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ASEAN's Energy Transition Policy Landscape

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ASEAN's Energy Transition Policy Landscape

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Abstract

Energy transition is increasingly important to ASEAN's sustainable growth agenda, with the rising visibility and stronger language in official policy documents. This article addresses two questions on ASEAN's energy transition. Firstly, we explore how the energy structure of ASEAN and its member states evolved with heightened policy attention. The findings show that fossil fuels remain dominant in ASEAN's energy structure while renewable energy deployment is more sluggish than expected. Secondly, we delve into energy transition policies on two levels, ASEAN and AMS, examining whether they align with each other. There is a notable misalignment between the goals outlined in the ASEAN Plan of Action for Energy Cooperation (APAEC). The goals for renewable energy deployment and energy efficiency enhancement set in the APAEC are higher than most ASEAN member states. Additionally, APAEC and its key content receive limited attention in national energy policies in ASEAN member states. This underscores a lack of regional coordination in energy transition within ASEAN. To enhance the execution of the APAEC and fulfil the regional energy transition objectives, ASEAN member states need to expedite collective efforts, ensuring synchronisation between their individual national objectives and the overarching regional policies.

Keywords: ASEAN; energy transition; APAEC

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1. Introduction

Globally, energy transition has gained rising attention, driven by countries' commitment to international agreements like the Paris Agreement, Sustainable Development Goals (SDGs), and other national sustainability targets. This imperative extends to ASEAN, where all member states have committed to Nationally Determined Contributions (NDC) in line with the Paris Agreement and an accelerated pursuit of the SDGs.

While striving to meet these high-level goals, it is crucial to understand that satisfying the growing energy demands is at the heart of economic development. Urbanisation, industrialisation, and the looming prospect of rapid economic growth in ASEAN are projected to triple the region's energy demand by 2050[3]. A continued reliance on fossil fuels to meet this demand threatens to increase greenhouse gas (GHG) emissions and undermine sustainability commitments.

Moreover, the volatile impact of the 2022 Russia-Ukraine War on fossil fuel prices has underscored the risks associated with overreliance on non-renewable energy sources. This volatility raises concerns about energy security in ASEAN, given its status as a large energy consumer and a net fossil fuel importer. Energy security is a long-standing concern for ASEAN and AMS. Addressing energy security aligns with the broader objective of building a resilient ASEAN, according to the ASEAN Economic Community Blueprint 2025[4]. Energy security is also a cornerstone of ASEAN's transition efforts, highlighted in the Joint Statement from the 40th ASEAN Ministers on Energy Meeting (AMEM) in 2022. The statement stresses energy transition, including clean energy adoption, decarbonisation of fossil fuels, and enhanced energy efficiency, all aimed at bolstering energy resiliency[5] and security[6].

According to the International Renewable Energy Agency (IRENA), energy transition comprises goals and actions from three perspectives, energy efficiency, the growth of

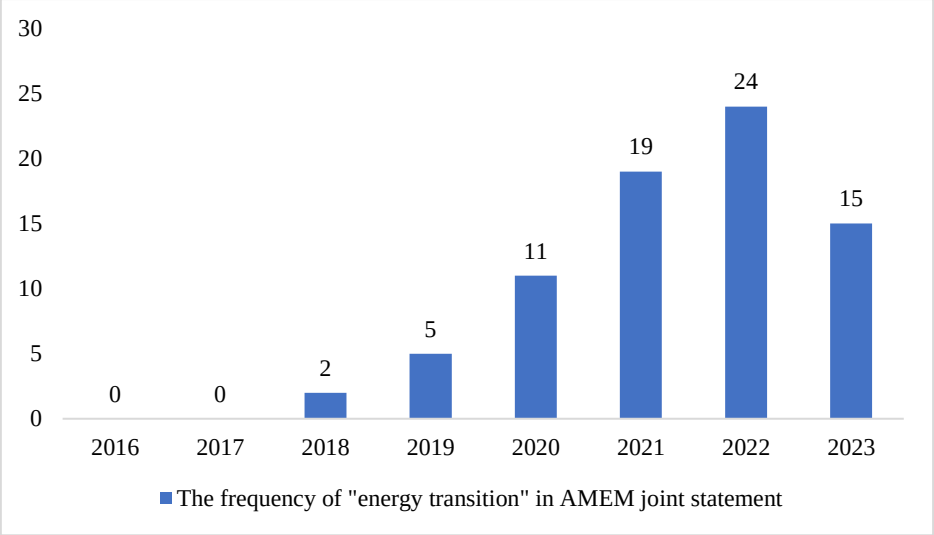
[3] ASEAN Centre for Energy (ACE). (2022, September 15). The 7th ASEAN Energy Outlook. https://aseanenergy.org/the-7th-asean-energy-outlook/
[4] ASEAN Secretariat. (2015). ASEAN Economic Community Blueprint 2025. https://asean.org/book/asean-economic-community-blueprint-2025/
[5] ASEAN defines energy resilience as the capability of an energy system to withstand and recover from high-impact events and reduce the duration, cost and impact. APAEC Drafting Committee. (2020). ASEAN Plan of Action for Energy Cooperation 2016-2025 Phase II. ASEAN Centre for Energy. https://aseanenergy.org/asean-plan-of-action-for-energy-cooperation-apaec-phase-ii-2021-2025/
[6] ASEAN Secretariat. (2022, September 16). Joint Ministerial Statement of the 40th ASEAN Ministers on Energy Meeting. https://asean.org/joint-ministerial-statement-of-the-40th-asean-ministers-on-energy-meeting/

renewables, and electrification[7]. A successful energy transition needs countries to decarbonise their energy sector from fossil-based sources and reduce energy-related CO2 emissions to address climate change and limit global temperature to within 1.5° of the pre-industrial level[8]. Similarly, ASEAN defines energy transition as a "decarbonisation pathway to transform the energy system from carbon-intensive to cleaner energy"[9]. Though ASEAN's definition does not explicitly specify transition avenues in its definition, the policy plans for the energy transition of ASEAN and ASEAN member states (AMS) converge into the three perspectives IRENA outlined. Their actions in the energy transition also serve to reduce national GHG emissions and are a part of the efforts to achieve their climate goals.

Energy transition has been an increasingly important agenda in ASEAN since it has been on ASEAN's energy policy agenda. AMEM, the highest policy-making body in ASEAN's energy cooperation, has attached a stronger emphasis on energy transition since 2017. This can be seen in their joint statements. The term "energy transition" was first mentioned in the 36th AMEM joint statement in 2018[10] and became a single section in the 37th AMEM (2019), covering ASEAN's efforts and achievements in the field over the years[11]. "Energy transition" became a theme and one of the priorities on the energy policy agenda for the first time in the 39th AMEM (2021)[12]. There has also been a rapidly increasing visibility of the term "energy transition" in AMEM statements, from only five times in the 37th statement to 24 times in the 40th joint statement (2022) (Figure 1).

Figure 1. The Frequency of "Energy Transition" in AMEM Joint Statements, 2016-2023

[7] IRENA. (2019). A New World: The Geopolitics of the Energy Transformation. https://www.irena.org/-/media/files/irena/agency/publication/2019/jan/global_commission_geopolitics_new_world_2019.pdf
[8] IRENA. (2023). Energy Transition Outlook. https://www.irena.org/Energy-Transition/Outlook
[9] APAEC Drafting Committee. (2020). ASEAN Plan of Action for Energy Cooperation 2016-2025 Phase II. ASEAN Centre for Energy https://aseanenergy.org/asean-plan-of-action-for-energy-cooperation-apaec-phase-ii-2021-2025/
[10] An earlier mention of "energy transition" in ASEAN's official documents was in its joint statement with IRENA. Joint Statement of The First Dialogue Between The ASEAN Ministers on Energy Meeting and International Renewable Energy Agency in 2017. ASEAN Secretariat. (2018, October 30). Joint Ministerial Statement of The 36th ASEAN Ministers on Energy Meeting. https://asean.org/speechandstatement/joint-ministerial-statement-of-the-36th-asean-ministers-on-energy-meeting-2/
[11] ASEAN Secretariat. (2019, 4 September). Joint Ministerial Statement of The 36th ASEAN Ministers on Energy Meeting. https://asean.org/speechandstatement/joint-ministerial-statement-of-the-36th-asean-ministers-on-energy-meeting-2/
[12] ASEAN Secretariat. (2021, September 16). Joint Ministerial Statement of The 39th ASEAN Ministers on Energy Meeting. https://asean.org/joint-ministerial-statement-of-the-39th-asean-ministers-on-energy-meeting/



Source: Author's own based on the 34th-40th AMEM Joint Statements

The language of energy transition in AMEM statements became stronger as well, indicating ASEAN and AMS became more determined on it. In the 37th AMEM Joint Statement, the description of the energy transition was about ASEAN-IRENA cooperation in the field. To be specific, it mentioned a Memorandum of Understanding (MOU) ASEAN signed with IRENA during the meeting, aiming to achieve ASEAN's aspirations for renewable energy. IRENA would help ASEAN scale up the penetration of renewable energy and transition to a "sustainable energy future"[13]. The wording was upgraded to "highlight the need to accelerate energy transition" in the 38th and 39th AMEM Joint Statements[14]. In the 39th AMEM Joint Statement, energy ministers called for concrete actions for energy transition, such as developing robust policies and measures to form the foundation. This indicates that AMEM's emphasis on energy transition is strengthened, from words and reliance on external cooperation to actual actions in its member states. In the 40th AMEM Meeting, the Prime Minister of Cambodia (Chair of the 40th ASEAN Summit) appealed to increase attention to accelerating the energy transition. He stressed that ASEAN "must focus on energy transition" to promote

[13] ASEAN Secretariat. (2019, September 5). Joint Ministerial Statement of the 37th ASEAN Ministers on Energy Meeting. https://asean.org/joint-ministerial-statement-of-the-37th-asean-ministers-on-energy-meeting/
[14] ASEAN Secretariat. (2020, November 20). Joint Ministerial Statement of the 38 ASEAN Ministers On Energy Meeting. https://asean.org/joint-ministerial-statement-of-the-38-asean-ministers-on-energy-meeting/ ; ASEAN Secretariat. (2021, September 16). Joint Ministerial Statement of The 39th ASEAN Ministers on Energy Meeting. https://asean.org/joint-ministerial-statement-of-the-39th-asean-ministers-on-energy-meeting/

sustainable and resilient social-economic recovery[15]. This further highlights ASEAN's determination to energy transition.

This paper asks two questions. Firstly, with the rising importance of energy transition on the policy agenda, how do ASEAN and its member states' energy structure transit? Secondly, what are existing policies on energy transition at the ASEAN level and its member states (AMS) level and do their goals and policy efforts align? The article will proceed as follows. After the introduction, section 2 will discuss the energy structure of ASEAN and AMS. Section 3 focuses on the policy efforts on energy transition in ASEAN and AMS, covering intra- and extra-regional as well as national efforts. We also identified a misalignment problem between policies at the ASEAN and national level. Section 4 will be a conclusion.

2. The Energy Structure of ASEAN and ASEAN Member States

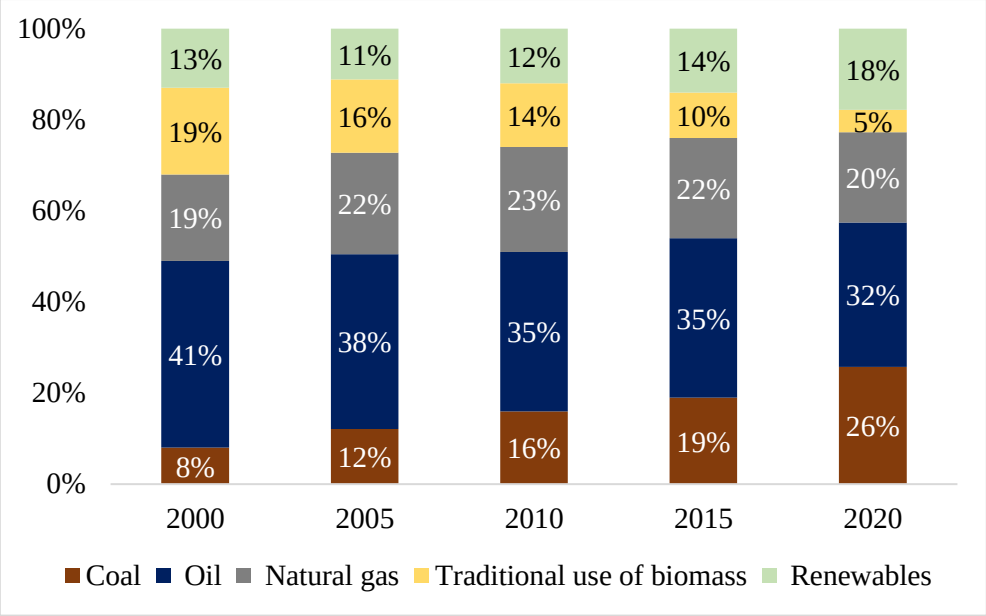
2.1 The Energy Supply Structure of ASEAN and AMS

2.1.1 Fossil fuels

Fossil fuels have dominated ASEAN's energy mix. As Figure 2 shows, fossil fuels, including coal, oil and natural gas,[16] collectively accounted for 78% of ASEAN's total primary energy Supply (TPES)[17] in 2020. Oil, coal and gas contributed 32%, 26% and 20% to the TPES, respectively, while renewable energy took up only 18%. As presented in Figure 3, fossil fuels stood for more than half of the TPES in seven and eight AMS in 2010 and 2020. Among fossil fuels, coal and oil are predominant sources of energy supply. In total, they are the largest supply sources for six AMS[18]. Notably, there was a 10 percentage point rise in coal's share in AMS' TPES from 2010 to 2020, on average.

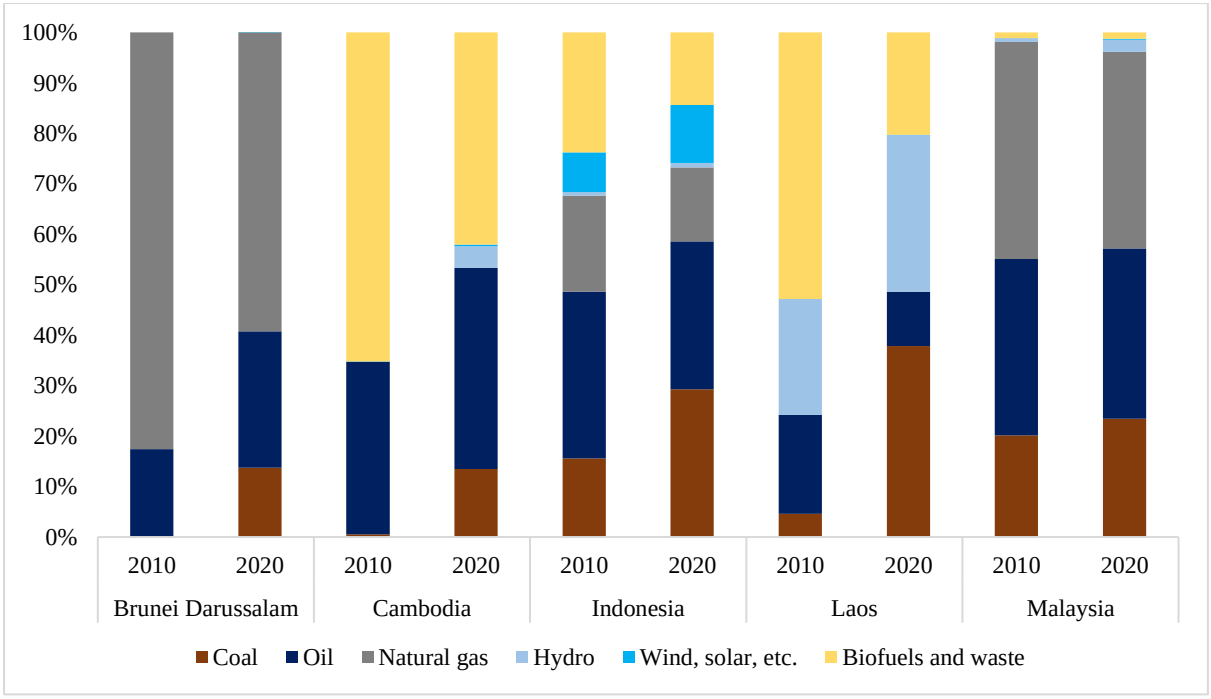
Figure 2. Composition of Total Primary Energy Supply by Fuel in ASEAN, 2010, 2015, 2020 (Unit: Percentage)

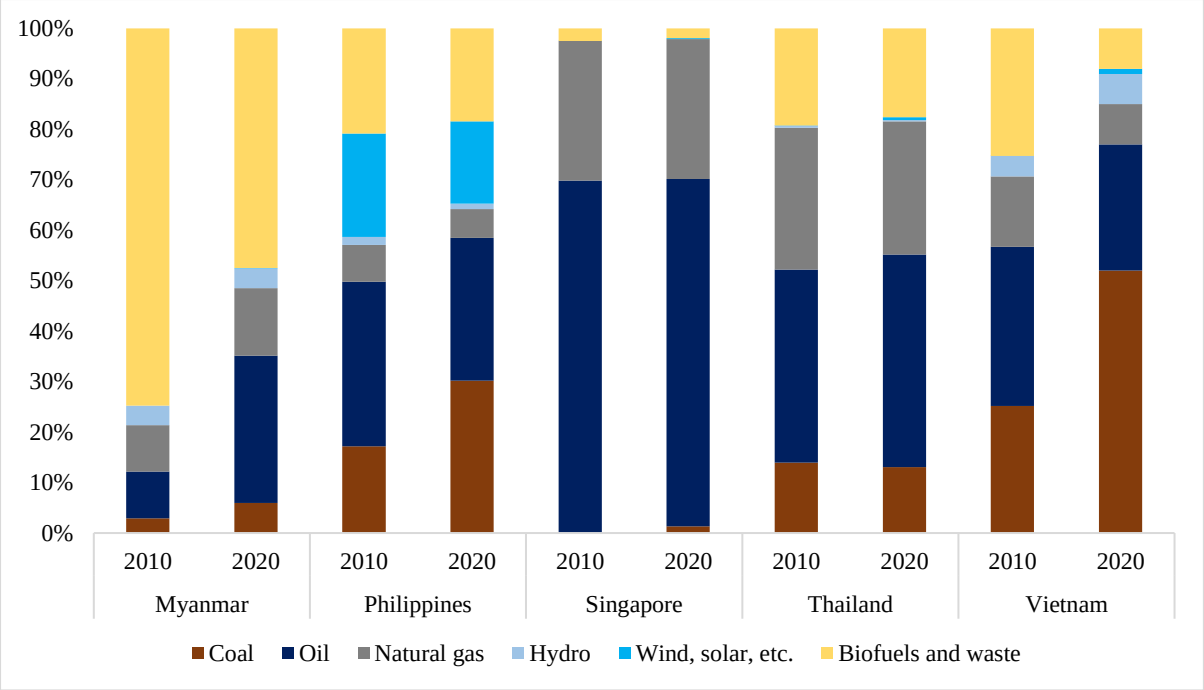
[15] ASEAN Secretariat. (2022, September 16). Joint Ministerial Statement of the 40th ASEAN Ministers on Energy Meeting. https://asean.org/joint-ministerial-statement-of-the-40th-asean-ministers-on-energy-meeting/
[16] Hereafter fossil fuels refer to coal, natural gas and oil.
[17] TPES is derived by calculating energy production, adding energy imports, omitting energy exports and international bunkers, plus or minus changes in stock. Source: ASEAN Centre for Energy (ACE). (2022, September 15). The 7th ASEAN Energy Outlook. https://aseanenergy.org/the-7th-asean-energy-outlook/
[18] Coal is the dominant energy source for Laos, the Philippines and Vietnam. Oil is the dominant source for Indonesia, Singapore and Thailand.



Source: International Energy Agency

Figure 3. Composition Total Primary Energy Supply by Source of ASEAN Member States, 2010 and 2020





Source: ACI based on data from International Energy Agency

Note:

1) *Biofuels and wastes include Industrial waste, municipal waste, primary solid biofuels, biogases, biogasoline, biodiesels, bio jet kerosene, other liquid biofuels, non-specified primary biofuels and waste and charcoal*
2) *In IEA's definition, renewable energy is the direct sum of hydro, geotherm, solarpv, solarth, tide, wind, munwaster, primsbio, biogases, biogasol, biodiesel, obioliq, renewns and charcoal.*
   It does not include any estimation of the amount of electricity and heat derived from renewable sources.

IEA (2022). Database Documentation. Retrieved from https://iea.blob.core.windows.net/assets/25266100-859c-4b9c-bd46-cc4069bd4412/WORLDBAL_Documentation.pdf

Exceptions are Cambodia and Myanmar, whose predominant supply source is biofuels and waste. Biofuels and waste covered over 40% of the two countries' TPES in 2020 (Figure 3). However, among all AMS, the volume and the share of fossil fuels increased most significantly in the energy supply of the two countries from 2010 to 2020. One of the reasons is that the two countries experienced rapid economic growth and structural change over the decade. Their

GDP growth rates were above the ASEAN average in most years from 2010 to 2020. In some years, their growth rates were among the top three in the region[19]. Additionally, their economic structure was shifting from agriculture-led to manufacturing and industry-led. The share of manufacturing and industry value added to GDP increased from 37% to 51% between 2010 and 2020, while the share of agriculture decreased from 34% to 23%[20]. This requires a larger amount of affordable and stable energy supply.

In Cambodia, the share of coal in TPES increased from only 1% in 2010 to 13% in 2020. Coal has been chosen as its price is cheaper and more stable than other fossil fuels. It has also been a prioritised source to meet Cambodia's energy demand in the near future, according to its Power Development Plan in 2015[21].

For Myanmar, the rising share of fossil fuels was led by the increasing oil supply. The oil's share in its TPES tripled between 2010 and 2020, marking the largest growth among all supply sources. This fuelled its economic growth, especially in power generation, construction, and transportation, notably in heavy-duty vehicles[22]. Myanmar's electricity-generated capacity also doubled during the same time frame[23]. The registered trucks in Myanmar grew by a factor of six and the number of passenger cars doubled[24]. Additionally, though the country is endowed with natural gas, most of its gas was exported to make revenue, making it unable to be self-sufficient with natural gas. In 2019, 73% of Myanmar's gas was exported to Thailand and China[25]. While Myanmar does have domestic coal resources, Myanmar's domestic coal production is limited due to public opposition, low investment in its mining and environmental

[19] World Bank. (2023a). GDP growth (annual %). Retrieved from https://data.worldbank.org/indicator/NY.GDP.MKTP.KD.ZG?locations=BN-KH-MM
[20] World Bank. (2023b). Agriculture, forestry, and fishing, value added (% of GDP), Manufacturing, value added (% of GDP), Industry (including construction), value added (% of GDP) , Services, value added (% of GDP) https://data.worldbank.org/indicator/NV.IND.MANF.ZS; https://data.worldbank.org/indicator/NV.IND.TOTL.ZS ; https://data.worldbank.org/indicator/NV.SRV.TOTL.ZS https://data.worldbank.org/indicator/NV.AGR.TOTL.ZS
[21] Asian Development Bank. (2018). Cambodia Energy Sector Assessment, Strategy, and Roadmap. https://www.adb.org/sites/default/files/institutional-document/479941/cambodia-energy-assessment-road-map.pdf ; ACE. (2016). Coal's Role in ASEAN Energy. https://aseanenergy.org/coals-role-in-asean-energy/
[22] Wallis, K., & Jaganathan, J. (2017, January 5). Myanmar's breakneck growth brings surge in fuel oil shipping from Singapore. Reuters. https://www.reuters.com/article/us-myanmar-singapore-gasoil-idUSKBN14P0U4
[23] IEA (2022), Southeast Asia Energy Outlook 2022, IEA, Paris https://www.iea.org/reports/southeast-asia-energy-outlook-2022
[24] ASEANStatsDataPortal. (n.d.). Number of registered trucks (in thousand). https://data.aseanstats.org/indicator/ASE.TRP.ROD.B.008 ;
[25] Kimura, S., Hiruma, T., Hashimoto, H., & Setyawati, C. E. (2023). Oil and Gas Strategic Pricing in Myanmar. Economic Research Institute for ASEAN and East Asia. https://www.eria.org/uploads/media/Research-Project-Report/RPR-2023-02/Oil-and-Gas-Strategic-Pricing-in-Myanmar-.pdf

concerns[26]. This explains why, in fossil fuels, the share of oil, rather than other energies, increases significantly.

In other AMS, although the growth of fossil fuels in energy supply is not as fast as in Cambodia and Myanmar, there was still a positive growth in eight AMS during 2010-2020. The trend tends to continue, as AMS governments will not phase out fossil fuels in the short term. Cambodia approved the construction of two coal-fired powered plants in 2020[27]. The Philippines will invest around Philippine Peso (PHP) 100 billion (approximately USD 1.8 billion[28]) in building new oil distribution depots and import terminals by 2040 to ensure a secure oil supply[29]. Malaysia anticipated rising reliance on natural gas and crude oil by 2050[30]. According to Indonesia's goals in its Enhanced Nationally Determined Contribution in 2022, fossil fuels will account for at least 77% of TPES by 2025 and 69% by 2050, way higher than renewable energy[31].

2.1.2 Renewable Energy

Renewable energy accounted for only a small proportion of ASEAN's TPES, 18% in 2020.[32] The renewable supply was led by biofuels and waste, followed by hydro. From 2010 to 2020, the total volume of renewable energy (measured by primary energy supply in TJ) increased by 2% in ASEAN. The growth was primarily driven by hydro energy, whose volume doubled over the time frame. It was followed by wind, solar and other energy,[33] with a 55% increase over the decade. However, the volume of biofuels and wastes dropped moderately by 4% in the two

[26] International Trade Administration of the US. (2023). Burma - Country Commercial Guide. https://www.trade.gov/country-commercial-guides/burma-energy ; Asian Development Bank. (2016). Myanmar Energy Sector Assessment, Strategy, and Road Map. https://www.adb.org/sites/default/files/institutional-document/218286/mya-energy-sector-assessment.pdf
[27] Sao, P. N. (2020, August 26). For the Sake of Cambodia's Future—Quit Coal. Cambodianess. https://cambodianess.com/article/for-the-sake-of-cambodias-futurequit-coal
[28] 1 Philippine peso equals 0.018 United States Dollar.
[29] Department of Energy of the Philippines. (2020). Philippine Energy Plan: Towards a Sustainable and Clean Energy Future. https://www.doe.gov.ph/sites/default/files/pdf/pep/PEP-2020-2040-Final%20eCopy-as-of-15-June-2023.pdf
[30] Malaysia's Ministry of Economy. (2023). National Energy Transition Roadmap. https://www.ekonomi.gov.my/sites/default/files/2023-09/National%20Energy%20Transition%20Roadmap_0.pdf
[31] United Nations Framework Convention on Climate Change. (2022). Enhanced Nationally Determined Contribution. https://unfccc.int/sites/default/files/NDC/2022-09/23.09.2022_Enhanced%20NDC%20Indonesia.pdf
[32] Authors' calculation based on the IEA data.
[33] Note: wind, solar and other energy is a category of energy source in TPES.

countries. One of the reasons is that the region has shifted from traditional biomass to modern clean fuels in cooking and heating.

At the AMS level, seven AMS experienced growth in the absolute amount of renewable energy in TPES, except for Brunei, Indonesia and Vietnam. Malaysia led the growth with a 161.04% increase, followed by Laos, which increased by 69.19%. Hydro energy was a primary driver for the growth in both Malaysia and Laos. It grew by a factor of four in Malaysia and tripled in Laos.

From the consumption perspective, primarily, renewable energy is used in electricity generation. We will delve into the details in the next section. Besides, renewable energy is also consumed in other forms in transport, industrial, agricultural and other sectors.

In transportation, biofuels are gaining attention as clean fuels for land, maritime and aviation transport, such as sustainable aviation fuels. Indonesia and Thailand were the world's third and ninth-largest biofuels producers in 2022[34]. The Indonesian government plans to increase the blend rate of biodiesel from 20% in 2016 to 30% in 2025[35]. Thailand aims for 30% renewable energy of TFEC by 2037. Within the renewable energy composition, the Thai government targets to have 2,700 and 2,900 million litres of ethanol and biodiesel consumption by 2037[36].

Hydrogen is another clean fuel alternative for transportation, especially in the long run. Singapore sees liquefied hydrogen as a potential low-carbon fuel for ship liners[37]. Additionally, Singapore plans to build a plant to generate an estimated 55 – 65 MW of electricity from low- or zero-carbon ammonia and facilitate ammonia bunkering at a capacity of at least 0.1 million tons per annum. The plant will also develop a way to store and transport the ammonia as a fuel for vessels[38].

[34] Statista. (2023, August 25). Global biofuel production 2022, by select country. https://www.statista.com/statistics/274168/biofuel-production-in-leading-countries-in-oil-equivalent/
[35] US Department of Agriculture. (September 29, 2023). Indonesia: Biofuels Annual. https://www.fas.usda.gov/data/indonesia-biofuels-annual-7
[36] US Department of Agriculture. (June 6, 2023). Thailand: Biofuels Annual. https://www.fas.usda.gov/data/thailand-biofuels-annual-7
[37] Ministry of Trade and Industry of Singapore. (2022). Singapore's National Hydrogen Strategy. Retrieved from https://www.mti.gov.sg/Industries/Hydrogen
[38] Maritime and Port Authority of Singapore. (2023). Singapore Launches Next Stage of Selection of Low- or Zero-Carbon Ammonia Power Generation and Bunkering Project Developer. https://www.mpa.gov.sg/media-centre/details/singapore-launches-next-stage-of-selection-of-low--or-zero-carbon-ammonia-power-generation-and-bunkering-project-developer

In the industrial sector, geothermal can be used to support industrial activities. For example, hospitality can use low-temperature geothermal to pasteurise and sterilise. Medium-temperature geothermal can be utilised in steel making, dyeing and drying fish meals[39]. However, these direct usages of geothermal energy are limited. In Indonesia, which has the largest geothermal potential in the ASEAN region, the direct use of geothermal energy was only 3645 BOE in 2022, less than 0.001% of the country's TPES[40]. Similarly, there had been two drying plants using geothermal directly in the Philippines, with a total installed heat capacity of 1.63 MWt, but the two plants stopped operation in the late 1990s. Currently, the Philippine government is carrying out research on the direct use of geothermal[41]. Another renewable energy used in manufacturing is hydrogen. Singapore aims to use hydrogen as feedstock for industrial processes. For example, hydrogen is used to produce semiconductor wafer fabrication, sustainable chemicals, and refineries[42].

In agriculture, there are wind- or solar-powered irrigation systems and water-pumping systems in the Philippines. They also built Biomass furnaces and Gasifiers and Small-Scale Biogas Plants near farmlands and fishery ponds[43].

2.2 ASEAN's Electricity Generation Composition

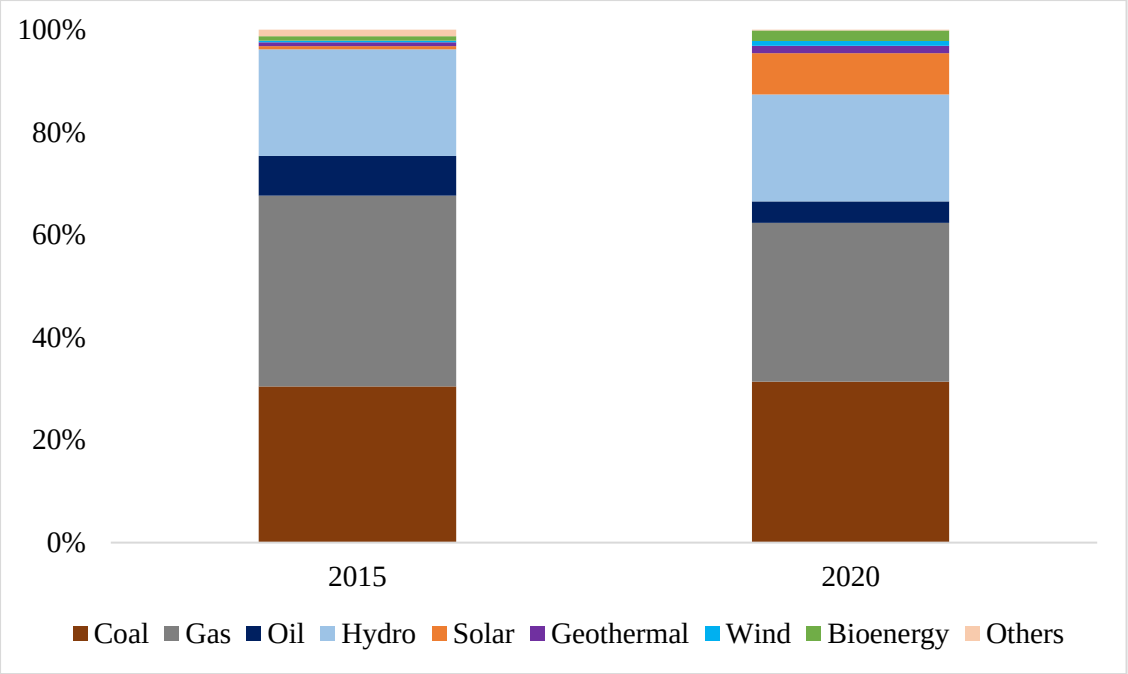
2.2.1 Electricity Generated by Fossil Fuels

With electrification advances in ASEAN, electricity has become an increasingly important source of energy consumption in AMS. From 2010 to 2020, ASEAN's total electricity generation capacity increased by 64%[44]. Fossil fuels also play dominant a role in ASEAN's electricity generation. In total, coal and gas accounted for 45% and 31% of ASEAN's

[39] ASEAN Centre for Energy (ACE). (2022, September 15). The 7th ASEAN Energy Outlook. https://aseanenergy.org/the-7th-asean-energy-outlook/
[40] Ministry of Energy and Mineral Resources of Indonesia. (2023). Handbook of Energy & Economic Statistics of Indonesia 2022. https://www.esdm.go.id/assets/media/content/content-handbook-of-energy-and-economic-statistics-of-indonesia-2022.pdf
[41] Think Geoenergy. (May 2021). Philippines Geothermal Energy Market Overview. Retrieved from https://www.thinkgeoenergy.com/wp-content/uploads/2021/05/Philippines-short.pdf
[42] Ibid
[43] Asis, M. L. (2021, December 2). Department of Agriculture of the Philippines. DA and DOE scale up renewable energy use to boost agriculture-fisheries production and postharvest operations. Department of Agriculture of the Philippines. http://bafe.da.gov.ph/index.php/2021/12/02/http-bafe-da-gov-ph-wp-admin-post-phppost11816/#:~:text=REPAFS%20short%2Dterm%20projects%20from,fisheries%20production%20and%20postharvest%20operations%3B
[44] IEA (2022). Southeast Asia Energy Outlook 2022. IEA Paris. https://www.iea.org/reports/southeast-asia-energy-outlook-2022

electricity generation[45]. In terms of installed capacity, coal and gas accounted for a third of ASEAN's installed capacity, respectively, in 2020, a similar level to 2015 (Figure 4).

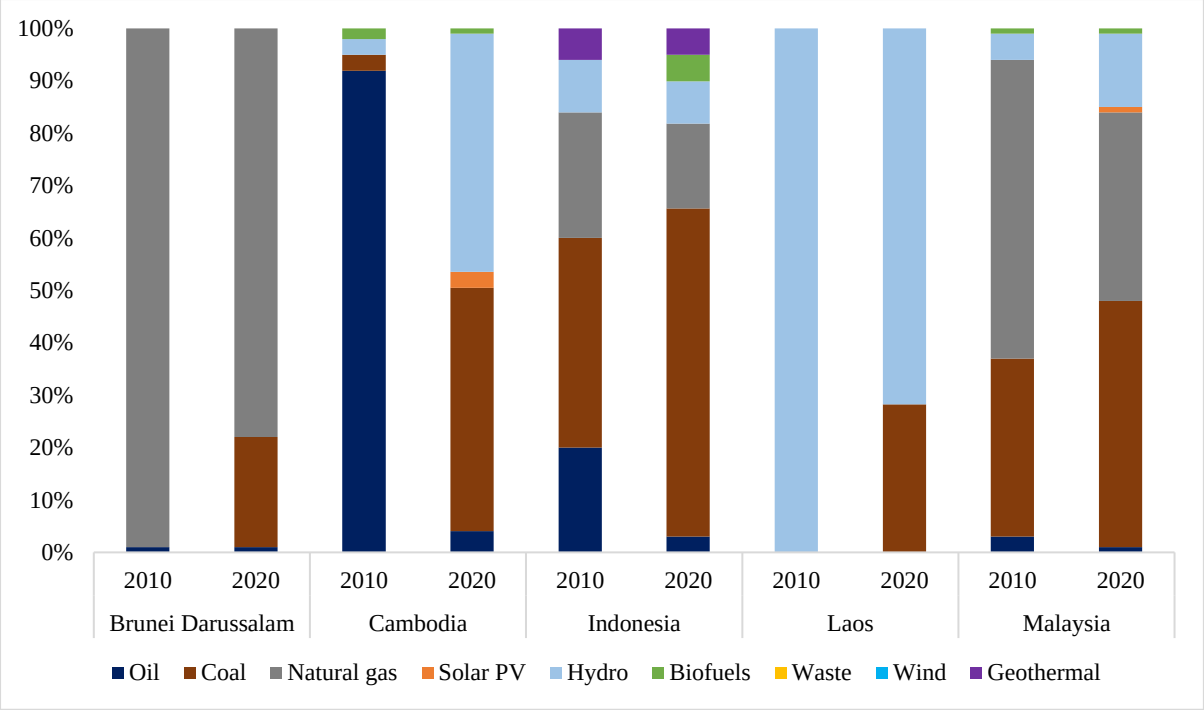
Figure 4. ASEAN's Installed Power Capacity by Source in 2015 and 2020 (Unit: Percentage)

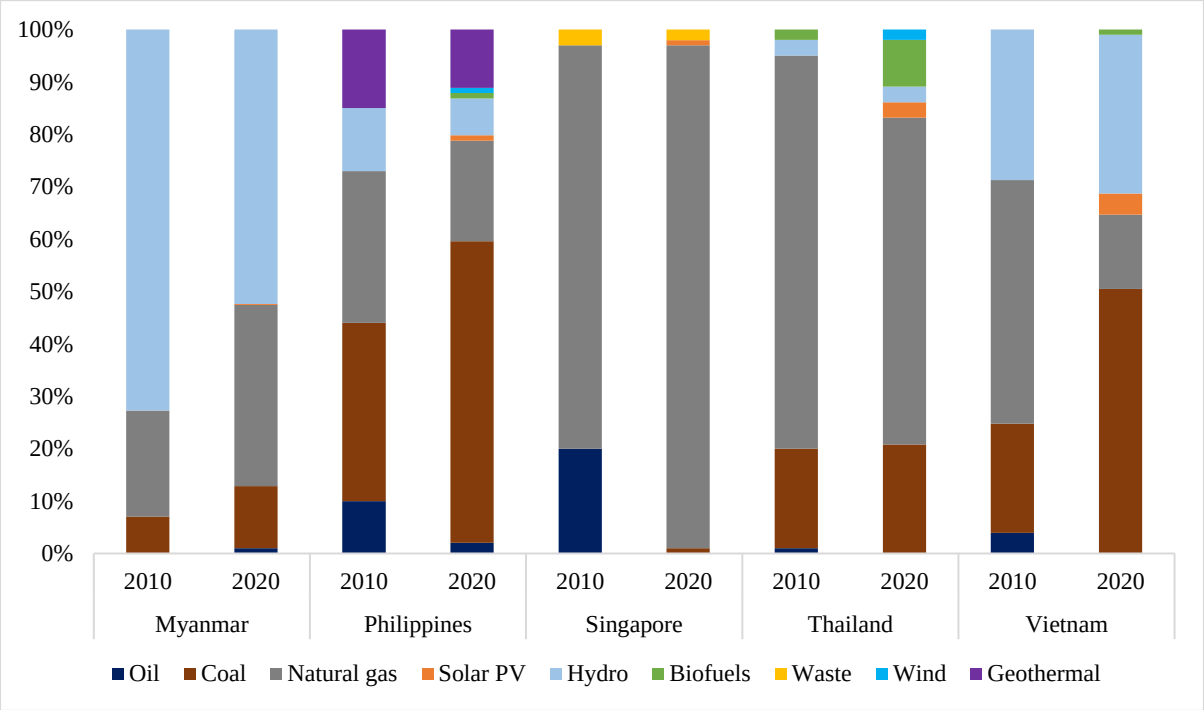


Source: ASEAN Centre for Energy[46]

Figure 5. Electricity Generation by Source for ASEAN Member States, 2010 and 2020

[45] Ibid
[46] Data source for 2015: 5th ASEAN Energy Outlook; Data source for 2020: ASEAN Energy in 2022





Source: ACI based on data from the International Energy Agency

At the AMS level, electricity generated by fossil fuels accounted for 71% of electricity generation, on average, in 2020, slightly less than 74% in 2010 (Figure 5). On average, the largest sources of electricity generation were coal (34%) and natural gas (36%) in 2020. Notably, as shown in Figure 5, the share of coal in Cambodia's electricity generation increased by 43 percentage points from 2010 to 2020. Oil accounted for a decreasing share in the

electricity mix for most AMS during the time frame. In particular, the share of oil in Cambodia's electricity generation plunged from 91% to 4%, replaced by coal and hydro. There was also a substantial decrease in natural gas's share in Brunei Darussalam, Malaysia and Vietnam over the same time frame, approximately 15 percentage points. Notably, the share of natural gas in Vietnam's electricity generation in 2020 was only a third of the number in 2010. Oppositely, natural gas accounted for an increasing share of electricity generation in Myanmar, increasing from 20% in 2010 to 35% in 2020.

2.2.2 Electricity Generated by Renewable Energy

Hydropower

Hydro was the third largest source of electricity generation in the ASEAN region, standing for an average of 23% of the generation in 2020 (Figure 4). At the AMS level, as shown in Figure 5, the share of hydropower surged in Cambodia's electricity generation, from only 3% in 2010 to 45% in 2020. However, the share of renewable electricity decreased by 28 and 19 percentage points, respectively, in Laos and Myanmar, led by the drop in hydropower. For both countries, the share of coal-based electricity soared in their electricity mix.

Though hydropower is relatively more affordable compared to other renewable resources, with cheap cost and without high technological requirements, it is vulnerable to climate change and the extreme weather it brings. The heatwaves in Asia led to low reservoir levels in 2023, resulting in insufficient hydropower to meet the electricity demand and countries needed to seek alternatives, according to the Cambodian Energy Minister and energy expert [47]. Additionally, hundreds of new hydropower projects in Southeast Asia were built without considering increasing climate risks, such as flooding or water scarcity, generating doubts about their capability to provide a stable power supply[48]. In the face of such instability, countries may return to fossil fuels such as in Vietnam, which expanded the use of domestic

[47] Varadhan, S. (2023, October 23). Cambodia to bank on solar, imports to address hydropower volatility. *Reuters.* Retrieved from https://www.reuters.com/business/energy/cambodia-bank-solar-imports-address-hydropower-volatility-2023-10-23/

[48] Mercado, L. (2023, January 18). Climate change cements hydropower as risky renewable. *Southeast Asia Globe.* Retrieved from https://southeastasiaglobe.com/hydropower-risky-renewable/

coal reserves as it is running out of its hydropower potential[49]. If other AMS follow a similar pattern, the share of renewables may further decline in the long run[50].

Other Renewable Energy

Biofuels, solar PV, geothermal and wind power in total stood for 9% of ASEAN's electricity generation. Biofuels accounted for 2% of ASEAN's total power generation capacity in 2020, with Thailand and Indonesia leading the way. Their bioenergy generation capacity was the world's eighth and tenth largest, respectively, in 2020[51]. Thailand's electricity generated by biofuels grew by a factor of five from 2010 to 2020 and reached 16, 368 GWh in 2020[52]. Biofuels accounted for 9% of Thailand's electricity generation. In Indonesia, the bioenergy power surged from less than 100 GWh to 14, 448 GWh in 2020, accounting for 5% of Indonesia's power generation capacity in 2020[53].

The installed capacity of solar power increased sharply in Thailand and Vietnam. Thailand's solar power doubled from 2015 to 2020[54]. Vietnam's solar power capacity skyrocketed from only 5 GWh in 2015 to 25,717.5 GWh in 2021, making it one of the world's top 10 countries in solar power installed capacity[55]. The rapid growth in Vietnam is mainly supported by its feed-in tariff scheme, in which consumers will pay for rooftop solar power at the rate of US$0.0838 per kWh for 20 years for rooftop systems commencing commercial operation before December 31, 2020[56].

Geothermal power, though only comprised 1% of ASEAN's electricity generation composition, is promising in the region. The total geothermal capacity of two AMS, Indonesia and the

[49] Overland, I., Sagbakken, H. F., Chan, H. Y., Merdekawati, M., Suryadi, B., Utama, N. A., & Vakulchuk, R. (2021). The ASEAN climate and energy paradox. *Energy and Climate Change*, *2*, 100019.
[50] Nguyen, P. A., Abbott, M., & Nguyen, T. L. T. (2019). The development and cost of renewable energy resources in Vietnam. *Utilities Policy*, *57*, 59-66.
[51] IRENA. (2023). Country Rankings. https://www.irena.org/Data/View-data-by-topic/Capacity-and-Generation/Country-Rankings
[52] IEA (2022). Southeast Asia Energy Outlook 2022. IEA Paris. https://www.iea.org/reports/southeast-asia-energy-outlook-2022
[53] Ibid
[54] International Energy Agency (IEA). (n.d.). "Thailand Data Explorer." https://www.iea.org/countries/thailand.
[55] IRENA. (n.d.). Capacity and Generation – Country Ranking. https://www.irena.org/Data/View-data-by-topic/Capacity-and-Generation/Country-Rankings
[56] Gunther, E. A. (2021, January 6). Vietnam rooftop solar records major boom as more than 9GW installed in 2020. PV Tech. Retrieved from https://www.pv-tech.org/vietnam-rooftop-solar-records-major-boom-as-more-than-9gw-installed-in-2020/

Philippines accounted for about a third of the world's total geothermal installed capacity from 2017 to 2022[57]. The two countries are the world's second and third largest geothermal installed capacity in 2022, with 2360 and 1935 MW, respectively[58]. Particularly, Indonesia owns 40% of the world's geothermal reserve[59]. Geothermal is one of the prioritised alternatives in Indonesia in its energy transition. According to the Indonesian Electricity Supply Business Plan 2021-2030, Indonesia's renewables generation capacity will grow by 45–46 TWh from 2021 to 2025, with geothermal taking a share of 20–24%, the third largest renewable source. Besides, 8% of the total power capacity addition between 2021 and 2030 will also come from geothermal. Medco Energi and Pertamina Indonesia, two leading Indonesian fossil fuel companies have been involved in geothermal generation businesses. The National Electricity Company will also heavily rely on geothermal power to achieve Indonesia's goal of renewable energy as it is dispatchable and suitable for baseload generators[60]. In its General Plan for National Energy (RUEN), Indonesia aims to achieve 7 GW of geothermal power by 2025, requiring a US$15 billion investment, and 9.3 GW by 2035. However, the progress is sluggish. The Geothermal Director of the Energy and Mineral Resources Ministry estimated that the 7 GW goal will be achieved five years later (in 2030) than its original schedule as policy uncertainties in the field might hamper the required private investment[61]. The Indonesian government is implementing the Geothermal Power Generation Project, including the construction and commissioning of two geothermal power plants. Its total capacity is 110 MW[62].

[57] IRENA. (2023). RENEWABLE CAPACITY STATISTICS 2023

[58] Richter, A. (2023, January 10). ThinkGeoEnergy's Top 10 Geothermal Countries 2022 - Power Generation Capacity (MW). ThinkGeoEnergy. Retrieved from https://www.thinkgeoenergy.com/thinkgeoenergys-top-10-geothermal-countries-2022-power-generation-capacity-mw/

[59] Koty, A. C. (2022, July 28). An Overview of Indonesia's Geothermal Energy Sector. ASEAN Briefing. Retrieved from https://www.aseanbriefing.com/news/an-overview-of-indonesias-geothermal-energy-sector/ ; Ministry of Energy and Mineral Resources of Indonesia. (2023). Handbook of Energy & Economic Statistics of Indonesia 2022. https://www.esdm.go.id/assets/media/content/content-handbook-of-energy-and-economic-statistics-of-indonesia-2022.pdf

[60] Kurniawan, D., Tumiwa, F., Christian, J., Puspitarini, H. D., Vianda, F., Wiranegara, R., ... Institute for Essential Services Reform. (2023). Indonesia Energy Transition Outlook (IETO) 2023.

[61] Arkyasa, M. (2023, September 22). Challenges persist in accelerating Indonesia's geothermal energy growth. Indonesia Business Post. Retrieved from https://indonesiabusinesspost.com/risks-opportunities/challenges-persist-in-accelerating-indonesias-geothermal-energy-growth/

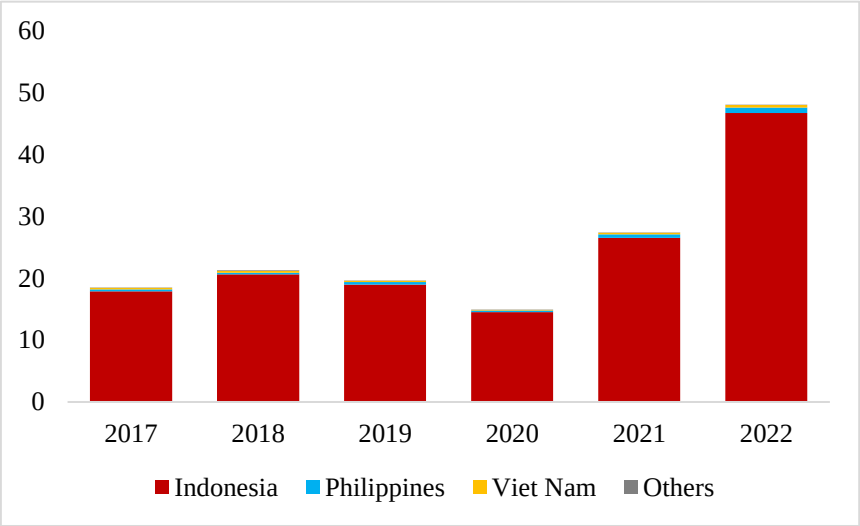
[62] Asian Development Bank. (2023). Geothermal Power Generation Project: Social Monitoring Report (January-June 2023). Retrieved from https://www.adb.org/sites/default/files/project-documents/52282/52282-001-smr-en_4.pdf

2.3 Energy Trade of ASEAN Member States

As we discussed earlier, the ASEAN energy supply heavily leans on fossil fuels for primary energy supply and electricity generation. However, they are not self-sufficient in meeting fossil fuel demand. Consequently, it is important to look at AMS's energy trade.

Coal is the most exported and least imported fossil fuel in ASEAN. Indonesia has led the coal exports, with 46 billion USD in 2022, contributing 95% to ASEAN's coal exports (Figure 6). Its coal exports grew substantially by more than 50% between 2017 and 2020[63]. India, China and Japan are the top three destinations for Indonesia's coal, accounting for 23%, 17% and 15% of Indonesia's coal exports in 2022. On the other hand, Malaysia is the largest (or second largest) coal importer in ASEAN from 2017 to 2022, with 7 billion USD in 2022. Australia is also a large coal import source for ASEAN, accounting for 35% of the region's total coal import[64].

Figure 6. ASEAN Member States' Coal Export, 2017-2022, Unit: Billion USD



Source: ASEANstatsDataPortal

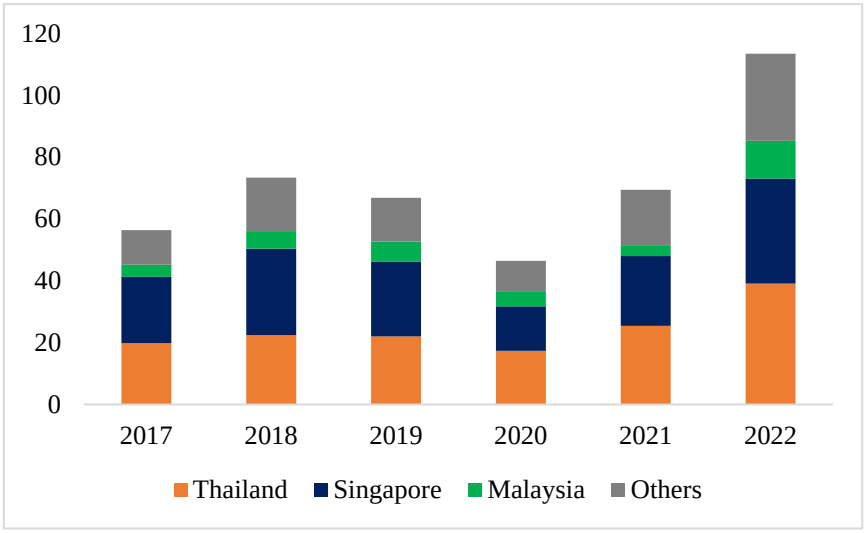
Oppositely, oil is the most imported but least exported fossil fuel in ASEAN from 2017 to 2022, as illustrated in Figure 7. The oil imports were 113 billion USD in 2022, double the total amount of gas and coal imports. Prominent ASEAN importers are Thailand, Singapore and Malaysia. The three AMS accounted for 75% of the regional imports, USD 85 billion in total.

[63] Ministry of Energy and Mineral Resources of Indonesia. (2023). Handbook of Energy & Economic Statistics of Indonesia 2022. https://www.esdm.go.id/assets/media/content/content-handbook-of-energy-and-economic-statistics-of-indonesia-2022.pdf

[64] ASEANstatsDataPortal. (n.d.). Trade in Goods (IMTS), Annually, HS 2-digit up to 8-Digit (AHTN), in US$. https://data.aseanstats.org/trade-annually

Oil is primarily imported from the United Arab Emirates, Saudi Arabia and the US, with 25%, 19% and 11%, respectively, in 2022[65].

Figure 7. ASEAN Member States' Oil Import, 2017-2022, Unit: Billion USD

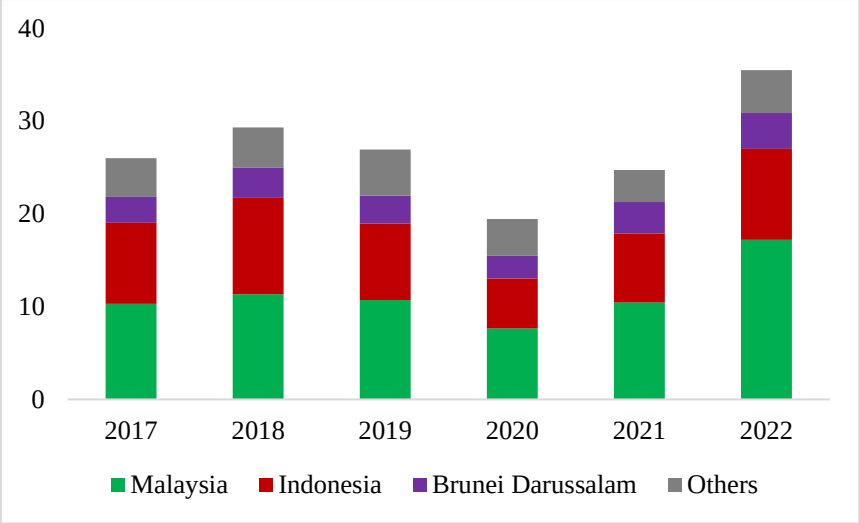


Source: ASEANstatsDataPortal

Natural gas is ASEAN's second-largest exported and imported fossil fuel from 2017 to 2022. Natural gas exports and imports are worth USD 35 and 31 billion, respectively, in 2022. As presented in Figure 8, Malaysia, Indonesia and Brunei are leading exporters. Notably, Malaysia covered almost half of ASEAN's total exports in 2022. Japan and China are the largest gas export markets, absorbing a third and a fourth of ASEAN's gas exports in 2022. The gas imports are concentrated in Thailand, Singapore and Indonesia. They contributed to 80% of ASEAN's total natural gas imports in 2022. Australia, Qatar and Malaysia are major import sources[66].

Figure 8. ASEAN Member States' Natural Gas Export, 2017-2022, Unit: Billion USD

[65] Ibid.
[66] Ibid.



Source: ASEANstatsDataPortal

In summary, Section 2 findings suggest that although energy transition is more important in ASEAN's energy agenda, there hasn't been significant progress in adopting renewable energy. Fossil fuels still dominate the energy structure and electricity generation in most AMS. Moreover, the trade volume of fossil fuels has consistently risen from 2017 to 2022, despite the increasing emphasis on energy transition during this period. This trend appears persistent, as some AMS have recently initiated new fossil fuel projects, and their national policies suggest a reluctance to swiftly phase out fossil fuels.

3. ASEAN and AMS' Policies on the Energy Transition

3.1 Energy Transition Policies at the ASEAN Level

3.1.1 Intra-Regional Efforts

ASEAN Plan of Action for Energy Cooperation (APAEC) is the most important policy document in ASEAN's energy sector. The latest APAEC, APAEC 2016-2025 Phase II serves as regional guidance to accelerate the energy transition to allow ASEAN to achieve energy security, accessibility, affordability and sustainability. It also marks the first time that energy transition has become the theme of APAEC, indicating that it is gaining higher importance in ASEAN's energy policy agenda.

Goals for energy transition are clearly set in the APAEC 2016-2025, particularly in renewable energy and energy efficiency (Table 1). However, data shows that the progress of all goals is

behind. In 2021, renewable energy accounted for 15.4% of TPES and 33.6% of installed power capacity. However, the share of renewable energy in of installed power capacity dropped slightly to 33.29% in 2022.[67] Energy intensity was reduced by 24.5% based on the 2005 level.[68] With existing regional policy efforts, the 23% goal in renewable energy will only be met in 2050, 25 years later than scheduled. The energy intensity reduction will also be slightly lower than planned, 29.2% versus 32%[69].

Table 1. ASEAN's Goals in Energy Transition

Area	Goal	Target Year
Renewable energy	23% of TPES	2025
	40% of TPES	2040
	35% of the total installed power capacity	2025
Energy efficiency	Reduce 32% of its energy intensity based on 2005 level	2025

Source: ACI based on APAEC 2016-2025 Phase II: 2021-2025

There are seven prioritised programmes in the APAEC 2016-2025 Phase II, expected to play different roles in accelerating the energy transition. These include 1) ASEAN Power Grid; 2) Trans-ASEAN Gas Pipeline; 3) Coal and Clean Coal; 4) Energy Efficiency and Conservation; 5) Renewable Energy; 6) Regional Energy Policy and Planning; and 7) Civilian Nuclear Energy. Each of them entails two to five outcome-based strategies and action plans, compassing studies on relevant topics, capacity-building activities, database construction, and building institutional mechanisms. In total, there are 31 outcome-based strategies and 99 action plans for the seven programmes[70].

[67] ASEAN Centre for Energy. (2023). ASEAN Power Updates 2023. Retrieved 2 April 2024, from https://aseanenergy.org/publications/asean-power-updates-2023/
[68] ASEAN Secretariat. (2023). Joint Ministerial Statement of the 41st ASEAN Ministers on Energy Meeting. https://asean.org/wp-content/uploads/2023/08/41st-AMEM-JMS-Final-and-Adopted.pdf.
[69] ASEAN Centre for Energy (ACE). (2022, September 15). The 7th ASEAN Energy Outlook. https://aseanenergy.org/the-7th-asean-energy-outlook/
[70] APAEC Drafting Committee. (2020). ASEAN Plan of Action for Energy Cooperation 2016-2025 Phase II. ASEAN Centre for Energy https://aseanenergy.org/asean-plan-of-action-for-energy-cooperation-apaec-phase-ii-2021-2025/

Among the seven programmes, there are more detailed plans for the Trans-ASEAN Gas Pipeline and Renewable Energy. The Gas Advocacy White Paper was published in 2018 to build a common gas market in the region, focusing on raising awareness and driving sustainable gas market developments through public engagement, education, and existing policies[71]. Yet, after five years, we can hardly see updates for the white paper or similar policy documents. For the Renewable Energy programme, ASEAN has been working on the ASEAN Renewable Energy Long-term Roadmap since 2022. There are four stages to articulate the roadmap, desktop study, development, primary elements, and expert engagement. In 2023, ACE was at the stage of desktop study. It worked with the United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP) to publish the *ASEAN Renewable Energy Regional Approach*, identifying the strengths, weaknesses, opportunities, and threats of the roadmap[72]. There aren't more detailed or in-depth implementation plans for the remaining five programmes.

In addition, while there is no prioritised programme called "regional energy trade", it garners significant attention in the APAEC Phase II. Electricity and gas are key sectors in regional energy trade. This has been highlighted in APG and TAGP, which aim to enhance connectivity, energy security, and sustainability in the ASEAN region by promoting multilateral trade in power and gas and expanding interconnection. According to the APAEC 2016-2025 Phase II, ASEAN has been and will continue studies on energy infrastructure, transmission systems and the harmonisation of institutional frameworks (including legal, regulatory, tax, and financing frameworks) for cross-border trade in gas and electricity within the region as well as searching for suitable models for the regional market.

3.1.2 Extra-Regional Cooperation

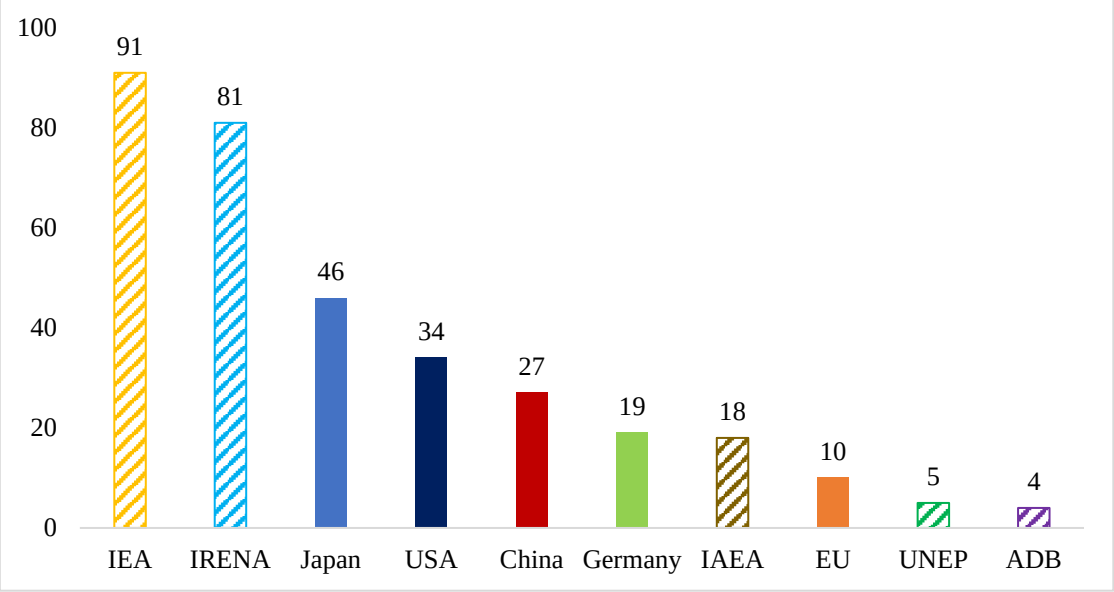
Besides regional efforts, ASEAN also has extensive energy cooperation with its dialogue partners and international organisations. Japan, the US, China, Germany, IEA and IRENA are major dialogue partners and international organisations of ASEAN in energy transition. These countries and organisations have the highest visibility in the APAECs' and AMEM's joint statements (Figure 9). This can also be seen in the public investment flow (Figure 10). China,

[71] ASEAN Council on Petroleum (ASCOPE). (2018). Gas Advocacy White Paper. http://www.ascope.org/Projects/Detail/1063

[72] ASEAN Centre for Energy and United Nations ESCAP. (2023). ASEAN Renewable Energy Regional Approach. Jakarta, Indonesia. https://aseanenergy.org/asean-renewable-energy/

Japan, the US, and Germany are also the top four public investors in ASEAN's renewable energy projects. However, we also see that international organisations like IEA and IRENA, which have the highest visibility in ASEAN's energy policy documents, are not public investors in the region. This is because the missions of the two institutions are to provide data and policy analysis in the energy sector, promote knowledge-sharing and dialogue platforms, and carry out capacity-building activities[73]. They don't provide financial assistance, including loans or grants for their partners. On the other hand, the International Bank for Reconstruction and Development, International Finance Corporation and so on are invisible in ASEAN energy documents, though they are leading public investors in the region. Similarly, France, the tenth-largest renewable energy investor in the region is also invisible in the policy documents. A potential reason is that a large portion of the French investment from 2010 to 2020 flowed to two projects in two AMS, which were in 2010 and 2015. From the perspective of timing, the projects were old and did not fall within the time frame we calculated for the frequency of visibility for AMEM statements. Additionally, France does not have a specific programme for its cooperation with ASEAN in the energy sector, while other country-level public investors have.

Figure 9. Top Five Dialogue Partners and International Organisations with Highest Visibility in APAECs and AMEM Joint Statements, 2010-2023



Note:

[73] IEA. (2022). Agreement on an International Energy Program (As amended 20 February 2022). Retrieved from https://iea.blob.core.windows.net/assets/86dfa7af-a122-4f83-93e7-8689fa42d101/IEPAgreement_Updated2023.pdf

1) *The frequency of the international organisations, countries and governmental agencies is counted based on their occurrence in the APAEC 2010-2015, 2016-2025 Phase I, 2016-2025 Phase II and the AMEM Joint Statements between 2017-2023. The visibility of a government agency will be included the country's visibility. The visibility in acknowledgement, reference, and the list of acronyms is excluded. For the USA, we do not count it when "US" appears as USD.*

   We count the frequency of visibility from AMEM statements from 2017 onwards because before 2017, energy transition was not mentioned at all in the AMEM statements. It also did not exist in APAECs before 2010.

2) *Abbreviation list:*

   IEA: International Energy Agency

   IRENA: International Renewable Energy Agency

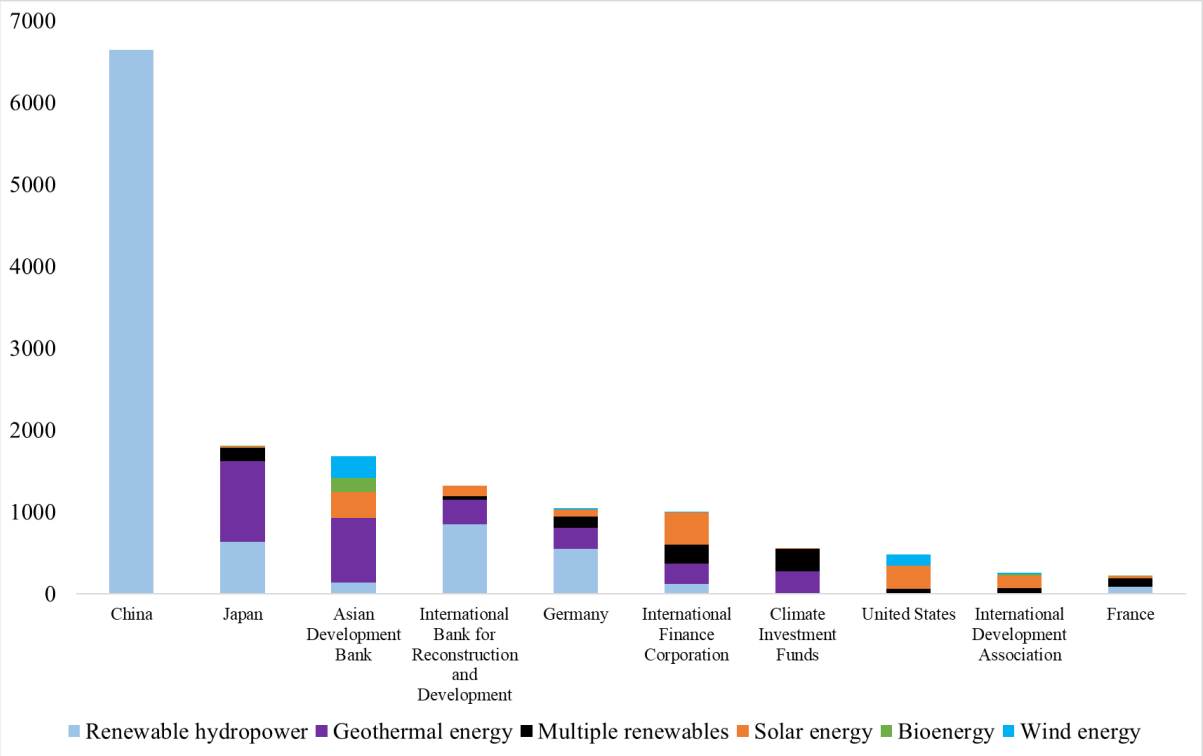
   IAEA: International Atomic Energy Agency

   ADB: Asian Development Bank

   UNEP: United Nations Environment Programme

Source: ACI based on ASEAN Centre for Energy

Figure 10. Top Five Public Investors to ASEAN in Renewable Energy, 2010-2020 (Unit: 2020 USD Million)



Source: ACI based on IRENA

Major activities of ASEAN's international cooperation with its partners fall in knowledge sharing and capacity building, joint studies on renewable energy, energy efficiency and clean technologies, such as carbon capture utilisation and storage (CCUS) and investments in renewable energy projects. However, the focus of the cooperation projects varies across Dialogue Partners (DP) and International Organisations (IO) and have different highlights in their collaborative activities. In the coming section, we will discuss the highlights of the cooperation in energy transition between ASEAN and its partners.

International Cooperation with Leading Dialogue Partners

ASEAN-China cooperation

ASEAN-China cooperation in the energy transition focuses on renewable power, primarily hydro, solar, and wind power, with a smaller emphasis on activities related to nuclear power. As shown in Figure 10, all public-invested renewable projects in ASEAN from China between 2010 and 2020 were hydropower projects. In capacity building, the China-ASEAN Clean Energy Capacity Building Programme, operating since 2017, included themes of hydro, solar, and wind power training from 2017 to 2023. Solar was a theme for over four years, followed by hydro for three years, and wind power for two years. The training covered policy design and technical skills in these renewable technologies, including equipment application and grid operation, among others[74]. By 2023, the program had trained more than 1,000 personnel[75].

ASEAN- Japan cooperation

The ASEAN-Japan cooperation in the energy transition is comprehensive and enduring, encompassing diverse renewable energies and energy efficiency. In renewable energy, ASEAN-Japan cooperation primarily focuses on hydro and geothermal energy. More than half of Japanese public investment in AMS has been directed toward geothermal projects and 35%

[74] Belt and Road Energy Cooperation. (2021). China-ASEAN Clean Energy Capacity Building Program. Retrieved from http://obor.nea.gov.cn/pictureDetails.html?id=2556

[75] Wang, Z. (2023, September 22). 2023 China-ASEAN Clean Energy Cooperation Week concludes, forming a series of achievements. China News Services. https://www.hi.chinanews.com.cn/hnnew/2023-09-22/689914.html

was in renewable hydropower from 2010 to 2020 (Figure 10). Additionally, there are renewable projects involving bioenergy, solar, wind, and ammonia[76].

In energy efficiency, the two parties have collaborated on implementing Energy Efficiency and Conservation under the APAEC through initiatives over the past two decades. Programmes like the ASEAN-Japan EE&C Capacity Building Programme and ASEAN-Japan Energy Efficiency Partnership (AJEEP) have addressed capacity-building activities in improving energy efficiency, including regulatory frameworks, building codes evaluation criteria, promotion of energy efficiency technology, and energy management. Take the AJEEP Scheme 2: Training of Trainers (2016-2022) as an example. The Scheme chose to train more senior energy managers to be energy manager trainers so they can train other energy professionals back home. This can extend the impact of the training programme and benefit more people than only the attendees. Trainees of the programme attended the training for approximately six months. This duration is comparatively longer than typical training programs between ASEAN and its partners. The six-month training will expose trainees to energy conservation technologies and energy audits in factories and buildings, teaching energy managers trainers the intricacies of producing effective energy audits and generating implications from Japanese EE&C policies. From 2016 to 2022, the program successfully trained and certified 80 energy manager trainers. These certified trainers are mainly from government institutions and actively engage in training other energy managers in their respective home countries, playing a pivotal role in building and improving robust energy management systems[77].

Another highlight of ASEAN-Japan cooperation lies in clean technologies, which is uncommon in cooperation with other dialogue partners. Japan and Indonesia signed a memorandum of cooperation to promote the development and adoption of decarbonisation technologies such as hydrogen, clean fuel ammonia production and carbon capture utilisation and storage (CCUS)[78]. It also conducted joint studies on Carbon Capture and Storage (CCS)

[76] Takanashi, M. (2023, June). CCS Potential and Challenges in ASEAN: JOGMEC's Activities and Support Schemes. Asia Zero Emission Community Technical Seminar. Retrieved from https://static1.squarespace.com/static/645dd77837384a49f437cc02/t/649ba6acabf6c80809848c86/1687922356864/JOGMEC-CCS+for+AZEC_June2023-updated.pdf

[77] The Energy Conservation Centre Japan (ECCJ) & ASEAN Centre for Energy (ACE). (2023). ASEAN-Japan Energy Efficiency Partnership (AJEEP) Scheme 2 Training of Trainers (2016-2022): Achievements and Impacts. Retrieved from https://aseanenergy.org/asean-japan-energy-efficiency-partnership-ajeep-scheme-2-training-of-trainers-2016-2022-achievements-and-impacts/

[78] IEA. (2022, February 11). Japan - Indonesia cooperation agreement on decarbonization technologies. Retrieved from https://www.iea.org/policies/14737-japan-indonesia-cooperation-agreement-on-decarbonization-technologies ; Takanashi, M. (2023, June). CCS Potential and Challenges in ASEAN: JOGMEC's Activities and Support Schemes. Asia Zero Emission Community Technical Seminar. Retrieved from

development with Malaysia and Indonesia and successfully implemented a CCUS pilot project in Indonesia[79]. Asia Zero Emission Community, wherein Japanese governmental agencies plan to mobilise up to $8 billion for member countries, including ASEAN states, Japan, and Australia. This initiative aims to encourage the adoption of renewable energy and CCUS technologies while providing crucial human resources training in relevant fields[80].

ASEAN-Germany Cooperation

Germany is interested in deploying hydro and solar energy in ASEAN. As presented in Figure 10, 53% of the German public investment in renewable energy in the ASEAN region was directed to renewable hydropower and a quarter contributed to geothermal energy projects. Additionally, the ASEAN-German Energy Program (AEGP), facilitated by the German Agency for International Cooperation (GIZ) dedicated efforts to better financing the energy transition in ASEAN. It published detailed investment and development guidelines for projects in energy efficiency, solar, wind, bioenergy and hydro energy for multiple AMS, Indonesia, Malaysia, Thailand, the Philippines, Vietnam and so on[81]. Though many collaborative projects between ASEAN and its dialogue partners aim to promote investment in renewable energy and energy efficiency, such detailed and practical guidelines to help stakeholders make actual investments are hardly seen in other collaborative projects, marking the uniqueness of ASEAN-Germany cooperation.

The AEGP also stands out by focusing on fostering ACE's organisational growth, positioning ACE as a "regional centre of excellence for sustainable energy". During the initial phase, AEGP Phase I (2016-2019), the program encouraged harmonised regional actions to advance renewable energy and energy efficiency across AMS. Emphasis was placed on encouraging regional technical exchange in the fields of renewable energy and energy efficiency, alongside

https://static1.squarespace.com/static/645dd77837384a49f437cc02/t/649ba6acabf6c80809848c86/1687922356864/JOGMEC-CCS+for+AZEC_June2023-updated.pdf

[79] Takanashi, M. (2023, June). CCS Potential and Challenges in ASEAN: JOGMEC's Activities and Support Schemes. Asia Zero Emission Community Technical Seminar. Retrieved from https://static1.squarespace.com/static/645dd77837384a49f437cc02/t/649ba6acabf6c80809848c86/1687922356864/JOGMEC-CCS+for+AZEC_June2023-updated.pdf

[80] Indonesia Business Post. (2023, September 19). Japan increases funding commitment for Indonesia's energy transition but criticism persists. Retrieved from https://indonesiabusinesspost.com/risks-opportunities/japan-increases-funding-commitment-for-indonesias-energy-transition-but-criticism-persists/#:~:text=AZEC%20members%2C%20including%20Australia%2C%20Brunei,Asia%20as%20the%20next%20step.

[81] ASEAN-German Energy Program. (n.d.) Guidelines. https://agep.aseanenergy.org/publications/guidelines/

initiatives to strengthen R&D in renewable energy within the ASEAN region[82]. Building on Phase I, the AEGP Phase II (2019-2022) specifically targeted ACE's organisational growth by enhancing its capability in energy data collection and processing. Moreover, the programme played a role in developing pertinent guidelines for data processing to bolster ACE's competency. In addition to this, support was provided to ACE in formulating a sustainable business plan and establishing a robust financing mechanism[83].

ASEAN- US cooperation

ASEAN- US cooperation on energy transition emphasises the power sector, clean power development in particular. Commenced in 2021, the USAID Southeast Asia Smart Power Program will be operated for five years with USD $40 million. It aims to mobilise $2 billion in blended financing for clean energy infrastructure, deploy 2,000 MW of advanced energy systems and contribute to a five percent increase in regional power trade. By 2023, the programme delivered 13 technical trainings on clean energy for around 1000 energy practitioners in ASEAN and supported the development of 348 MW of renewable energy projects[84].

Another example is the USAID Clean Power Asia. Operating from 2019 to 2021, it helped to close a $283 million deal to build the first solar farms with 257 MW in generation capacity in Vietnam, sufficient to supply the needs of over 50,000 households. In Thailand, the project supported to procure and install 7.6 MW of rooftop solar projects valued at more than $10 million[85]. The joint studies and capacity-building activities under the project extended to regional power trade, such as regional power market design and budget allocation for regional transmission lines[86]. Besides, it spearheaded capacity-building activities by developing the

[82] ASEAN-German Energy Program (AEGP). (2018). [Factsheet] ASEAN-German Energy Programme (AGEP). https://agep.aseanenergy.org/asean-german-energy-programme-agep/
[83] ASEAN-German Energy Program (AEGP). (2021). [Factsheet] ASEAN-German Energy Programme (AGEP) Phase II. https://agep.aseanenergy.org/publications/factsheets/
[84] USAID. (2023). USAID Southeast Asia Smart Power Program Fact Sheet. https://www.usaid.gov/sites/default/files/2023-06/FS_USAID%20SPP_May_2023.docx_2_0.pdf
[85] USAID. (2020). USAID Clean Power Asia Fact Sheet. https://2017-2020.usaid.gov/sites/default/files/documents/FS_Clean_Power_Asia_May_2020.pdf
[86] USAID and Deloitte. (2022). USAID Southeast Asia Smart Power Program Year 1 Performance Report (December 10, 2021 – September 30, 2022).

Clean Edge Asia Power Sector Learning Series, which focuses on solar power development and using technological tools in energy management[87].

International Cooperation with Leading International Organisations

In comparison to collaboration with dialogue partners, who offer both technical and financial support for ASEAN's energy transition, cooperation with international organisations centres around seminars, joint studies, and roadmaps. These activities involve discussions on pertinent issues and the development of strategic plans for energy efficiency, the deployment of renewable energy, and multilateral power trade within the region.

ASEAN-IEA Cooperation

ASEAN and IEA established the AMEM-IEA Energy Dialogue to discuss their cooperation annually[88]. Bilateral cooperation has centred on energy efficiency, financing clean energy and regional power trade. Cooperation in energy efficiency was primarily in developing energy-efficient buildings. Many of the capacity-building activities were conducted in Singapore, as it is the hub of the ASEAN-IEA cooperation activities. There were multiple capacity-building activities under the Singapore-IEA Training Programme aiming to enhance energy efficiency in buildings, including developing efficient grid-interactive buildings, low-carbon buildings, and energy-efficient cooling systems[89].

Furthermore, IEA also conducted joint studies and training on clean energy investment with ASEAN. For example, the ASEAN Clean Energy Investment and Financing Training

[87] USAID Southeast Asia EDGE Hub. (n.d.). Clean Edge Asia Power Sector Learning Series Archive. Retrieved from https://www.usaidseaedgehub.org/archive/

[88] APAEC Drafting Committee. (2020). ASEAN Plan of Action for Energy Cooperation 2016-2025 Phase II. ASEAN Centre for Energy https://aseanenergy.org/asean-plan-of-action-for-energy-cooperation-apaec-phase-ii-2021-2025/ ; IEA. (2018, August 31). Singapore and the IEA co-host first-ever ASEAN Clean Energy Investment and Financing Training Programme. Retrieved from https://www.iea.org/news/singapore-and-the-iea-co-host-first-ever-asean-clean-energy-investment-and-financing-training-programme

[89] ASEAN Secretariat. (2019, September 5). Joint Ministerial Statement of the 37th ASEAN Ministers on Energy Meeting. https://asean.org/joint-ministerial-statement-of-the-37th-asean-ministers-on-energy-meeting/ ; ASEAN Secretariat. (2022, September 16). Joint Ministerial Statement of the 40th ASEAN Ministers on Energy Meeting. https://asean.org/joint-ministerial-statement-of-the-40th-asean-ministers-on-energy-meeting/

Programme in 2018 for policymakers and energy professionals aimed to build up capability in developing country-level strategies and attracting investments for energy infrastructure[90].

Increasing regional power trade and integrating renewable energy in the power system are also focuses of the ASEAN-IEA Three-Year Rolling Working Programme (2019-2021). The ASEAN Renewable Integration Analysis Study by Thailand and ASEAN analysed the impact of integrating renewable energy into the APG[91]. The joint report *Establishing Multilateral Power Trade in ASEAN* by IEA and ACE identified minimum requirements to advance regional power trade and proposed possible trade models for ASEAN based on international best practices [92]. Following that, IEA also planned to conduct knowledge and information workshops with ASEAN on frameworks for grid code, data and information sharing, and dispute resolution, which are the minimum requirements identified in the report[93].

Cooperation with IRENA

Similar to ASEAN-IEA cooperation, ASEAN-IRENA cooperation is also in the form of capacity-building activities, joint studies, and developing policy roadmaps. As IRENA is an international organisation focusing on renewable energy, the cooperation with it shares the same focus. For example, IRENA trained ASEAN and AMS officials to use FlexTool, a power system flexibility assessment tool developed by IRENA for ramping up the integration of renewable power into existing power systems. FlexTool is also used to develop renewable energy roadmap and energy transition roadmaps[94]. In 2019, IRENA worked with Thailand's Department of Alternative Energy Development and Efficiency to assess the flexibility of the

[90] International Energy Agency (IEA). (2018, August 31). Singapore and the IEA co-host first-ever ASEAN Clean Energy Investment and Financing Training Programme. Retrieved from https://www.iea.org/news/singapore-and-the-iea-co-host-first-ever-asean-clean-energy-investment-and-financing-training-programme ; Energy Market Authority of Singapore. (2018, August 28). Singapore and IEA Co-host Inaugural Training Programme on Energy Investment and Financing. Retrieved from https://www.ema.gov.sg/news-events/news/media-releases/2018/singapore-and-iea-co-host-inaugural-training-programme-on-energy-investment-and-financing#:~:text=This%20programme%20is%20designed%20to,sustainable%20financing%20for%20energy%20infrastructure.

[91] ASEAN Secretariat. (2019, September 5). Joint Ministerial Statement of the 37th ASEAN Ministers on Energy Meeting. https://asean.org/joint-ministerial-statement-of-the-37th-asean-ministers-on-energy-meeting/

[92] International Energy Agency (IEA) & ASEAN Centre for Energy (ACE). (2019). Establishing Multilateral Power Trade in ASEAN. Retrieved from https://asean.org/book/establishing-multilateral-power-trade-in-aseanestablishing-multilateral-power-trade-in-asean/

[93] International Energy Agency. (2020). IEA working with ASEAN on developing multilateral power trade in the region. Retrieved from https://www.iea.org/news/iea-working-with-asean-on-developing-multilateral-power-trade-in-the-region

[94] IRENA. (n.d.). The IRENA FlexTool. https://www.irena.org/Energy-Transition/Planning/Flextool

Thai power system to integrate a high share of renewable energy and explore cost-efficient investment options to achieve a high rate[95]. Among diverse renewables, the sustainable development of modern bioenergy is highlighted on their cooperation agenda, which can be seen in the 38th-41st AMEM statements through the sections about their cooperation with IRENA. Besides, IRENA has developed energy transition roadmaps for ASEAN and three AMS, including Indonesia, Malaysia and Thailand.

The preceding examination of ASEAN's energy transition policies underscores the regional bloc's commitment to clear objectives, accompanied by considerable efforts to realise them. However, the observed progress hints at a potential shortfall, raising pertinent questions about the factors contributing to ASEAN's struggle to meet its energy transition targets. To unravel this, it becomes imperative to shift our focus from ASEAN as a collective entity and delve into the individual national policies of its member states. Despite a comprehensive regional blueprint like APAEC, the absence of legally binding implications at the national level places significant reliance on the actions and implementations of individual AMS. Section 3 delves into an in-depth review of energy transition policies at the AMS level, shedding light on the challenges that could impede ASEAN's progress toward the outlined goals in APAEC.

3.2 Energy Transition Policies in the ASEAN Member States

3.2.1 Energy Transition Policy Landscape in AMS

In AMS, policies on energy transition fall under the umbrella of energy policies, so we will start the section by reviewing AMS' energy policies. All AMS have their national energy plans. An exception is Brunei Darussalam, whose energy plan is a part of its national climate policy. Not all AMS mentioned "energy transition" in their most recent energy policy documents, but they have spent efforts in enlarging the adoption of renewables and reducing energy intensity and GHG emissions, which are actions about energy transition, by definition. AMS set numeric goals in the three fields. The goals to reduce GHG emissions range from 20% to 30% by around 2030, except for the Philippines (Table 2). In renewable energy, AMS' goals emphasise integrating renewable energy into the power system, measured in the share of renewables in installed capacity or power generation. Goals of adopting renewable energy for the whole

[95] IRENA. (2019). Thailand power system flexibility assessment. https://www.irena.org/Publications/2019/May/Thailand-power-system-flexibility-assessment

energy sector, measured by total primary energy supply or final consumption are rarely seen (Table 3). Goals for energy efficiency were also set but measured in different ways and it's difficult to compare the level of commitment across countries (Table 4). Although AMS set specific goals for energy transition, the problem is that they fall short of the ASEAN goals mentioned in the APAEC. We will discuss the problem in detail in the section 3.2.2.

Table 2. ASEAN Member States' Goals in National Determined Contributions

Member state	GHG emission reduction based on 2005 level (Unconditional)	GHG emission reduction Target Year	Net-zero emission by	Carbon neutrality by
Brunei Darussalam	20%	2035	2050	
Cambodia	27%	2030		2050
Indonesia	29%	2030	2060	
Laos	60%		2050	
Malaysia	35% GHG Emissions per GDP	2030		2050
Myanmar	30%	2030		2050
Philippines	2.71%	2030		
Singapore	36% GHG Emissions per GDP		Around mid-century	
Thailand	20%		2065	2050
Vietnam	27%		2050	

Source: ACI based on UNCCC

Table 3. ASEAN Member States' Goals in Renewable Energy

Member state	Goals of Renewable Energy in Installed Capacity	Target Year	Meet ASEAN's Goal?
ASEAN	**35%** **23% (of the TPES)**	**2025**	**--**
Brunei Darussalam	30% (in power generation capacity)	2035	
Cambodia	25% (in power generation capacity)	2030	
Indonesia	23% (of the TPES)	2025	
Laos	1 GW for solar and wind 300 MW for biomass	2030	

	(with international support)		
Malaysia	29% (Business-as-usual scenario) 31% (New Capacity Target scenario) [96]	2025	
Myanmar	48%	2030	
Philippines	35%	2030	
Singapore	3% of solar power	2030	
	30% of import power from low-carbon resources	2035	
Thailand	15%-20% (in electricity generation) 68% of total electricity generation in 2040	2037	
Vietnam	30.9% - 39.2% in electricity generation (final) 11.9-13.4% by 2030 (draft)	2030	

Note:

The country will meet ASEAN's goals if the national goal can be achieved on time.

Not sure whether the country will meet ASEAN's goal or not if the national goal can be achieved on time.

The country will fall short of ASEAN's goal even if the national goal can be achieved on time.

If the country sets an equal or higher goal in renewable energy deployment than the goal in the APAEC (ASEAN goal), we argue that it will meet ASEAN's goals if the national goal can be achieved on time.

The Indonesian government plans to update its National Energy Policy (KEN) and launch the updated version in 2024. The policy draft under discussion in the House of Representatives shows that Indonesia will downgrade the goal to include 23% of renewable energy in the TPES by 2025 to 17% - 19%.[97] If this is launched, it means that not a single AMS has an equal level of commitment to renewable energy adoption as the regional goal.

[96] The business-as-usual scenario means that Malaysia will implement existing energy policies and programmes. There will not be further extension and/or introduction of new programmes. The New capacity target scenario targets a higher renewable energy capacity (40% of the total installed capacity) by 2035, with further decarbonisation of the electricity sector in Malaysia. Source: Sustainable Renewable Energy Authorities of Malaysia. (2021). Renewable Energy Transition Roadmap 2035. https://www.seda.gov.my/reportal/wp-content/uploads/2021/12/MyRER_webVer-1.pdf

[97] ASEAN Centre for Energy. (2023). ASEAN Power Updates 2023. Retrieved 2 April 2024, from https://aseanenergy.org/publications/asean-power-updates-2023/; Mutya, Yustika. (2024, February 13). *The dark cloud over Indonesia's pledge to achieve net-zero emissions by 2060*. Institute for Energy Economics and Financial Analysis. https://ieefa.org/resources/dark-cloud-over-indonesias-pledge-achieve-net-zero-emissions-2060

Source: ACI based on ASEAN Renewable Energy Regional Approach (for Laos and Myanmar), The Philippine's National Renewable Energy Program 2020-2040, Malaysia Renewable Energy Roadmap, Brunei Darussalam National Climate Change Policy 2020, Cambodia's Updated Nationally Determined Contribution, Enhanced Nationally Determined Contribution Republic of Indonesia, Singapore Green Plan 2030, Vietnam's DECISION Approving the National Electricity Development Planning of 2021 - 2030 And Vision For 2050, The 7th ASEAN Energy Outlook and World Bank.

Table 4. ASEAN and ASEAN Member States' Goals in Energy Efficiency

Member State	Goal	Target Year
ASEAN	**32% reduction of energy intensity based on 2005 level**	**2025**
Brunei Darussalam	45% reduction of energy intensity based on 2005 level	2035
Cambodia	At least a 19% reduction of total energy consumption (thermal and electrical) compared to the BAU scenario	2030
Indonesia	An annual reduction of 1% in final energy intensity	2025
Laos	10% reduction in energy consumption by 2030 compared to the BAU scenario	2030
Malaysia	21% energy savings compared to the BAU scenario	2040
	22% energy savings compared to the BAU scenario	2050
	8% electrical efficiency savings	2016 – 2025
Myanmar	8% reduction of the total energy consumption based on 2005 level	2020
Philippines	5% energy saving from oil products and electricity compared to BAU	2040
Singapore	36% reduction of energy intensity based on 2005 level	2030
Thailand	30% reduction of energy intensity based on 2010 level	2037
Vietnam	Primary energy intensity to be 420-460 kgOE/ USD 1,000 GDP	2030

Note: BAU: Business-As-Usual

Source: ACI based on APAEC 2016-2025 Phase II, Brunei Darussalam National Climate Change Policy 2020, Lao's National Policy on Energy Efficiency and Conservation, Malaysia's Renewable Energy Transition Roadmap, Enhanced Nationally Determined Contribution Republic of Indonesia, The National Climate Change Secretariat of Singapore, Thailand's Energy Efficiency Plan 2018-2037, Resolution No 55NQ/TW on the Orientation of the National Energy Development Strategy of Vietnam to 2030, The 7th ASEAN Energy Outlook

It is worth mentioning that Malaysia and Singapore have specific policy plans for energy transition. Singapore's *Charting the Energy Transition to 2050* is for the energy transition in the power sector. The plan focuses on facilitating the transition from three perspectives, supply, grid and demand. It emphasises maximising its solar potential, managing solar intermittency, leveraging digital technologies to improve the efficiency of grid planning and operation, and shaping consumption patterns by price signals[98]. Malaysia's *National Energy Transition Roadmap* is more comprehensive for the energy sector. This detailed plan has six prioritised levers, including energy efficiency, renewable energy, hydrogen, bioenergy, green mobility and carbon capture, utilisation and storage. For each lever, the plan sets goals, identifies challenges to meet the goals and proposes responding initiatives. It will take Malaysian Ringgit (RM) 1.2-1.3 trillion (approximately USD 252 – 273 billion[99]) to achieve the goals in the roadmap, with RM 2 billion (approximately USD 420 million) as the initial seed. It also presents investment opportunities worth RM 25 billion (approximately USD 5.25 billion)[100].

Other AMS, though without a policy plan specifically for energy transition, focus on enhancing energy efficiency and deploying renewable energy. All AMS have policy plans on improving energy efficiency. Yet, some of their policies are out of date. For example, Myanmar's *National Energy Efficiency and Conservation Policy, Strategy and Roadmap* was published in 2015 and set the goals due in 2020. It has no goals from 2020 onwards[101]. Some AMS have policy programs implemented to reduce energy intensity. Malaysia and the Philippines have action plans on energy efficiency. Singapore provides Energy Efficiency Grants for SMEs in the food and retail sector to adopt energy-efficient equipment[102]. Thailand's Smart Farm Subsidy Programme subsidised 30% of the investment cost for 19 farms, which saved 750 tonnes of oil equivalent of energy annually in 2018[103]. Cambodia has requested mandatory energy efficiency

[98] Energy Market Authority of Singapore. (March 2022). Charting the Energy Transition to 2050. Energy 2050 Committee Report. https://www.ema.gov.sg/resources/industry-reports/energy-2050-committee-report
[99] Note: 1 Malaysian Ringgit equals 0.21 United States Dollar.
[100] Malaysia's Ministry of Economy. (2023). National Energy Transition Roadmap. https://www.ekonomi.gov.my/sites/default/files/2023-09/National%20Energy%20Transition%20Roadmap_0.pdf
[101] ADB. (2015). Energy Efficiency & Conservation Policy, Strategy and Roadmap. Asia Development Bank. https://policy.asiapacificenergy.org/sites/default/files/National%20Energy%20Efficiency%20and%20Conservation%20Policy%20%28NEECP%29%2C%20Strategy%20and%20Roadmap%20%28Draft%29.pdf
[102] Enterprise Singapore. (2023). Energy Efficiency Grant. https://www.enterprisesg.gov.sg/financial-support/energy-efficiency-grant
[103] Ministry of Energy of Thailand. (19 November 2020). Thailand Economy Update. https://www.apec.org/docs/default-source/satellite/EGEEC/Files/55/20201120-0930-EGEEC55-_Thailand-economy-update-2020.pdf

labelling for all electronic appliances[104]. These policy plans and programmes indicate that the countries have more concrete efforts or at least a stronger willingness to take concrete actions in the field.

Increasing renewable energy deployment also attracts great attention in energy policies. Seven AMS have specific policy plans for it. Malaysia put forward its *Renewable Energy Transition Roadmap 2035*, setting up the strategic framework with solar power, bioenergy and hydropower as priorities[105]. It also has the *National Biomass Action Plan*. The Philippines has a long-term *National Renewable Energy Program 2020-2040*. One of the focuses of renewable energy deployment is in the power sector, as the sector is a major consumer of energy. Brunei, Malaysia, Vietnam and the Philippines also have sector-specific policies on renewable energy or energy efficiency for energy-intensive sectors such as transport, chemicals and minerals. Many of them stress promoting the adoption of EVs and clean fuels. For example, Brunei targets electric vehicles to make up 60% of its annual vehicle sales by 2035. Indonesia's objective is to achieve 2 million units of electric cars by 2030[106].

Comparatively, clean energy technologies receive limited policy attention in energy policies. Only few AMS have policies on the development of clean energy technologies. In *Malaysia's Green Technology Masterplan 2017-2030*, energy is one of the targeted sectors for Malaysia's green technology, emphasising electricity generation and efficiency. This involves clean coal technologies in new coal-fired plants, renewable energy exploration to diversify the electricity supply mix, and the implementation of smart grids to enhance electricity usage efficiency. The plan further promotes cross-sectoral research collaboration for localised energy technology development. However, a large portion of the plan is about existing policy plans. The section about future plans is generic and vague, without concrete actions to achieve the goals it mentioned at the beginning[107]. Indonesia does not have policy plans on clean technologies but has eight carbon capture, utilisation and storage projects under construction. These projects

[104] Manoj Mathew. (2023). Kingdom makes EE labels must for electrical appliances. Khmer Times. August 16, 2023. https://www.khmertimeskh.com/501343447/kingdom-makes-ee-labels-must-for-electrical-appliances/
[105] Sustainable Renewable Energy Authorities of Malaysia. (2021). Renewable Energy Transition Roadmap 2035. https://www.seda.gov.my/reportal/wp-content/uploads/2021/12/MyRER_webVer-1.pdf
[106] ASEAN Centre for Energy (ACE). (2022, September 15). The 7th ASEAN Energy Outlook. https://aseanenergy.org/the-7th-asean-energy-outlook/
[107] Ministry of Energy, Green Technology and Water of Malaysia. (2017). Green Technology Master Plan 2017-2030. https://www.pmo.gov.my/wp-content/uploads/2019/07/Green-Technology-Master-Plan-Malaysia-2017-2030.pdf

will commence operation as early as 2026[108]. As we discussed in Section 2, in the near future, given that most AMS will continue to rely on fossil fuels, where a large proportion of GHG emissions come from, it is concerning that they do not have policy plans or supporting programmes on clean energy technologies, which play a vital role in reducing GHG emissions from fossil fuels consumption and help AMS to be better on track to meet their goals in sustainability while ensuring a secure and affordable energy supply.

3.2.2 Misalignment between Regional and National Energy Transition Policy

The previous review of energy transition policies at the AMS level demonstrates their willingness to conduct energy transition. However, comparing the policies between ASEAN and AMS, we find that the national goals and plans of energy transition in AMS misalign with the ASEAN's, which are specified in the APAEC 2016-2025. Additionally, the seven prioritised programmes in the APAEC are not reflected in the national energy transition policies of AMS. Furthermore, existing efforts at the AMS level are insufficient to meet ASEAN's regional goal mentioned in the APAEC 2016-2025 Phase II.

For most of the AMS, their goals in increasing the share of renewable energy fall short of the APEAEC's goal. Table 3 compares each of the AMS goals in renewable energy to the APAEC. Under the current policy landscape, Indonesia is the only AMS whose goal in renewable energy is at the same level as the APAEC's. Six out of the ten AMS will fail to meet APAEC's goal with existing policy efforts. For the remaining three countries, Laos, Myanmar and Singapore, we fail to tell whether they could meet the goal or not because their goal measurement differs from APAEC's. Yet, according to the 7th ASEAN Energy Outlook, even if all AMS can hit their national energy goals, the share of renewable energy in TPES will be 17.5%, 5.5 percentage points lower than the goal of 23%. The 23% goal will be met in 2050, much later than expected[109].

Regarding energy efficiency, most AMS' goals in the area are measured in a different way from the APAEC's. Some set goals to reduce energy intensity, while others aim to reduce energy consumption. This makes it difficult to evaluate whether they are on track to meet the

[108] I Gusti Suarnaya. (2023). Indonesia Tabled CCS and CCUS in Net Zero Emission Road Map: Opening Possibilities for Cross-Border Carbon Trading/Storage. May 26 2023. Asia CCUS Network. https://www.asiaccusnetwork-eria.org/articles/indonesia-tabled-ccs-and-ccus-in-net-zero-emission-road-map
[109] ASEAN Centre for Energy (ACE). (2022, September 15). The 7th ASEAN Energy Outlook. https://aseanenergy.org/the-7th-asean-energy-outlook/

APAEC's goal. However, under the circumstances that all AMS meet their national efficiency goals on time, ASEAN will be able to reduce energy intensity by 29.2% based on the 2005 level, by 2025, which still falls short of the target of 32%[110].

In terms of APAEC and its seven prioritised programmes, they did not receive significant attention in AMS' energy policies and were hardly mentioned in most AMS' energy or power development policies. Exceptions are Malaysia and the Philippines. Malaysia mentioned aligning its national development of MEPS with APAEC's timeline in its *National Energy Transition Roadmap*[111]. The Philippines found that in both the energy development scenarios it proposed in the *Philippine Energy Plan 2020-2040*, it is able to satisfy APAEC's goals in renewable energy[112]. The insufficient attention further highlights the challenges of having regional collective efforts to achieve APAEC's goals.

Energy trade, another policy agenda highlighted in the APAEC, also has relatively low visibility in national energy policies, compared to the APAEC. Furthermore, though energy security has been underlined in both the APAEC and AMS' national energy policies, the focus of it is different. In the APAEC, regional power and gas trade aims to help the ASEAN region develop a diverse, secure and sustainable energy supply. Yet, regional security does not necessarily mean national energy security for AMS.

National energy security concerns have been raised by six AMS (Cambodia, Laos, Malaysia, Myanmar, Singapore, and Vietnam) due to a projected increase in import dependency on their primary fossil fuels, with a particular focus on gas and oil. Cambodia argued that it needs to strengthen energy security by reducing its import dependency[113]. Laos will promote the adoption of EVs to reduce the import of fossil fuels[114]. Malaysia is concerned that the rising gas import might generate energy insecurity. Thereby, it will diversify its energy import sources and scale up the adoption of renewable energy[115]. Yet, these concerns about national energy security are not deeply concerned in the APAEC. ASEAN considers regional trade a

[110] Ibid
[111] Malaysia's Ministry of Economy. (2023). National Energy Transition Roadmap. https://www.ekonomi.gov.my/sites/default/files/2023-09/National%20Energy%20Transition%20Roadmap_0.pdf
[112] Department of Energy. (2020). Philippine Energy Plan: Towards a Sustainable and Clean Energy Future. https://www.doe.gov.ph/sites/default/files/pdf/pep/PEP-2020-2040-Final%20eCopy-as-of-15-June-2023.pdf
[113] Ministry of Mines and Energy of Cambodia. (2022). Power Development Masterplan 2022-2040.
[114] Ministry of Planning and Investment of Laos. (2021). The 9th Five-Year National Socio-Economic Development Plan (2021-2025).
[115] Malaysia's Ministry of Economy. (2023). National Energy Transition Roadmap. https://www.ekonomi.gov.my/sites/default/files/2023-09/National%20Energy%20Transition%20Roadmap_0.pdf

solution to address energy insecurity among the regions, but this is also actually where some countries' import dependency came from. Singapore, Malaysia and Cambodia are a few AMS that have aligned goals in regional trade with ASEAN. Singapore believes that the regional power grid could increase its energy security[116]. This is unsurprising as Singapore does not have energy resources and needs to import a most of its energy. It can benefit from a well-developed regional power grid. As a current member of the first multilateral electricity trade project in APG, Malaysia is also willing to add impetus to the regional electricity trade[117]. Cambodia would like to develop a cleaner power grid by importing power from its neighbouring countries. It has numeric goals for electricity imports from Laos and Thailand by 2030 and 2040[118]. Countries like Myanmar and Laos are also interested in regional energy trade though, they are interested in energy export rather than import and export. Myanmar thinks that it can generate more income from electricity exports. Laos has set a list of numeric goals for electricity export to different destinations by 2025[119].

4. Conclusion

Energy transition is an increasingly important agenda in ASEAN. This article addresses two research questions concerning ASEAN's energy transition. Firstly, we explore how the energy structure of both ASEAN and its member states transitions in the face of the escalating importance of energy transition. The findings show that though energy transition is of rising importance on ASEAN's policy agenda, the energy structure of the AMS in 2020 remains similar to the one in 2010. Fossil fuels continue to increase and maintain their dominance in energy structure.

Secondly, we study the policies on energy transition at two levels: ASEAN and AMS. At the ASEAN level, the APAEC 2016-2025 serves as a blueprint for regional energy cooperation. It sets specific goals for energy transition and has seven prioritised programmes with outcome-based strategies. However, its progress is sluggish and is estimated to fall short of its goals

[116] Energy Market Authority of Singapore. (March 2022). Charting the Energy Transition to 2050. Energy 2050 Committee Report. https://www.ema.gov.sg/resources/industry-reports/energy-2050-committee-report
[117] Ministry of Planning and Investment of Laos. (2021). The 9th Five-Year National Socio-Economic Development Plan (2021-2025).
[118] Ministry of Mines and Energy of Cambodia. (2022). Power Development Masterplan 2022-2040.
[119] Ministry of Planning and Investment of Laos. (2021). The 9th Five-Year National Socio-Economic Development Plan (2021-2025).

shortly. Additionally, APAEC lacks a legally binding effect at the national level. This underscores the reliance on individual AMS actions to achieve APAEC's goals. Thereby, we also examine the energy transition policies at the AMS level and identify a policy misalignment between ASEAN and AMS. Although AMS also set specific goals for adopting renewable energy and enhancing energy efficiency, most are at a lower level than the ASEAN's. Furthermore, APAEC and its seven prioritised programmes are rarely mentioned in AMS energy policies. This demonstrates that AMS lack sufficient regional coordination in regional energy transition. To better implement the APAEC and meet the regional energy transition goals, AMS need to accelerate collective actions, aligning their national goals and policies with the regional ones.