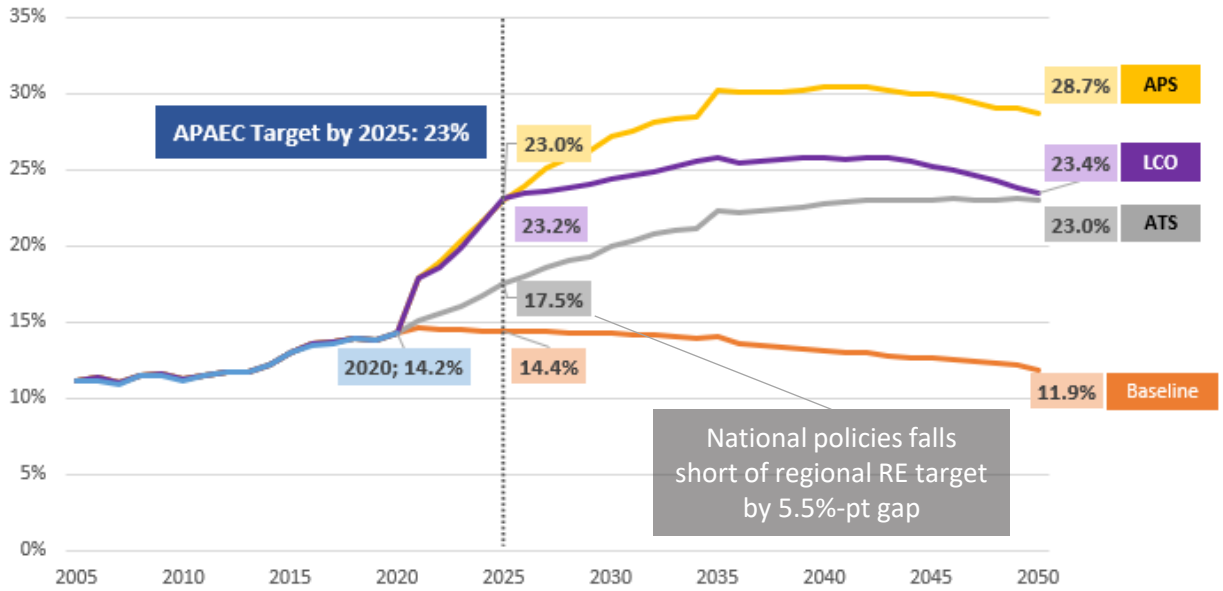
Cooking takes-up an average of 43% of energy consumption in residential demand in the 2050 Baseline Scenario

Progress and projections of APAEC EE and RE targets

AEO7 EE target monitoring across scenarios



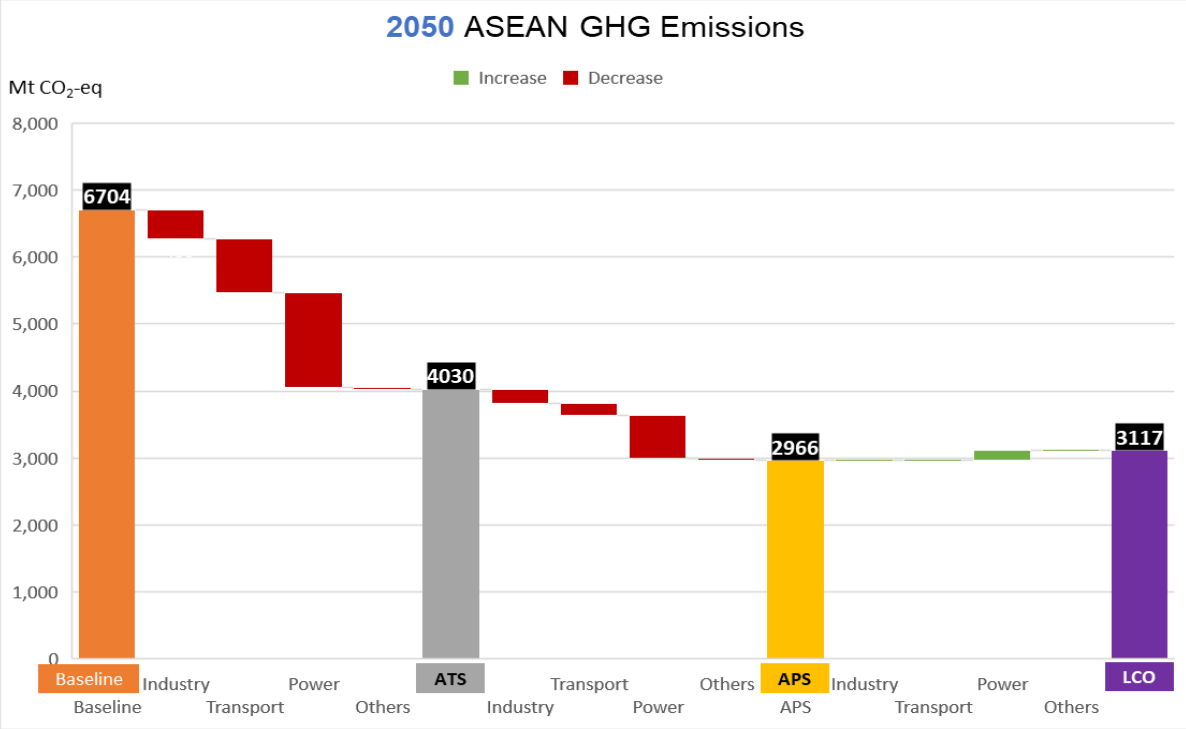
AEO7 RE target monitoring across scenarios

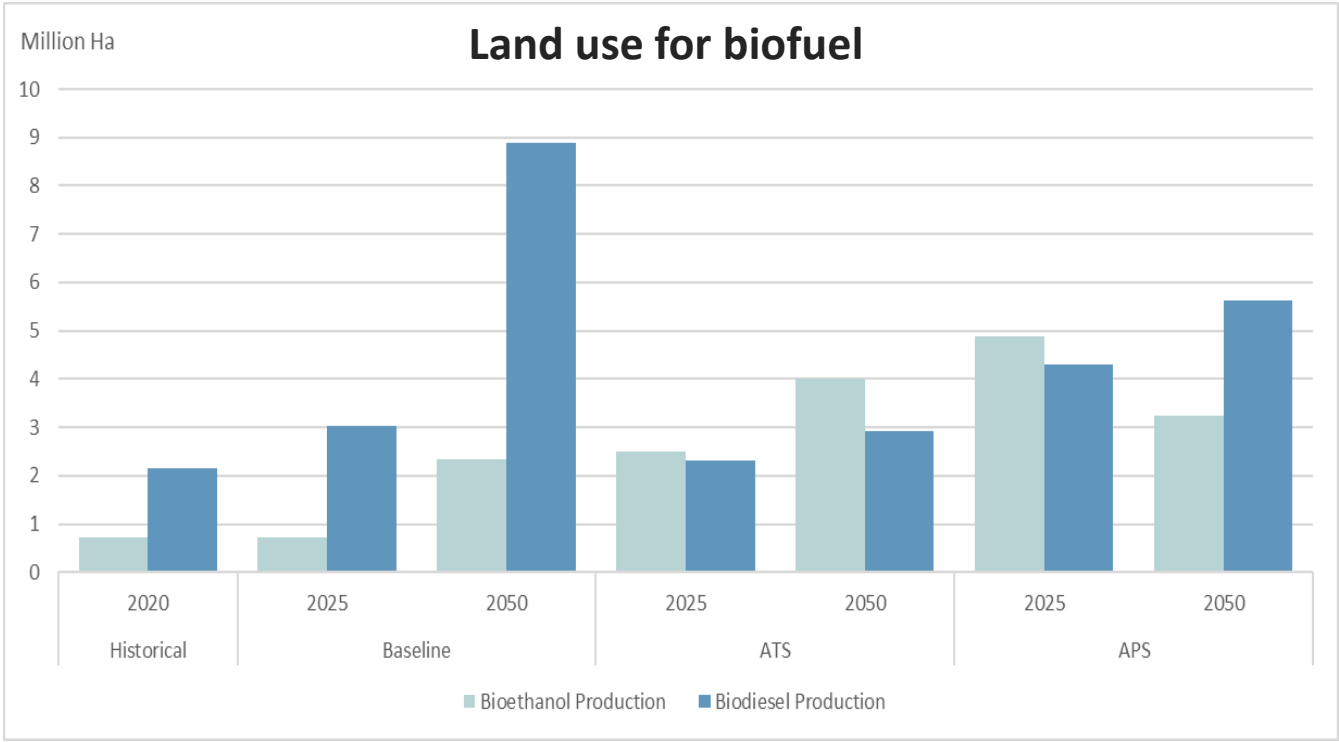


In 2020, **Energy Intensity (TPES/GDP) reduction** reached 23.8% based on 2005 level, due to the economic contraction caused by the pandemic. Even so, AMS is projected to not reach the 2025 target, with a 2.8%-point gap

Amidst increasing installed capacity, **RE share in TPES** reached 14.2% in 2020. The same trend of national policy would result in 17.5% of share in 2025, 5.5%-point gap of the aspirational target

Sustainability: Emission and land use of biofuel





In 2050, the annual GHG emissions from energy system would reach 6.7 Gt $CO_{2\text{-eq}}$ in Baseline Scenario

In 2050 Baseline Scenario, 8.8 million Ha of land is required to produce biodiesel (oil palm) and 2.3 million Ha for bioethanol (sugarcane), or about 2.5% of the AMS land mass

Policy Recommendations

- Power and Supply – RE penetration should go beyond capacity, and translate to higher generation; All RE options should be optimized; For vRE, storage should be developed; Grid modernization and interconnection towards stability, flexibility, and resiliency is key; Securing energy should also consider geopolitics, materials availability, and reserve.

- End use sectors – Higher energy efficiency is a must (fuel economy, energy-efficient appliances), demand should be managed, electrification should be pursued (EV, cooking, etc.), and shift to more use of bioenergy (biofuel, biomass co-firing) and solar heating.

- Navigating secure and resilient energy transition should be the theme of the region energy system. All technology and policy options should be assessed in a comprehensive way, including efficiency, resource and materials availability, and end-of-life management.

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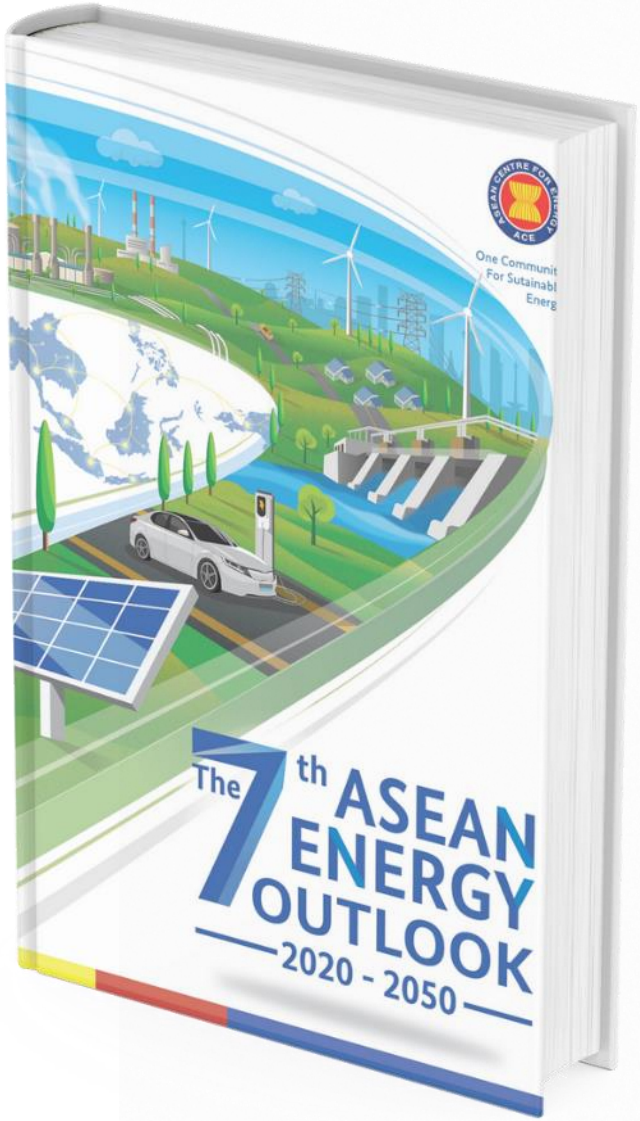

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AEO7: What's Next?

- Asia Nuclear Business Platform – 1 November 2022
- Modelling Training for Philippines DOE – 5-9 December 2022
- AEO7 Webinar Series (Dec '22 – Mar '23)
- AEO7 ASEAN Member States Roadshow (Dec '22 – Apr '23)

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