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Energy

ASEAN Energy Investment 2024

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Abbreviations

ACE	ASEAN Centre for Energy
ADB	Asian Development Bank
AEO7	The 7th ASEAN Energy Outlook
AIF	ASEAN Infrastructure Fund
AIIB	Asian Infrastructure Investment Bank
AMS	ASEAN Member States
APAEC	ASEAN Plan of Action for Energy Cooperation
APG	ASEAN Power Grid
ASEAN	Association of Southeast Asia Nation
ATS	AMS Target Scenario
BIMP-PIP	Brunei-Indonesia-Malaysia-Philippines Power Interconnection Project
BOO	Build-Own-Operate
BOT	Build-Operate-Transfer
BPDLH	Badan Pengelola Dana Lingkungan Hidup / Indonesian Environment Fund
CIT	Corporate Income Tax
DFI	Development Finance Institution
EMR	Electricity Market Reform
ESG	Environmental, Social, Governance
ESMAP	Energy Sector Management Assistance Program
EV	Electric Vehicle
FCY	Foreign Currency Yield
FDI	Foreign Direct Investment
FiT	Feed-in Tariff
GBP	Great Britain Pound
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GITA	Green Investment Tax Allowance
GITE	Green Income Tax Exemption
GSSB	Green, Social and Sustainability Bonds
GW	Gigawatt
GWp	Gigawatt-peak
IDR	Indonesian Rupiah
IEA	International Energy Agency
IFC	International Finance Corporation
IPP	Independent Power Producer
JETP	Just Energy Transition Partnership
JICA	Japan International Cooperation Agency
kV	Kilovolt

kWh	Kilowatt per hour
Lao PDR	Lao People's Democratic Republic
LCOE	Levelised Cost of Energy
LCY	Local Currency Yield
LEAP	Leading Asia's Private Infrastructure Fund
LNG	Liquified Natural Gas
LPG	Liquefied Petroleum Gas
LTMS-PIP	Laos-Thailand-Malaysia-Singapore Power Integration Project
$MtCO_2$	Metric tonnes of CO_2
Mtoe	Million tonne of oil equivalent
MWh	Megawatt per hour
NCIP	National Commission on Indigenous Peoples
NDC	Nationally Determined Contribution
PLN	Perusahaan Listrik Negara / Indonesian state-owned electricity company
PPA	Power Purchase Agreement
PPI	Private Participation in Infrastructure
PPP	Public-Private Partnership
PSN	Proyek Strategis Nasional / National strategic project
PSO	Public Service Obligation
PSW	Private Sector Window
PV	Photovoltaic
RE	Renewable Energy
REC	Renewable Energy Certificate
REDD+	Reducing Emissions from Deforestation and Forest Degradation in Developing Countries
REE	Rare earth element
RISE	Regulatory Indicators for Sustainable Energy
RPS	Renewable Portfolio Standard
SAF	Sustainable Aviation Fuel
SOE	State-Owned Enterprises
tCO_2e	Tonnes CO_2 equivalent
TFEC	Total Final Energy Consumption
TPES	Total Primary Energy Supply
TWh	Terawatt per hour
UK ETS	UK Emissions Trading Scheme
UNESCAP	United Nations Economic and Social Commission for Asia and the Pacific
USD	United States Dollar
VAT	Value Added Tax
VGF	Viability Gap Fund

Forewords

The ASEAN Centre for Energy (ACE) plays a crucial role as a regional knowledge hub and think tank, providing ASEAN Member States (AMS) with insights into current and future energy trends. Recognising the importance of investment in driving sustainable development, the ASEAN Energy Investment (AEI) Report offers comprehensive updates that not only highlight investment trends in the region but also address barriers and provide recommendations for overcoming challenges.

Whilst the global foreign direct investment (FDI) flows declined, even after recovering from the pandemic, ASEAN showed the region's resiliency through an increase in FDI of more than 17% in 2022, reaching USD 224 billion. As one of the largest economies in the world, driven by a transition toward service and industry, the energy sector plays a key role in maintaining this trend. The innovation and adoption of emerging technologies offer solutions to meet future energy demands in a sustainable, affordable, and resilient manner, reshaping the investment landscape of the energy sector.

However, challenges in financing ASEAN's energy transition remain. Currently, around 57% of energy projects are financed through commercial banks, signalling the region's limited ability to diversify its funding sources. This is also due to the high upfront capital needed, making debt financing a primary source of financing, whilst the capital market remains underutilised. Yet, ASEAN has shown notable growth in green bond issuance over the past few years. Along with that, a few AMS also show growing domestic capital market figures, with more than 50% of capital for energy infrastructure sourced domestically.

Given the limited public funds available for financing the energy transition, partnerships with other countries and international organisations are essential not only to reduce the investment gap but also to provide financial aid to support AMS achieve their national and regional energy goals toward carbon neutrality. Approximately 17% of funding for energy infrastructure comes from multilateral and bilateral debt, reflecting the vital role of international partnerships in addressing financing hurdles. Furthermore, the public sector could amplify its role by pushing for clear incentives and regulatory support, which has been proven to affect investment decisions in the region. The perceived risk by private investors in ASEAN energy investment needs to be mitigated not only with a well-designed policy package but also by addressing the manner in which stakeholders are engaged.

The AEI 2024 Report highlights the importance of improving the legal and institutional framework and creating financial instruments that accelerate energy investment opportunities. This report reflects ACE's commitment to supporting the AMS in their journey toward clean energy. It is aligned with the ASEAN Plan of Action for Energy Cooperation (APAEC) 2021-2025, especially the Regional Energy Policy and Planning (REPP) programme area. By working together, we can achieve our shared goals of a just and inclusive energy transition through collaborative and innovative strategies across the ASEAN region.

I would like to express my profound thanks for the ACE team's efforts and our partner's support. I hope this report will act as a vital reference for stakeholders, and a guide for policymakers and decision-makers in creating holistic and supportive regulations for ASEAN energy investment.

Beni Suryadi

Acting Executive Director, ACE

Executive Summary

ASEAN has experienced remarkable economic growth in recent years, and demonstrated a swift recovery from the COVID-19 pandemic. Strong GDP growth in the region has attracted foreign investors, leading to increased Foreign Direct Investment (FDI) inflows, even amid a global post-pandemic decline. Whilst ASEAN offers appealing investment opportunities, it still faces complex investment risks, particularly in renewable energy projects. The region's steady socio-economic growth signals a transformative expansion in its energy sector, attracting potential investment opportunities across various aspects of energy supply and demand.

ASEAN's Total Final Energy Consumption (TFEC) is projected to reach approximately 735 Mtoe by 2050, or nearly a 69% increase relative to 2023 levels. This is primarily due to energy-intensive activities, such as manufacturing and transportation. Recovery of economic activities following the COVID-19 pandemic, coupled with ambitious renewable energy targets and policy measures aimed at enhancing energy efficiency, will affect a surge in demand in key sectors, including residential, transportation, and heavy industry.

ASEAN's Total Primary Energy Supply (TPES) is projected to increase significantly, with fossil fuels continuing to play a major role. The region is set to achieve a 23% share of renewable energy in its energy mix, particularly through solar, wind, and hydropower. This transition, supported by favourable policies and declining technology costs, will require substantial investments in renewable technologies, particularly in modernising infrastructure.

ASEAN's power sector presents compelling investment opportunities in both installed capacity and power generation, with a focus on expanding renewable energy capacity, upgrading grid infrastructure, and integrating advanced technologies. As of 2021, ASEAN's installed capacity was 315 GW, with fossil fuels accounting for 66% of the total. Looking ahead, the region's installed capacity is projected to more than triple, reaching 1,047 GW by 2050. This growth will be driven by a strong shift towards renewable energy sources, particularly solar PV and wind, supported by declining technology costs and favourable government policies. Consequently, ASEAN will require increased financing to transition toward clean energy in the long term.

Financial instruments for the energy sector in ASEAN are predominantly driven by public investment, with a growing share of private investment. A key factor influencing private sector investment in the energy sector is the capital cost, which reflects the expected rate of return on investment. A higher rate of return is typically associated with a lower perceived risk of energy projects. However, most developing countries, including those in ASEAN, face challenges in reducing perceived risks. Therefore, lowering and mitigating the risks perceived by the private sector in ASEAN energy projects will be crucial.

The region employs common blended financial products used in the energy sector. This includes concessional loan schemes, guarantees or risk-sharing facilities, and concessional equity. Current energy investment in the AMS is composed of roughly 60% in commercial debt. Bilateral and multilateral debt account for nearly 18% of the total financial instruments in ASEAN. Grants and guarantees account for the smallest portion of total energy investment in AMS. Another alternative blended funding resource is green bonds. Although the issuance of green bonds has been limited, there has been notable growth in this area over the past few years.

Mitigating the perceived risk level in energy investment in ASEAN would require a regulatory framework aligned with government priorities and direction. The AMS have addressed fundamental issues in their institutional and regulatory frameworks across three key areas: legal framework, planning, and counterparty risk. Except for Myanmar's counterparty risk and Cambodia's planning policy, the AMS generally achieves medium to high scores in these areas, indicating that most have established appropriate regulations for renewable energy investments.

In policy aspects of investment challenges, ASEAN has diverse regulatory environments that can hinder investors from funding an energy project. To address this, the region has recently developed an overarching guide for the AMS, called the ASEAN Taxonomy for Sustainable Finance, to facilitate the assessment of sustainable activities and attract investment. However, its dependency on fossil fuels in the region remains, as governments still allocate budget items for electricity, oil, gas, and coal subsidies.

Financing remains a significant obstacle for ASEAN, as the capital market is not yet fully developed, a situation worsened by the region's high debt related to emerging technologies. The ASEAN investment market is fragmented, leading to inefficiencies, higher costs, and slowing down regional collaboration efforts such as the ASEAN Power Grid and Trans-ASEAN Gas Pipeline. The immaturity of clean energy technologies, which results in higher upfront costs, presents risks for private investors and continues to be a challenge for ASEAN in attracting private investment. Although ASEAN countries have made considerable efforts to enable supportive policies through incentives and carbon markets to encourage investment in clean technologies, the overall business environment has seen little improvement.

The Report also provides two country deep dives which present different economic, energy, and investment landscapes. **The Indonesian energy investment landscape is largely financed by commercial banks (49%), followed by bilateral debt (39%). Only a small portion is financed by equity (12%). On the other hand, Lao PDR energy investment is largely financed by commercial banks (35.4%), equity (28%), and multilateral debt (23.2%)**. The remainder is financed by bilateral debt (12.5%). It is not surprising to see equity and multilateral debt account for a larger portion in Lao PDR, than in Indonesia.

Lao PDR implemented the specific supporting policy under **the Renewable Energy Fund, which allows the investor to borrow from the commercial banks**. Most of the commercial banking and equity for energy investment in Lao PDR are from Thailand. The country applied **the use of equity for a specific energy project, the Monsoon Wind Power Project**, and also implemented **several incentives for specific sectors, land use, and zones** to accelerate the investment opportunities for some key energy sector priorities.

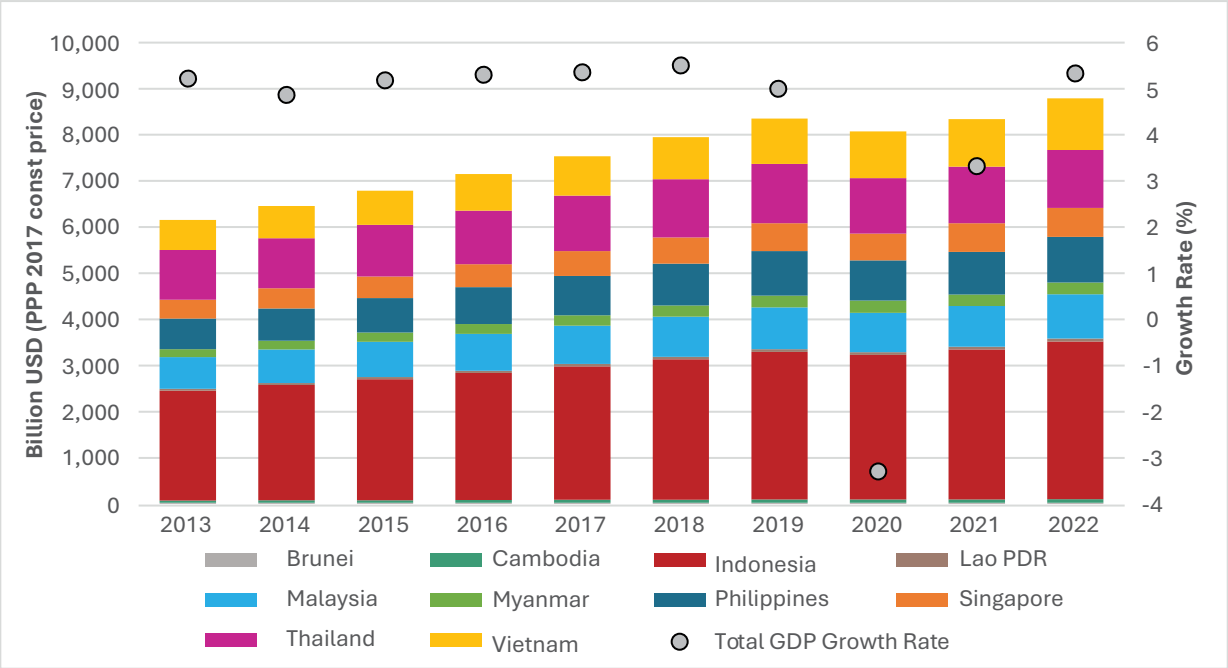
Indonesia and Lao PDR have both implemented **tax and duty exemptions** to attract more investment in the energy sector. **The structure of the energy investment landscape is affected significantly by both the financial market structure and the designed supporting policies for energy investment**.

CHAPTER 1
Introduction

Economic Background of ASEAN Member States

The Association of Southeast Asian Nations (ASEAN) is home to the world's largest growing economies. In the last ten years, the region maintained about 5% annual GDP growth until 2020 (Figure 1.1). Although in 2020, the ASEAN Member States (AMS) experienced a significant decrease in GDP due to the COVID-19 pandemic, they managed to recover and bounce back in 2021. Through governments' pertinent fiscal and monetary policies, the region gained almost the same total GDP as before the pandemic [1]. ASEAN achieved a 4.1% economic growth rate in 2023, higher compared to most developed countries, with a projected increase to 4.6% and 4.7% in 2024 and 2025, respectively. With a robust environment for development growth, **ASEAN is one of the most dynamic and rapidly expanding regions in the global economy.**

Figure 1.1 GDP of ASEAN Member States 2013-2022



Source: ACE calculation based on ADB's Key Indicators Database and the World Bank's World Development Indicators

At the national level, each of the AMS had different trends, in terms of economic growth. Indonesia, Thailand, and Lao PDR experienced an increase in the 2022 GDP through rising exports [2]. Indonesia has abundant natural resources and has the 4th largest population in the world, which offers a large consumer market. Malaysia and the Philippines continued their domestic consumption and household spending, increasing the GDP in 2022 by 7% and 8%, respectively.

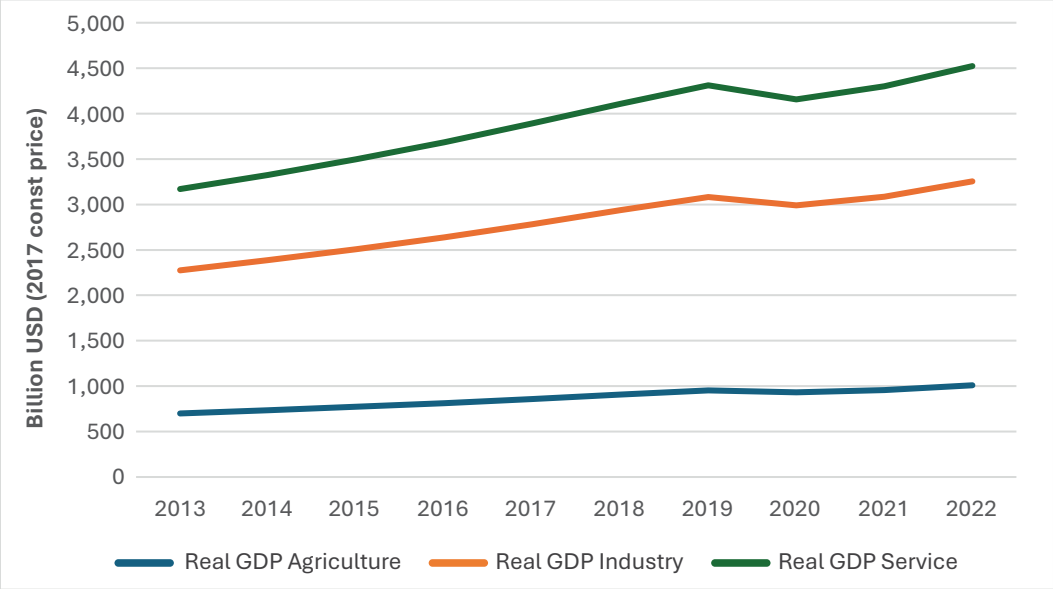
Not all AMS had significant economic development after the COVID-19 pandemic. After showing a negative growth rate, Myanmar experienced a 2% increase in GDP in 2022 from 2021, and is projected to continue rising through the energy and mineral sector. For Singapore, GDP remained stagnant between 2021 and 2022, potentially due to a weak trade sector. On the other hand, Brunei Darussalam was the only country to experience negative growth of about -1.5% and -1.6% of GDP, in the years 2021 and 2022 respectively. Nevertheless, Singapore and Brunei Darussalam maintained their top positions in ASEAN, in terms of total GDP per capita in 2022.

[1]ASEAN in this report refers to 10 member states: Brunei Darussalam, Cambodia, Indonesia, Lao PDR, Malaysia, Myanmar, Philippines, Singapore, Thailand, Vietnam.

Sectoral Contributor in Enhancing Economic Structure

The transition towards service and industry economies helps the region's GDP growth. The ASEAN economy is led by the service sector, which is the highest contributor to GDP. After plummeting in 2021, this sector bounced back in 2022 (Figure 1.2), due to AMS tourism activity, as countries opened their borders and rebuilt their economies. In the past few years, the service sector has been heavily influenced by digitalisation, particularly in Singapore, Malaysia, and Indonesia, due to its positive impact on the finance, education, and government sectors [3]. Lao PDR is also projected to experience economic growth through exports and logistic services, along with Cambodia, which is expected to be the region's logistics hub [4].

Figure 1.2 Structural Economy of ASEAN 2013-2022



Source: ACE calculation based on ADB's Key Indicators Database and the World Bank's World Development Indicators

As for the industrial economy, a significant contributing factor has been foreign direct investment (FDI) in the manufacturing and energy industries in several of the AMS. Industrial activities in ASEAN peaked in 2019, covering the high demand for electricity, gas, and water supply [5]. Manufacturing industries, mainly electronics, are expected to grow in the coming year, catering to expanding demand from the rising consumer class in Indonesia and the Philippines [6]. However, the countries' political environments, along with COVID-19, slowed recovery in manufacturing exports, which had nearly come to a halt. From 2020 to 2022, Myanmar still had a negative 5% growth rate in the industrial economy. Brunei Darussalam was another of the AMS whose GDP in the industrial sector has not yet recovered. Nonetheless, the overall 2022 GDP for industry in ASEAN has exceeded pre-pandemic levels.

Industrial activities are expanding into their life cycle, in terms of scale. As electric vehicles (EVs) become more prevalent in the region, Indonesia aims to manufacture its own EV batteries with local resources, contributing to GDP through investments in the industry in 2021 [7]. The textile industry, a major contributor to Myanmar's GDP, expanded to focus on its domestic supply chain [8].

Foreign Direct Investment to Drive Economic Growth

Foreign Direct Investment (FDI) drives the region's economic growth, reflecting the AMS' developing market. Whilst the global FDI flows declined, even after recovering from the pandemic, ASEAN showed the region's resiliency through an increase in FDI of more than 17% in 2022, reaching USD 224 billion [9]. Malaysia and Vietnam are quickly growing industrial markets that present significant opportunities for foreign investors. Both countries experienced a notable rebound in FDI flows from 2021 to 2022, with 41% and 14%, respectively. Thailand is also becoming an investment hub in the region, attracting funds primarily in the industrial sector.

Despite the growing FDI inflows in the region, the gaps between the FDI received in Singapore and the other AMS are significant. In 2022, Singapore received over USD 141 billion in FDI, whilst Indonesia, with the second-highest FDI inflow, recorded USD 22 billion. The Singapore number is aligned with its credit rating, which is the highest across ASEAN (Table 1.1).

Table 1.1 ASEAN Member States' Credit Ratings by Agency

Country	S&P	Moody's	Trading Economy (TE)
Brunei Darussalam	NR	NR	NR
Cambodia	NR	B2	30
Indonesia	BBB	Baa2	60
Lao PDR	NR	Caa3	15
Malaysia	A-	A3	68
Myanmar	NR	NR	NR
Philippines	BBB+	Baa2	61
Singapore	AAA	Aaa	98
Thailand	BBB+	Baa1	65
Vietnam	BB+	Ba2	46

Source: ACE compilation from TE [10]. Notes: NR means Not Reported, AAA is the highest rate in S&P, Aaa is the highest rate in Moody's, and 100 is the highest rate in TE. A higher credit rate means a better investment environment.

Credit ratings are a crucial factor in assessing the risk level of investing in a country. A good credit rating is vital for ensuring a country's stability, attracting foreign investors, and securing funding for large-scale projects. Apart from Singapore, the AMS generally have low to medium credit ratings, highlighting the need for partnerships to secure financial assistance for funding projects.

Given the varying credit ratings across ASEAN, which influence investment attractiveness and risk perception, the region's focus on innovation—particularly in sustainable development and green technologies—plays an important role in supporting ASEAN's economic growth, with USD 34 billion allocated to research and development in 2020 [11]. The ecosystem for regional startups is improving, with early-stage companies expanding their businesses through cross-border mergers and acquisitions and greenfield investments (i.e., establishing operations in foreign countries). The region has supported collaboration and investment through the ASEAN Business Advisory Council, reducing market barriers and standardising regulations across the region. Current investment in ASEAN is focused on innovation related to sustainable development, green energy, and technologies such as smart cities and electric vehicles (EVs), particularly to move towards low-carbon economies.

The Role of Energy Investment in ASEAN Energy Landscape

The growth in ASEAN markets has resulted in increasing energy demand. Ensuring stable and affordable energy will be vital to economic growth, whilst addressing energy-related emissions. **ASEAN's commitment to addressing energy security and sustainability presents opportunities for energy investment**, both for demand and supply sectors, as well as fossil fuels and renewable energy. Numerous energy projects have been planned and undertaken throughout the AMS, not only at the national level but also in regional implementation, such as the ASEAN Power Grid (APG).

Heightened energy demand will threaten the region's energy security if financing is not optimised. It is projected that the amount of USD 1,070 billion in power sector investment will be required from 2021 to 2050, to meet the threefold growth in energy demand, without any policy intervention. By implementing the national and regional policies listed in the ASEAN Plan of Action for Energy Cooperation (APAEC) 2016-2025 Phase II: 2021-2025, the required investment could be reduced to USD 726 billion, to reach regional targets and align with the APG plans [12].

Continuous investment support is essential to ensure the economic viability of clean technologies. Specifically, renewable energy will necessitate an annual investment of USD 27 billion in the region to meet the APAEC targets by 2025 [13]. However, from 2016 to 2021, only around USD 8 billion per year was invested in renewables. Additionally, the total investment gap for renewable energy is estimated at USD 95.5 billion from 2021 to 2030. Under the ASEAN Carbon Neutrality Strategy, the region may require total green investments across all sectors amounting to approximately USD 3.7 trillion to USD 6.7 trillion [14]. With this level of investment, international partners have a significant opportunity to expand existing collaborations through various schemes, including human resources and technical assistance. In particular, countries with low credit ratings will need global partnerships to continue attracting foreign investments to ASEAN to finance their climate and energy transitions.

This AEI 2024 report provides a full update on the energy investment status in ASEAN. **Chapter 1** presents an overview of the AMS economic background. **Chapter 2** shows the trends and opportunities of energy investment in ASEAN, covering energy demand, electricity, and fuel supply. **Chapter 3** examines the investment challenges in ASEAN to achieve the energy targets. Challenges involve policy and regulatory environment, market and financing, infrastructure and technological capabilities, as well as environmental and social concerns.

Chapter 4 reviews the available financial instruments used to finance the energy sector in ASEAN. Mitigating the perceived risk level in energy financing in ASEAN would require regulatory frameworks aligned with government priorities and direction. Therefore, **Chapter 5** addresses fundamental issues in AMS institutional and regulatory frameworks across three key areas: legal framework, planning, and counterparty risk. The financial instruments and supporting policies laid out in these two chapters answer the challenges discussed in Chapter 3.

Chapter 6 represents two interesting cases on the energy investment landscape in ASEAN (Indonesia and Lao PDR). Each country presents different economic, energy, and investment landscapes. This section also showcases some best practices from other regions (China, Denmark, and the United Kingdom). The concluding **Chapter 7** considers policy recommendations and implications.

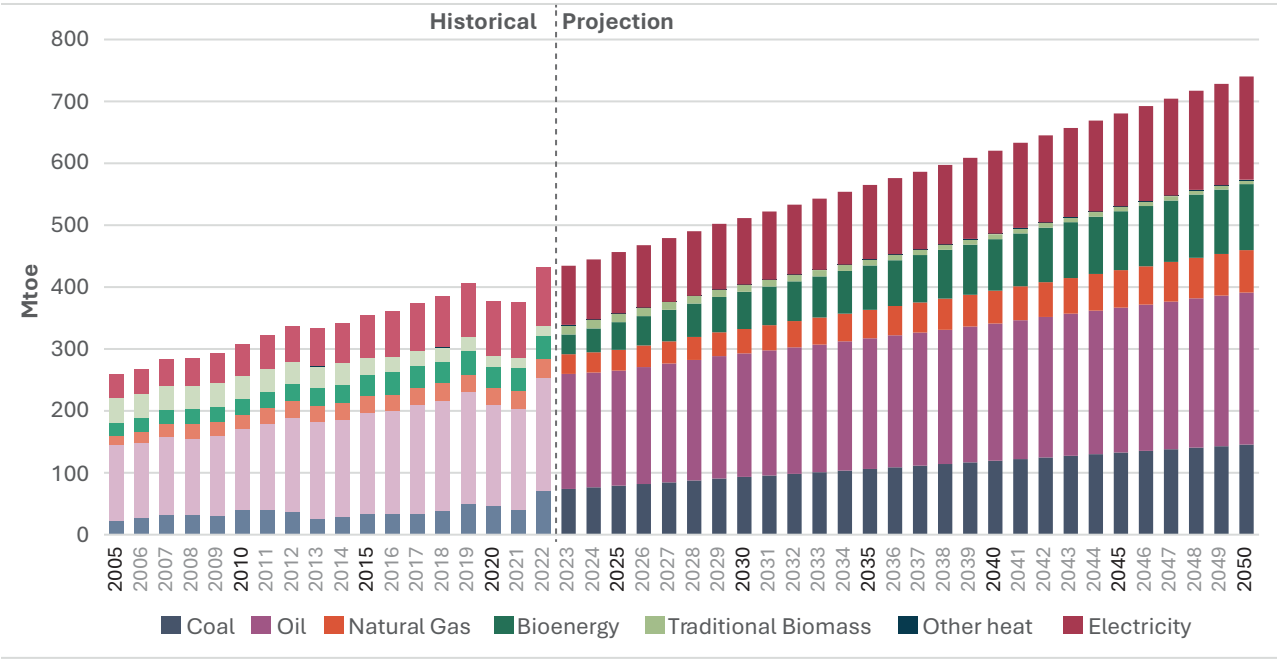
CHAPTER 2
Trends and Opportunities

Total Energy Demand

Rapid population growth, coupled with urbanisation and economic development, represented by the GDP per capita growth across the ASEAN region has triggered a significant increase in Total Final Energy Consumption (TFEC). The trend will continue to increase through 2050, due to the demand for energy-intensive activities, such as manufacturing and transportation, along with the improving standards of living in urban areas, thereby amplifying overall energy consumption.

The COVID-19 pandemic had a substantial effect on energy consumption across the ASEAN region. The TFEC dipped by around 7% in the year 2020, as compared to 2019 (Figure 2.1). This consumption drop was particularly driven by the economic slowdown, lockdowns, and travel restrictions, which largely impacted major energy-intensive sectors, including industrial activity and transportation. The contraction of energy demand was evident in industries heavily reliant on oil and coal in their main production activities, as many of them temporarily operated at reduced capacity.

Figure 2.1 Total Final Energy Consumption by Fuel in ASEAN 2005-2050



Source: ACE projection in AEO8's AMS Targets Scenario (ATS). Note: Other heat includes solar thermal.

Looking ahead, ASEAN's energy demand is projected to reach 746.2 Mtoe, approximately 73% higher than the 2023 level, taking into account renewable energy targets, energy efficiency goals, technology adoption, policy and regulatory measures, and economic and demographic factors. Since 2021, the trend in energy demand has shown a steady recovery, highlighting the resilience of ASEAN economies and their ability to rebound from global disruptions. The increase in energy consumption aligns with the resumption of economic activities following the easing of restrictions. The recovery period is characterised by a return to pre-pandemic energy demand levels, followed by continued growth.

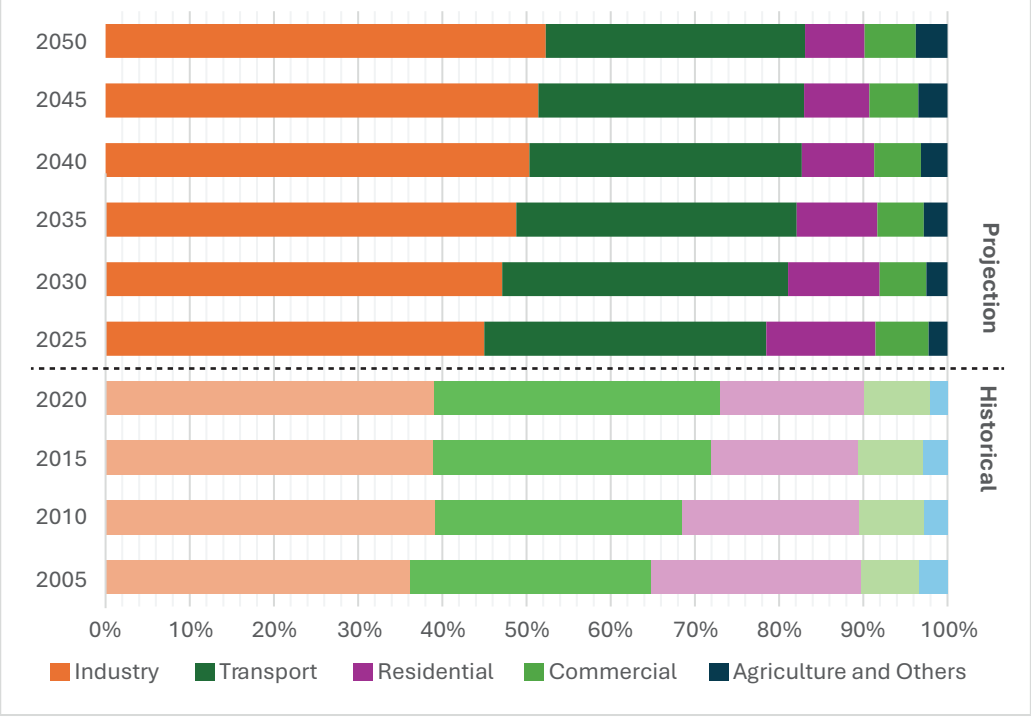
ASEAN's evolving energy landscape is marked by a gradual shift from traditional biomass and fossil fuels to cleaner energy sources. Despite steady growth in coal and oil projections, the data indicate a faster rise in electricity consumption, suggesting an accelerated transition towards more sustainable energy sources. This trend reflects the AMS Target Scenario (ATS) for achieving their energy sustainability objectives by 2050.

Sectoral Energy Demand

The energy demand projection for ASEAN will continue to grow across various sectors, each influenced by the variability of key factors and necessitating considerable investments to fulfil future consumption. The rapid growth of digital technology penetration and smart energy system integration will greatly influence energy management practices across all sectors, offering opportunities for more efficient energy use [15].

Within the "Agriculture and Others" sector, the share will remain low until 2050, with a steady share of TFEC (Figure 2.2). Policies like the Green Growth Strategy and Bioeconomy Transformation Programme in Thailand, Vietnam, Lao PDR, and Malaysia will support the practice of sustainable farming activities [16], [17]. Therefore, investments in modern agricultural technologies and practices are imperative for achieving these goals, ensuring food security, and environmental sustainability in maintaining future regional energy demand.

Figure 2.2 Total Final Energy Consumption Share by Sector in ASEAN 2005-2050



Source: ACE projection in AEO8's AMS Targets Scenario (ATS).

The commercial sector accounts for minor shares of the overall TFEC. The commercial sector's proportion remains relatively stable (6-8%), indicating the growth of services and retail industries. Higher energy use in offices, retail spaces, and other commercial establishments is led by the expansion of urban areas. Several of the AMS with high urbanisation rates, such as Thailand and Malaysia, will consume more energy in the commercial sector because their major economic growth is underpinned by service industries. Additionally, Cambodia's Renewable Energy Master Plan underscores the importance of energy efficiency in commercial buildings, whilst Lao PDR's Energy Policy 2030 advocates for increased use of renewable energy in the commercial sector [18], [19]. Moreover, the increasing use of cooling systems, driven by rising temperatures and improved living standards, contributes significantly to energy demand in commercial buildings. Enhancing energy efficiency to manage energy demand in commercial buildings in urban areas should be taken into account [20].

The industrial sector is predicted to use a significant amount of energy because some countries are actively expanding their manufacturing and processing activities [21]. The demand for products from energy-intensive industries, including petrochemicals, steel, and electronics manufacturing, has been the main contributing factor to energy usage. There is also a growing trend towards the use of renewable energy sources, such as solar and biomass, in industrial processes to reduce carbon footprints and comply with international standards [22]. Due to rapid industrialisation and urbanisation Indonesia, as the largest economy in ASEAN, will see a substantial rise in industrial energy consumption, growing from 44% in 2023 to 52% by 2050. Required investments in this sector will cover the modernisation of industrial facilities, adopting energy-efficient technologies, and integrating RE sources into industrial operations.

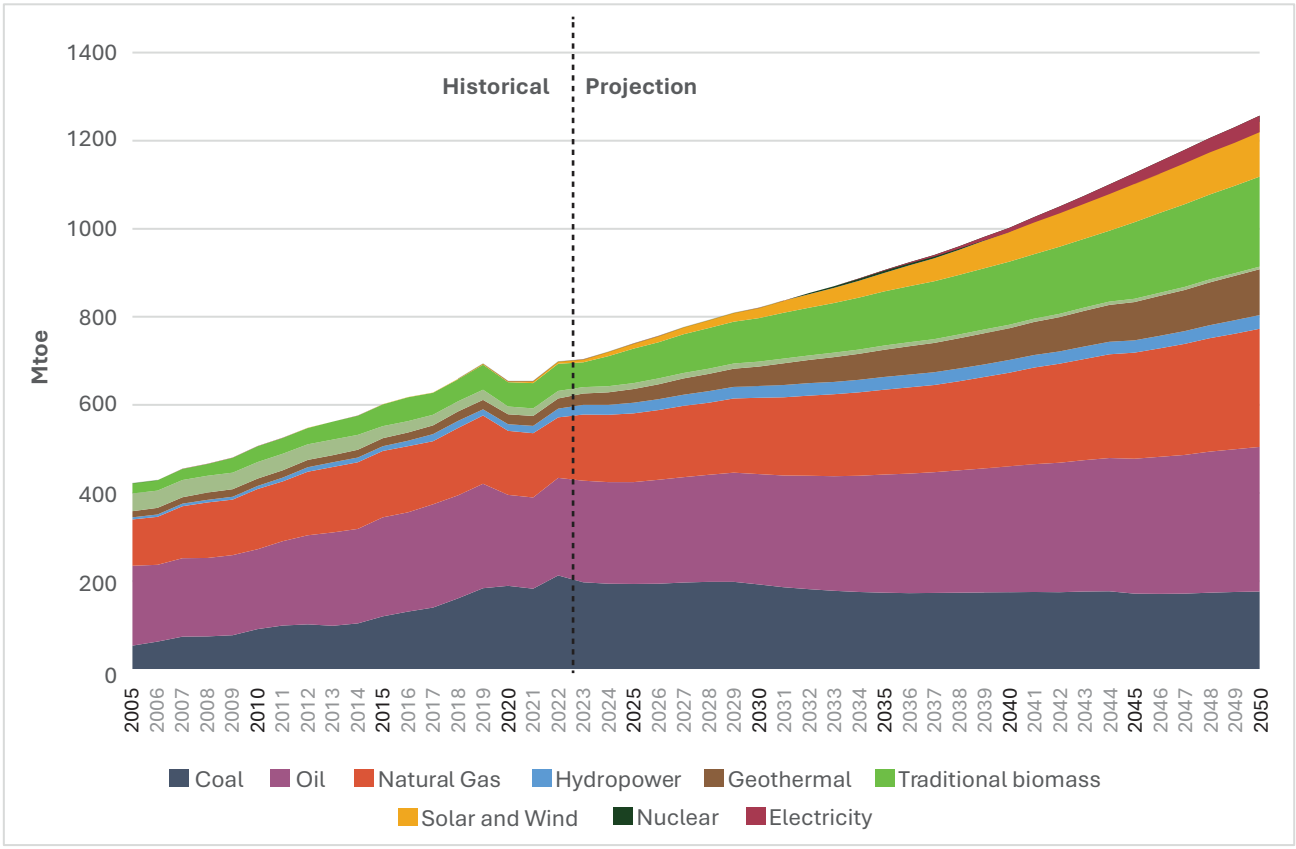
The transportation sector consistently holds the second largest share of TFEC in the ASEAN region amounting to one-third of the sectoral share in 2023, although its proportion slightly decreases by 2% towards 2050. The energy demand growth in this sector is mainly driven by economic growth and rising mobility demands, which influence the trend in vehicle ownership and the development of public transportation networks. One of the key drivers is electric vehicle (EV) penetration. The ASEAN EV market will rise to USD 2.7 billion by 2027, more than four times that of the 2021 market [23]. The growing expansion of EVs will promote investments in EV facilities, including charging stations and upgrades to the public transportation systems, to accommodate emerging urban communities. The region's push toward EVs is also driven by international commitments to reduce greenhouse gas emissions, with several countries setting ambitious targets for carbon neutrality [24]. Government regulations promote incentives for industry and consumers to expand EV market penetration, whilst also encouraging EV car manufacturers, particularly Chinese companies, to establish factories or assembly plants in ASEAN.

The residential sector's share of TFEC shows a gradual decline over time, influenced by advancements in energy efficiency and the adoption of energy-saving technologies. An improvement in standards of living and lifestyles, supported by expanding access to gas and rigorous electrification programmes, will drive increasing consumption until 2050. The growing middle class in ASEAN is expected to drive demand for modern energy services, including air conditioning and other electric appliances [15]. In addition, several of the AMS will deploy clean cooking programmes, by promoting a shift from traditional biomass and carbon-intensive cooking fuels, to increasing use of biogas and electricity. Myanmar has targeted the distribution of 260,000 energy-efficient cooking stoves between 2016-2031, and reduced the use of traditional biomass by 5%, whilst Lao PDR has set the goal of increasing biogas use in 50,000 households by 2025 [25]. Notable policies have set biofuel use, with 5% biodiesel and 10% bioethanol blending targets by 2040 in the Philippines and 50% in Indonesia by 2050. This will further add to the demand for bioenergy in the future. Furthermore, modern appliances, lighting, heating, and cooling will be more accessible, causing surges in electricity consumption [26], [27]. The use of distributed energy resources, such as rooftop solar panels, is expected to increase, providing households with a means to generate their own electricity and reduce dependency on the grid [20]. This trend will be particularly prevalent in countries where economic development and urbanisation are rapidly transforming rural areas, notably in Vietnam and the Philippines. The region will require investments focusing on expanding grid facilities to balance household energy demand, promoting energy-efficient electronics and increasing the use of roof-mounted solar photovoltaic (PV) installations.

Energy Supply

ASEAN's energy supply has grown significantly. The total primary energy supply (TPES) is projected to increase from 421.9 Mtoe in 2005, to a forecasted 1,219.5 Mtoe by 2050, following the national targets (Figure 2.3). The COVID-19 pandemic led to a minor dip in TPES, dropping from 693.2 Mtoe in 2010, to 653.4 Mtoe in 2020 and 2021. However, there was a strong recovery in 2022, with TPES rising to 698.1 Mtoe. This resilience underscores the region's capacity to rebound in energy supply as economies recover.

Figure 2.3 Total Primary Energy Supply by Fuel in ASEAN 2005-2050



Source: ACE projection in AEO8's AMS Targets Scenario (ATS).

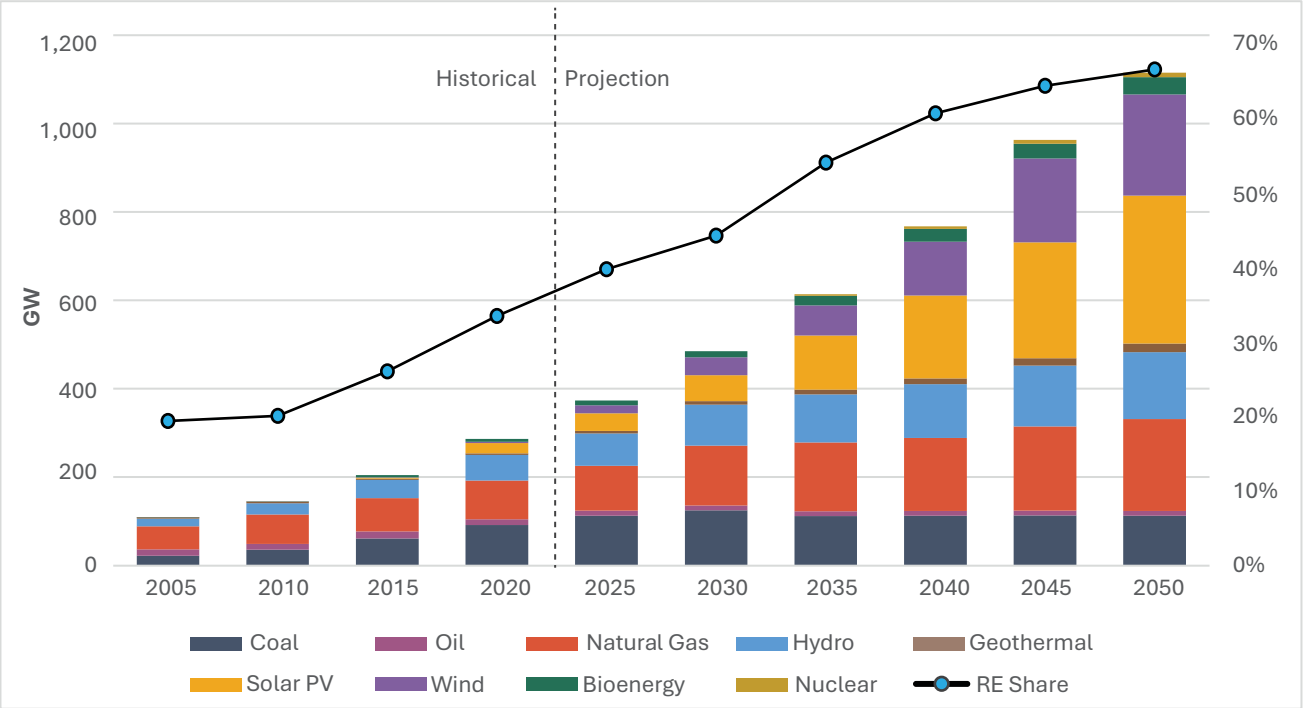
The current energy supply in ASEAN is characterised by fossil fuels, renewables, and emerging technologies. Fossil fuels—particularly oil, coal, and natural gas—continue to dominate the energy supply, although their shares have evolved. Oil has shown consistent growth and remains a critical energy source. Coal's share continues to increase until nearly 2030 before stabilising, reflecting ongoing usage in countries like Indonesia and the Philippines, where electricity generation is heavily dependent on coal-fired power plants [28]. Natural gas has gained importance, particularly post-2020, driven by its lower emissions compared to coal, and its role in power generation and industry, notably in Malaysia and Thailand [29].

Renewable energy share of future energy supply is expected to resemble the fossil fuels trend. Solar and wind energy have displayed substantial growth since 2020, driven by increased investments and adoption across the region. Geothermal energy and hydropower maintain steady growth, whilst nuclear energy is expected to enter the mix post-2030, albeit cautiously. Biomass and other traditional energy sources are anticipated to decline as the region shifts toward more modern and efficient technologies, reflecting the broader adoption of cleaner solutions in response to electrification across residential and commercial sectors.

Installed Power Capacity

ASEAN's power sector is defined by a diversified energy mix and differing degrees of infrastructural development across its member states. The region's installed power capacity was 315 GW in 2022, with fossil fuels accounting for 66% of the total generation share (Figure 2.4). Forecasting the evolving landscape with national policies, the overall installed capacity is estimated to grow substantially to 1,115 GW by 2050. This rising trend is primarily fuelled by renewable energy sources, particularly solar PV and wind technology, revealing significant expansion, especially post-2030.

Figure 2.4 Installed Capacity in ASEAN 2005-2050



Source: ACE projection in AEO8's ATS. Note: RE Share includes hydro, geothermal, solar PV, wind, bioenergy.

Hydropower and bioenergy maintain steady growth, underscoring their continued importance in the region's energy portfolio. Hydropower helps the region diversify its energy mix, especially in Lao PDR and Vietnam. Geothermal and nuclear are forecasted to show modest increases, reflecting ongoing but cautious adoption of these technologies.

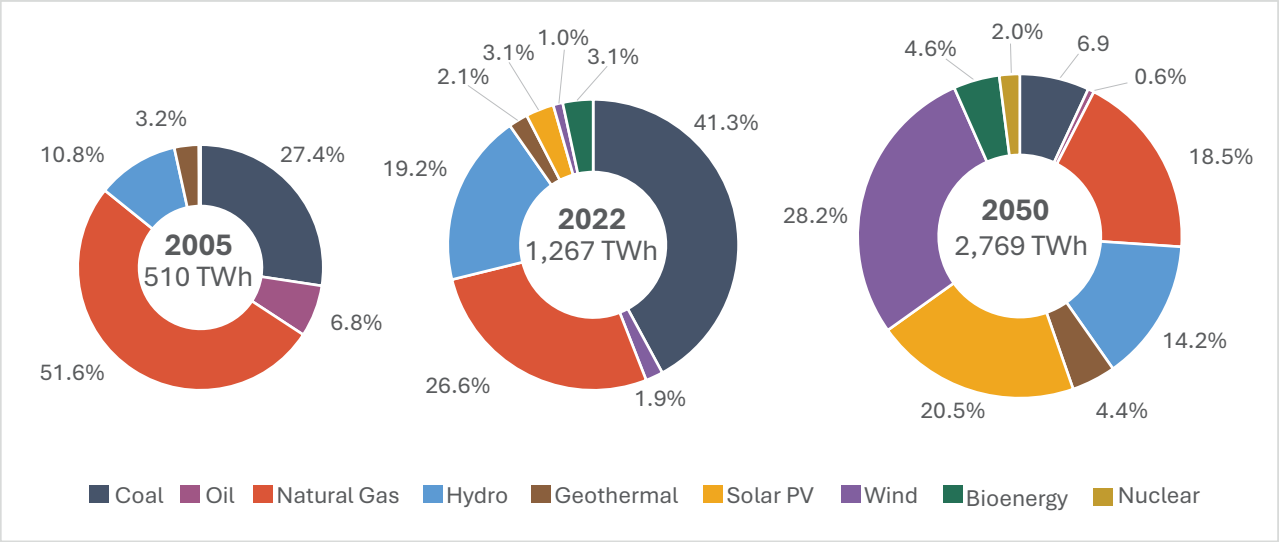
Fossil fuels continue to contribute to the energy mix in installed capacity, although their relative share decreases over the period. Coal, whilst maintaining a steady capacity, exhibits a smaller gigawatt share than renewables, indicating a gradual shift toward cleaner energy sources. Natural gas remains a crucial component of the energy mix until 2050, given its lower emissions compared to coal. Thailand, the Philippines, and Vietnam have begun to promote more investments in Liquified Natural Gas (LNG) terminals in response to the depletion of their domestic gas fields to anticipate growing energy demand [31].

Despite slower adoption rates, energy storage technologies, such as batteries and pumped hydro storage, also emerge as a key component of the future energy mix, reaching 66.8 GW by 2050. It facilitates the integration of variable renewable energy, and hedging against power intermittency by ensuring a stable and reliable power supply. Investing in these technologies will ensure a stable electricity supply and help stabilise the grid.

Power Generation

The future of power generation in ASEAN will be heavily dependent on renewable energy. More than half of total electricity will be generated from renewable energy sources by 2050, with solar, wind, and hydro contributing 1,742 TWh, or 63% of the total share of the energy mix, exceeding the domination of fossil fuels in 2005 and 2022 (Figure 2.5). Large increases in solar and wind power capabilities are anticipated, fuelled by falling technology costs, and encouraged by government regulations. For example, with several large-scale projects in process, Vietnam and Thailand are leading the region in the development of solar energy. Wind energy is also expected to quickly grow, especially in offshore and coastal areas, with Vietnam emerging as a major player in this market.

Figure 2.5 Power Generation by Fuel in ASEAN



Source: ACE projection in AEO8's ATS.

The energy policies implemented across ASEAN will significantly influence the region's green electricity growth. Governments are introducing measures to promote renewable energy adoption, improve energy efficiency, and attract investment in the energy sector. APAEC is one such strategic initiative aimed at enhancing energy security and sustainability. National renewable energy targets and incentive programmes, like feed-in tariffs (FiT) and tax rebates, are driving investment in renewable energy projects. Expanding the energy supply will also require regulatory frameworks that liberalise the energy market and encourage private sector participation. These initiatives create an environment conducive to investment and innovation in the energy sector [32].

AMS are seeking to increase renewable energy generation investment by implementing regulations to facilitate foreign investment in clean energy. The Philippines released a bold regulation that will allow full foreign ownership of new renewable energy projects. More foreign investors may be attracted by this policy, but it comes at the risk of losing renewable energy generation independence to the Philippine government.

Grid Improvement

The power sector confronts some difficulties despite the renewables advancements. Concerns about the quality of electricity and grid dependability stem from outdated infrastructure and poor maintenance, causing frequent outages and voltage variations. These problems must be resolved to guarantee a steady and dependable power supply throughout the region. Energy availability is still a major problem, especially in rural and isolated parts of nations, where a sizable proportion of the population does not have access to consistent energy [33], [34].

Upgrading grid infrastructure is essential to supporting the expected expansion of the electricity sector. However, ASEAN is relatively lagging in attracting large-scale grid investment. Grid investments in the region have halted, mainly driven by financial and regulatory-related issues [35]. Enhancing grid management involves modernising existing transmission and distribution networks, implementing advanced metering equipment, and integrating digital technologies.

Smart grid technologies have the potential to significantly improve grid efficiency and reliability. These include automated demand response, real-time grid monitoring, and advanced data analytics. Such technologies enable greater energy efficiency, improved outage management, and better integration of renewable energy sources. Singapore and Malaysia are leading the way in the adoption of smart grid technologies, intending to enhance energy management and lower losses [36].

Encouraging regional grid interconnections, such as the APG and TAGP, will facilitate cross-border energy trade and enhance regional energy security [13], [32]. The pooling of renewable energy resources will be made easier by this integrated system, which will also increase overall grid stability. ASEAN is expected to save up to USD 800 billion in decarbonisation costs, through a regional power grid and interconnected hydrogen pipeline infrastructure [37].

It is also crucial to support regulatory efforts that liberalise the energy industry and foster competition [15]. Peninsular Malaysia and Vietnam have partially adopted power sector market liberalisation, following Singapore and the Philippines. These programmes offer the capital and know-how required to expand the electricity sector, by encouraging private-sector involvement and luring foreign investment.

ASEAN requires approximately USD 1.5 trillion to satisfy the investment gap until 2030 [38]. Utility-scale solar and wind power remains a prospective investment opportunity in ASEAN, with a potential investment market of USD 18.1 billion. Personal solar generation, for residential and business use is another potential opportunity in ASEAN, especially with expanding manufacturing and service industries. Solar self-generation is estimated to have a potential value of USD 4.3 billion in ASEAN. Transmission lines and other electric infrastructure are expected to reach a potential investment value of USD 29.3 billion.

Costs of Renewable Energy

As technology advances and demand for cleaner energy sources increases, renewable energy (RE) is expected to become cheaper than fossil fuels. In addition to the significant benefit of reducing carbon emissions, greater adoption of RE could lead to substantial cost savings. RE was projected to save USD 520 billion in 2022 [39]. Despite high post-pandemic inflation, RE costs will continue to decline, becoming more competitive compared to fossil fuels. The weighted average cost of utility-scale solar, onshore wind, geothermal, and biogas has continued to fall. In 2022, the weighted global average cost of solar had fallen by 89%, to 0.049 kW/h, followed by concentrating solar power and onshore wind, which saw costs fall by 69% from 2010's levelised cost of energy (LCOE) [40]. The rising global fossil fuel prices will continue to make renewables a lucrative investment opportunity.

Maturing technology and production, along with increasing utility-scale renewable power, have significantly decreased the price of RE [41]. Solar alone has seen a rapid drop in LCOE, the overall price of a power plant, considering the cost of building and operating costs throughout the plant's lifetime. Utility solar cost has decreased by 89% in ten years, dropping from USD 359 in 2009, to the current USD 40 [42]. Onshore wind has also been reduced by 70% in ten years, whilst the LCOE for a coal power plant remained roughly static in the same period [43].

One significant factor in the lower cost of renewables and stagnant fossil fuel costs is the operating costs associated with each technology. Running fossil-fuel plants requires fuel to operate, while RE generation has zero fuel costs. As renewable energy deployment increases, the price will continue to decrease, causing demand to rise. More profitability in this sector will lead to more innovation and competitiveness, further driving down the price. Maturing technology increases generation efficiency in the RE sector, whilst fossil fuel generation efficiency has likely been maximised over the years.

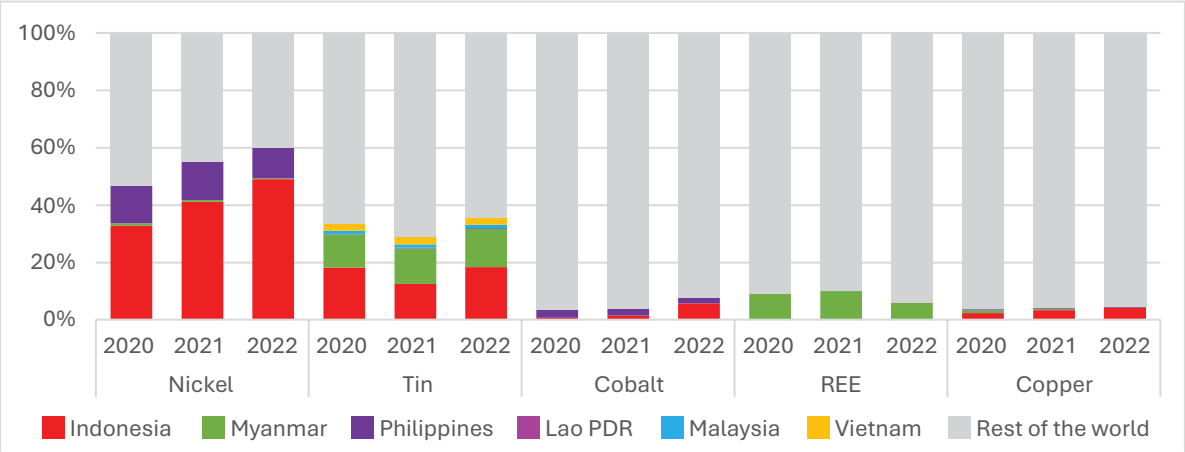
Solar has been undergoing a significant investment in ASEAN to accelerate the energy transition. Until 2030, an investment of USD 156 billion is needed to increase 241 GW of capacity [30]. In recent years, solar LCOE in Vietnam, Thailand, the Philippines, and Malaysia have surpassed coal-generation LCOE. With a solar cost of 44 – 76 USD/MWh, competition in the market with a coal cost of 54 – 79 USD/MWh could make it easier for solar to overpower new coal plants' costs [44]. On the other hand, solar LCOE still ranges between 56 – 99 USD/MWh in Cambodia, Lao PDR, Myanmar, and Indonesia [44]. Although still higher than the cost of existing coal, the solar LCOE is already cost-competitive with the new coal plants' costs, with an LCOE of 72 USD/MWh.

New technological advancements stimulate the creation of a clean hydrogen market, especially when gas prices are expected to increase. With the current price for gas fuel at USD 0.68/kg, hydrogen could emerge as a solution for the hard-to-decarbonise sectors in the coming years [45]. Pilot hydrogen projects have attracted interest in the region, along with a planned target to produce green hydrogen. Some countries, such as Malaysia and Thailand, have even begun producing green hydrogen. A decrease in solar LCOE to USD 20 makes the electricity costs for electrolysers cheaper, hence the cost of green hydrogen is predicted to decrease in the coming year, reaching USD 1.1 to USD 2/kg by 2030 [46]. Currently, the most promising green electricity comes from hydropower, with a cost of just USD 0.046/kWh across ASEAN, except for Brunei Darussalam [45]. Through a direct support mechanism and partnerships, green hydrogen will promote competitiveness and help to reduce emissions, whilst expanding a country's energy mix.

Critical Materials

Many critical minerals are vital for clean energy technologies, such as battery EVs and renewable energy technologies. ASEAN dominates the global critical materials supply chain, and production is continuing its upward trend. In 2020, the total production of five selected critical materials in ASEAN —nickel, tin, cobalt, rare-earth element (REE), and copper—was 3.7 million metric tonnes. The amount grew to 4.3 million metric tonnes in 2022. Moreover, nickel has become a primary material in ASEAN, since the region produces 60% of global production in 2022, and is the most-used material for energy transition technologies. In 2020, the ASEAN energy material consumption was valued at USD 179.1 trillion, with a 70% share of domestic consumption. Amongst the AMS, Indonesia and the Philippines have an abundance of critical materials and dominate global production (Figure 2.6) [47].

Figure 2.6 Share of Critical Materials Production in ASEAN 2020-2022



Source: ACE calculations based on World Mining Data [48]

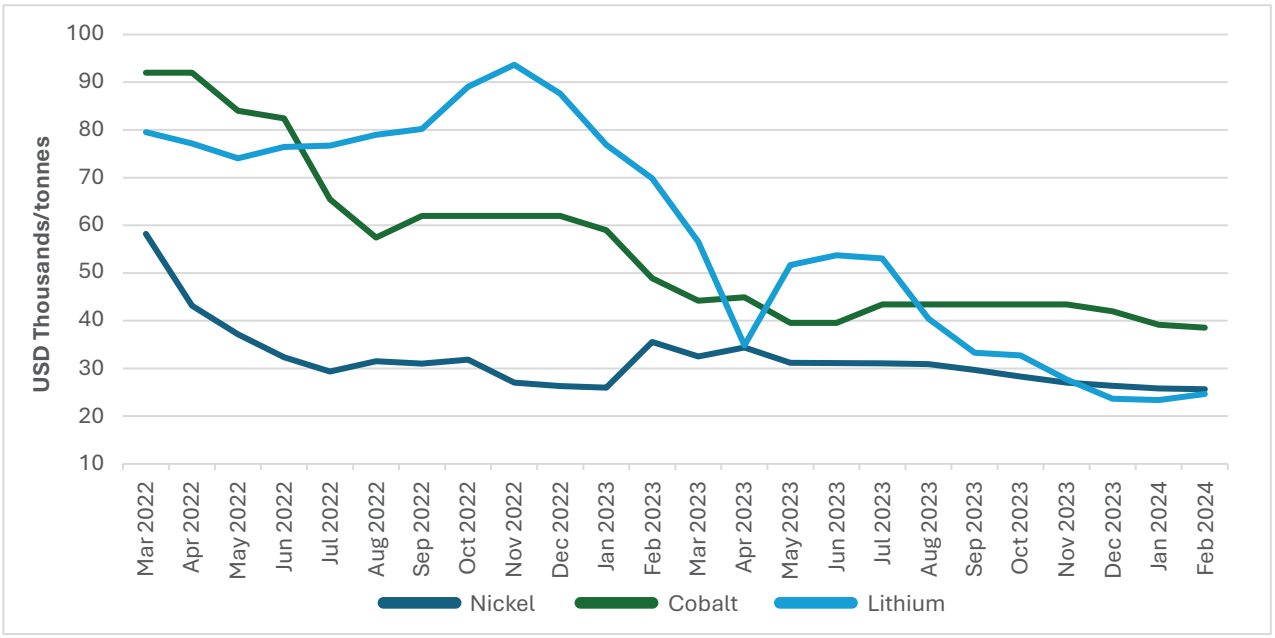
This large reserve has not been commercially utilised to its fullest potential. This is attributable to a lack of overall mineral investment, due to a deficiency in geological data. The region only saw USD 200 million invested in mineral exploration, with spending decreasing by 32%. To address this, some ASEAN countries are attempting to attract foreign investors by easing regulations to expand geological data.

In spite of decreasing investment in mineral exploration, raw output is still increasing in ASEAN. Most of ASEAN's minerals, especially minerals for energy production, are exported primarily to China, in the form of raw ore exports. Indonesia is attempting to increase the value of its mineral resources by banning the export of raw minerals and expanding its capability to export value-added products, particularly with regard to nickel. This policy also aims to downstream and further integrate Indonesia's EV production industry. This regulation has led the Philippines to become ASEAN's largest nickel exporter.

ASEAN has an increasing share of refinery capacity, especially in Indonesia, where the ban on raw ore exports has fostered a rise in domestic refining expansion and additional capacity, through domestic and foreign investments. China has been a significant source of refinery investment in Indonesia, due to its history of reliance on Indonesian nickel exports. This includes an additional USD 30 billion of Chinese investment in the nickel supply chain. Malaysia received a few investments from foreign sources, as well, notably a USD 120 million project funded by the US Department of Defense to build a refinery project. Malaysia is a key player in global refined rare earth minerals, accounting for 12% of the total supply of minerals that play a key role in decarbonisation.

The early part of 2024 witnessed some of the most volatile mineral markets, introducing a higher level of uncertainty and impacting investment risk. Figure 2.7 shows a significant decrease in selected minerals, such as nickel, lithium, and cobalt. Lithium, in particular, experienced a sharp decline within just over a year, nearly reaching USD 13,000 per tonne. The prices of cobalt and nickel also fell significantly, by almost 80% to USD 15,000 per tonne and 64% to USD 2,000 per tonne, respectively, in early 2024 [49]. Whilst price fluctuations are common in the refining industry, the prices of critical materials tend to be more volatile than those of fossil fuels and base metals.

Figure 2.7 Critical Materials Price Year-to-Date



Source: Trading Economics [50]

The price volatility is driven by the high geographical concentration of both mining and refining processes, which further strengthens the role of dominant players in critical materials. The falling prices pose a supply-side risk, creating pressure to diversify and meet the demand for critical minerals, whilst addressing the financial challenges faced by producers. Consequently, there is concern about economic viability and business continuity, which may become less attractive to investors. On the demand side, however, the falling prices increase affordability for consumers and reduce the costs of clean energy technologies.

ASEAN's Role in the Global Clean Energy Market

As the world joins the effort to produce environmentally friendly energy and reduce greenhouse gas emissions, there is an increase in the deployment of clean energy technologies and associated markets. Solar, wind, and battery deployment is surging rapidly—supplying 12% of the global demand—whilst the cost continues to decline [51]. The number is slightly higher for ASEAN, which reached 14.2% in 2020 [52]. The number is slightly higher for ASEAN, which reached 14.2% in 2020 [12]. The number is expected to keep increasing, in line with the net-zero targets of the ASEAN members' Nationally Determined Contribution (NDC).

The clean energy sector's growth is concurrent with its contribution to the global economy. In 2023, clean energy investment reached USD 1.8 trillion, nearly a 50% increase from 2019, with the number growing at a 10% rate per year [53]. The sector is boosting the global economy, accounting for 10% of global GDP growth in 2023 [54]. Despite this growth, investment in ASEAN clean energy only represents about 2% of the global total, showing a significant gap from the region's energy transition goals [35]. ASEAN will require an estimated USD 150 billion of annual investment in clean energy by 2030, to align with its Paris Agreement trajectory, a wide gap from the USD 30 billion annually in 2021 [55]. A comprehensive transition towards clean energy will further require approximately USD 7 trillion over the period up to 2050, primarily in the power sector [30].

It will require an effort to address the issues to increase ASEAN's standing in the global clean energy market. A Deloitte survey reveals that the biggest challenges for renewable energy deployment plans are costs, permitting, and concerns over resiliency [56]. Deployment of clean energy is also more challenging for countries with carbon-intensive economies [57]. Moreover, most of the countries in Southeast Asia do not offer incentive investment in their power purchasing arrangements for projects fuelled by renewable energy sources, especially when government-controlled agencies oversee the power market.

At the 44th General Assembly of the ASEAN Inter-Parliamentary Assembly in 2023, one of the proposed resolutions to drive energy transition and develop the green economy in the ASEAN region was to "enhance energy connectivity and market integration in ASEAN" [58]. Additionally, with the right infrastructure and policies to harness its vast renewable energy resources, ASEAN could achieve net-zero emissions and strengthen its clean energy market. It is also crucial to anticipate economic risks, such as job security and energy affordability, when designing clean energy policies or projects. The enactment of clean energy policies must be accompanied by environmental regulations and supported by a well-developed financial sector [59]. Through continuous efforts toward energy transition and carbon neutrality targets, the region is solidifying its significant role in the global clean energy landscape.

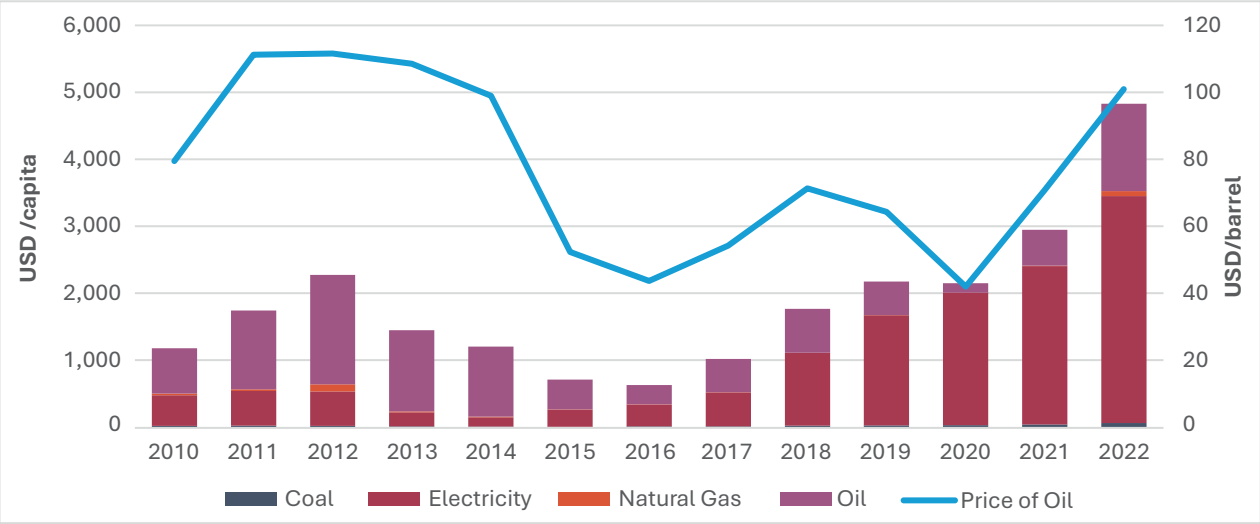
CHAPTER 3
Challenges

Policy and Regulatory Environment

Each of the AMS has its regulatory framework and policies regarding energy investment. Harmonising these regulations can be complex and time-consuming for investors. The regulatory landscape in ASEAN countries can be complex, and policies related to energy investment, including regulations on foreign ownership, licensing and environmental standards, can vary widely. Navigating these diverse regulatory environments can be a challenge for investors [52], [55], [60].

During the policymaking process, the government assesses long-term cost-benefit analysis to evaluate policy that led to fossil fuel subsidies' adoption. In 2022, the electricity subsidies were at a peak, hovering around USD 3,400 per capita while coal subsidies remained low. Meanwhile, the oil subsidies followed an upward trajectory of crude oil prices (Figure 3.1). Fossil fuel subsidies can distort clean energy market prices and discourage investments in renewable energy and energy efficiency measures.

Figure 3.1 ASEAN Energy Subsidies and the Price of Crude Oil



Source: Authors' calculations based on Fossil Fuel Subsidy Tracker [61] and Statista [62]

Additionally, the legal framework to attract foreign investment inflows also includes binding regulations for foreign investors' protection, investment promotion, and transparency requirements. Although ASEAN countries have made significant strides in adopting sophisticated regulatory policies, little has been accomplished in terms of reforming the governance structure. The investment governance structure in ASEAN is not yet sufficient to ensure that these policies are executed transparently, resulting in an undeveloped business environment for the cleantech industry.

A significant challenge facing the ASEAN energy sector is the lack of coordination among regional energy initiatives. This lack of coordination can lead to duplicated efforts, inconsistent policies, and missed opportunities for collaborative investment and development. Moreover, some ASEAN countries experience political instability, which can lead to market uncertainty for investors in the energy sector. Changes in government policies or leadership can affect the investment climate, thereby posing risks to energy investments. Investors are often cautious about potential changes in government policies and their impact on energy projects.

There are political implications for restrictive regulations that make it difficult for foreign investors to enter domestic markets. A high FDI may lead to a risk of losing domestic ownership by foreign investors, who can acquire significant shares or control domestic companies. This could also cause unpopular policy choices and public sentiment concerns over the dependence on foreign money.

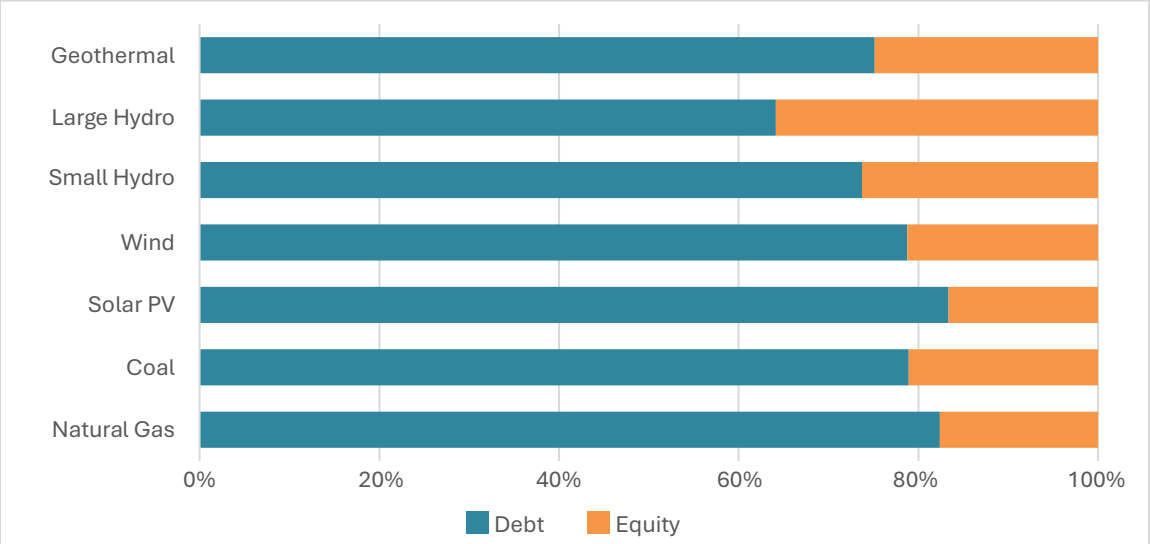
Financing

The ASEAN region faces a range of funding and financing challenges that impact the development and deployment of energy projects. These challenges are multifaceted, encompassing limited access to capital markets, currency, investment risks, and the inherent risks associated with clean energy investments, which can reduce investor confidence. **Securing adequate financing for large-scale energy projects can be difficult, due to some ASEAN countries' limited access to capital markets and financial resources**. This is particularly challenging for newly emerging technologies, which often require significant upfront investment. This further defines the limitation to raising sufficient funds for clean energy projects for both public and private actors, especially in countries with less developed clean energy markets.

Expanding access to capital markets is crucial for raising funds beyond traditional bank loans. Limited capital market access hampers activities, such as bond issuance or Initial Public Offerings (IPOs), resulting in a relatively small trading market. This restriction affects private sector involvement, including global investors, due to limited capital flows, which impedes the bankability of projects. Consequently, ASEAN countries often rely on bank credit to finance their activities, despite efforts to reform the capital market by increasing corporate bonds and public equities. This reliance is evident in the fact that bank credit accounts for 88% of GDP [63].

The debt-to-equity ratio for various energy technologies is presented in Figure 3.2. The highest debt is exhibited from solar PV (83%), followed by natural gas (82%), indicating dependency on borrowed capital to finance projects. For fossil fuels, the high debt of these technologies is related to an established project with high confidence in revenue generated. Substantial amounts of loans are able to be borrowed because of the secure returns, even with long project timelines. Clean energy projects, such as solar, wind and geothermal, also raise substantial amounts of loans due to its project financing scheme. A notable amount of loan could lead to an increase in financial risk during the repayment period as revenue flows could be affected by fluctuating global commodity prices.

Figure 3.2 Debt/Equity Ratio of Technology in ASEAN 2003-2023



Source: World Bank [64]

Whilst the nature of financing long-term projects is through debt –in which revenue stream is usually guaranteed through long-term concession or purchase agreement to ensure the cash flow can repay the debt– overlooking risks associated with debt can affect a project's sustainability. With more financial burdens, projects are also becoming more vulnerable to exchange rate volatility and fluctuating economic conditions. Thus, capital structure adjustments are needed to optimise the best blend of equity and debt to achieve optimal revenue and prevent higher capital costs.

Debt sizing is important to attracting potential investors, especially in countries across ASEAN that will experience a significant impact of private participation in renewable project development [65]. Due to their bankability, established projects – such as hydropower, solar, and wind – could increase the debt component when risks have been mitigated. Thus, debt could help increase investment returns and strengthen buying power in the market. However, a large portion of debt could increase financial risk and vulnerability for capital-intensive emerging technologies. With a high cost of borrowing due to the lender's country interest rate, the financial burden of repaying debt will also increase.

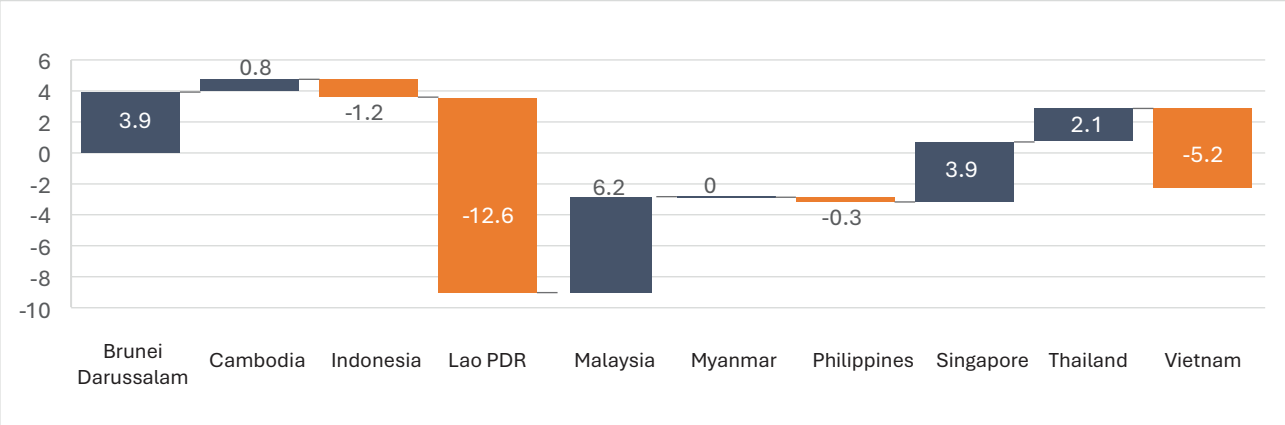
Governments could accelerate energy transition and compensate for high interest rates through incentives, such as tax incentives and subsidies. These incentives could reduce renewable projects' capital, despite the high cost of borrowing. Countries across ASEAN have implemented this strategy to generate interest in renewable projects and encourage more investors. Thailand offers investment incentives through corporate income tax exemptions, and Malaysia provides tax incentives for producers and consumers through Green Investment Tax Allowance (GITA) and Green Income Tax Exemption (GITE) [66]. With a more developed market, Vietnam adjusted its FiT incentives, from the previously constant price for solar across the country to varying FiTs based on solar radiation across three parts of the country (north, central, and south) [67].

Substantial government spending could increase debt and service costs, especially in countries already having high levels of debt [68]. As the government presses fiscal health to finance these initiatives, managing policies and balancing funding is crucial to enable private sector contribution, as the weight will be shifted from intensive public sector funding, towards a market-based model, which once again highlights the importance of gaining access to the capital market. Thus, whilst incentives are proven to accelerate energy transition measures in the short term, fiscal space is also important and might lose its balance if not carefully managed [69].

Currency Exchange Rate

Currency exchange rate risks could alter the investment decisions in ASEAN countries, posing a challenge in attracting foreign investors. The AMS are susceptible to significant fluctuations and to experiencing depreciation in the long term. The cause ranges from political instability, economic uncertainties, and global prices, in which such issues could delay foreign investment flows. With currency volatility, ASEAN faces a higher capital cost for clean energy infrastructure, whilst funding sources are limited. Addressing this challenge is harder in the region due to the smaller market size and limited capital account convertibility, meaning that there is limited-to-no currency hedging to facilitate investors in managing risk [70].

Figure 3.3 ASEAN Currencies Against USD from 2023 to 2024



Source: ACE calculations based on Xe Currency Converter [71]

Over the last five years, almost every AMS currency has been subjected to depreciation against the USD, except Singapore and Brunei Darussalam. Yet, because of financial aid from international institutions, a significant portion of investment came from hard currency through international loans, bonds, and other financing instruments [72]. The fluctuating exchange rate against USD continues to do so, even in the past year (Figure 3.3). The global economic landscape influenced Lao PDR (-12.6%) and Vietnam (-5.2%), in which both countries experienced a significant currency depreciation. The steep decline in Lao Kip happened due to their limited foreign exchange reserves, along with large public debt repayments and high foreign exchange demand for imports [73]. On the other hand, Vietnam has been lowering its interest rate to stimulate economic growth. However, this is like two sides of the same coin; while interest rate makes the borrowing cost cheaper, it can also lead to Vietnamese Dong depreciation, as dong-denominated assets would also reflect a low return on investments [74].

In contrast, Malaysia experienced recovery after depreciation in October last year, reaching a 6% appreciation, due to improvements In the tourism sector, a rebound in exports, and increased electronics shipments [75], [76]. While not significant, the Thai Baht also experienced an appreciation with heavy contribution from the service and tourism sectors. In early 2024, Thailand also received high capital inflows from the government bond market after previously experiencing a large outflow [77]. However, the currency still faces the risk of high volatility due to political uncertainty. Thus, managing and monitoring monetary policy is crucial to stabilise the currency.

Sovereign debt, issued by a government to fund government activities, correlates with currency depreciation. With the currency volatility in most ASEAN countries, loan or bond repayments using hard currency pose barriers to financing renewable energy in emerging markets, as renewable projects are known for their long-term financing nature. For governments, significant currency depreciation leads to increasing repayment costs in foreign currencies. With higher debt to repay, the fiscal space becomes narrower, and the government needs to cut back on other public services, potentially impacting economic stability. Similarly, risk arises for the lender. The revenue stream is more likely to be generated using the local currency during the project's life. The project's net return will decrease if the local currency weakens against the hard currency, in which the debt is denominated [78]. Thus, depreciation will lead to a declined project's attractiveness, higher perceived risk, and strict lending procedure in the long run.

Diverse Market Condition

With some ASEAN countries in the process of liberalising their energy markets, challenges arise for incumbent players and new entrants alike, as they navigate market rules, competition, and pricing mechanisms (Table 3.1). This transitional period, along with different challenges for each country, affects the ASEAN countries' ability to deploy energy projects effectively. The regulatory landscape often changes, or even becomes overly complex, during the transition to liberalised energy markets. Investors need to adjust to the changing market dynamics and investment frameworks, and these might lead to higher entry barriers that affect the investment climate.

Table 3.1 Electricity Market Status in ASEAN Countries

Country	Liberalisation Status	Regulatory Challenges	Trade Barriers Index	Ease of Doing Business
Brunei Darussalam	Limited	High dependency on the oil and gas sector, state-owned enterprises (SOE) being a key and sole player, low market competitiveness	N/A	66
Cambodia	Partially liberalised	Power supply inefficiencies, infrastructure gaps, low public investments	N/A	144
Indonesia	Moderately liberalised	Regulatory uncertainties, SOE monopoly dominance, local content requirements	5.47	73
Lao PDR	Limited	Macro-financial instability, low job creation, vulnerable financial sector	N/A	154
Malaysia	Moderately liberalised	Slower economic growth, foreign equity restriction, lack of regulation and framework implementation	3.88	12
Myanmar	Limited	Political instability, low to no market competitiveness, technical capacities	N/A	165
Philippines	Fully liberalised	Consumer protection, grid integration, complicated permit process	5.15	95
Singapore	Fully liberalised	Market competition dynamics, shortage of feasible projects, grid integration	2.57	2
Thailand	Moderately liberalised	Policy uncertainty, infrastructure readiness, transmission, and distribution coordination challenges	5.42	21
Vietnam	Partially liberalised	Environmental mismanagement, underdeveloped power grid infrastructure, improving human resources	4.75	70

Limited : *Independent power producer (IPP) participation is minimal to none, with SOE generating electricity.*
Partial : *IPP is allowed to generate electricity, but SOE still gains full control of transmission and distribution. Less complex market structure*
Moderate: IPP is allowed to generate electricity, but SOE still gains full control of transmission and distribution. Higher competition between IPPs.
Full : *IPPs are the key suppliers and developers of electricity sources.*

Source : *Authors' compilation* [79], [80], [81], [82], [83], [84], [85], [86], [87], [88], [89], [90], [91], [92]

In countries with limited market liberalisation, such as Brunei Darussalam and Myanmar, challenges are rooted in the heavy dominance of SOEs. For Brunei Darussalam, high revenue from oil and gas improves its fiscal state, but increases the reliance and continued dependency on these resources. In addition, with fluctuating global energy prices, Brunei Darussalam's fiscal space is vulnerable and could lead to delayed economic growth. With the presence of SOEs that have full control of the energy supply and distribution, market competitiveness in the energy sector stiffens. Thus, energy supply and investment are influenced solely by targets set by the government, rather than private sector participation, in broadening the energy mix. On the other hand, political instability is the key driver in low market competitiveness in Myanmar. Limited private practices are reflected in the high ease-of-doing-business index, discouraging new entrants from investing due to no investment certainty, and leading to low deployment of renewable projects to secure electricity access [87].

Regulatory challenges in a partially liberalised market are also faced by Cambodia and Vietnam. With the infrastructure and electricity access gap between urban and rural areas, Cambodia still struggles to provide an efficient power supply. These barriers, along with low public investments, are creating further challenges for existing players, who must face inadequate infrastructure leading to high electricity prices due to transmission shortages, despite the significant role of independent power producers, especially in rural areas [93]. In Vietnam, whilst clean energy investments are gaining traction, power grid infrastructures are still considered sparse. Thus, integrating clean energy projects results in higher capital costs, and securing investment to finance new projects could be more difficult.

The ASEAN energy market is characterised by fragmentation, with varying levels of market integration and cross-border energy trade. This fragmentation limits the development of a cohesive regional energy strategy and impedes efficient energy trade and investment. The lack of integration amongst national energy markets may result in inefficiencies, higher costs, and missed opportunities for regional collaboration. Developing a more integrated regional energy market could enhance cooperation, reduce costs, and improve overall market efficiency.

The fragmented market impedes investment, as investors face a patchwork of regulations and market conditions across different countries. This complexity may deter investment in regional energy projects and hinder the development of the interconnected infrastructure necessary for efficient energy distribution and trade. Efforts to address this fragmentation include initiatives aimed at enhancing regional energy integration, such as the APG and the Trans-ASEAN Gas Pipeline projects. These initiatives seek to improve cross-border energy trade and infrastructure, but progress has been slow. Greater coordination and integration are essential for creating a more cohesive and efficient regional energy market, enabling ASEAN to better manage its energy resources and meet its growing demand.

Infrastructure and Technological Capabilities

Energy transition in ASEAN requires support in the form of infrastructure development and new energy technologies innovation. Its importance is identified in the Framework for Improving ASEAN Infrastructure Productivity, which is one of the milestones under the Master Plan for ASEAN Connectivity 2025 [94].

One of the main characteristics of ASEAN's energy landscape is its uneven energy resource distribution amongst the member countries [31]. Whilst some countries have abundant potential and capability to export renewable energy—such as Lao PDR with hydropower and Indonesia with solar—there are also countries with limited and depleting natural resources despite growing energy demands. The solution to this issue lies in increasing interconnectivity, which has already progressed in regional grid projects such as the Laos-Thailand-Malaysia-Singapore Power Integration Project (LTMS-PIP) and the Brunei-Indonesia-Malaysia-Philippines Power Interconnection Project (BIMP-PIP). This kind of large-scale project, however, requires big funding generally supported by investment.

In addition to uneven distribution, many of the ASEAN countries are struggling with financing infrastructure, due to the status of being a developing economy. Infrastructure investments in ASEAN primarily rely on domestic public funding, but renewable energy projects are harder to get funding [95]. Domestically, renewable energy projects are considered too risky and have a high level of debt relative to tax revenue, discouraging public banks from investing in them. Adding to that, the private sector often struggles with government support and underdeveloped domestic capital markets. Internationally, ASEAN already receives some funds to finance infrastructure investment projects, with the key examples being the Asian Development Bank (ADB) funding a wind farm development in Thailand, a wind power plant in Lao PDR, and a solar power project in Cambodia [96], [97], [98].

Along with infrastructure, having new energy technology and innovation is crucial for ASEAN's energy transition. As we shift from conventional energy to renewable energy sources, technology can support ensuring energy supply security, such as energy storage, high-voltage alternating or direct current interconnectors, and smart grids [99]. Four of the AMS already state their commitment to technology development in their Intended NDC document [100]. Yet, staying abreast of technological advancements and adoption comes with challenges for investors.

There are some challenges in new energy technology projects for ASEAN. For instance, the utilisation of biogas for power generation projects in half of the ASEAN countries are still unrealistic, due to high costs and unpredictable social impacts [12]. Beyond that, adopting sustainable energy technologies in ASEAN is influenced by cost, environmental awareness, social norms, habits, and attribution of responsibility [101].

Action plans to mitigate the challenges related to infrastructure and technological capacity need to be developed to seize more opportunities for energy investment in the ASEAN region. Improving the legal and regulatory framework with enabling policies to reduce the barriers to energy investment in ASEAN needs to be set as a priority for action. To ensure the optimisation of upcoming technologies, it is also recommended to improve the skills of the workforce. Additionally, improving collaboration amongst relevant stakeholders would be necessary to support ASEAN in enhancing credibility for large-scale projects.

Social and Environmental Concerns

Energy projects often face opposition from local communities due to concerns about environmental impacts, land use issues, and social displacement. Many ASEAN countries are vulnerable to climate change impacts, which necessitates investments in cleaner and more sustainable energy sources. However, balancing the need for energy access with environmental and social impacts presents a significant challenge for investors.

Ensuring environmental sustainability and meaningful engagement of local stakeholders is essential for a fair and equitable energy transition, as the AMS seek to balance energy security with the acceleration of their transition to low-carbon economies. Community engagement is crucial for the social acceptance and successful deployment of renewable technologies, highlighting its integral role in facilitating the transition [102]. Although national legislation and international standards set by development financial institutions have integrated measures to protect local communities from potential negative impacts of projects, challenges in ensuring meaningful participation from these communities persist.

A study has found that between 2010 and 2020, 197 allegations of human rights abuse related to renewable energy projects were reported [103]. The intersection of the energy transition with Indigenous Peoples and local community rights must be addressed and safeguarded, as local communities often do not possess the formal means to voice their concerns over the negative environmental and social impact of various programmes [104], [105]. The social impact of energy projects includes implications for local livelihood, cultural sites, and the distribution of project benefits and risks. In addition, the environmental impact of advancing renewable energy infrastructure has been found to cause considerable disruptions to surrounding local communities and habitats. Hydropower, biofuel production, and geothermal power plants are reported to pose the most significant threats to the environment [105].

Regulatory tools, such as Environmental Impact Assessments, have been found to be inadequate in incorporating local voices into programme objectives and structures, characterised by the tendency for a bureaucratic checklist exercise resulting from the narrow involvement of local communities [106]. Key to the long-term success of energy investments is ensuring that communities are engaged as decision-makers in the projects that affect them. Implementation success is contingent on local perception, support, and acceptance of the project [107]. Low perception and support of projects have led to tension and conflict, resulting in project delays and cancellation. In addition to affecting financial returns, reputational and legal risks undermine project integrity. The imperative for an inclusive, community-centred approach is salient for successful energy investments.

CHAPTER 4
Supporting Policies

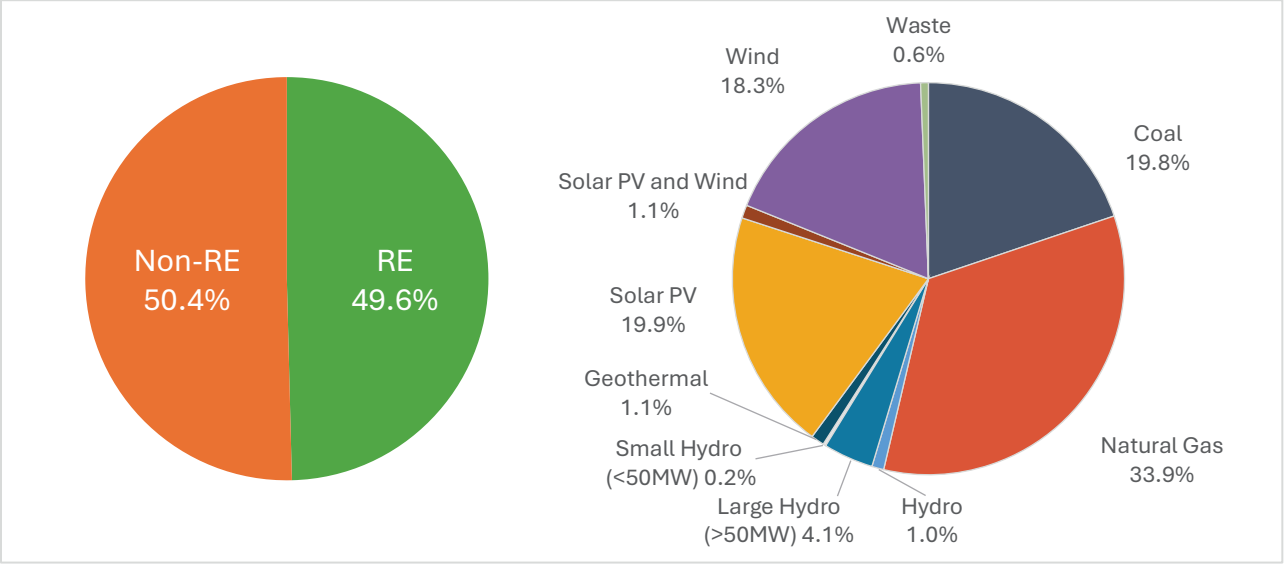
Enabling Regulatory Frameworks

Reducing investor risks and lowering the risk premiums as reflected in the cost of capital requires strong governmental commitment. This commitment is expressed through a supportive regulatory environment, which then requires the government to increase the capability of the relevant institution [64], [1]. This section aims to identify the most impactful policies in mobilising investment, by finding a correlation between the amount of investment in the energy sector and regulatory frameworks in the AMS from 2021-2023.

Investment amounts at the project level in each country can be difficult to obtain due to the confidential nature of commercial information. Therefore, the analysis of investment employs data from the World Bank's Private Participation in Infrastructure (PPI) Project Database, which includes infrastructure projects in 137 low and middle-income countries. This means that the database excludes the AMS classified as high-income countries, i.e., Singapore and Brunei Darussalam.

The PPI data indicate that more than USD 11 billion have been invested in the AMS in the period 2021-2023. By its value, 50.4% of investment in energy infrastructure was towards renewable energy projects (Figure 4.1). Regarding technology, the largest investments were made in natural gas projects in Malaysia, Thailand, and Vietnam, with Solar PV being the second.

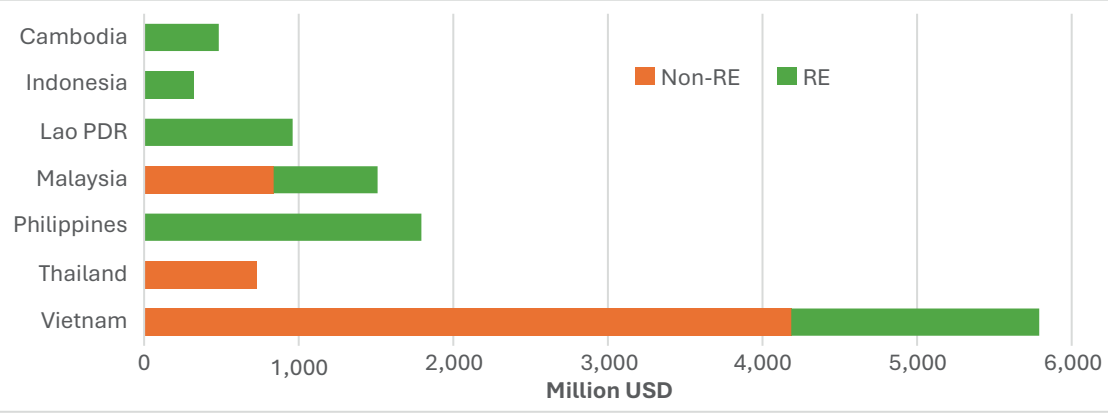
Figure 4.1 Investment Share by Energy Technology in ASEAN



Source: Authors' calculations based on the World Bank's PPI Project Database [64]

Figure 4.2 indicates the total investment value in energy infrastructure during the period 2021-2023, from local and foreign investors. Vietnam led overall energy investment in the AMS, whilst the Philippines led investment in renewable energy. Thailand, Cambodia, and Indonesia lagged in terms of energy investment, as compared to the other AMS, with Thailand and Indonesia having no investment in renewable energy during the noted period.

Figure 4.2 Cumulative Investment in Energy Infrastructure by Country and Technology Type



Source: Authors' calculations based on the World Bank's PPI Project Database [64]

Whilst the qualitative nature of institutions and regulatory frameworks makes cross-country comparisons challenging, various initiatives aim to define best practices for clean energy regulation, and measure the effectiveness of policies supporting clean energy investments. The World Bank's Regulatory Indicators for Sustainable Energy (RISE) is used to assess the regulatory frameworks within the AMS, except for Brunei Darussalam. RISE assesses four indicators of sustainable energy, i.e., renewable energy, electricity access, clean cooking, and energy efficiency. However, as the PPI data contain only energy infrastructure projects, the most relevant indicator to be considered is renewable energy.

Based on detailed information for each sub-indicator of the RISE score, most of the AMS have addressed fundamental issues in their institutional and regulatory frameworks across three key areas: legal framework, planning, and counterparty risk (Table 4.1). Except for Myanmar's counterparty risk and Cambodia's planning policy, the AMS generally achieved medium to high scores in these areas, indicating that most have established appropriate regulations for renewable energy investments.

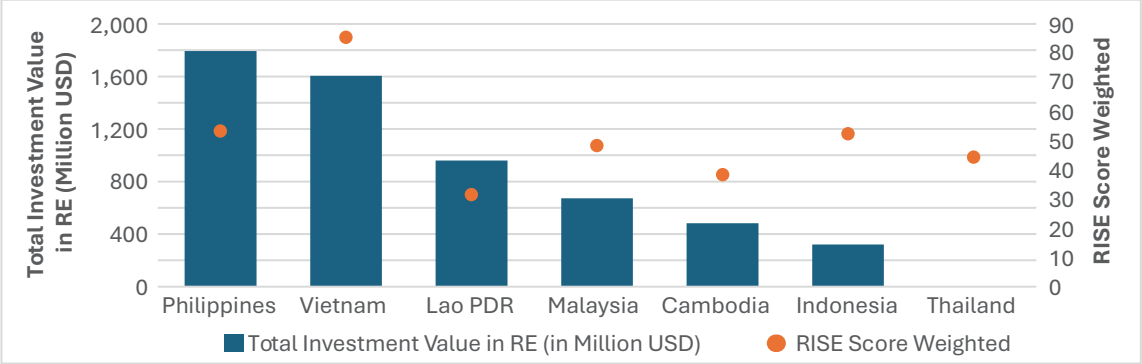
Table 4.1 ASEAN Countries RISE Scores for Renewable Energy

Country	Sub-Indicator							Weighted Total Score
	Legal framework for RE	Planning for RE expansion	Incentives and regulatory support for RE	Attributes of financial and regulatory incentives	Network connection and use	Counterparty risk	Carbon Pricing and Monitoring	
Cambodia	80.0	29.2	17.5	0.0	30.0	64.6	50.0	**39**
Indonesia	80.0	54.2	35.4	33.3	30.0	90.6	50.0	**53**
Lao PDR	80.0	54.2	39.2	8.3	6.7	33.3	0.0	**32**
Malaysia	80.0	66.7	45.4	63.3	32.2	58.3	0.0	**49**
Myanmar	60.0	41.7	27.5	20.0	5.6	16.7	0.0	**24**
Philippines	60.0	54.2	60.0	80.0	70.0	53.7	0.0	**54**
Singapore	60.0	62.5	29.2	73.3	76.7	52.3	100.0	**65**
Thailand	40.0	95.8	12.5	73.3	20.0	74.0	0.0	**45**
Vietnam	80.0	100.0	73.3	83.3	60.0	90.9	100.0	**84**

Source: Authors compilation based on data from the RISE Website [108]

As given in the World Bank data, the RISE score is not the only indicator of progress toward investment in sustainable energy space [109]. Nevertheless, it provides a comprehensive indicator to track the progress of participating countries. In the analysis, investment value is plotted against the overall weighted score of renewable energy, as seen in Figure 4.3. It indicates that there is a very weak correlation between total investment value and RISE Scores for renewable energy. For example, Lao PDR has the third largest renewable energy investment, but the lowest RISE score for renewable energy amongst the countries listed.

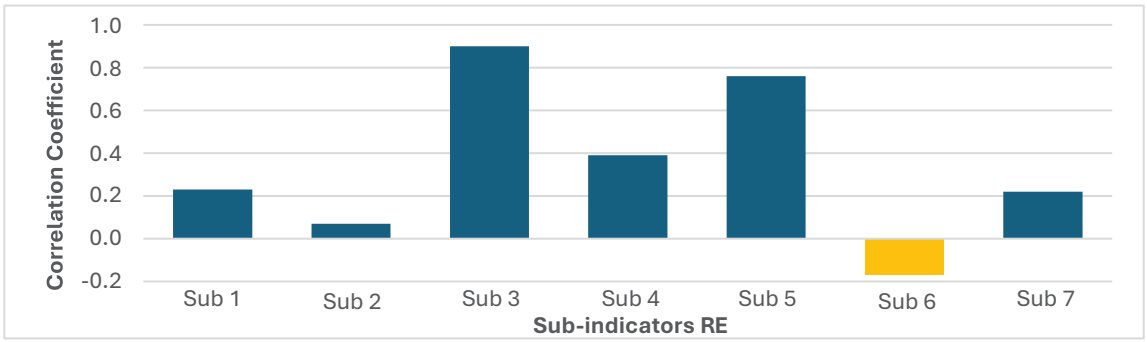
Figure 4.3 Total Investment Value and RISE Scores



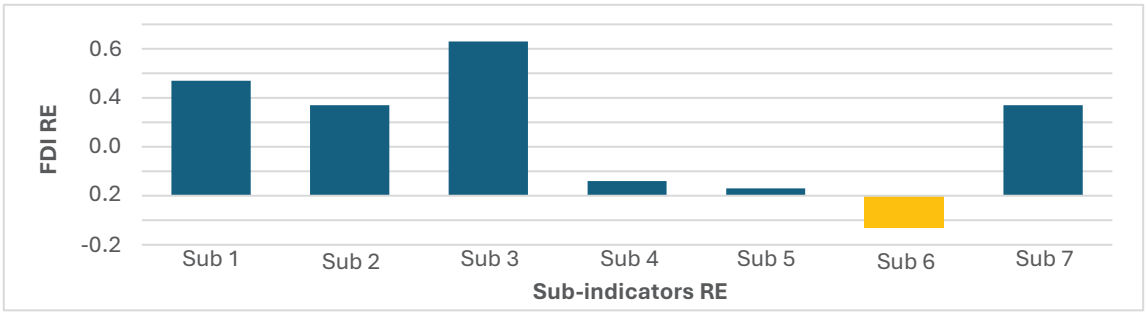
Authors' calculations based on the World Bank's RISE [109]

Hence, there is a need for further investigation into the sub-indicators to identify which ones are relatively more impactful, by using the Pearson correlation formula between the sub-indicator scores and investment in the participating countries. Correlations nearing a value of 1, mean a positive correlation in which the data sets move linearly. The result is shown in Figure 4.4.

Figure 4.4 The Correlation Coefficient Between RISE RE Sub-indicators and Investment Value



(a) Correlation between the sub-indicators and overall investment (local and FDI)



(b) Correlation between the sub-indicators and FDI

Source: Authors' calculations based on the World Bank's RISE [109]

Legend:
Sub 1. *Legal framework for RE*
Sub 2. *Planning for RE expansion*
Sub 3. *Incentives and regulatory support for RE*
Sub 4. *Attributes of financial and regulatory incentives*
Sub 5. *Network connection and use*
Sub 6. *Counterparty Risk*
Sub 7. *Carbon Pricing and Monitoring*

In evaluating the overall investment, i.e. both domestic and foreign, the highest correlations are found in sub-indicators 3 (Incentives and regulatory support for RE) and 5 (Network connection and use). When evaluating for FDI only, the highest correlations are found in sub-indicator 3 (Incentives and regulatory support for RE) and 1 (Legal framework for RE). The other sub-indicators show a weak correlation to investment. The result is consistent with other studies, which indicate that policies without additional international climate finance and improvement in institutional capacity will be unlikely to impact decarbonisation efforts [2], [110].

The incentives and regulatory support evaluated in sub-indicator 3 of the RISE Scores include concerns over long-term power purchase agreements (PPAs), clear guidance on permitting processes, and direct fiscal incentives. For investors, a bankable long-term PPA is key to obtaining competitive financing and lowering the perceived risk premiums. As described [3], "A bankable PPA is essentially a long-term offtake agreement executed with a creditworthy off-taker and having a sufficient tenor to enable repayment of a debt by providing an adequate and predictable revenue stream" [111]. A bankable PPA, which is key to securing financing, follows the principle that risks should optimally be allocated to the party best able to manage such risks.

The direct fiscal incentive is a public derisking instrument for renewable energy investment, which was found to be effective in derisking the project by reducing the total project cost and playing an important role in low carbon transition [112], [113], [114]. The country's capability to provide direct fiscal incentives for energy investment is determined by its fiscal space, which is measured by: (i) government debt sustainability; (ii) balance sheet composition; (iii) external debt; and (iv) market perception [115]. However, the COVID-19 pandemic adversely impacted the fiscal conditions in the AMS, due to the disruption in government revenue collections and massive additional fiscal budgets to recover from the pandemic, which limits the AMS' capabilities to continuously provide fiscal incentives for the energy sector.

Table 4.2 summarises the status of incentives and regulatory support in ASEAN countries. Only Vietnam provides long-term PPAs for large utility-scale energy producers, which are essential for ensuring stable revenue streams for renewable energy projects. Most of the countries, except Cambodia, offer long-term PPAs for small-scale producers. Indonesia, Malaysia, the Philippines, Singapore, and Vietnam provide clear and practical guidance on the permissions required to develop a renewable electricity project. This guidance is crucial as it helps to reduce uncertainties for developers, ensuring timely project initiation and implementation. Vietnam and Thailand are the countries that offer direct fiscal incentives such as capital subsidies, grants, and tax incentives for renewable energy projects.

Table 4.2 AMS' Detailed RISE Scores for Renewable Energy, 2021

Country	Offer long-term PPAs for renewable electricity production by large-scale producers (e.g. via feed-in tariffs, PPAs awarded through auctions, etc.)	Offer long-term PPAs for renewable electricity production by small-scale producers (e.g. via feed-in tariffs, PPAs awarded through auctions, etc.)	Does the government publish clear and practical guidance on what permissions are required to develop an RE electricity project?	Does the government offer the following direct fiscal incentives for renewable electricity (e.g.: capital subsidies, grants, tax incentives)?
Cambodia	No	Yes	No	No
Indonesia	No	Yes	Yes	No
Lao PDR	No	Yes	No	No
Malaysia	No	Yes	Yes	No
Myanmar	No	Yes	No	No
Philippines	No	Yes	Yes	Yes
Singapore	No	No	Yes	No
Thailand	No	Yes	No	No
Vietnam	Yes	Yes	Yes	Yes

Source: Authors' compilation

Supporting Policies at National and Regional Levels

Legal frameworks or planning for energy sector expansion is thought to be advantageous for attracting investment in sustainable energy, and is critical for governments [116]. Regionally, ASEAN has set out to boost the proportion of renewable energy in TPES and installed capacity to 35% by 2025, as outlined in the APAEC [117]. The document also targets reducing energy intensity by 32% in 2025, based on the 2005 level. As of 2022, RE accounted for only 15.6% of TPES, and approximately 33.6% of installed capacity, whilst EI reduction in 2022 reached 24.5% [12]. To date, the AMS have official energy targets, including renewable, coal, oil, and gas (Table 4.3).

Table 4.3 ASEAN Member States' Energy Planning Targets

AMS	Renewable Energy	Fossil Fuel
Brunei Darussalam	30% share of RE in the power generation mix by 2035	Oil and gas production 650,000 BOE per day by 2035
Cambodia	Aiming to achieve a minimum of 70% renewable energy capacity by 2030	• Coal installed capacity share 40.4% by 2030 and 21.4% by 2040 • Oil capacity share 8.7% by 2030 and 4.6% by 2040 • Natural gas capacity share 8.5% by 2050
Indonesia	Increase RE share to 19% in TPES by 2025 and 25% by 2033	• Coal-fired power plant retirement of 1.1 GW by 2030 • Oil supply share 19.5% (197.7 Mtoe) by 2050 • Natural gas supply share 24% (242.9 Mtoe) by 2050 • Coal supply share 25.3% (255.9 Mtoe) by 2050
Lao PDR	Achieve a 30% share of renewables in TFEC by 2025	N/A
Malaysia	Increase the RE share to 31% in the power capacity mix by 2025, 40% by 2035, and 70% by 2050	• Decrease the percentage of coal in installed capacity by 12.8% in 2040 • Almost complete phase-out of coal-fired power generation by 2045
Myanmar	Increase the RE share to 39% in electricity generation by 2030 (28% hydro and 11% other RE)	• Share of coal in installed capacity mix 6.5% by 2025 and 20% by 2030 • Share of LNG in installed capacity mix 46% by 2025 and 33% by 2030
Philippines	Increase the RE share to 35% in the power generation mix by 2030 and 50% share by 2040	• Increase production of 66 MMB of crude oil and 3.5 TCF of natural gas by 2040 • Increase production of coal to 282 million metric tonnes by 2040
Singapore	Increase solar energy deployment to at least 1.5 GWp by 2025 and 2 GWp in 2030	Reduce reliance on natural gas from 94.3% share to approximately 50% by 2035
Thailand	Increase share of renewables in final energy consumption to 30% by 2037	• Prioritise the exploration of natural gas from the Gulf of Thailand to maintain production at 43 BCM of natural gas per day
Vietnam	The proportion of RE in the TPES will be 15%-20% by 2030	• Crude oil production at 6 million to 9.5 million tonnes a year by 2030 • Natural gas production is expected to reach 5.5 billion to 15 billion m^3 per year by 2030 • Coal production to reach 41 million to 47 million tonnes of commercial coal per year by 2030

Source: Authors' compilation [12], [119], [120], [121]

Supporting Policies on the Energy Supply Side

During COVID-19, renewable energy appeared to be comparatively resilient, despite the fact the pandemic caused disruptions in the development of numerous projects. The renewables supply rose 13 Mtoe, whilst the oil and gas share decreased by approximately 2.4% in 2022, from 2020 levels. Investments in fossil fuels have declined due to the pandemic, whilst RE saw a steady increase of 6.4% in 2020, from the year before [122]. Despite ASEAN's budgetary constraints for green recovery and increasing the proportion of renewable energy, the AMS have unveiled energy-related fiscal stimulus packages that include incentives for the advancement of RE and other sectors. Table 4.4 presents fiscal policies in ASEAN countries that can attract renewable energy investment.

Table 4.4 Renewable Energy Policy Measures

Type of Policy	BN	KH	ID	LA	MY	MM	PH	SG	TH	VN
Tax Incentives		●	●	●	●	●	●		●	●
Grants/Subsidies/Loans		●	●	●	●		●	●	●	●
Auctions		●	●		●	●	●	●	●	●
Feed-in tariffs		●	●		●		●		●	●
Net metering	●		●		●		●	●	●	●
RPS or quotas			●		●		●		●	●
Voluntary REC Market	●	●	●	●	●		●	●	●	●

Source: Authors' compilation from UNCTAD Framework. Notes: BN = Brunei Darussalam, KH = Cambodia, ID = Indonesia, LA = Lao PDR, MY = Malaysia, MM = Myanmar, PH = Philippines, SG = Singapore, TH = Thailand, VN = Vietnam

Policy tools for the promotion of RE investment include tax incentives, grants and subsidies, loans, auctions, FiT, renewable portfolio standards (RPS) / quotas, tradeable Renewable Energy Certificates (REC), other guarantee schemes, and business facilitation [123]. Government agencies oversee renewable energy policies in the AMS, particularly for Indonesia, Malaysia, the Philippines, Thailand, and Vietnam, to attract investment. Whilst most ASEAN countries have made significant strides in implementing sophisticated fiscal and regulatory policies, little has been accomplished in terms of reforming governance structures, and the business environment for RE has shown little improvement [13]. The region can take encouragement from individual success stories like Vietnam, which is currently the 11th best emerging market for clean energy investments globally [125]. The local renewables market could reach a valuation of USD 714 billion, and continue to grow for at least 25 years, due to government's goals to become less dependent on thermal and coal power [126].

Fossil fuel subsidies are a prominent feature of many of ASEAN's economies, which can create fiscal imbalances in the long term. Malaysia increased its budget dedicated to petroleum products and Liquefied Petroleum Gas (LPG) subsidies, through a targeted approach to enhance spending efficiency [127]. In 2022, the Philippines allocated USD 44.3 million and USD 8.9 billion in subsidies for transportation fuel and agriculture, respectively, to soften the high price of oil [128]. The Thai government implemented ten support measures, including subsidies, capped diesel prices via excise tax reduction, Compressed Natural Gas, and LPG. Vietnam also continued to implement cuts to its environmental tax on fuels from January to December 2023, to curb high prices. ASEAN's reliance on fossil fuel spending in fiscal policy may create risks for investors.

Supporting Policies on the Energy Demand Side

In addition to renewables, substantial investments in energy efficiency are necessary to meet sustainability targets and reduce the overall effort required from energy supply measures. Investment in energy efficiency remains largely focused on the building and industrial sectors, with spending increasing by about 14% between 2021 and 2022 [129]. Singapore has allocated a budget for the Energy Efficiency Grant, which provides up to 70% of financial aid for qualifying costs, with an annual maximum cap of USD 30,000 per enterprise [130]. This grant is designed to help companies manage their expenses by co-funding investments in equipment that improves energy efficiency. Singapore's Energy Conservation Act mandates energy management practices for large industrial facilities, aiming to reduce energy intensity and operational costs [131].

A total of 11 banks in Thailand have participated in the Energy Efficiency Revolving Fund offering fixed-rate loans up to USD 1.5 million, and interest rates below 4% [132]. Cambodia has prepared financial instruments to mobilise financing for energy efficiency through fiscal and non-fiscal incentives, such as loans, tax exemptions, carbon pricing instruments, and green credit [133]. Moreover, the government does not intend to introduce new taxes that may burden enterprises. Vietnam's National Energy Efficiency Programme promotes energy efficiency in industrial processes, which is key to reducing overall energy consumption [134].

Supporting policies on the demand side include EV penetration targets. Singapore, at the forefront of EV expansion, has put forth plans to shift toward 100% electric public buses and taxis by 2030. Similarly, Cambodia is optimistic about increasing the share of EVs in the transport sector, targeting 40% for electric cars and city buses, and 70% for EVs overall by 2050. Malaysia has targeted 100% EVs for private transports, and 40% EVs for public transports by 2030. Indonesia is aiming for 20% electric or hybrid vehicles by 2025, 13 million electric motorcycles by 2030, and the production of 250,000 electric cars, and 3,000 electric buses by 2025. Scaling up private sector investment in the EV industry requires more stringent government intervention. ASEAN has experienced a significant increase of 656% in EV battery production between 2021-2022, following the AMS decision to further boost EV adoption by means of cost reduction measures, as well as facilitating the infrastructure and downstream markets [135]. The Thai government earmarked USD 0.7 billion in its 2023 budget to subsidise the development of EV batteries to lower production costs and achieve lower pricing for EVs in local markets [136]. The Indonesian government allocated USD 458 in cash subsidies for the purchase of battery EVs to increase EV sales [137]. Its Ministry of Finance also enabled a Value Added Tax (VAT) reduction of 5% to 10% on battery EVs, notably on cars and buses, to attract investment [138]. Like Indonesia, Malaysia has devised a 100% tax exemption and allowance for a 5-year to 10-year period for the manufacturing of EV charging equipment [139].

There is growing policy support in ASEAN to boost critical minerals processing capacity, which has led to increasing investment in minerals mining companies. To maximise the value of its abundant nickel reserves, Indonesia reduced tax incentives to discourage investment in lower-quality nickel products, and encouraged additional downstream investment [140]. The two largest nickel producers in the Philippines intend to invest roughly USD 2 billion to construct processing facilities and advance the downstream mining sector [141]. Thailand has offered financial incentives to entice FDIs in the production of critical minerals for the EV supply chain, including tax exemptions on corporate income and import duties for machinery [142].

Energy Justice in Energy Investment

A citizen-centred approach can address the challenges of social and environmental concerns [143]. In this approach, the contribution of local knowledge and wisdom is embedded into energy project designs, to advance social equity and inclusivity. The particularities of the geographic and socio-economic contexts of AMS communities inevitably highlight that there is no one-size-fits-all framework [144]. Best practices for this method have been developed and the AMS have employed different measures to safeguard and promote local community participation. Foundational to citizen-centred approaches is the facilitation of meaningful participation for local communities. Meaningful participation is characterised by the opportunity to improve three aspects of energy justice: procedural, distributive, and recognition justice (Table 4.5) [145].

Table 4.5 Forms of Justice Theory

Procedural Justice	Distributive Justice	Recognition Justice
Free, Prior, and Informed Consent	Job creation; Improvement of livelihoods; benefit sharing	Development Financial Institutions' Safeguards standards and framework
Continuous engagement in planning processes	Equitable distribution of cost; equitable distribution of benefits	Domestic law on the recognition of Indigenous rights

Source: Authors' compilation, adapted from Vega-Araújo & Heffron (2022) [144] .

Conceptualisations of energy justice have provided guiding principles for indicators that can be used to assess and improve the rights-responsiveness of projects. In the context of regulating energy finance, voluntary financing frameworks such as the ASEAN Taxonomy provide an exhaustive list of guiding principles for best practices that can be applied to financing requirements that incentivise sustainable and good governance principles within the private sector [60]. In evaluating procedural justice aspects of projects, the principle of Free, Prior, and Informed Consent (FPIC) concerns the participatory right of local communities and the right of local communities to access timely and accurate information [147]. In assessing the distributive justice aspects of projects, indicators such as job creation, improvement of livelihoods, and the establishment of benefit-sharing mechanisms in collaboration with local communities are considered [148]. Recognition justice in the context of energy investment concerns the rights of Indigenous Peoples, whether projects respect affected communities as rights-holders or improve their rights in the absence of formal recognition through project implementation. Through the above guiding domains, the reduction of risk in social aspects supports the longevity of investment returns through responsible project practices.

The AMS have taken various measures to promote community-based engagement. In the Philippines, the Indigenous Peoples Rights Act of 1997 provides the legal basis for national FPIC guidelines, wherein no agreement for land acquisition across sectors can be approved without certification from the National Commission on Indigenous Peoples (NCIP), and until the FPIC from affected communities has been obtained [149]. In addition, the draft of the ASEAN Declaration on Environmental Rights reflects a step forward in signalling the region's ambition to implement rights-responsive principles in projects to safeguard environmental sustainability and local communities at the frontlines of the energy transition [150].

The following are some key recommendations for the planning and execution of energy projects to foster a more just and inclusive approach that not only enhances a project's social and environmental outcomes but also attracts and secures successful investment [144], [151]:

- Mandate due diligence assessment prior to the approval of investments;
- Place equal weight on the social and environmental impact of investment to avoid obscuring possible negative implications of projects;
- Require companies to implement FPIC and incorporate participatory engagement into project design;
- Provide consideration for small-scale projects that facilitate energy access and co-equity arrangements with local communities; and
- Provide access to remedy for local communities in cases of rights violations through the establishment of a Grievance Redress Mechanism (i.e., official channels through which stakeholders can submit grievances concerning the design, implementation, or evaluation of policies) [152].

Examples of successful and mixed-success energy projects found in the AMS that inform challenges of social concerns faced in energy investments provide key lessons on the opportunities or implications resulting from strengths or gaps in its implementation. Crucially, in the ASEAN context, the private sector has been integral in spurring rural electrification in the face of public financing gaps [153]. The following case study sheds light on the implications of fostering community-based renewable projects that take the projects beyond the baseline factors determining community acceptance, or lack thereof. Through a public-private partnership (PPP) scheme by UNESCAP, a 120 kW micro-hydropower plant in Cinta Mekar village, West Java, Indonesia, has provided rural electrification and economic value for surrounding communities, for more than two decades, since 2004 [154]. In a cooperative model jointly owned by the community and a private company, funds generated from electricity sales exported to the national grid are directed at providing small loans and productive activities for the community, to spur job creation and improve local livelihoods. The success of the pilot project has been widely attributed to the facilitation of a community-centered approach to rural electrification by a local non-governmental organisation, focusing on providing small-scale renewable infrastructure for rural communities [155]. The community-centered approach enabled local ownership of the project, resulting in the continued longevity and success of the project. The Cinta Mekar project provides promising pathways for small-scale community-based renewable energy projects in support of broader regional goals of accelerating renewable energy, whilst acknowledging the high upfront costs and investment risks associated with small-scale rural electrification. In the broader context of energy investment, the example of the Cinta Mekar project is instructive in its ability to surpass the risks associated with investing in community renewable energy projects through the participatory engagement of the community embedded into the PPP structure [156].

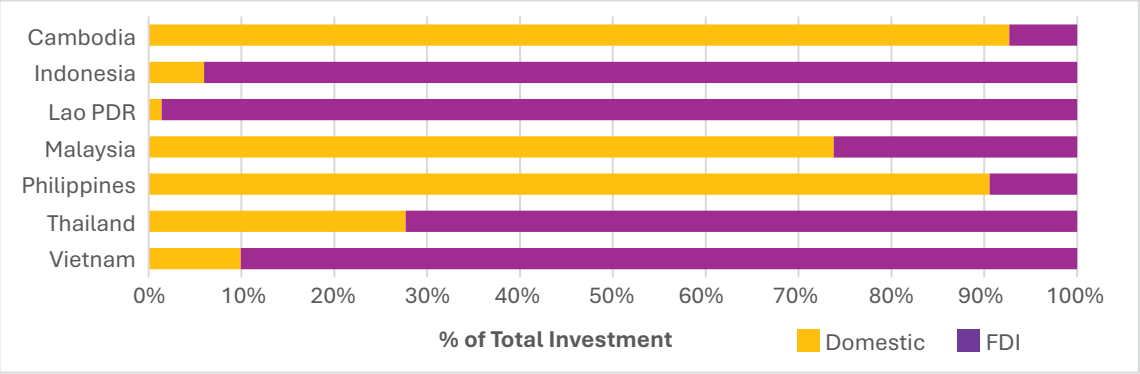
CHAPTER 5

Financial Instruments

Investment Flows to AMS

Significant energy investment in ASEAN during 2021-2023, was made by local private investors, which signals the growing domestic capital markets in some of the AMS. This is particularly true for the Philippines, Malaysia, and Cambodia, in which more than 50% of capital for energy infrastructure projects is from domestic sources (Figure 5.1). It is worth noting, however, that in Cambodia, the large domestic capital is due to a 170 MW hydropower project financed in full by equity in 2023.

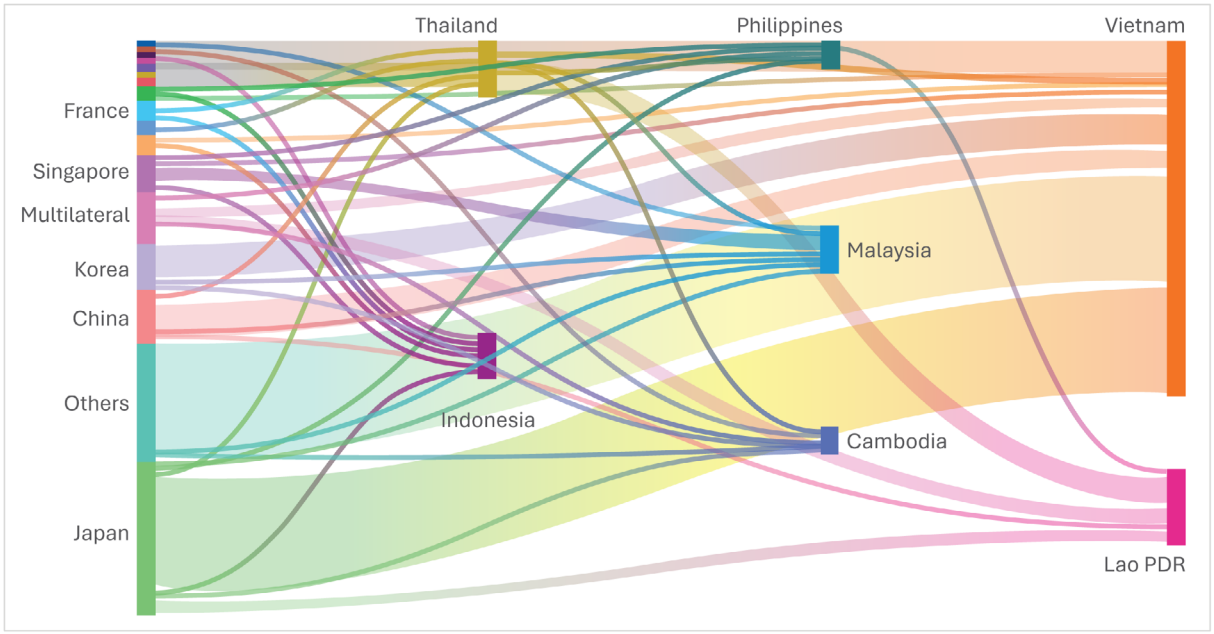
Figure 5.1 Domestic and Foreign Investment Sources in ASEAN Countries



Source: Authors' calculations based on World Bank's PPI Projects [64]. Notes: Exclude Brunei, Myanmar and Singapore

Japan is the largest source of investment for AMS, with most of the investment made in Vietnam and Lao PDR (Figure 5.2). Japan's investment in the AMS uses highly diversified financing instruments and technology, via equity, commercial loans, and concessional loans for renewable and non-renewable energy infrastructure projects across seven countries. China is the second largest source of investment, primarily in Vietnam and Thailand, through loans for gas and coal power plant projects receiving the largest amount of investment. China invests in wind and solar PV in Lao PDR, Vietnam, and Malaysia through equity and commercial loans. Multilaterals, including ADB, Asian Infrastructure Investment Bank (AIIB), and International Finance Corporation (IFC), are active in the region, providing blended financing solutions for renewable energy projects. In addition to commercial funds, these organisations provide concessional funds through grants, guarantees, and concessional loans to improve project bankability.

Figure 5.2 Investment Flows to AMS



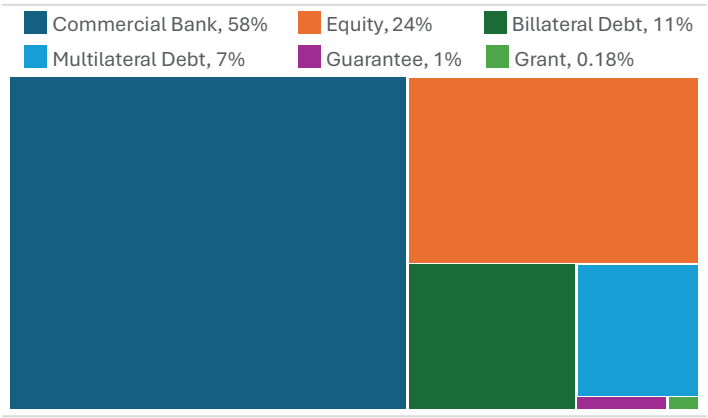
Source: Authors' calculations based on World Bank's PPI Projects [64]. Notes: Exclude Brunei, Myanmar and Singapore

Financing Instruments in ASEAN

Foreign funds flow into the AMS through various financing instruments, both commercial and concessional, as illustrated in Figure 5.3. Whilst loans are trackable, the concessional amounts in multilateral and bilateral debt remain unclear. Approximately 57.9% of the funds flowing into the AMS come from commercial debt, which is priced at the market rate. Bilateral and multilateral debt account for 10.7% and 7.1% of total financing, respectively, with concessional levels unknown. Grants and guarantees constitute less than 1% of total financing, which could indicate either (i) the projects in the AMS are progressing toward commercial viability, or (ii) there is a shortage of high-quality projects nearing commercial viability.

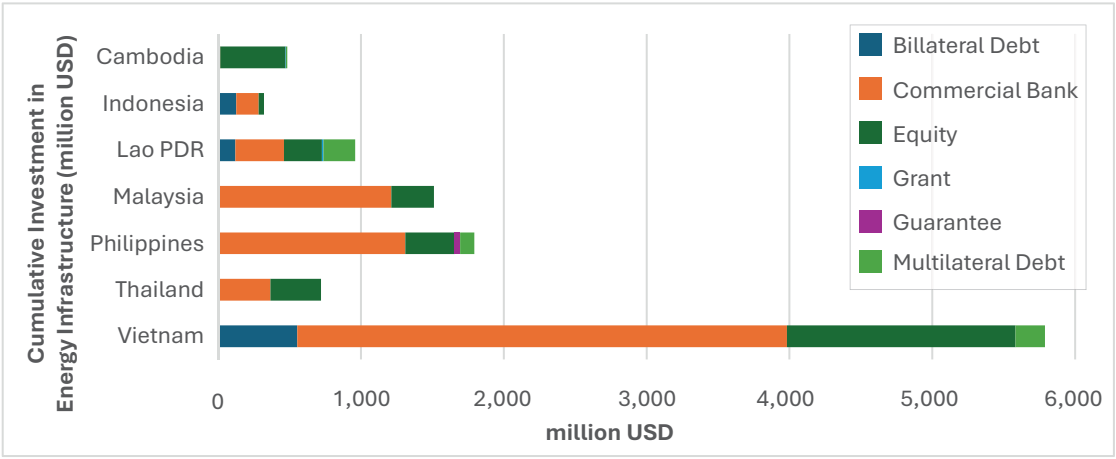
In terms of recipient countries, Vietnam, the Philippines, and Malaysia are the largest recipients of loans from Development Finance Institutions (DFIs) (Figure 5.4). Grants have been provided for one solar PV project in Cambodia and one wind project in Lao PDR. ADB has guaranteed a solar PV developer in the Philippines to fund its solar PV project platform. ADB has provided a 20% partial credit guarantee to a local bank offering sustainability-linked loans to the company. This blended financing scheme, which includes a guarantee, exemplifies how blended finance can facilitate the development of smaller-scale PV projects.

Figure 5.3 Financing Instruments from Foreign Fund Sources to AMS



Source: Authors' calculations based on the World Bank PPI Datasets [64]. Notes: Exclude Brunei, Myanmar and Singapore

Figure 5.4 Financing Instruments in AMS



Source: Authors' calculations based on the World Bank PPI Datasets [64]. Notes: Exclude Brunei, Myanmar and Singapore

The lower-income countries tend to have a higher percentage of concessional financing [157]. In ASEAN, lower-middle-income countries receive much greater funding from DFIs, including from the Japan International Cooperation Agency (JICA). The result aligns with IFC's experience executing blended finance in emerging markets. Hence, it is likely that the percentage of concessional funds will remain higher in lower- and middle-income countries, as seen later in blended finance section.

Fiscal and Public Space

The role of the public sector in clean energy funding will accelerate the achievement of national and regional energy targets. In most ASEAN countries, electricity transmission and distribution are funded by the public sector, especially SOEs. Indonesia, with over 60% of its electricity generation from coal, is still funding new coal projects that are already stipulated in the national strategic projects [158], [161]. With the current affordability of coal, it is undeniable that coal still exists to participate in the energy mix for electricity security. Coal is still expected to be present, even by the year 2050, although the share of generation and capacity will gradually decrease over the years [12].

Plans to build new coal plants will affect the speed of the commitment to energy transition. For example, the limited investment amount available will affect the amount to be disbursed amongst priority sectors. For example, EV development in which battery SOEs in Indonesia, funded by other SOEs, required an investment of around USD 16 billion, for a production capacity of 140 GW of lithium batteries in 2030 [160]. This reflects the two sides of the same coin for Indonesia's energy transition commitment.

On the other hand, public sectors in other countries are tailoring an established policy to fund renewable projects. Whilst Vietnam still aims for a fair amount of imported coal and LNG, it also prioritises its domestic power sources through gas and renewable energy. Until 2030, the total capital investment needed to develop prioritised projects is around USD 99 billion to USD 115 billion [161]. The public sector owns less than half of the development projects for coal and LNG, whilst investing in most of the hydropower plants during the period 2026-2030, reflecting a strategic plan to shift away from coal [161].

A substantial investment in long-term infrastructure requires a role for the state bank and government to create a favourable environment for power project investment, such as exploring the bank's credit fund and approaching credit agencies. This is due to the public sector having limited resources, capabilities, and funds. Whilst domestic investment, both public and private, can allocate a certain amount of capital, meeting the full capital investment will necessitate global investors from the private sector and financial institutions. This will ensure that all the goals for energy projects, especially clean energy, have a secure financial foundation, and attract more investments. Increasing sources through loans, grants, or bonds as funding instruments will attract both domestic and international actors due to the shared risk scheme in project development.

In Thailand, for example, the Khon Kaen 1 Solar Plant has a total investment of USD 21.8 million, from project banks and the private sector, which is supported by the government through revenue subsidies and payment guarantees [64]. With direct and indirect support from the government, emerging renewable projects will remain financially stable, with a clear path towards market maturity.

Private Participation

Public funding alone will not be sufficient to meet the growing energy demand and support the green energy transition. Therefore, foreign investment will be crucial in bridging the gap in ASEAN's energy investment. Private funding, both from domestic sources and abroad, will be essential to ensuring that ASEAN's energy needs are met. The increasing demand from the developing economies within ASEAN is likely to attract foreign companies to invest in energy infrastructure, encompassing both renewable and conventional energy sources.

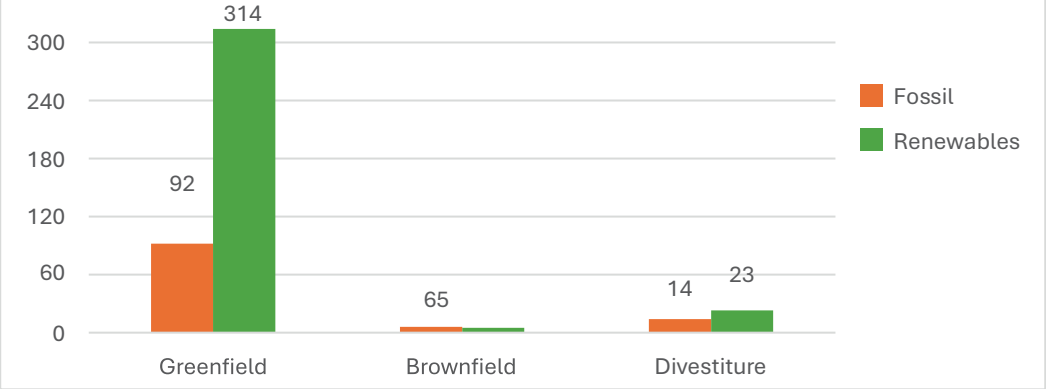
State and multinational firms that have traditionally invested in fossil fuels are now expanding their investments toward energy transition technologies. Additionally, the rise of EVs in ASEAN is being supported by international car manufacturers expanding their sales and market penetration within the region.

Partnering with international organisations, the private sector plays a crucial role in advancing the development of the power sector. With limited domestic debt available to fund energy projects, particularly clean energy infrastructure, governments stand to benefit from the involvement of the private sector, including through PPP.

The importance of private investors is further evidenced by their contribution to energy infrastructure, which accounts for 28% of total private partnerships globally, with total investments amounting to USD 25.9 billion [162]. Between 2020 and 2023, total equity for energy infrastructure in ASEAN reached approximately USD 3.7 billion, with contributions from private investors, multilateral and bilateral support, governments, and project banks [64].

Energy funding patterns can be distinguished through greenfield, brownfield, and divestiture investments. From 2003 to 2023, the majority of energy financing came from greenfield investments, where projects were created from scratch (Figure 5.5). The private sector contributed to just 92 projects, whilst renewable energy projects totalled 314.

Figure 5.5 Private Participation in ASEAN Energy Infrastructure 2003-2023



Source: Authors' calculations based on the World Bank PPI Datasets [64]

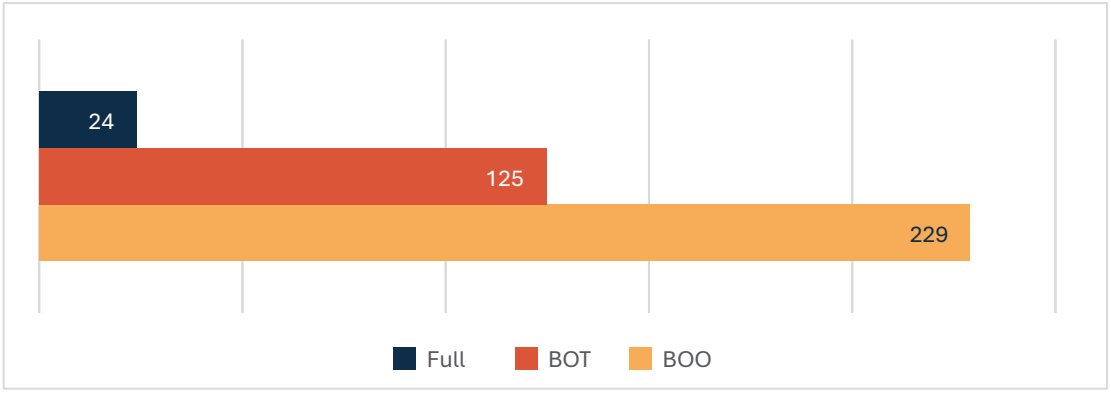
Brownfield investments, which involve upgrading existing infrastructure, showed the lowest project numbers, accounting for fewer than 10 projects with private participation. When the private sector takes over existing energy infrastructure, there is a risk of changes in capital and operational expenditure, making brownfield investments less attractive, particularly in the ASEAN region.

Another form of private participation is divestiture, where the private sector buys equity in state-owned enterprise (SOE) assets and takes full responsibility for operating and investing during the agreed period. For private investors, initial costs can be reduced due to existing infrastructure, which lowers both cost and time.

Most funding schemes for energy projects in ASEAN, both fossil and renewable, are directed towards the build-own-operate (BOO) model (Figure 5.6). The BOO scheme offers stability and ensures full control for the private sector, unlike the build-operate-transfer (BOT) model, which involves an asset handover at the end of the concession period. With the BOO scheme becoming the frontrunner, funding from the private sector is likely to increase, allowing the public sector to allocate funds to other areas of development, as there is no need for further infrastructure investment.

Additionally, the full divestiture scheme, where 100% of equity is transferred to a private entity, is also a favourable option. Privatisation will focus on revenue generation and competition, leading to capital raising or new investments, thereby expanding the market.

Figure 5.6 PPI Schemes in the ASEAN Energy Sector from 2003-2023



Source: Authors' calculations based on the World Bank PPI Datasets [64]

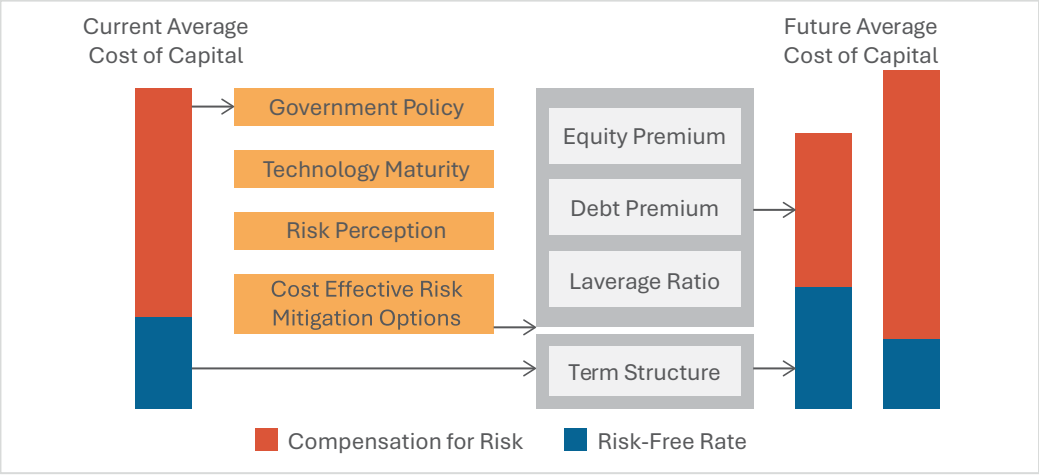
The adaptation of the BOO scheme in the energy sector has demonstrated advantages aligned with private sector investment benefits, whilst also driving technological advancements in energy infrastructure. With over 200 projects implemented under the BOO scheme since the early 2000s, established PPP practices are expected to further stimulate renewable energy projects.

This scheme benefits the private sector by ensuring long-term control, supporting business objectives and revenue targets. For the public sector, the BOO scheme reduces operational responsibilities, whilst still allowing it to benefit from the energy supply and distribute it according to agreed contracts. Governments could leverage PPPs as an initial procurement mechanism to help overcome the biggest challenge in funding clean energy—the high upfront investment.

Cost of Capital as Private Investment Driver

For the private sector, the cost of capital critically influences final investment decisions in the clean energy sector. The cost of capital is defined as the expected rate of return that investors require from funding a project. It is linked to the capital structure of a project, specifically the proportion of debt and equity used in the project's financing. Figure 5.7 provides a simplified diagram of the cost of capital drivers, which effectively demonstrates that the cost of capital depends on a risk-free rate and compensation for risk. Both the debt and equity components of the financing structure include a risk-free or base-rate portion (indicated in blue) that remains unaffected by the project's risk profile or sector-specific policies. However, they are influenced by current and anticipated macroeconomic conditions. The compensation for risk (indicated in red) is also known as the premium, and it is primarily driven by actual and perceived risks associated with project cash flow certainty [163]. Higher perceived risks in these areas lead to a higher cost of capital, which can deter investment, especially in developing countries and emerging clean energy technologies.

Figure 5.7 Drivers of Cost of Capital



Source: Coleman, 2021 [161]

Perceived risks become the key drivers of the private sector's decision to fund certain projects. Perceived risks include country, sector, technology, and project-specific details, which are explained in Table 5.1.

The investor's cost of capital varies depending on country-, sector-, and project-specific factors. The cost of capital in clean energy projects in developing markets, such as most countries in the AMS, is typically higher due to the perceived risks, which consequently cause private capital to frequently fail to find the right balance between risk and return. Lowering and mitigating risk in these clean energy projects is essential to attracting private capital to clean energy projects.

Table 5.1 Drivers of Investor Risk Perception

Macroeconomic, country-and sector-specific risk	Macroeconomic and country-level	Sovereign risk
		Impact of economic crises, credit crunches, and monetary policy
	Sector level	Structure of the electricity market and generator exposure to price risk
		Design of renewable energy support policies (e.g. feed-in tariffs, premia, quotas, carbon pricing)
		Credibility/expected stability of policies and regulations
	Financial sector	Financial sector maturity and competitiveness level
		Financing/investment experience for clean energy technologies
		Availability of concessional financial or de-risking mechanisms

Technology- and project-specific risk	Technology level	Portfolio of generation technologies and fuels and their emission intensity
		Maturity of technology (commercial readiness)
	Company level (in the case of corporate finance)	Company track record and local experience
		The firm's financial characteristics
		ESG characteristics
	Project/asset level (in case of project finance)	Project characteristics (e.g. size, resource risk, operational risk)
		Project finance structure (e.g. financing of the construction period, loan tenors, guarantees)

Source: Authors' compilation based on OECD [163]

Referring to the table above, country risk refers to loss due to events specific to a particular country, such as force majeure. This risk is typically measured through sovereign borrowing rates as in many cases the sovereign entity acts as the guarantor for contractual obligations to the project. There is a well-documented relationship between low country credit ratings and high-risk premiums, particularly in developing countries. Developing countries are typically considered high risk, which leads to higher financing costs than in developed countries.

A common macroeconomic risk in developing countries such as AMS is foreign exchange risk, which occurs when project revenue is generated in a currency different from the investment. In countries with underdeveloped capital markets, project financings are often conducted using hard currencies such as USD or Euro. The mismatch consequently causes projects to be vulnerable to local currency devaluation and interest rate fluctuations. To mitigate currency devaluation, as an example, Indonesian renewable energy projects have selling tariffs in USD. Other than such policy, measures such as currency hedges or swaps with third-party providers, often commercial banks, are employed.

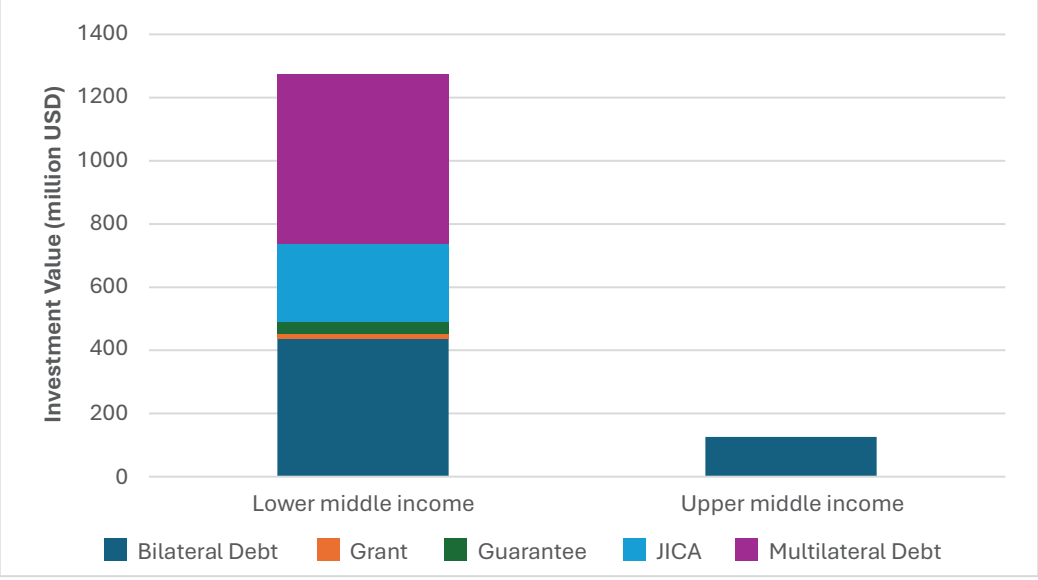
Political and regulatory risks are also a critical part of attracting private capital, as extensively discussed in Chapter 4.

Blended Financing Instruments to Leverage Private Investment in the AMS

Blended finance entails the integration of concessional funds from donors and philanthropic sources, with commercial funds from private investors and DFIs, both multilateral and bilateral. This approach is used to de-risk high-impact projects in priority areas, including sustainable energy, and improve bankability, thereby attracting private investment. In the disbursement of concessional financing, a path to commercial viability must be present. The following are the types of blended finance products commonly available for emerging markets [155], [162]:

- **Concessional Senior Loans:** Loans with top repayment priority, offered at below-market interest rates or other non-commercial terms (e.g., maturity, grace period, security, repayment profile).
- **Concessional Subordinated Loans:** Loans with lower repayment priority (or with deferred interest or principal payments in certain pre-agreed situations), provided at below-market interest rates or other non-commercial terms.
- **Guarantees or Risk-Sharing Facilities:** These transfer all or part of the financial risk of a loan or group of loans to the guarantor up to a maximum agreed amount, with fees charged below market rates. This could include first-loss protection, where the donor guarantees a portfolio of investments for a financial intermediary and pays out before the senior guarantor in case of a payment default. In the context of the power sector, a form of guarantee can be a standby letter of credit should the off-taker fail to honour its payment obligation.
- **Concessional Equity:** An ownership stake in a company or participation in a fund, with return expectations below what market investors would expect, or subordinated equity with cash waterfall.
- **Grants:** These can be Performance-Based Incentives to achieve certain expected milestones, or Viability Gap Fund (VGF), which provide a certain portion of the capital investment. VGF is aimed at projects which are not yet commercially viable.
- **Local Currency Support:** Provision of fully or partially subsidised currency hedge through concessional funds.

Figure 5.8 Investment Value in Lower-Middle-Income and Upper-Middle-Income Countries

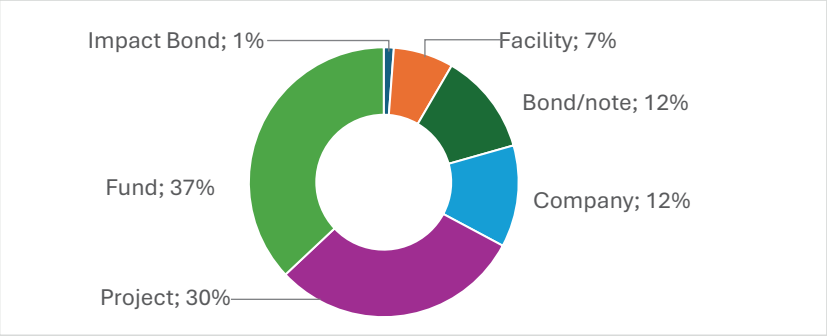


Source: Authors' calculations based on IFC [155]

When structuring projects with blended finance, selecting financial instruments considers macroeconomic, sectoral, and project-specific risks. It is imperative that the structuring requires a minimum amount of concessional funds, whilst providing maximum leverage for private investment. Although each of these instruments can address common challenges in emerging markets, e.g. political and currency risks, each project will have a different blended finance structure. However, the percentage of concessional funds required in projects in lower-income countries tends to be higher than in upper-middle-income countries (Figure 5.8) [157].

The use of blended finance is an attractive way for AMS to increase private funding in clean energy projects, by pooling resources and reducing the risk associated with green investment [15]. ASEAN has seen about USD 20 billion in blended finance investment, with 127 blended transactions, accounting for 6% of global blended finance transactions [164]. To make the most of this scheme, the region must promulgate bankable projects, whilst ensuring they align with country, region, and global macroeconomic conditions. Currently, ASEAN receives the most blended finance through transactions on funds and projects (Figure 5.9). Funds are usually allocated towards financing equity, whilst projects tend to focus on long-term development plans, such as energy infrastructure projects.

Figure 5.9 ASEAN Transactions by Blended Instruments in 2022



Source: Authors' calculations based on Convergence [163].

While crucial to a country's economic growth, ASEAN still faces a significant infrastructure gap. The region requires around USD 60 billion to fund infrastructure projects, including those in the energy sector. One of the largest sources of funding in the region is ADB, which offers various funding instruments, including grants, bonds, loans, and technical assistance. ADB currently co-finances the ASEAN Infrastructure Fund (AIF), the largest fund established by ASEAN. To support the region, ADB provided USD 150 million of initial equity [164]. Until 2023, AIF has funded seven energy projects across ASEAN. As of 2023, AIF has funded seven energy projects across ASEAN. One ongoing project is a power infrastructure project in Vietnam, which is developing 220 kV and 110 kV power grids in Hanoi and Ho Chi Minh City, using a sector loan of USD 100 million funded by the AIF [166].

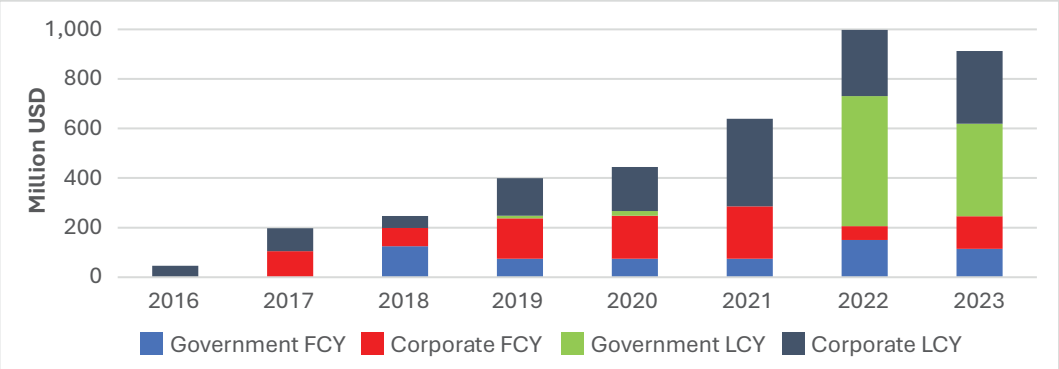
Another example of the blended financing scheme is in Indonesia's geothermal projects, which usually have high capital costs. The Geothermal Resource Risk Mitigation programme is funded by the World Bank through the sector using three instruments: 14.6% in equity, 22.6% in grants, and 62.8% in loans, totalling approximately USD 65 million [167]. Joint financing has been implemented to engage public and private developers, by offering financial security during the exploitation phase, eventually increasing geothermal power generation capacity in the country. For high-risk projects still in their growing market phase, a blended scheme could be a suitable substitute for PPP, due to its efficiency and transparency to increase bankability and secure investor financing, because of the shared risks between governments, DFIs, and donors.

Green Bonds

A new financial product known as “green bonds” has been growing rapidly on a global scale. For long-term projects, green bonds can be an attractive option to finance initiatives that might be challenging to fund due to high risk. Whilst green bonds have seen significant growth globally, most issuances have originated in Europe. ASEAN still lags in green bond issuance, though the market has expanded over the past 7 years [167]. In 2016, corporate local currency yield (LCY) was the only green bond issuance in the region. By 2017, corporate foreign currency yield (FCY) bonds began to appear and quickly surpassed the value of corporate LCY bonds. Despite fluctuations, the value of green bond issuances demonstrated an upward trend, reaching USD 2.1 billion in 2021. This suggests that corporate financing remained resilient despite the economic challenges posed by COVID-19.

Although the value dropped significantly the following year, the total value of green bond issuances peaked due to a notable increase in government LCY bonds. Government LCY bonds entered the market in 2019, but it has been in the last two years that their value has been particularly high (Figure 5.10). This trend reflects several enabling factors, including a growing market and stronger policy frameworks for financing green projects.

Figure 5.10 Green Bonds Issuance in ASEAN 2016-2023



Source: Authors’ calculations based on Asian Bonds Online [169].

Foreign currency in prior years demonstrates a fair share of value. Issuing FCY green bonds could leverage foreign investors to increase project viability in the international capital markets, broadening funding sources. However, this poses a risk to the country (issuer) because of inflation and unstable currency rates, resulting in a high risk of financial strain when repaying the bond. In the last two years, government and corporate LCY showed a large share, particularly due to the ADB and ASEAN+3’s efforts to encourage LCY to diversify sources. Along with boosting sustainable development, using local currency will attract domestic investors and increase the domestic markets, stimulating economic growth, and thus accelerating capital and reducing dependency on project financing in foreign currencies.

The Philippines has made significant progress in its commitment to promoting a sustainable capital market, having issued USD 6.58 billion in Green, Social, and Sustainability Bonds (GSSB) that can be directed toward clean energy projects [170]. Similarly, the Bank of Thailand established a sustainable finance framework with its 3-year Strategic Plan (2020-2022), which encourages financial institutions to integrate ESG (Environmental, Social, and Governance) information into their business and operating models. Thai private banks have issued GSSB to finance and refinance green assets [171]. In Indonesia, the Financial Services Authority, supported by Bank Indonesia, issued green bonds in 2017. These bonds outline specific green practices, procedures, criteria, and regulations that issuers must adhere to [172].

Carbon Credits

Carbon credits can play a crucial role in attracting private capital, along with the government's complementary policies to bridge the investment gap. Due to the high upfront costs of clean technologies, carbon credits can push the emitters to adopt and fund low-emission technologies. This has led to the creation of a new revenue stream from the carbon credit trading scheme. A robust and clear guidance on carbon credit could help countries navigate the complex market due to volatile credit prices and uncertainties.

Several AMS have adopted regulations on carbon credit trading, and established a dedicated platform to facilitate the trading. Indonesia and Singapore are amongst the countries in ASEAN with a set of legal and regulatory frameworks on carbon credits [173]. Moreover, most AMS have put into practice carbon credit programmes and voluntary market activities [173]. However, the price of carbon applied in Southeast Asia is considered low. The IMF has estimated that a carbon price of USD 35/tCO_2e to USD 70/tCO_2e would significantly reduce emissions by 2030 [174].

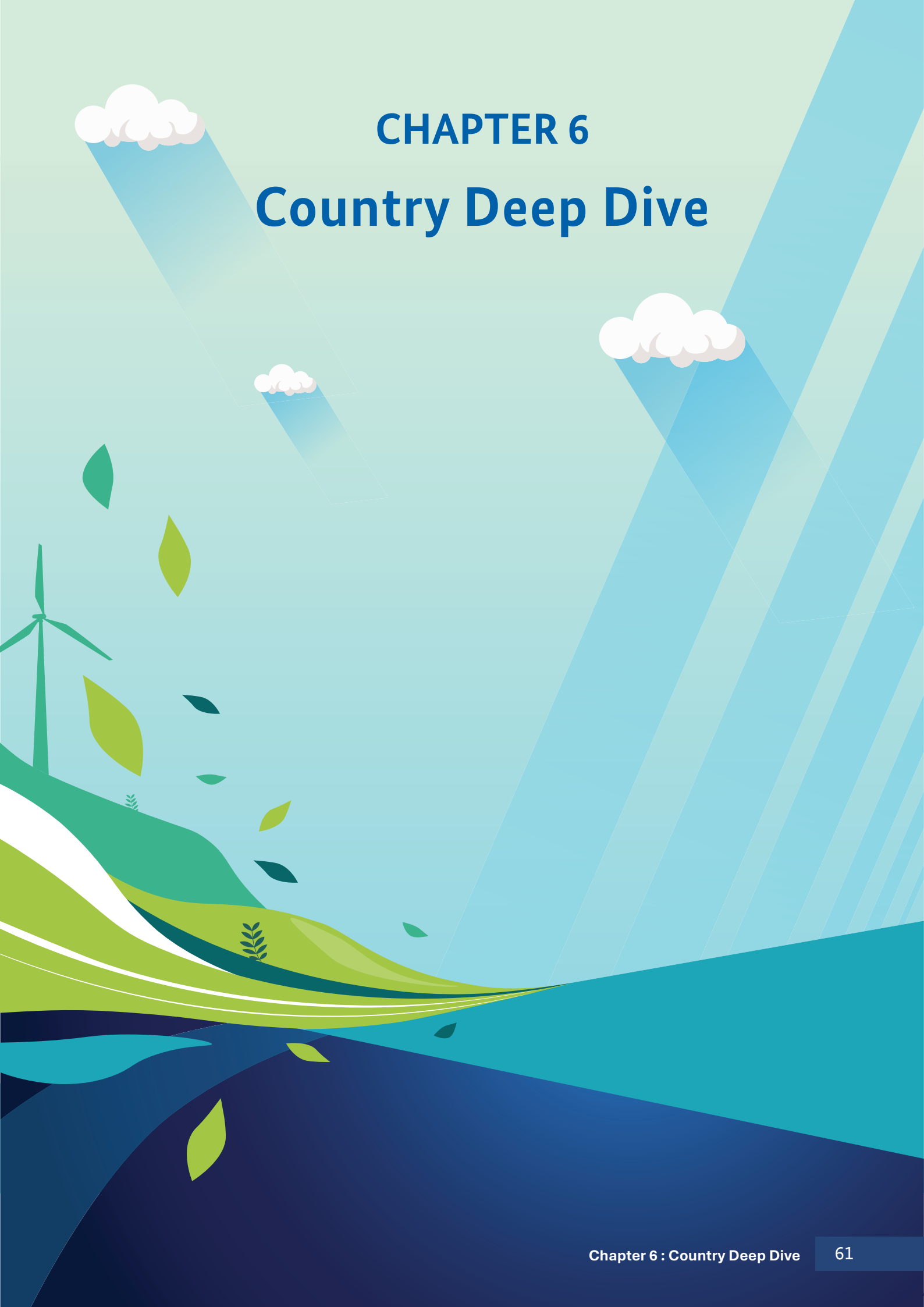
Singapore's carbon price was at SGD 5/tCO_2e (around USD 3.8) from 2019 until 2023 [174]. The country will progressively raise the price of carbon to SGD 25/tCO_2e (USD 19.1) by 2024 and SGD 45/tCO_2e (USD 34.5) in 2026 and 2027, with a view to reaching SGD 50-80/tCO_2e (USD 38.4-61.4) by 2030 [175]. In addition, a new system for international carbon credits (ICCs) was introduced in 2022 for effective cooperation with international carbon markets, enabling businesses and industry to use voluntary carbon credits to offset up to 5% of their taxable emissions [177]. In 2023, Singapore's Carbon Credit market size reached USD 14.5 million, and is projected to grow 21% annually until 2030 [178].

Given its current economic condition, Indonesia only imposes a carbon tax of USD 2/tCO_2e, which is limited to coal-fired power plants [179]. Thailand operates a voluntary domestic carbon market, and recently launched a carbon credit exchange, called FTIX, which is operated by the Federation of Thai Industries [180]. In 2022, Malaysia launched a voluntary carbon exchange—the Bursa Carbon Exchange—and has seen the trading of 150,000 credits from 15 companies in the energy and agriculture, forestry, and other land use sectors in 2023 [181].

As of this time, Brunei, Lao PDR, Myanmar, and the Philippines are considering carbon credit. Since 2004, Myanmar has benefited from carbon credit purchases through 36 approved projects that have reduced emissions by less than 500,000 tCO_2e [182]. In 2024, Lao PDR launched a forest carbon credit initiative (REDD+) to reduce emissions from forest destruction and degradation, but a legal framework is not yet in place [183]. Vietnam is currently in the development stage of a carbon credit exchange—including the national registration system to track regulated emission quotas and carbon credits—and will officially start operations in 2028 [184].

CHAPTER 6

Country Deep Dive



Indonesia

Economic Background

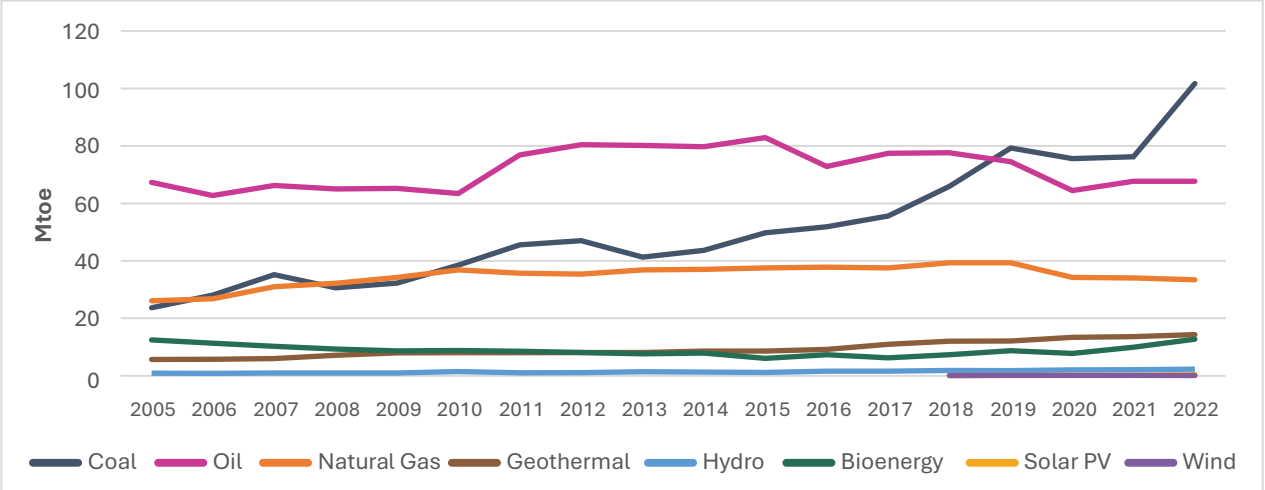
Indonesia, the largest economy in Southeast Asia, has shown impressive economic resilience and growth in recent years. As the fifth largest economy in Asia, its GDP surpasses USD 1 trillion. Between 2013 and 2022, Indonesia's GDP growth exceeded the average for emerging markets, driven by strong domestic consumption and a growing middle class. The economy consistently grew despite global economic challenges and volatile commodity prices. Over the decade leading up to 2022, Indonesia's average real GDP growth was 4.3%, just below the Asia-Pacific region's average of 4.4%. In 2022, real GDP growth reached 5.3%. The average inflation in the ten years to 2022 is 4.1%, and during the same period, the local currency rupiah weakened by 38.1% against the USD [185].

In 2021, the services sector contributed 47% to the total GDP, whilst manufacturing made up 19%, other industrial activities 21%, and agriculture 13%. From the expenditure side, private consumption contributed to 56% of GDP, government spending accounted for 9%, fixed investment 31%, and net exports 4% [185]. According to Moody's, the Indonesian credit rating is Baa2, considered medium grade and may pose a moderate credit risk [10].

Energy Mix Landscape

In 2021, Indonesia's TPES was 235.4 Mtoe, an increase of 1.7 times from 2005 (Figure 6.1). Coal and oil are the primary energy sources, constituting 60% of the total energy supply. In particular, coal has grown significantly since 2014, surpassing natural gas. However, according to the Indonesia Electricity Supply Business Plan 2021 – 2030, no new coal-fired power plants are to be constructed, except for those that have already reached financial close or are under construction, which is approximately 13.8 GW of additional capacity until 2027 [186].

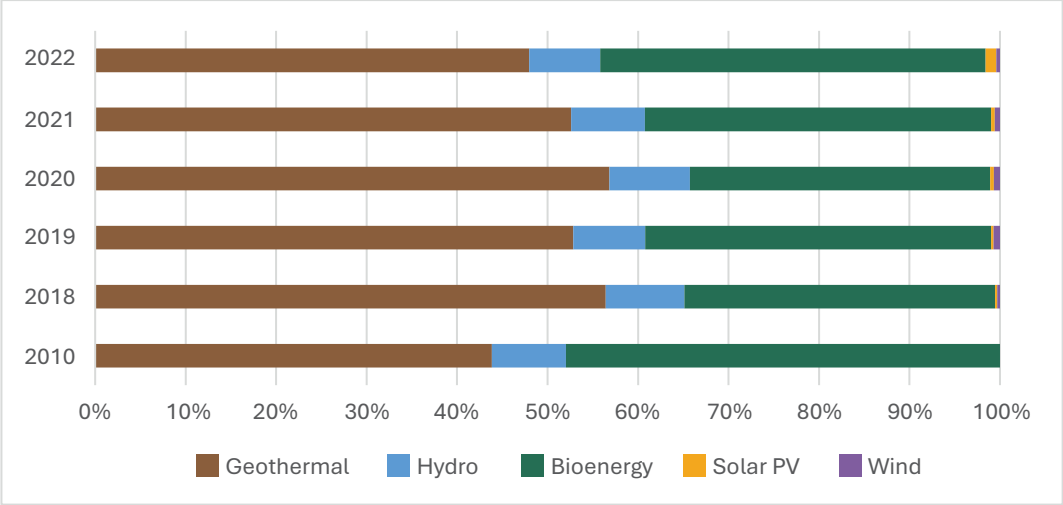
Figure 6.1 Indonesia's Total Primary Energy 2005 -2022



Source: ACE. All rights reserved.

Variable renewable energy, such as solar and wind, have grown consistently, picking up some fraction of the energy supply since 2018 (Figure 6.2). Biofuels and waste have decreased since 2010, which could indicate a shift away from these sources. The Electricity Supply Business Plan 2021 – 2030 intends to add 40.6 GW of renewable energy through 2030, focusing on developing biomass co-firing technology, hydro, and geothermal [185]. The government of Indonesia has set a target to increase the share of new and renewable energy in TPES to 23% by 2025, and 31% by 2050 [186].

Figure 6.2 RE Share by Type 2018-2022



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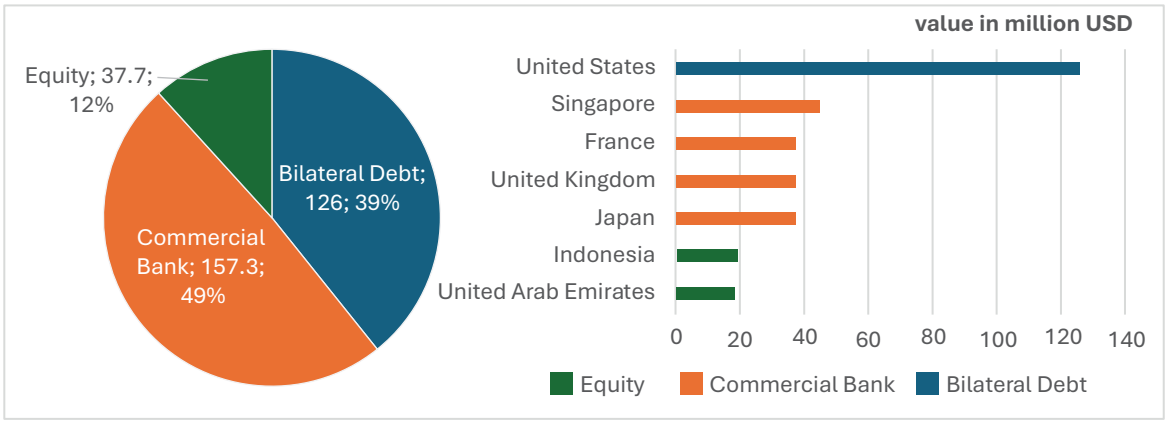
Energy Investment Landscape

Figure 6.3 shows the distribution of foreign investment values by instrument and by country of origin in Indonesia over the period 2021 - 2023. During this period, the total energy investment in Indonesia was USD 321 million, the lowest amongst the other AMS. The largest portion of investments, accounting for 49%, is from commercial banks, amounting to USD 157.3 million. Bilateral debt follows closely, representing 39.3% of total investments with USD 126 million. Equity investments contribute the least, at 11.7% and USD 37.7 million [64].

Figure 6.3 Energy Investment Share in Indonesia by Financing Instrument and Country of Origin 2021 – 2023



Source: ACE calculations based on World Bank [64]

The United States is the predominant financier, with a significant amount of bilateral debt, amounting to USD 126 million. Singapore, France, Japan, and the UK also contribute notable investments, primarily through commercial loans. With regard to equity instruments, Indonesia and the United Arab Emirates were the main contributors to the energy investment landscape in Indonesia during 2021 – 2023 [64].

In 2019, ADB identified some key challenges for financing in the renewable energy sector, such as high perceived risks by banks, which leads to high interest rates and cost of capital, relatively small project capacity, leading to high project development and transaction costs, and lack of profitability [187]. This condition makes fiscal incentives and supporting measures from the Government of Indonesia essential to promote investment in clean energy sectors.

Applicable Incentives

The government of Indonesia employs several fiscal incentives to boost clean energy investments.

a. **Tax Exemptions**
   Government Regulation No.78/2019 provides an income tax reduction of up to 30% for qualifying expenditures on fixed assets (including land), prorated at 5% per year for six years. This regulation also gives companies a relaxation to carry forward tax losses for up to ten years, accelerated depreciation and amortisation rates, and a maximum withholding tax rate of 10% for dividends paid to foreign shareholders [188].
b. **Import Duty Exemptions**
   Ministry of Finance Regulation No. 218//2019 provides exemptions from import duties for goods used in geothermal activities during various phases (exploration, exploitation, and utilisation). Ministry of Finance Regulation No. 66/2015 also provides import duty exemptions for capital goods (excluding spare parts) imported by PLN, Business License (Wilayah Usaha) holders, and Independent Power Producers (IPP) [188].
c. **VAT Exemptions**
   Government Regulation No.48/2020 provides VAT exemptions on imports of strategic capital goods such as power plants, machinery, and equipment (excluding spare parts). Specifically for geothermal activities, Ministry of Finance Regulation No.198/2019 provides the same VAT exemptions [188].
d. **Tax Holiday**
   Ministry of Finance Regulation No.130/2020 offers a 50% to 100% corporate income tax reduction for up to 20 years for businesses involved in "Pioneer Industries," including renewable energy projects [188].

In addition to the several fiscal incentives offered by the Government of Indonesia, there are some financing instruments established by the Indonesian Environment Fund Management Agency (BPDLH) in 2019. Under Government Regulation No.46/2017 and Presidential Regulation No.77/2018, the Government of Indonesia created the BPDLH to raise, manage and disburse funds to achieve Indonesian environmental initiatives and climate targets [189]. The BPDLH directed a number of funding instruments supporting various projects, including renewable energy [190].

a. **Viability gap fund**
   The viability gap fund was established to provide cash support to make projects financially viable, particularly renewable energy infrastructure. The viability gap fund was usually intended to benefit energy end-users. However, the BPDLH provides funding for energy producers, instead of end-users.
b. **Project development fund**
   The project development fund was created to offer grants and zero-to-low interest loans for renewable energy projects, such as rooftop solar, that benefit public schools, developers, and government entities.
c. **Credit enhancement fund**
   The credit enhancement fund targets capital owners and financiers with risk reduction through low-interest loans, insurance premium subsidies, grants, and guarantees.
d. **Technical assistance fund**
   The technical assistance fund supports project preparation, development, and capacity building, especially for renewable energy projects.

Project Case Study: Cirata Reservoir Floating Solar PV Plant

The Cirata Reservoir Floating Solar PV Plant project is located in West Java, Indonesia, with a total capacity of 192 MWp, the largest floating solar project in Southeast Asia. The project value is approximately USD 150

million. The project sponsors are PT Nusantara Power (Indonesia), a subsidiary of PT PLN Indonesia, and Masdar (United Arab Emirates). The equity portion of the project constitutes 24% of the total project cost amounting to USD 37.7 million. The remaining 76% is financed by three international commercial banks, Sumitomo Mitsui Commercial Bank (Japan), Société Generale (France), and Standard Chartered (Singapore) [191].

The Cirata Reservoir Floating Solar PV Plant project was declared a "National Strategic Project", which may receive benefits from the Government of Indonesia. Government Regulation 42/2021 provides certain facilities to accelerate permitting, licensing, and land acquisition [191]. These facilities offer investment certainties to the project. Additionally, Ministry of Finance Regulation 130/2020 provides tax holidays for National Strategic Projects meeting certain investment criteria (Table 6.1).

Table 6.1 Tax Holiday Provision in Indonesia

Provision	Capital Investment Plan (IDR 100 bn < IDR500bn)	Capital Investment Plan (>IDR 500 bn)
Corporate Income Tax (CIT) Rate	50%	100%
Concession Period from Operation Date	Five years	• IDR 500 bn up to < IDR 1 trillion: 5 years • IDR 1 trillion up to < IDR 5 trillion: 7 years • IDR 5 trillion up to < IDR 15 trillion: 10 years • IDR 15 trillion up to < IDR 30 trillion: 15 years • > IDR 30 trillion: 20 years
Transition	25% CIT reduction for the next two years after the Concession Period ends	50% CIT reduction for the next two years after the Concession Period ends

Source: Authors' compilation based on PWC [188]

According to (Table 6.1), the Cirata Reservoir Floating Solar PV Plant project may benefit from a 100% reduction in CIT for seven years and a 50% reduction for two years after the first concession period ends. This facility can increase the project's profitability and returns, improving its attractiveness.

Some studies have identified local content regulations in Indonesia that had the unintended effect of increasing project costs, due to a gap between the domestic and international production costs [192], [193]. Previously, the local content regulation, Ministry of Industry Regulation 54/2012, stipulated that the minimum local content for solar PV power plants is 40.68% for combined goods and services. An exemption for the local content regulation was generally allowed under these conditions [194]:

1. The goods are not produced domestically;
2. The specifications for domestic goods/equipment do not meet the project requirements; and/or
3. The level of domestic goods production does not meet the demand, as confirmed by the relevant manufacturer.

The previous local content regulation significantly impacted the execution of the Cirata Reservoir Floating Solar PV Plant project. The process of obtaining exemptions to use imported equipment for the project was time-consuming, leading to delays in project execution [195]. The Government of Indonesia eventually granted the exemption to use imported equipment for the project, and the final local content for the Cirata Reservoir Floating Solar PV plant was 24% of combined goods and services [196].

In August 2024, the Government of Indonesia amended local content regulation Ministry of Energy & Mineral Resources Regulation No.11/2014, by issuing Ministry of Energy & Mineral Resources Decree No.191/2024, which stipulates that the minimum local content for a solar PV power plant is 20% [194]. This minimum local content is lower than the previous regulation, and appearing more achievable, based on the experience of the local content in the Cirata Reservoir Floating Solar PV Plant project.

Lao PDR

Economic Background

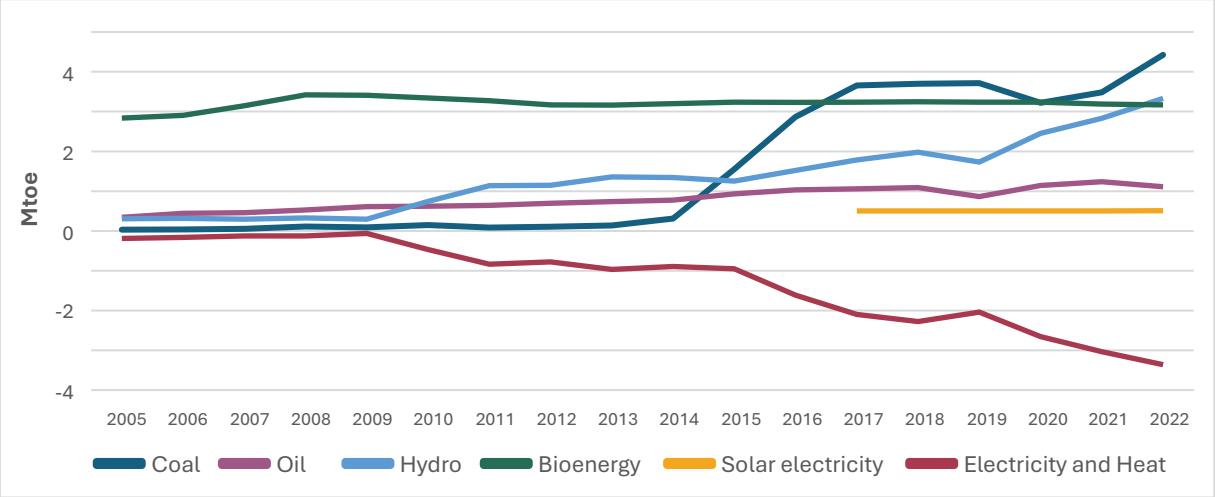
In 2023, economic growth in Lao PDR accelerated to 3.7%, though it remained below pre-pandemic levels. High inflation – amongst the highest in Asia – reduced consumer spending, and a shortage of foreign currencies affected private businesses. The average inflation rate is 5.1%, in the ten-year period to 2022. Moving into 2024, persistently high inflation will continue to affect private spending. During 2012 – 2022, the local currency Kip weakened by 53.7% against the USD [197].

In 2021, the services sector comprised 50% of total GDP, whilst manufacturing contributed 9%, other industrial activities 25%, and agriculture 16%. Regarding GDP by expenditure, private consumption represented 66% of GDP in 2016, government spending accounted for 14%, fixed investment comprised 29%, and net exports were at -9% [197]. According to Moody's, Lao PDR's credit rating is Caa3, which falls under speculative grade and poses very high credit [10].

Energy Mix Landscape

Figure 6.4 depicts the TPES in Lao PDR from 2005 to 2022, illustrating significant trends. In 2021, the TPES of Lao PDR was 8.5 Mtoe, increasing almost threefold from 2010. Coal constitutes 37% of the total energy supply, whilst hydropower makes up 33%. Coal emerged as the dominant energy source, experiencing a substantial surge beginning in 2015, when the Hongsa Thermal Power Plant, with a capacity of 1,878 MW, was commissioned [198]. According to Lao PDR Power Generation Planning (2020 – 2030), the coal used in the power plant is to be processed using clean coal technology, and the share of coal-fired power plants should remain at 30% until 2030 [186].

Figure 6.4 Lao PDR Total Primary Energy Supply 2005-2022



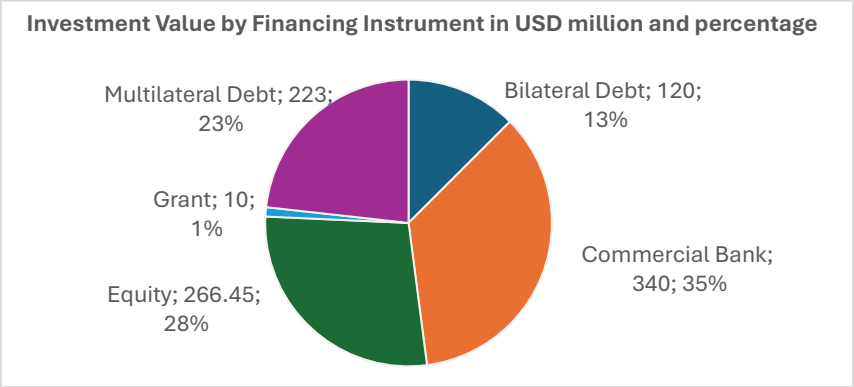
Source: ACE. All rights reserved.

The share of variable renewable energy, such as wind and solar, is notably small. However, the Government of Lao PDR set the target for new solar power plants at 957 MW in 2030, which may increase the share of variable renewable energy in the total energy mix. The Government of Lao PDR has set a target of achieving a 30% renewable energy proportion of total energy consumption by 2025. The government also plans to set a tentative objective of achieving 10% RE energy consumption using biofuels in the transport sector [199].

Energy Investment Landscape

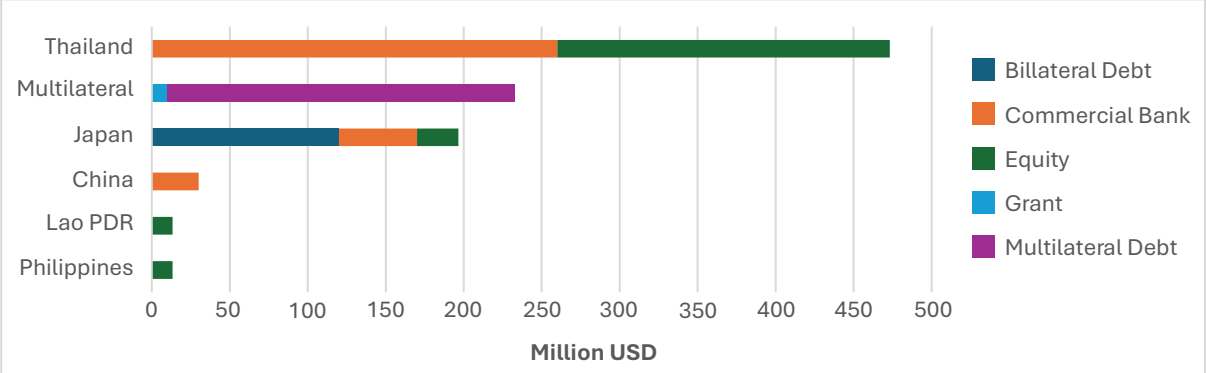
Figure 6.5 and Figure 6.6 illustrate the distribution of investment values by various financial instruments in Lao PDR from 2021 to 2023. Total energy investment during this period was USD 959 million, the 4th largest investment amount after Vietnam, the Philippines, and Malaysia in the same period. The types of financing instruments vary from commercial loans to equity, public financing (multilateral & bilateral debt), and grants.

Figure 6.5 Value and Share of Energy Investment in Lao PDR by Financing Instrument, 2021 – 2023



Source: Authors' calculations based on World Bank [64]

Figure 6.6 Energy Investment Value in Lao PDR by Investor's Country, 2021 – 2023



Source: Authors' calculations based on World Bank [64]

Commercial banks are the primary source of investment, accounting for 35.44% of total investment value, with USD 340 million. This is followed by equity investments, which constitute 27.8%, or USD 266.45 million. Thailand mobilised the largest share of commercial loans and equity investment to Lao PDR during 2021-2023.

Multilateral debt accounts for 23.24% of investments, amounting to USD 223 million, highlighting the involvement of international financial institutions in Lao PDR's investment landscape. Bilateral debt, involving agreements between two countries, represents 12.51%, or USD 120 million. Japan is the sole source of bilateral debt in Lao PDR's energy investment landscape. Grants, which are non-repayable financial aids, constitute the smallest segment in the chart, estimated to indicate limited dependence on this form of financial support [64]. The Monsoon Wind Power Project in Lao PDR is driving the country's energy investment landscape. This is the first cross-border project in Asia, which will be constructed in Lao PDR, with electricity exported to Vietnam.

Available Incentives

The Law on Investment Promotion 2016 in Lao PDR regulates the supporting measures to attract domestic and foreign investment. Some key incentives are identified as [200]:

a. Sectoral Incentives

Investment incentives are provided based on the business sector. Some business sectors that can benefit from the investment incentives are environmentally friendly technologies, energy-efficient technologies, environmental-friendly agriculture processing, and eco-tourism.

b. Zonal Incentives

Tax exemption on profits is possible for a certain period of time, depending on the previously mentioned business sectors, investment areas, and size of the investment. Incentive areas that can benefit from profit tax exemptions are categorised as:

- **Zone 1 (Remote Areas):** areas with socio-economic infrastructure unfavourable for investment. Investors in the prioritised business sectors and Zone 1 will benefit from the profit tax exemption for ten years, plus an additional five years.
- **Zone 2 (Developed Areas):** areas with socio-economic infrastructure that is favourable to investment. Investors in the prioritised business sectors and Zone 2 will benefit from the profit tax exemption for four years, plus an additional three years.
- **Zone 3 (Special Economic Zones):** specific regulations apply, providing special financial incentives.

c. Tax and Duty Exemptions

- Import duty is exempted for machinery, equipment, and raw materials used for exports. Furthermore, the VAT for exports is 0%.
- Investors who re-invest their net profit for additional investment activities will receive the applicable profit tax exemptions.
- Tax loss carries forward for three years, subject to proper assessment from the tax authority.

d. Land Use Incentives

Investors in prioritised sectors can receive exemptions on state land rental or concession royalties:

- Zone 1 receives exemptions for ten years, with an additional five years
- Zone 2 receives exemptions for five years, with an additional three years
- Zone 3 to comply with specific regulatory requirements

e. Financial Access

Investors can access the financing incentives by borrowing from commercial banks and other financial institutions in Lao PDR and overseas.

The Government of Lao PDR has issued the Renewable Energy Development Strategy for Lao PDR 2011 – 2025. Under this development strategy, the Government of Lao PDR will establish the Renewable Energy Fund, which aims to:

- Assist the development of renewable energy and biofuel industry in Lao PDR;
- Remove financial barriers in resource assessment, research, project development, and related activities; and
- Fund capacity-building activities, and disseminate knowledge on energy efficiency, and related goals.

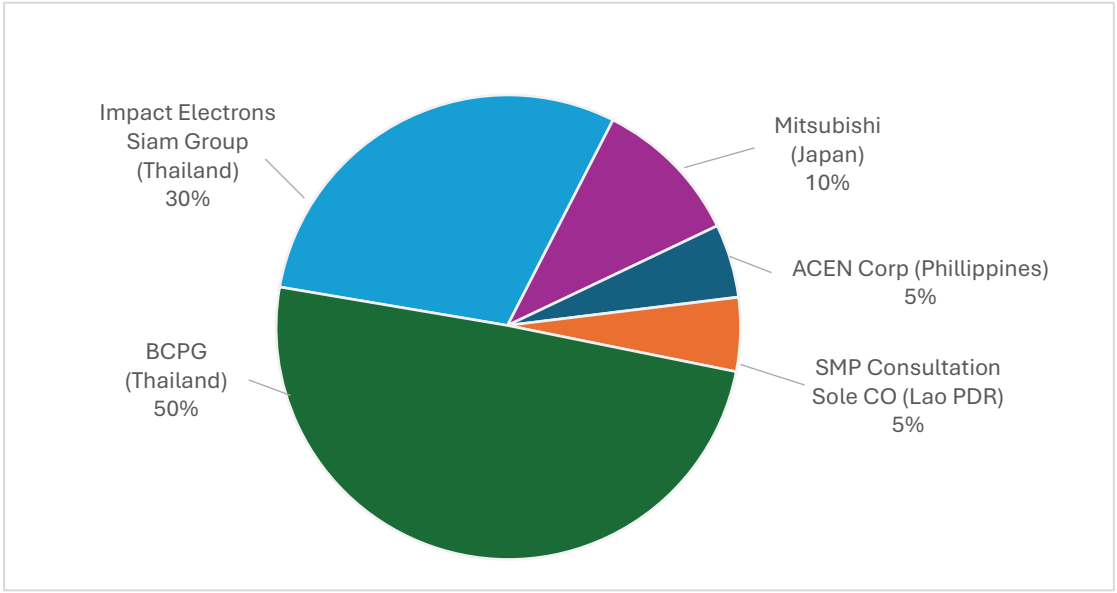
The source of this Renewable Energy Fund will be the government budget, as well as from international donors and non-governmental organisations [199].

Project Case Study: The Monsoon Wind Power Project

The Monsoon Wind Power Project, located in the Attapeu and Sekong provinces, has a stated capacity of 600 MW, and is designed to export electricity to neighbouring Vietnam. This initiative marks the first wind power project in Lao PDR, the largest in Southeast Asia, and the first cross-border wind project in Asia. It will have a long-term electricity purchase agreement with EVN, a Vietnamese state-owned utility company. The total project value is approximately USD 959.5 million, financed through multiple financing instruments ranging from equity, commercial loans, multilateral debt, and grants [64].

Equity financing will be provided by the project sponsors, who are initially from various countries in Asia. The total equity raised is around USD 266.5 million, which comprises 27.7% of the total project cost. Figure 6.7 shows the project sponsors and their respective equity shares.

Figure 6.7 Monsoon Project Sponsors and Equity Shares

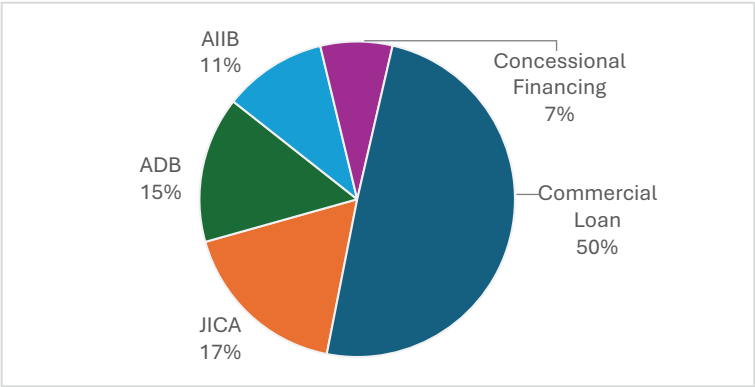


Source: Authors' calculations based on World Bank [64]

Debt financing will carry the remainder of the project cost. ADB, as the sole mandated lead, will arrange, structure and syndicate the entire financing package for the project. The package comprises USD 340 million from commercial loans, USD 293 million from multilateral and bilateral financing, and USD 50 million from concessional financing. The commercial loans constitute 50% of the debt portion (Figure 6.8). They are backed by banks from China (Hong Kong Mortgage Corporation), Thailand (EXIM Bank of Thailand, Siam Commercial Bank, Kasikorn Bank), and Japan (Sumitomo Mitsui Banking Corporation). The multilateral and bilateral debts are financed by ADB, AIIB, and JICA. The concessional financing that constitutes 7% of the debt portion is provided by Leading Asia's Private Infrastructure Fund and the Canadian Climate Fund for the Private Sector in Asia [201].

Apart from the equity and debt financing portion, the Monsoon Wind Power Project will benefit from grant financing through ADB's Asian Development Fund – Private Sector Window (ADB – PSW). This grant, as part of a blended finance solution, was established in 2020, to support private sector transactions with financing hurdles in frontier markets. This grant is intended to establish a curtailment debt service reserve account [202]. The borrower can use this account to partially alleviate repayment risk in the event of severe curtailment, which is a key bankability issue for lenders. The application of concessional blended finance was essential in addressing the project's bankability challenges and attracting commercial capital.

Figure 6.8 Monsoon Project Debt Financing Source



Source: World Bank [64]

The curtailment risk is closely linked to the reduction of electricity that can be delivered to the grid. The curtailment is sometimes due to the grid default or operational purpose. This curtailment poses a risk to the investor because it affects the investor's ability to generate revenue and repay the debt portion. Thus, sometimes compensation is given to the investor when there is a curtailment due to the grid default. In Vietnam, where the project transaction happens, there is no such compensation, increasing the curtailment risk, which is a bankability issue (refer to the RISE – Energy Sector Management Assistance Programme (ESMAP) indicator in Table 6.2).

Table 6.2 Regulatory Indicators: Incentives and Regulatory Support for Renewable Energy

Sub-indicators : Electricity grid access and dispatch	Yes/No
Does the country provide prioritised access to the grid for RE?	Y
Do RE projects receive priority in dispatch?	Y
Are there provisions to compensate sellers if offtake infrastructure is not built in time?	N
Are there mechanisms to compensate RE projects for lost generation due to certain curtailments after project commissioning?	N
Is the compensation due because of curtailment actually given out?	N

Source: Authors' compilation based on RISE-ESMAP [109]

Table 6.2 indicates that there is no mechanism in place to compensate developers for grid curtailment in Vietnam. As a result, developers face significant curtailment risk, which could disrupt their revenue streams. The uncertainty surrounding long-term revenue creates bankability issues, reducing the attractiveness of the project and potentially deterring investors or financial institutions from committing their capital.

Therefore, the curtailment debt service reserve account is created using grants to reduce the high curtailment risk. Established using the USD 10 million grant from ADB-PSW, it gives certainty to the investor when the curtailment arises [201]. This greatly reduces the project risk, which will attract private financing for the project.

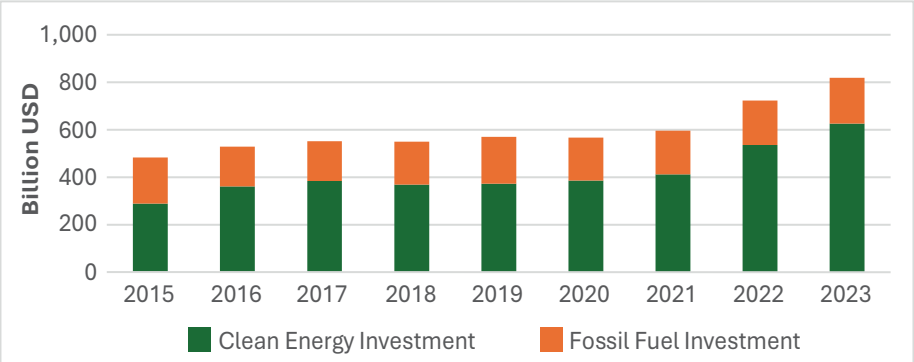
Best Practices from Other Regions

China

In 2022, the Government of China introduced the 14th Five-Year Plan for Renewable Energy Development for 2021 – 2025, in efforts to accelerate renewable energy growth. The plan seeks a 50% increase in renewable energy generation, rising from 2,200 TWh in 2020, to 3,300 TWh in 2025. Additionally, it sets a target for renewable electricity consumption to reach 33% by 2025 and mandates that half of the increase in China's electricity consumption over the period should come from renewables [203].

China is set to surpass its 2030 renewable energy targets by 2025, facilitated by a rapid expansion in solar power installed capacity. Investments in solar energy have surged by 70% year-on-year, and as of October 2023, China added 143 GW of solar capacity, contributing to a significant shift in the energy landscape where solar power exceeds wind power in total capacity. Projections suggest China could reach its 1.2 TW renewable energy target five years ahead of schedule [204]. Figure 6.9 shows the current status of energy investment in China from 2015 to 2023.

Figure 6.9 Energy Investment in China 2015 – 2023



Source: IEA [35]

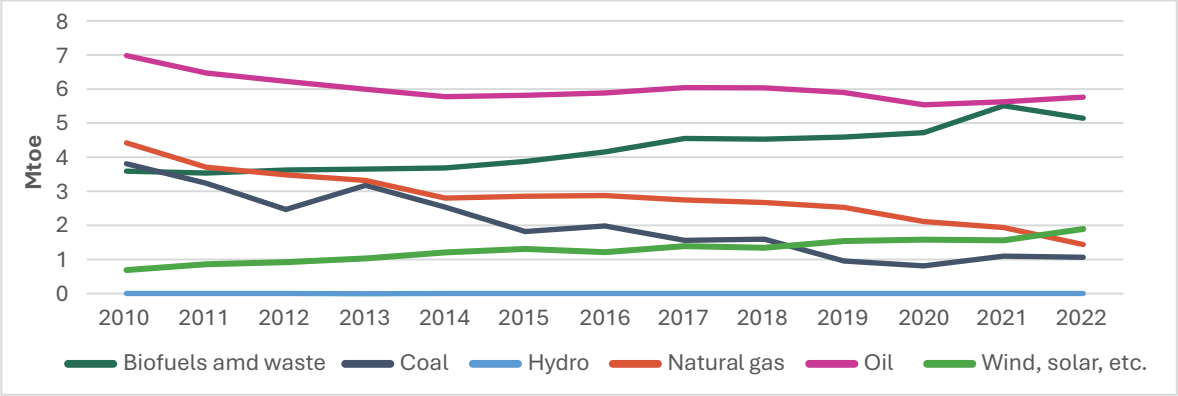
Figure 6.9 illustrates the trends in energy investment in China from 2015 to 2023, highlighting significant growth in clean energy investments, as compared to fossil fuels. Clean energy investments have consistently increased, peaking dramatically in 2023. This surge indicates China's strategic shift towards renewable energy and commitment to a low-carbon economy. Conversely, investments in fossil fuels have remained relatively stable, with minor fluctuations, indicating a steady but not expanding focus. Notably, the gap between clean energy and fossil fuel investments widened substantially in 2022 and 2023, reflecting China's intensified efforts in clean energy. In 2023, clean energy investment reached its highest level at around USD 626 billion, constituting 76.5% of the total energy investment in China. This data observedly reflects China's prioritisation of clean energy, driven by policy incentives and global climate commitments, enabling pathways towards a more sustainable energy future.

In the global context, China remains the largest investor in energy transition development in 2023, constituting 38% of the global energy investment, surpassing the USA and the EU [206]. The country has dominated wind and solar technology manufacturing and the global supply chain. China significantly accounts for the world's solar manufacturing capacity, with more than 80% of global capacity [205]. In 2022, China exported more than 143 GW of PV modules, reaching a record high of more than USD 51.25 billion, a major highlight in China's foreign trade. Through a combination of sizeable government investments, aggressive policy frameworks and technological advancements, China has consequently emerged as a global leader in renewable energy. The country has focused on scaling up renewable energy capacity, particularly solar and wind power, whilst driving down costs through innovation and economies of scale.

Denmark

The government of Denmark has set a target to end fossil fuel production by 2050, and to achieve 100% biomethane for heating before 2030. Under its Climate Act 2020, the government is bound to reduce greenhouse gas (GHG) emissions by 50% to 54% in 2025, and 70% by 2030, as compared to 1990 levels [207]. The TPES in Denmark between 2010 and 2022 is shown in Figure 6.10.

Figure 6.10 Total Primary Energy Supply in Denmark 2010 – 2022

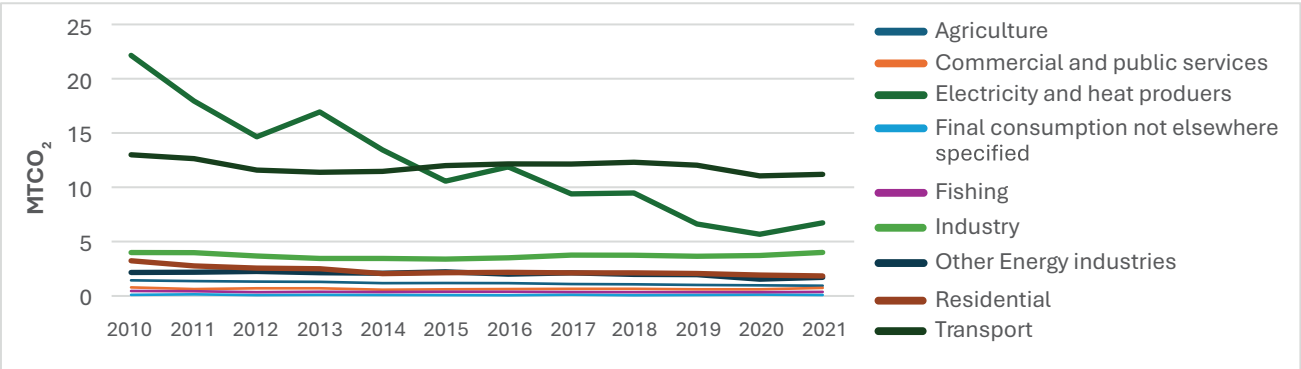


Source: IEA [35]

In 2022, oil remained the largest energy source for Denmark's total primary energy supply. Over the period of 2010 to 2022, Denmark has reduced its energy supply from coal and natural gas, whilst increasing the supply from biofuels, waste and variable renewable energy (wind, solar, etc). In 2022, the combined output of renewable energy made up 83.5% of electricity generation, dominated by wind energy. This significant share of renewable electricity caused the emissions from the electricity sector to decline by 68% over the last decade, from 22 $MtCO_2$ in 2010, to 7 $MtCO_2$ in 2021 (Figure 6.11).

The steep decline in emissions from the electricity and heating sectors reflects Denmark's transition to wind power (54% of total generated electricity in 2022), reducing the use of fossil fuels for the electricity and heat sectors [208]. Denmark's targeted renewable energy deployment is to quadruple the capacity of onshore wind and solar power generation by 2030, and increase offshore wind capacity to 18 GW in 2030, and 35 GW in 2050, from the current capacity of 2.3 GW [207]. Through 2022, the Danish Government provided renewable energy support schemes to achieve this target, which were financed by the Public Service Obligation tariff under the Danish Electricity Supply Act. The revenue from the PSO tariff was utilised to subsidise renewable energy. Currently, the renewable energy subsidy is directly financed from the state budget [207].

Figure 6.11 The CO_2 Emissions in Denmark by Sector, 2010 – 2022



Source: IEA [35]

In 2022, Denmark established a green fund to accelerate its shift to sustainable energy and reduce dependence on fossil fuels. The fund will allocate DKK 53.5 billion (USD 7.8 billion) in total, with DKK 1.5 billion (USD 219 million) designated for 2024, and DKK 3.5 billion (USD 512 billion) annually from 2024 to 2040. Eligible projects must be related to energy and supply, food and agriculture, buildings and infrastructure, materials and resources, or transport and mobility [207].

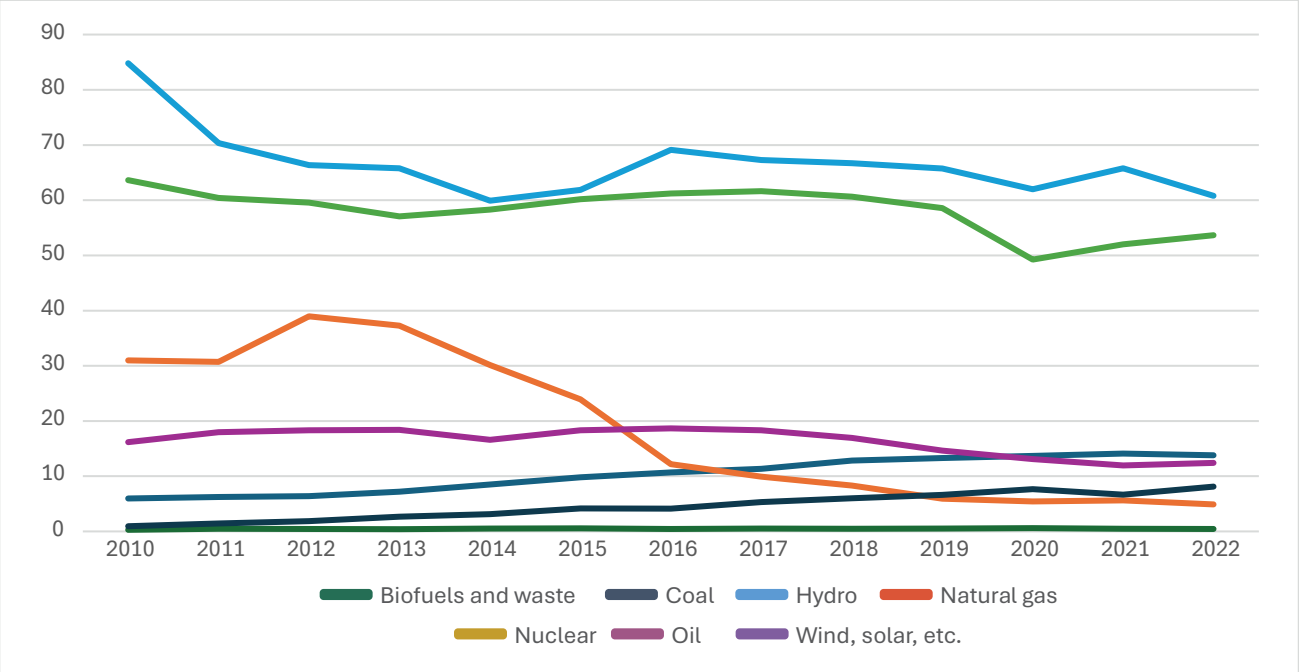
Denmark's example in transitioning to renewable energy, especially wind power, results from a combination of clear government targets, substantial investments, and a supportive financing scheme. These efforts have moved Denmark up the list of the Energy Transition Index in 2024, and may be a model for other countries to follow [209].

United Kingdom

The UK has undertaken significant steps to transform its energy policy landscape, focusing on decarbonisation, innovation, and energy security. The Climate Change Act 2008 is groundbreaking legislation establishing a legally binding framework to reduce the United Kingdom's GHG emissions by at least 80% by 2050, as compared to 1990 levels [210]. This target was later revised to net zero emissions by 2050 following advice from the Committee on Climate Change in 2019. In 2017, under the United Kingdom's Clean Growth Strategy, the government set out policies and government funding of GBP 2.5 billion (USD 3.2 billion) for innovation and low-carbon investment until 2021. The Climate Change Act of 2008, and the Clean Growth Strategy drive the UK's ambitious climate targets [210].

Figure 6.12 shows a significant decline in the use of coal, particularly after 2013, when the supply sharply dropped from 1.5 million terajoule, or 35 Mtoe (20% of total energy supply), to just 0.2 million terajoule or 4.8 Mtoe (3% of total energy supply). Variable renewable energy (solar, wind, etc) steadily increased throughout the period, surpassing the supply from coal in 2020. In 2022, the supply from variable renewable energy constituted 5% of the total energy supply. The impact of the steep decline of coal in the energy mix can be seen in total CO_2 emissions in the electricity and heating sectors.

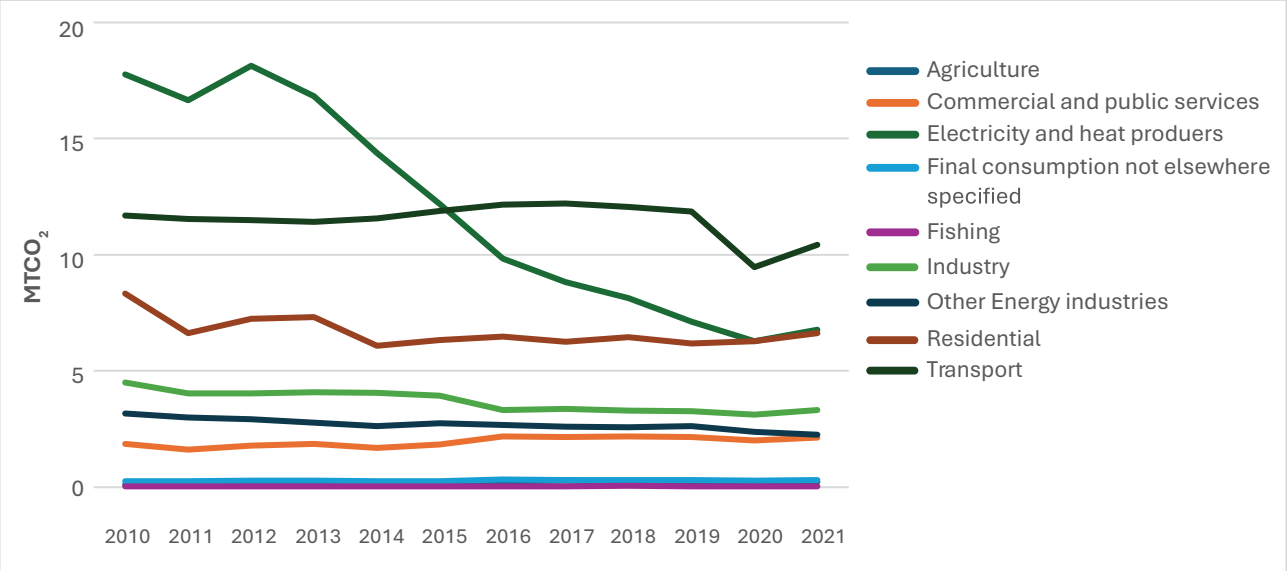
Figure 6.12 Total Primary Energy Supply in the United Kingdom, 2010 – 2022



Source: IEA [35]

Overall CO_2 emissions from the electricity and heating sectors have been reduced from 177 $MtCO_2$ in 2010, to 67 $MtCO_2$ in 2022, or a decrease of 62% (Figure 6.13). The UK government has implemented various measures, including the Electricity Market Reform (EMR), to support the transition towards a low-carbon economy. This measure has substantially reduced GHG emissions and increased renewable energy sources. The EMR, introduced through the Energy Act of 2013, aimed to incentivise investment in secure, low-carbon electricity, improve the security of supply, and reduce emissions. Key mechanisms include Contracts for Difference and a Carbon Price Floor [210]. The mechanisms will provide revenue certainty for investors, and protect them from carbon price volatility.

Figure 6.13 CO_2 Emissions in the UK by Sector, 2010 – 2022



Source: IEA [35]

In 2021, the UK government launched the UK Emissions Trading Scheme (UK ETS) because the UK was no longer participating in the EU ETS. The UK ETS is a cap-and-trade system that sets a limit on the total level of GHG emissions, and allows industries to buy and sell emission allowances. The cap will decrease over time, providing a long-term framework for companies to plan their decarbonisation strategies. The UK ETS could then incentivise investment in greenhouse gas removal technologies, which are still considered not commercially viable [211]. The success of the UK Government in reducing CO_2 emissions from the electricity sector can be seen as the result of strong policy frameworks, financial incentives, and market regulation in the form of the cap-and-trade system.

CHAPTER 7

Implications

Rising living standards and steady GDP growth in emerging economies like ASEAN will lead to increased energy consumption through 2050. This sustained economic expansion parallels a massive urbanisation rate that affects the demand for residential and commercial buildings, increased use of transportation, and public services. Despite the expected slowdown in the growth of energy demand due to smart technology penetration and breakthroughs in energy efficiency measures, the consumption of energy will keep rising, depending on the speed of technology penetration and the infrastructure readiness of each AMS. Regional and national policies in fostering energy efficiency, RE, and sustainable development will also influence ASEAN energy demand trends.

In meeting the growing energy demand, ASEAN remains committed to sustainable growth through the transition to a more resilient and low-carbon energy system which requires substantial investments in infrastructure, energy efficiency measures, and the adoption of renewable energy technologies. AMS' commitment to sustainable growth is evident through their policy frameworks and international agreements, which emphasise the importance of reducing carbon emissions and enhancing energy security.

Despite the momentum toward transitioning to cleaner energy, reliance on fossil fuels as primary energy sources still poses a vital challenge in the region. Looking at the power generation share, investments are still directed to fossil fuels because it is considered a safe option and a faster return. ASEAN countries acting as fossil fuel producers are still prominent as they contribute a significant amount to the GDP and are still perceived as an important commodity [212], resulting in a focus on investment in fossil fuels for speedy investment flows and revenue. However, the cost of fossil fuels will always fluctuate due to global conditions. The conflicts in Ukraine and the Middle East have caused prices of oil and natural gas to be unstable, along with supply chain issues and inflation in the aftermath of the COVID-19 pandemic that caused disruptions in fossil fuel prices. These tandem occurrences affect fossil fuel supply, thus accelerating the development and implementation of renewable energy.

Bridging the energy transition needs a significant investment in supporting infrastructure, especially during the market creation phase. A step that AMS could take is to consider natural gas before fully transitioning from coal to renewable energy. Thus, energy supply quality is ensured while catering to the growing demand. For countries leading in certain technology due to the abundant natural energy resources, such as hydro and geothermal, investment could be focused on those resources.

In encouraging renewable energy investments, AMS have put relevant policies and regulations in place. Despite varying success, all AMS have deployed various RE projects and natural gas to bolster their electricity capacity and production from cleaner sources. For example, the Philippines is taking a step in investing in five LNG projects to support the energy transition, totalling USD 865 million in capital cost [170]. For countries leading in certain technology due to the abundant resources, investment could be focused on those resources. Cambodia planned to spend USD 6.7 billion on hydro dams, solar PV plants, and battery energy storage system projects starting in 2032 [213]. The hydro investment might have a smaller number due to bilateral cooperation of power imports from Lao PDR, between the year 2026 to 2031.

Nonetheless, the investment gap for renewable energy remains significant, requiring USD 95.5 billion from 2021-2030. Under the ASEAN Carbon Neutrality Strategy, the region could unleash the total green investment for all sectors approximately USD 3.7 trillion – 6.7 trillion. With this amount of investment, international partners have an enormous opportunity to deepen our existing collaboration through numerous schemes, including human resources and technical assistance. To continue attracting foreign investments to ASEAN, especially for countries with low credit ratings, a global partnership is needed to finance their climate and energy transition.

One notable example of global participation in Southeast Asia is the Just Energy Transition Partnership (JETP), with Indonesia and Vietnam already announcing the agreements and the Philippines potentially

working towards having one for itself [214]. JETP aims to support developing countries in transitioning away from coal and towards cleaner energy with financing from wealthier countries.

Under JETP, Indonesia has just launched one of the largest investment plans, with USD 20 billion allocated for the energy transition. The investment aims to achieve a 44% RE share in power generation by 2030 and emit no more than 250 metric tons of CO_2 ($MtCO_2$) from power grids, down from a baseline of 305 $MtCO_2$. Indonesia's partnership will focus on projects, loans, and technical assistance. Meanwhile, Vietnam has a USD 15 billion investment plan and is projected to achieve 44% RE share and a 240 $MtCO_2$ carbon emission peak (down from 280 $MtCO_2$) by 2030, with a 30 GW energy peak from coal-fired generation [214]. Vietnam's investment plan focuses on financial and technological capacity building, with assistance in policy and regulation to increase private investment towards RE.

At the project level, de-risking of renewable energy projects is critical to encourage foreign private sector investment in AMS. One of the fundamental risks perceived by the private sector is country risk. Countries with constant shifts in policies and regulations in a country expose a high risk for foreign investors, which could reduce FDI flows. Nonetheless, strong policies and regulations without additional international climate finance and improvement in institutional capacity will be unlikely to impact decarbonisation efforts.

International climate finance intervention is often in the form of blended finance to act as a catalyst to leverage private capital. Development banks, which have the mandate to finance projects with high developmental impact, are in a position to provide blended financing products. These products include but are not limited to guarantees, grants, concessional financing, and local currency support. An example of a blended finance program is ASEAN Catalytic Green Finance owned by ADB along with finance ministries across AMS [216]. The program is launched to boost the development of green infrastructure by providing technical assistance and concessional financing to increase bankability and attract private capital to projects such as renewable energy and energy efficiency.

Renewable energy projects in AMS are highly leveraged which causes these projects to be vulnerable to macroeconomic risks. Highly leveraged projects are exposed to default risk should interest rates rise significantly. The central bank policy rate, economic growth, inflation, exchange rate, and employment rate have a significant positive effect on ASEAN's investment in the long run [217]. Policymakers need to handle monetary policy carefully to avoid a long-term decrease in investment. Rising energy prices which occurred globally can drive high inflation, prompting the central bank to raise key interest rates. High interest rates affect the financing of the energy industry and in the end will impede investment, particularly in renewable energy projects [218]. Meanwhile, the oil and gas industry is less likely affected by higher rates as it has less exposure to the cost of debt.

Effective regional coordination is essential for optimising energy development, aligning policies, and achieving common goals. Enhancing coordination among regional initiatives can help address shared challenges, streamline efforts, and create a more cohesive energy strategy for the ASEAN region.

In conclusion, ASEAN's future energy supply trend demonstrates the region's commitment to a diversified and sustainable energy future. By focusing on investments in renewable energy sources, streamlining energy infrastructure, and adopting supportive policies, ASEAN will achieve its energy goals and participate in global climate change adaptation and mitigation efforts. However, to attract investments, the region should resolve financial and regulatory framework challenges to ensure the successful implementation of its energy targets.

Lastly, enhancing coordination among regional initiatives can help address shared challenges, streamline efforts, and create a more cohesive energy strategy for the ASEAN region. Effective regional coordination is essential for optimising energy development, aligning policies, and achieving common goals. Such measures will also ease foreign investors to scale up in investing through multiple assets in different ASEAN countries.

References

[1] ASEAN Secretariat, "ASEAN Statistical Highlights 2023," Sep. 2023. Accessed: Sep. 04, 2024. [Online]. Available: https://www.aseanstats.org/wp-content/uploads/2023/10/ASH-2023-v1.pdf

[2] OECD, "Economic Outlook for Southeast Asia, China and India 2023 - Update: Resilience Under Uncertainty," Paris, 2023.

[3] ASEAN Secretariat, "A Special ASEAN Investment Report 2023," Jakarta, 2023.

[4] World Bank, "Lao Economic Monitor, November 2023: Fiscal Policy for Stability - Key Findings," World Bank. Accessed: Aug. 21, 2024. [Online]. Available: https://www.worldbank.org/en/country/lao/publication/lao-economic-monitor-november-2023-fiscal-policy-for-stability-key-findings

[5] ASEAN Secretariat, "ASEAN Key Figures 2020," Jakarta, 2020.

[6] K. Buchholz, "What percentage of the world's consumer class live in Asia?," World Economic Forum. Accessed: Aug. 21, 2024. [Online]. Available: https://www.weforum.org/agenda/2021/10/growth-consumers-asia-indonesia-bangladesh-pakistan-philippines/

[7] J. Canto, "Manufacturing of Batteries in ASEAN," 2023.

[8] Myanmar Garment Manufacturers Association, "The Transformation of Myanmar's Garment Industry," Market Research Myanmar. Accessed: Aug. 21, 2024. [Online]. Available: https://www.researchinmyanmar.com/insight/transformation-of-myanmar-garment-industry

[9] UNCTAD, "World Investment Report 2023 (Overview)." Accessed: Sep. 04, 2024. [Online]. Available: https://unctad.org/publication/world-investment-report-2023

[10] Trading Economics, "Credit Rating - Countries." Accessed: Aug. 21, 2024. [Online]. Available: https://tradingeconomics.com/country-list/rating

[11] A. Rasjid, "ASEAN is the world's economic dark horse. Here's why," World Economic Forum. Accessed: Aug. 21, 2024. [Online]. Available: https://www.weforum.org/agenda/2023/08/asean-economic-growth/

[12] ACE, " The 7th ASEAN Energy Outlook (AEO7)," Jakarta, 2020.

[13] R. Vakulchuk, I. Overland, and B. Suryadi, "ASEAN's energy transition: how to attract more investment in renewable energy," Energy Ecol Environ, vol. 8, no. 1, pp. 1–16, Feb. 2023, doi: 10.1007/S40974-022-00261-6/TABLES/6.

[14] ASEAN Secretariat, "ASEAN Strategy for Carbon Neutrality: Public Summary," Jakarta, 2023.

[15] International Energy Agency and Imperial College London, "ASEAN Renewables: Opportunities and Challenges," 2023.

[16] R. Rinn et al., "Bioeconomy in countries of the Mekong region: Stakeholder understanding and perceptions in Thailand, Vietnam, and Laos," For Policy Econ, vol. 162, p. 103190, May 2024, doi: 10.1016/J.FORPOL.2024.103190.

[17] Malaysian Investment Development Authority, "Circular Bioeconomy in Malaysia – Emerging Opportunities Across Industries," Malaysian Investment Development Authority (MIDA). Accessed: Aug. 21, 2024. [Online]. Available: https://www.mida.gov.my/zh-hans/circular-bioeconomy-in-malaysia-emerging-opportunities-across-industries/

[18] S. Kimura, H. P. Leong, and S. Meng, "Energy Efficiency and Conservation Master Plan of Cambodia," 2020.

[19] Economic and Social Commission for Asia and the Pacific (ECSAP), "National Green Growth Strategy of the Lao PDR till 2030." Accessed: Aug. 21, 2024. [Online]. Available: https://policy.asiapacificenergy.org/node/4472

[20] DNV, “ASEAN INTERCONNECTOR STUDY: Taking a Regional Approach to Decarbonization,” 2024.

[21] A. Aggarwal, “Special Economic Zones in the Indonesia–Malaysia–Thailand Growth Triangle: Opportunities for Collaboration,” 2022, doi: 10.22617/TCS210449-2.

[22] Erdiwansyah, Mahidin, R. Mamat, M. S. M. Sani, F. Khoerunnisa, and A. Kadarohman, “Target and demand for renewable energy across 10 ASEAN countries by 2040,” The Electricity Journal, vol. 32, no. 10, p. 106670, Dec. 2019, doi: 10.1016/J.TEJ.2019.106670.

[23] Asian Development Bank, “ASEAN Gears Up for a Shift to Electric Vehicles,” ADB Southeast Asia Development Solutions. Accessed: Aug. 21, 2024. [Online]. Available: https://seads.adb.org/solutions/asean-gears-shift-electric-vehicles

[24] K. Handayani, P. Anugrah, F. Goembira, I. Overland, B. Suryadi, and A. Swandaru, “Moving beyond the NDCs: ASEAN pathways to a net-zero emissions power sector in 2050,” Appl Energy, vol. 311, p. 118580, Apr. 2022, doi: 10.1016/J.APENERGY.2022.118580.

[25] T. Z. Myint, “Myanmar Country Report,” Jakarta, 2021.

[26] Department of Energy Philippines, “Philippine Energy Plan 2020-2040,” 2023.

[27] A. Joko Purwanto and S. Kimura, “Forecast of Biomass Demand Potential in Indonesia: Seeking a Business Model for Wood Pellets,” 2022.

[28] Ember, “Record Coal Generation Share in Indonesia and the Philippines Surpasses Poland and China,” Ember.

[29] A. and S. E. (CASE) for S.-E. A. Clean, “Thailand Natural Gas Supply and Demand,” 2023.

[30] IRENA and ACE, “Renewable energy outlook for ASEAN: Towards a regional energy transition (2nd ed.),” Jakarta, 2022.

[31] R. Bedi, A. Sastry, and T.-Y. Chong, “How South-East Asian countries can cooperate to enhance energy interconnectivity,” World Economic Forum. Accessed: Aug. 21, 2024. [Online]. Available: https://www.weforum.org/agenda/2024/07/south-east-asia-energy-transition/

[32] Asian Development Bank, “Asian Development Outlook (ADO) 2022: Mobilizing Taxes for Development,” 2022.

[33] O. Z. Lin, O. Okka, and H. Y. Aye, “Potential and the Role of Dispersed Generation in Yangon, Myanmar,” European Journal of Sustainable Development, vol. 7, no. 1, pp. 150–150, Feb. 2018.

[34] V. Vai, M. C. Alvarez-Herault, B. Raison, and L. Bun, “Optimal Low-voltage Distribution Topology with Integration of PV and Storage for Rural Electrification in Developing Countries: A Case Study of Cambodia,” Journal of Modern Power Systems and Clean Energy, vol. 8, no. 3, pp. 531–539, May 2020.

[35] International Energy Agency, “World Energy Investment 2024,” 2024. Accessed: Aug. 21, 2024. [Online]. Available: www.iea.org

[36] A. Gnanasagaran, “Making Southeast Asian electricity grids smarter,” The ASEAN Post.

[37] S. Ho, “Asean could save up to US$800 billion on decarbonisation costs through fully interconnected grid, study shows,” Eco-Business. Accessed: Aug. 21, 2024. [Online]. Available: https://www.eco-business.com/news/asean-could-save-up-to-us800-billion-on-decarbonisation-costs-through-fully-interconnected-grid-study-shows/

[38] D. Hardcastle, Y. Tsukamoto, K. Tan, T. W. Harris, K.-A. Park, and B. Lee, “Southeast Asia’s Green Economy 2024 Report,” 2024. Accessed: Aug. 21, 2024. [Online]. Available: https://www.bain.com/insights/southeast-asias-green-economy-2024/

[39] IRENA, “Renewables Competitiveness Accelerates, Despite Cost Inflation,” IRENA. Accessed: Aug. 26, 2024. [Online]. Available: https://www.irena.org/News/pressreleases/2023/Aug/Renewables-Competitiveness-Accelerates-Despite-Cost-Inflation

[40] CDSS, “Renewable power generation costs in 2022,” CDS Solar. Accessed: Aug. 26, 2024. [Online]. Available: https://cdssolar.com/renewable-power-generation-costs-in-2022/#:~:text=The%20global%20weighted%20average%20levelised,)%20to%20USD%200.049%2FkWh.

[41] M. Roser, “Why did renewables become so cheap so fast?,” Our World in Data. Accessed: Aug. 26, 2024. [Online]. Available: https://ourworldindata.org/cheap-renewables-growth

[42] K. Toussaint, “The price of solar electricity has dropped 89% in 10 years,” Fast Company. Accessed: Aug. 26, 2024. [Online]. Available: https://www.fastcompany.com/90583426/the-price-of-solar-electricity-has-dropped-89-in-10-years

[43] Our World in Data, “Levelized cost of energy by technology,” Our World in Data. Accessed: Aug. 26, 2024. [Online]. Available: https://ourworldindata.org/grapher/levelized-cost-of-energy?country=~VNM

[44] Systemiq, KADIN Net Zero Hub, and Bezos Earth Fund, “The Breakthrough Effect in ASEAN: How to trigger a cascade of tipping points to accelerate ASEAN’s green growth,” 2023.

[45] Z. Arifin, “Outlook of ASEAN Green Hydrogen Potential and Its Feasibility,” Jakarta, 2024. Accessed: Aug. 26, 2024. [Online]. Available: https://www.researchgate.net/publication/377810879_Outlook_of_ASEAN_Green_Hydrogen_Potential_and_Its_Feasibility

[46] A. Joko, P. Ridwan, and D. Rusli, “Hydrogen Demand and Supply in ASEAN’s Industry Sector: Current Situation and the Potential of a Greener Future,” 2024.

[47] ACE, “ASEAN Energy in 2024,” Jakarta, 2024. Accessed: Aug. 21, 2024. [Online]. Available: https://aseanenergy.org/publications/asean-energy-in-2024/

[48] “World Mining Data - Data Section.” Accessed: Aug. 21, 2024. [Online]. Available: https://www.world-mining-data.info/?World_Mining_Data___Data_Section

[49] A. Febriyanti and A. Abdullah, “Aligning critical minerals policies with ASEAN energy transition,” The Jakarta Post. Accessed: Aug. 21, 2024. [Online]. Available: https://www.thejakartapost.com/opinion/2024/05/06/aligning-critical-minerals-policies-with-asean-energy-transition.html

[50] Trading Economics, “Commodities,” Trading Economics. Accessed: Aug. 22, 2024. [Online]. Available: https://tradingeconomics.com/commodities

[51] Rocky Mountain Institute (RMI), “Renewable energy deployment surge puts global power system on track for the IEA’s ambitious net-zero pathway,” Rocky Mountain Institute (RMI). Accessed: Aug. 21, 2024. [Online]. Available: https://rmi.org/press-release/renewable-energy-deployment-puts-global-power-system-on-track-for-ambitious-net-zero-pathway/

[52] International Energy Agency, “Massive expansion of renewable power opens door to achieving global tripling goal set at COP28,” International Energy Agency.

[53] International Energy Agency, “Clean Energy Market Monitor,” 2024.

[54] L. Cozzi, T. Gül, T. Spencer, and P. Levi, “Clean energy is boosting economic growth,” International Energy Agency.

[55] A. Zarim and A. Sastry, “How to achieve a just and responsible energy transition in ASEAN,” World Economic Forum.

[56] M. Motyka, J. Thomson, K. Hardin, and C. Amon, “2024 Renewable Energy Industry Outlook,” Deloitte.

[57] F. Hao and W. Shao, “What really drives the deployment of renewable energy? A global assessment of 118 countries,” Energy Res Soc Sci, vol. 72, p. 101880, Feb. 2021, doi: 10.1016/J.ERSS.2020.101880.

[58] ASEAN Inter-Parliamentary Assembly (AIPA), “Resolution on Driving Energy Transition in ASEAN,” Jakarta, 2023.

[59] A. Omri and S. Ben Jabeur, “Climate policies and legislation for renewable energy transition: The roles of financial sector and political institutions,” Technol Forecast Soc Change, vol. 203, p. 123347, Jun. 2024, doi: 10.1016/J.TECHFORE.2024.123347.

[60] ASEAN Capital Market Forum, "ASEAN Taxonomy for Sustainable Finance Version 3," ASEAN Capital Market Forum. Accessed: Aug. 21, 2024. [Online]. Available: https://www.theacmf.org/sustainable-finance/publications/asean-taxonomy-for-sustainable-finance-version-3

[61] Fossil Fuel Subsidy Tracker, "Global estimates on subsidies to fossil fuels," Fossil Fuel Subsidy Tracker. Accessed: Aug. 26, 2024. [Online]. Available: https://fossilfuelsubsidytracker.org/

[62] Statista, "Brent crude oil price annually 1976-2024," Statista. Accessed: Aug. 26, 2024. [Online]. Available: https://www.statista.com/statistics/262860/uk-brent-crude-oil-price-changes-since-1976/

[63] Organisation for Economic Co-operation and Development, "Mobilising ASEAN Capital Markets for Sustainable Growth," OECD, May 2024. doi: 10.1787/196B5BDE-EN.

[64] World Bank, "Data on Private Participation in Infrastructure (PPI)." Accessed: Aug. 21, 2024. [Online]. Available: https://ppi.worldbank.org/en/ppidata

[65] Redcliffe Training, "Why Does Project Finance Debt Sizing Matter? 4 Key Reasons Explained," Redcliffe Training. Accessed: Aug. 21, 2024. [Online]. Available: https://redcliffetraining.com/blog/project-finance-debt-sizing

[66] TMF Group, "Renewable energy in Asia: investment incentives in six key markets," TMF Group. Accessed: Aug. 21, 2024. [Online]. Available: https://www.tmf-group.com/en/news-insights/articles/esg/renewable-energy-asia-investment/

[67] A. Huld, "Vietnam to Set Annual Solar and Wind Prices Under New Rules," Vietnam Briefing. Accessed: Aug. 21, 2024. [Online]. Available: https://www.vietnam-briefing.com/news/vietnam-to-set-annual-solar-and-wind-prices-under-new-rules.html/

[68] S. Flowers and P. Martin, "Higher interest rates impact energy transition investment," World Economic Forum. Accessed: Aug. 21, 2024. [Online]. Available: https://www.weforum.org/agenda/2024/06/energy-transition-investment-interest-rates/

[69] Independent Evaluation Office (IEO) of the International Monetary Fund (IMF), "IMF Advice on Fiscal Policy," 2023.

[70] S. Spiegel and O. Schwank, "Bridging the 'great finance divide' in developing countries," Brookings. Accessed: Aug. 21, 2024. [Online]. Available: https://www.brookings.edu/articles/bridging-the-great-finance-divide-in-developing-countries/

[71] Xe Currency Converter, "Currency Charts." Accessed: Aug. 22, 2024. [Online]. Available: https://www.xe.com/currencycharts/

[72] Climate Bonds Initiative, "ASEAN Green Finance State of the market," 2018.

[73] World Bank, "Lao People's Democratic Republic Economic Monitor: April 2024," Washington, DC, 2024.

[74] D. Tran, "Vietnam's Currency Woes: Battling Depreciation amid Global Economic Headwinds," VnEconomy. Accessed: Aug. 22, 2024. [Online]. Available: https://en.vneconomy.vn/vietnams-currency-woes-battling-depreciation-amid-global-economic-headwinds.htm

[75] R. Singh, "MIDF Research forecasts ringgit to appreciate to RM4.20 by end-2024," The Malaysian Reserve. Accessed: Aug. 22, 2024. [Online]. Available: https://themalaysianreserve.com/2024/01/08/midf-research-forecasts-ringgit-to-appreciate-to-rm4-20-by-end-2024/

[76] MIDF, "Ringgit Getting Some Appreciation," Aug. 2024.

[77] SCBEIC, "Economic Outlook as of Q2/2024," 2024.

[78] R. Westerfield and J. Jordan, Corporate Finance Core Principles & Applications, 3rd ed. New York: McGraw-Hill/Irwin, 2011.

[79] Tholos Foundation, “International Trade Barrier Index 2023,” Tholos Foundation. Accessed: Aug. 21, 2024. [Online]. Available: https://www.tradebarrierindex.org/

[80] World Bank, “Ease of Doing Business rankings,” World Bank. Accessed: Aug. 21, 2024. [Online]. Available: https://archive.doingbusiness.org/en/rankings

[81] E. Yokota and I. Kutani, “Electric Power Policy and Market Structure in ASEAN Member States,” in Study on Electricity Supply Mis and Role of Policy in ASEAN, ERIA, 2017, pp. 3–46. Accessed: Aug. 21, 2024. [Online]. Available: http://www.eria.org/RPR_FY2015_No.18_Chapter_2.pdf

[82] World Bank, “The World Bank In Cambodia,” World Bank. Accessed: Aug. 21, 2024. [Online]. Available: https://www.worldbank.org/en/country/cambodia/overview

[83] World Bank, “The World Bank In Lao PDR,” World Bank. Accessed: Aug. 21, 2024. [Online]. Available: https://www.worldbank.org/en/country/lao/overview#:~:text=The%20Lao%20PDR’s%20macroeconomic%20situation,for%20a%20third%20consecutive%20year.

[84] N. Inayoshi and S. Nejime, “Lao PDR’s Electricity Sector: Risk or Opportunity?,” AMRO. Accessed: Aug. 21, 2024. [Online]. Available: https://amro-asia.org/lao-pdrs-electricity-sector-risk-or-opportunity/

[85] M. Lim, “Growing renewable energy market between Malaysia and Singapore offers opportunities,” The Edge, Malaysia, Aug. 05, 2024.

[86] N. Kasturi and K. Varges, “Challenges faced by policymakers in the renewable energy space,” Deloitte. Accessed: Aug. 21, 2024. [Online]. Available: https://www2.deloitte.com/my/en/pages/risk/articles/challenges-faced-by-policymakers-in-the-renewable-energy-space.html

[87] World Bank, “In the Dark: Power Sector Challenges in Myanmar,” World Bank. Accessed: Aug. 21, 2024. [Online]. Available: https://www.worldbank.org/en/country/myanmar/publication/in-the-dark-power-sector-challenges-in-myanmar

[88] T. T. S. Min, “Renewable Energy Situation in Myanmar,” 2023.

[89] D. Setyawati and A. Lolla, “Accelerating cross-border interconnections is critical for Singapore’s net-zero target,” Ember. Accessed: Aug. 21, 2024. [Online]. Available: https://ember-climate.org/insights/research/regional-grids-key-to-singapores-energy-future/#supporting-material

[90] A. M. Navarro and E. L. J. Camara, “Mapping the Energy Sector Issues in the Philippines,” Quezon, 2023. Accessed: Aug. 21, 2024. [Online]. Available: https://www.pids.gov.ph

[91] CASE for Southeast Asia, “Thailand,” CASE for Southeast Asia. Accessed: Aug. 21, 2024. [Online]. Available: https://caseforsea.org/thailand/

[92] L. H. Hiep, “The Unexpected Twist in Vietnam’s Renewable Energy Saga,” Fulcrum. Accessed: Aug. 21, 2024. [Online]. Available: https://fulcrum.sg/the-unexpected-twist-in-vietnams-renewable-energy-saga/

[93] International Trade Administration, “Cambodia - Country Commercial Guide,” International Trade Administration. Accessed: Aug. 21, 2024. [Online]. Available: https://www.trade.gov/country-commercial-guides/cambodia-energy-power-generation-equipment

[94] ASEAN Secretariat, “Framework for Improving ASEAN Infrastructure Productivity,” Jakarta, 2020.

[95] S. Srivastava, “How to unlock clean energy in South and Southeast Asia,” IEEFA. Accessed: Aug. 21, 2024. [Online]. Available: https://ieefa.org/resources/how-unlock-clean-energy-south-and-southeast-asia

[96] Asian Development Bank, “ADB Invests 3 Billion Thai Baht in Energy Absolute’s Green Bond for Wind Farm Development,” Asian Development Bank. Accessed: Aug. 21, 2024. [Online]. Available: https://www.adb.org/news/adb-invests-3-billion-thai-baht-energy-absolutes-green-bond-wind-farm-development

[97] Asian Development Bank, “ADB Signs Loan for First Cross-Border Wind Power Project in Asia, First Plant in Lao PDR and Largest in Southeast Asia,” Asian Development Bank. Accessed: Aug. 21, 2024. [Online]. Available: https://www.adb.org/news/adb-signs-loan-first-cross-border-wind-power-project-asia-first-plant-lao-pdr-and-largest

[98] Asian Development Bank, “Cambodia Solar Power Project,” Asian Development Bank. Accessed: Aug. 21, 2024. [Online]. Available: https://www.adb.org/projects/50248-001/main

[99] B. Klooss, “Making energy transition possible: how technology can help,” Oxford Policy Management. Accessed: Aug. 21, 2024. [Online]. Available: https://www.opml.co.uk/insights/making-energy-transition-possible-how-technology-can-help

[100] V. Veng, B. Suryadi, A. D. Pranadi, and N. Shani, “A review of renewable energy development and its policy under nationally determined contributions in ASEAN,” International Journal of Smart Grid and Clean Energy, pp. 149–161, 2020, doi: 10.12720/SGCE.9.1.149-161.

[101] C. Y. Lin, K. Y. Chau, M. Moslehpour, H. V. Linh, K. D. Duong, and T. Q. Ngo, “Factors influencing the sustainable energy technologies adaptation in ASEAN countries,” Sustainable Energy Technologies and Assessments, vol. 53, p. 102668, Oct. 2022, doi: 10.1016/J.SETA.2022.102668.

[102] P. Romero-Lankao et al., “Community Engagement and Equity in Renewable Energy Projects: A Literature Review,” Golden, CO, 2023. Accessed: Aug. 21, 2024. [Online]. Available: https://www.nrel.gov/docs/fy23osti/87113.pdf.

[103] Business & Human Rights Resource Centre, “Renewable Energy & Human Rights Benchmark,” Business & Human Rights Resource Centre. Accessed: Aug. 21, 2024. [Online]. Available: https://www.business-humanrights.org/en/from-us/briefings/renewable-energy-human-rights-benchmark/

[104] J. R. Owen, D. Kemp, A. M. Lechner, J. Harris, R. Zhang, and É. Lèbre, “Energy transition minerals and their intersection with land-connected peoples,” Nature Sustainability 2022 6:2, vol. 6, no. 2, pp. 203–211, Dec. 2022, doi: 10.1038/s41893-022-00994-6.

[105] S. Pratiwi and N. Juerges, “Review of the impact of renewable energy development on the environment and nature conservation in Southeast Asia,” Energy, Ecology and Environment 2020 5:4, vol. 5, no. 4, pp. 221–239, May 2020, doi: 10.1007/S40974-020-00166-2.

[106] S. V. Larsen, A. M. Hansen, and H. N. Nielsen, “The role of EIA and weak assessments of social impacts in conflicts over implementation of renewable energy policies,” Energy Policy, vol. 115, pp. 43–53, Apr. 2018, doi: 10.1016/J.ENPOL.2018.01.002.

[107] Organisation for Economic Cooperation and Development (OECD), “OECD Guidelines for Citizen Participation Processes,” Paris, 2022. Accessed: Aug. 22, 2024. [Online]. Available: https://www.oecd-ilibrary.org/governance/oecd-guidelines-for-citizen-participation-processes_f765caf6-en

[108] RISE, “Indicators,” RISE. Accessed: Aug. 26, 2024. [Online]. Available: https://rise.esmap.org/indicators

[119] World Bank, “Regulatory Indicators for Sustainable Energy (RISE) 2022 - Building Resilience,” Washington, DC, 2022.

[110] C. Galeazzi, J. Steinbuks, and L. D. Anadon, “Assessing the impact of renewable energy policies on decarbonization in developing countries,” Renewable and Sustainable Energy Reviews, vol. 199, p. 114444, Jul. 2024, doi: 10.1016/J.RSER.2024.114444.

[111] D. Eagan, “Energy Transition Initiative: Islands Playbook,” 2015. Accessed: Aug. 23, 2024. [Online]. Available: www.flickr.com/photos/our-planet/5371963671/in/photolist.

[112] UNDP, “Derisking Renewable Energy Investment,” 2020. Accessed: Aug. 23, 2024. [Online]. Available: www.undp.org/DREI

[113] A. Halimatussadiah et al., "The Impact of Fiscal Incentives on the Feasibility of Solar Photovoltaic and Wind Electricity Generation Projects: The Case of Indonesia," Journal of Sustainable Development of Energy, Water and Environment Systems, vol. 11, no. 1, Mar. 2023, doi: 10.13044/J.SDEWES.D10.0425.

[114] J. Roy, D. Ghosh, A. Ghosh, and S. Dasgupta, "Fiscal instruments: crucial role in financing low carbon transition in energy systems," Curr Opin Environ Sustain, vol. 5, no. 2, pp. 261–269, Jun. 2013, doi: 10.1016/J.COSUST.2013.05.003.

[115] M. A. Kose, S. Kurlat, F. Ohnsorge, and N. Sugawara, "A cross-country database of fiscal space," J Int Money Finance, vol. 128, p. 102682, Nov. 2022, doi: 10.1016/J.JIMONFIN.2022.102682.

[116] World Bank, "Regulatory Indicators for Sustainable Energy," ESMAP. [Online]. Available: https://rise.esmap.org/

[117] ASEAN Centre for Energy (ACE), ASEAN Plan of Action for Energy Cooperation (APAEC) Phase II: 2021-2025. 2021.

[118] ACE, "The 7th ASEAN Energy Outlook (AEO7):2020-2050," Jakarta, 2020

[119] Prime Minister's Office Negara Brunei Darussalam, "Energy White Paper," 2013.

[120] Ministry of Energy and Mineral Resources Republic of Indonesia, "National Energy General Plan (RUEN)," 2017.

[121] Perusahaan Listrik Negara (PLN), "Rencana Usaha Penyediaan Tenaga Listrik (RUPTL) 2021-2030," 2021.

[122] International Energy Agency (IEA), World Energy Investment 2021. Paris: IEA, 2021.

[123] UNCTAD, "Investment Policies for the Energy Transition: Incentives and Disincentives," Investment Policy Monitor, 2023.

[124] R. Vakulchuk, I. Overland, and B. Suryadi, "ASEAN's energy transition: how to attract more investment in renewable energy," Energy Ecol Environ, vol. 8, no. 1, pp. 1–16, 2023, doi: 10.1007/s40974-022-00261-6.

[125] V. Tachev, "Renewable Energy Investments in Vietnam in 2024 – Asia's Next Clean Energy Powerhouse," Energy Tracker Asia, Jun. 09, 2024.

[126] "Renewable energy sector may reach $714 billion: VietinbankSC," Viet Nam News, Nov. 06, 2020.

[127] Ministry of Finance Malaysia, "2023 Pre-Budget Statement," 2022.

[128] International Energy Agency (IEA), "Government Energy Spending Tracker: Policy Database." [Online]. Available: https://www.iea.org/data-and-statistics/data-tools/government-energy-spending-tracker-policy-database

[129] International Energy Agency (IEA), "World Energy Investment 2023," 2023.

[130] GoBusiness Singapore, "Energy Efficiency Grant (EEG)." [Online]. Available: https://www.gobusiness.gov.sg/energy-efficiency-grant/

[131] GoBusiness Singapore, "Energy Efficiency Grant (EEG)." Accessed: Sep. 04, 2024. [Online]. Available: https://www.gobusiness.gov.sg/business-grants-portal-faq/eeg/

[132] The ASEAN Catalytic Green Finance Facility and The Asian Development Bank (ADB), "Green Infrastructure Investment Opportunities: Thailand Report," 2021.

[133] Royal Governmet of Cambodia, "National Energy Efficiency Policy 2022-2030," 2023.

[134] MOIT, "Vietnam - National Energy Efficiency Program 2019-2030," Hanoi, 2018.

[135] ASEAN Secretariat and UNCTAD, A Special ASEAN Investment Report 2023. 2023.

[136] "Thai government allocates THB24 billion for subsidies to boost domestic manufacture of EV batteries," The Nation, Feb. 03, 2023.

[137] R. Y. A. Haizan, “Indonesia offers US$458 subsidy for electric motorcycles in bid to spur EV adoption,” CNA, Mar. 22, 2023.

[138] Fiscal Policy Agency, Regulation No. 38/2023 on Value Added Tax (VAT) Delivery of Four-wheeled Battery-based Electric Vehicles and Bus Battery-based Electric Vehicles Borne by the Government for Fiscal Year 2023. Indonesia, 2023.

[139] Ministry of Finance (MOF) Malaysia, Tax Measures Budget 2023. 2023.

[140] F. Nangoy and S. Sulaiman, “Indonesia cuts tax breaks to discourage low-quality nickel investment, minister says,” Reuters, May 04, 2023.

[141] C. H. Venzon, “Top Philippine Nickel Miners May Spend $2 Billion in New Plants,” Bloomberg, Sep. 21, 2023.

[142] C.-Y. Park and A. C. Melendez, “Building Resilient and Responsible Critical Minerals Supply Chains for the Clean Energy Transition,” ADB Briefs, no. 298, 2024.

[143] European Environment Agency, “The case for public participation in sustainability transitions,” 2023.

[144] H. Agrawal, L. El-Katiri, K. Muiruri, and S. Szoke-Burke, “Enabling a Just Transition: Protecting Human Rights in Renewable Energy Projects: A Briefing For Policymakers,” Columbia Center on Sustainable Investment, Apr. 2023, Accessed: Aug. 23, 2024. [Online]. Available: https://scholarship.law.columbia.edu/sustainable_investment/13

[145] H. S. Fathoni, A. B. Setyowati, and J. Prest, “Is community renewable energy always just? Examining energy injustices and inequalities in rural Indonesia,” Energy Res Soc Sci, vol. 71, p. 101825, Jan. 2021, doi: 10.1016/J.ERSS.2020.101825.

[146] J. Vega-Araújo and R. J. Heffron, “Assessing elements of energy justice in Colombia: A case study on transmission infrastructure in La Guajira,” Energy Res Soc Sci, vol. 91, no. 102688, Sep. 2022, doi: 10.1016/j.erss.2022.102688.

[147] K. Dudine and S. Szoke-Burke, “Government Briefing: Incorporating Free, Prior, and Informed Consent into Investment Approval Processes,” 2020, Accessed: Aug. 23, 2024. [Online]. Available: http://tiny.cc/legalsupport.

[148] P. Toledano, C. Albin-Lackey, M. D. Andres, and M. D. Brauch, “Community Benefit Sharing and Renewable Energy and Green Hydrogen Projects: Policy Guidance for Governments,” 2023.

[149] National Commission on Indigenous Peoples (NCIP), “NCIP Administrative Order No. 3, Series of 2012: The Revised Guidelines on Free and Prior Informed Consent (FPIC) and Related Processes,” 2012. Accessed: Aug. 23, 2024. [Online]. Available: https://ncip.gov.ph/wp-content/uploads/2020/09/ncip-ao-no-3-s-2012-fpic.pdf

[150] UNESCAP, “Draft ASEAN declaration on environmental rights,” 2023.

[151] PRI, “An introduction to human rights for responsible investors,” Principles for Responsible Investment (PRI). Accessed: Aug. 23, 2024. [Online]. Available: https://www.unpri.org/introductory-guides-to-responsible-investment/an-introduction-to-responsible-investment-human-rights/12026.article#downloads

[152] ICAT, “Stakeholder Participation Guide: Establishing grievance redress mechanisms,” ICAT. Accessed: Aug. 23, 2024. [Online]. Available: https://climateactiontransparency.org/wp-content/uploads/2020/10/Stakeholder-Participation-Guide_ch9.pdf

[153] M. Merdekawati, B. Suryadi, V. A. Pangestika, and Z. Zafira, “Rural electrification efforts from the perspective of ASEAN Energy Awards,” J Br Acad, vol. 11, pp. 13–31, Mar. 2024, doi: 10.5871/JBA/011S7.013.

[154] UNESCAP, "5P Project: partnerships for a resilient energy future," Dec. 2014. Accessed: Aug. 23, 2024. [Online]. Available: https://www.unescap.org/resources/brochure-5p-project

[155] S. Guerreiro and I. Botetzagias, "Empowering communities – the role of intermediary organisations in community renewable energy projects in Indonesia," 2017, doi: 10.1080/13549839.2017.1394830.

[156] International Water Power, "Micro model," International Water Power, 2003. Accessed: Aug. 23, 2024. [Online]. Available: https://www.waterpowermagazine.com/news/micro-model/

[157] IFC, "Using Blended Concessional Finance to Invest in Challenging Markets," 2021. Accessed: Aug. 23, 2024. [Online]. Available: www.ifc.org.

[158] International Energy Agency, "Executive summary – Enhancing Indonesia's Power System," International Energy Agency (IEA). Accessed: Aug. 21, 2024. [Online]. Available: https://www.iea.org/reports/enhancing-indonesias-power-system/executive-summary

[159] J. Simon, "Despite a $20 billion JETP deal Indonesia builds new coal: NPR," NPR. Accessed: Aug. 21, 2024. [Online]. Available: https://www.npr.org/2023/02/05/1152823939/despite-billions-to-get-off-coal-why-is-indonesia-still-building-new-coal-plants

[160] Center of Economic and Law Studies (CELIOS), "Energy Transition Polemic in Massive Development of Captive Power Coal-fired Powerplant 2023," 2023.

[161] Republic Socialist of Vietnam, Law on Amending and Supplementing a number of articles of the Law on Organization of the Government and Law on Organization of Local Administration dated November 22nd. 2021.

[162] World Bank, "Private Participation in Infrastructure (PPI) 2022 Annual Report," 2022.

[163] B. Coleman, "Assessment of a Social Discount Rate and Financial Hurdle Rates for Energy System modelling in Viet Nam," 2021, Accessed: Aug. 23, 2024. [Online]. Available: www.oecd.org/environment/workingpapers.htm

[164] Covergence, "Blended Finance in the Association of Southeast Asian Nations (ASEAN)," 2023.

[165] Asian Development Bank, "ASEAN Infrastructure Fund," 2016. Accessed: Aug. 23, 2024. [Online]. Available: www.adb.org

[166] Asian Development Bank, "Ha Noi and Ho Chi Minh City Power Grid Development Sector Project," Asian Development Bank. Accessed: Aug. 23, 2024. [Online]. Available: https://www.adb.org/projects/46391-001/main

[167] SMI, "Indonesia Geothermal Resource Risk Mitigation Project," 2021.

[168] Asian Development Bank, "Survey on Green Bonds and Sustainable Finance in ASEAN," 2022.

[169] AsianBondsOnline, "ABO Data Portal." Accessed: Aug. 23, 2024. [Online]. Available: https://asianbondsonline.adb.org/data-portal/

[170] DOE, "Philippine Energy Plan 2023-2050 (Volume II)," 2023.

[171] Bank of Thailand, "Bank of Thailand's Strategic Plan 2020-2022: Central Bank in a Transofrmative World."

[172] Financial Services Authority (OJK), OJK Regulation No.60/POJK.04/2017 on Issuance and Requirements for Environmentally Conscious Debt Securities (Green Bonds). Indonesia, 2017.

[173] The Asia Foundation, "The State of Carbon Pricing in Southeast Asia," The Asia Foundation. Accessed: Aug. 23, 2024. [Online]. Available: https://asiafoundation.org/publication/the-state-of-carbon-pricing-in-southeast-asia/

[174] International Monetary Fund. Fiscal Affairs Dept., "Fiscal Policies for Paris Climate Strategies—from Principle to Practice," Policy Papers, no. 010, 2019, doi: 10.5089/9781498311717.007.

[175] The Government of Singapore, Carbon Pricing Act 2018. 2018.

[176] The Parliament of Singapore, Carbon Pricing (Amendment) Bill. Singapore, 2022.

[177] J. Chih and M. Chang, "Singapore's Carbon Regulations: Paving the Way for the Green Plan 2030," Mayer Brown. [Online]. Available: https://www.mayerbrown.com/en/insights/publications/2024/02/singapores-carbon-regulations-paving-the-way-for-the-green-plan-2030

[178] S. S., "Singapore's Carbon Credit Market Surging at 21% CAGR," Carbon Credits. [Online]. Available: https://carboncredits.com/singapores-carbon-credit-market-surging-at-21-cagr/

[179] The Parliament of Indonesia, Law No. 7 on the Harmonization of Tax Regulations. Indonesia, 2021.

[180] P. Tanakasempipat, "Thailand Launches First Carbon Credit Exchange to Curb Emissions," Bloomberg. [Online]. Available: https://www.uobam.co.th/en/publication/download/283/#:~:text=Thailand's carbon credit market is,carbon emissions by the government.

[181] J. Lim, "Technology-based carbon credits clear at RM18.50 at Bursa Malaysia's inaugural auction; nature-based ones fetch RM68," The Business Times, Mar. 2023.

[182] The Asia Foundation, The State of Carbon Pricing in Southeast Asia. 2023.

[183] P. Visapra, "Laos Launches Forest Carbon Credit Initiative to Combat Climate Change," The Laotian Times, May 09, 2024.

[184] I. Yin, "Vietnam expedites domestic carbon market development to tackle CBAM, Article 6," S&P Global. [Online]. Available: https://www.spglobal.com/commodityinsights/en/market-insights/latest-news/energy-transition/052424-vietnam-expedites-domestic-carbon-market-Snt-to-tackle-cbam-article-6

[185] Focus Economics, "Indonesia Economic Overview," Focus Economics. Accessed: Aug. 25, 2024. [Online]. Available: https://www.focus-economics.com/countries/indonesia/

[186] ACE, "ASEAN Power Updates 2023," Jakarta, 2023.

[187] ADB, "Renewable Energy Financing Schemes for Indonesia," Manila, 2019.

[188] PwC, "Power in Indonesia: Investment and Taxation Guide 2023 - 7th Edition," Jakarta, 2023. Accessed: Aug. 25, 2024. [Online]. Available: https://www.pwc.com/id/en/pwc-publications/industries-publications/energy--utilities---mining-publications/power-guide-2023.html

[189] BPDLH, "Tentang Kami," BPDLH. Accessed: Aug. 26, 2024. [Online]. Available: https://bpdlh.id/about-us

[190] A. Suharsono, M. Hendriwardani, T. B. Sumarno, J. Kuehl, M. Maulidia, and L. Sanchez, "Indonesia's Energy Support Measures: An inventory of incentives impacting the energy transition GSI REPORT," 2022, Accessed: Aug. 25, 2024. [Online]. Available: www.iisd.org/gsi

[191] EBTKE, "Wujud Etalase Percepatan Transisi Energi, PLTS Terapung Cirata Bakal Resmi Beroperasi," Direktorat Jenderal EBTKE. Accessed: Aug. 25, 2024. [Online]. Available: https://ebtke.esdm.go.id/post/2023/11/08/3650/wujud.etalase.percepatan.transisi.energi.plts.terapung.cirata.bakal.resmi.beroperasi

[192] M. Yustika, "Unlocking Indonesia's Renewable Energy Investment Potential," 2024.

[193] R. Bridle et al., "Missing the 23 Per Cent Target: Roadblocks to the development of renewable energy in Indonesia," 2018, Accessed: Aug. 25, 2024. [Online]. Available: www.iisd.org/gsi

[194] Ashurst, "New Local Content Regime for Electricity Infrastructure Development in Indonesia," Ashurst. Accessed: Aug. 25, 2024. [Online]. Available: https://www.ashurst.com/en/insights/new-local-content-regime-for-electricity-infrastructure-development-in-indonesia/

[195] A. Azaria and R. Siahaan, "Pervading Factors Behind Floating Solar Power Gridlock in Indonesia," Petromindo. Accessed: Aug. 25, 2024. [Online]. Available: https://www.petromindo.com/news/article/pervading-factors-behind-floating-solar-power-gridlock-in-indonesia

[196] Kementerian Perindustrian, "P3DN," Kementerian Perindustrian. Accessed: Aug. 25, 2024. [Online]. Available: https://tkdn.kemenperin.go.id/sertifikat_perush.php?id=vqUH9qalfsZtbUNxr_FTaBzIcQ11dCMcjVMHKpkQJeU,&id_siinas=8e50x-LkIxHheOMpqKYPguWTeJHzXMw06wL8xdG2pr4

[197] Focus Economics, "Laos Economy: GDP, Inflation, CPI & Interest Rates," Focus Economics. Accessed: Aug. 25, 2024. [Online]. Available: https://www.focus-economics.com/countries/laos/

[198] S. Kimura, H. P. Alloysius, and J. Purwanto, "Energy Outlook and Energy-Saving Potential in East Asia 2023," 2023.

[199] Government of Lao PDR, "Renewable Energy Development Strategy in Lao PDR," 2011.

[200] Government of Lao PDR, "Law on Investment Promotion (Amended) No. 14/NA," Government of Lao PDR. Accessed: Aug. 25, 2024. [Online]. Available: https://www.laotradeportal.gov.la/en-gb/site/display/1195

[201] ADB, "ADB Signs Loan for First Cross-Border Wind Power Project in Asia, First Plant in Lao PDR and Largest in Southeast Asia," Asian Development Bank. Accessed: Aug. 25, 2024. [Online]. Available: https://www.adb.org/news/adb-signs-loan-first-cross-border-wind-power-project-asia-first-plant-lao-pdr-and-largest

[202] ADB, "55205-001: Monsoon Wind Power Project," Asian Development Bank. Accessed: Aug. 25, 2024. [Online]. Available: https://www.adb.org/projects/55205-001/main

[203] EFC, "China's 14th Five-Year Plans on Renewable Energy Development and Modern Energy System," Energy Foundation China. Accessed: Aug. 25, 2024. [Online]. Available: https://www.efchina.org/Blog-en/blog-20220905-en

[204] CEIC, "China is Set to Surpass Renewable Energy Targets Ahead of Schedule, Fueled by Solar Power," CEIC. Accessed: Aug. 25, 2024. [Online]. Available: https://info.ceicdata.com/china-is-set-to-surpass-renewable-energy-targets-ahead-of-schedule-fueled-by-solar-power

[205] BNEF, "Energy Transition Investment Trends," 2024.

[206] I. Hilton, "How China Became the World's Leader on Renewable Energy - Yale E360," Yale E360. Accessed: Aug. 25, 2024. [Online]. Available: https://e360.yale.edu/features/china-renewable-energy

[207] IEA, "Denmark 2023 - Energy Policy Review," 2024.

[208] IEA, "Denmark," International Energy Agency. Accessed: Aug. 25, 2024. [Online]. Available: https://www.iea.org/countries/denmark/electricity

[209] WEF, "Fostering Effective Energy Transition," 2024.

[210] IEA, "Energy Policies of IEA Countries: United Kingdom," 2019.

[211] HM Government, "Net Zero Strategy: Build Back Greener," 2021.

[212] APERC, "APERC Coal Report 2023," Tokyo, 20223.

[213] Ministry of Mines and Energy Cambodia, "Power Development Master Plan 2022-2040," 2022. Accessed: Aug. 21, 2024. [Online]. Available: https://climate-laws.org/documents/power-development-master-plan-2022-2040-6097?id=power-development-master-plan-2022-2040-0f75

[214] N. Kusuma, "What is Just Energy Transition Partnerships? - Green Network Asia," Green Network Asia. Accessed: Aug. 21, 2024. [Online]. Available: https://greennetwork.asia/news/what-is-just-energy-transition-partnerships/

[215] European Commission, "Political Declaration on establishing the JETP with Viet Nam," European Commission (EU). Accessed: Aug. 21, 2024. [Online]. Available: https://ec.europa.eu/commission/presscorner/detail/en/statement_22_7724

[216] ADB, “ACGF Overview,” Asian Development Bank. Accessed: Aug. 26, 2024. [Online]. Available: https://www.adb.org/what-we-do/funds/asean-catalytic-green-finance-facility/overview

[217] C. J. Anwar, D. Khairiyah, I. Suhendra, and V. M. Zahara, “Monetary Policy and Investment in ASEAN-5 Countries,” European Journal of Development Studies, vol. 3, no. 5 SE-Articles, pp. 112–118, Oct. 2023, doi: 10.24018/ejdevelop.2023.3.5.309.

[218] P. Martin, J. Whiteside, F. McKay, and S. Santhakumar, “Conflict of Interest: the Cost of Investigating in the Energy Transition in a High Interest-rate Era,” 2024.

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