ENERGY TRANSITION PARTNERSHIP
Powering Prosperity and Enabling Sustainability in South East Asia

UNOPS

2025: STOCKTAKE REPORT

SOUTHEAST ASIA'S ENERGY TRANSITION

Prepared by: Asia Clean Energy Partners — Connections. Insights. Impact. | Enerdata intelligence + consulting

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Federal Ministry for Economic Affairs and Climate Action

Department for Energy Security & Net Zero

Environment and Climate Change Canada
Environnement et Changement climatique Canada

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Editorial Note

Global Energy Crisis and Implications for Clean Energy Transitions in Southeast Asia

As of March 2026, the recent war in the Middle East has disrupted global oil and gas output and trade; precipitating an energy crisis that affects economies around the world. The Stocktake Report predates the start of the conflict therefore comprehensive data are not yet available to assess. Uncertainty persists over the degree and duration of the ongoing energy shock.

Nevertheless, it is important to reflect on how the ongoing situation presents both energy-related risks and opportunities for ASEAN economies. While geopolitical events are focusing attention on near-term actions to manage demand, mitigate supply disruptions and protect livelihoods of vulnerable populations, they also highlight the focus of this report: strengthening the case to accelerate clean energy transitions in Southeast Asia.

Southeast Asia is a net importer of oil, with over half of crude imports from the Middle East,[i] and faces a diminishing surplus of natural gas supply. Energy situations vary considerably by economy. Previous energy crises from the COVID-19 pandemic and war in Ukraine had already exposed the region's vulnerability to supply chain disruptions. [ii] In 2022, amid fuel shortages and soaring oil and gas prices, regional spend on fossil fuel subsidies rose to a record US$105 billion, nearly 60% higher than previous records. [iii]

As detailed in this report, ASEAN economies have made progress in diversifying energy systems through efficiency, electrification and prioritizing renewable energy to meet growing demand. Yet, they remain reliant on oil for transport and cooking, gas for power generation, and both fuels for industry. With oil and liquified natural gas (LNG) prices surging, countries face rising import bills, a tougher economy, and new challenges for clean energy transitions.

Despite ongoing efforts to reduce inefficient energy subsidies, which can spur energy savings, reforms have not made adequate progress to avoid budgetary strains. High fuel prices risk boosting fiscal burdens as subsidy spending shields consumers from volatility, exacerbating fragile debt positions and threatening public support for investments in electricity grids and clean energy.

Current conditions stress petrol and diesel supplies, leaving less developed economies and communities at risk. Power generation from LNG and gas-based industries are experiencing competitiveness shocks. The crisis may prompt countries to rethink the role of gas in energy planning, and give greater emphasis on firm power alternatives, such as battery storage.

However, governments and utilities in some ASEAN countries are signalling a return to coal-based systems and delaying coal phase-down timelines. This risks locking in emissions-intensive development for years to come. Supply chain disruptions from the crisis may also risk undermining cooperation more broadly, such as in critical minerals or regional trade, as policymakers seek to prioritize national sovereignty approaches in strategic areas.

By contrast, Southeast Asian economies have the opportunity to enhance long-term energy security and reduce exposure to fuel price shocks. Investing in cost-effective energy efficiency, electrification and renewables can help to stabilize energy costs, and the modular nature of these solutions allows them to be readily deployed and scaled.

Countries are already taking actions to reduce oil and gas use through behavioural shifts; optimized energy management of buildings and industry, faster roll-out of electric vehicles and biofuels, and accelerated replacement of diesel generators. The crisis could serve as impetus to more lasting change through strengthening energy performance standards and harnessing falling investment costs for clean technologies - solar PV, wind, batteries - that can be rolled out quickly and economically with the right enabling conditions, thereby avoiding fossil fuel imports.

Southeast Asia energy systems could better enhance their resilience with greater diversification and flexibility through widespread electrification and renewables integration. As highlighted in this report, achieving this shift in a secure and reliable manner depends on advancing electricity grid modernization plans and regional cooperation around the ASEAN Power Grid initiative to provide key enabling infrastructure, as well as efforts to strengthen clean energy supply chains.

Current geopolitical uncertainties reinforce the role of clean energy transitions as national security and economic imperatives, in addition to their environmental benefits. Faster transitions would support increased resilience and reduced vulnerability to potential future shocks. Conversely, a crisis response that reinforces the role of fossil fuels - even those in abundance - hinders the full realization of clean energy benefits, leaving ASEAN economies still at risk of potential price volatility, economic distress and growing impacts from climate change.

i) ASEAN Centre for Energy (2026), ASEAN Centre for Energy (ACE) on the situation in the Middle East and the impact on ASEAN energy security. https://aseanenergy.org/press-release/asean-centre-for-energy-ace-on-the-situation-in-the-middle-east-and-the-impact-on-asean-energy-security
ii) UN Economic and Social Commission for Asia and the Pacific (2023), Closing the gap for SDG 7 in the Asia-Pacific region: Regional trends report on energy for sustainable development 2023. https://www.unescap.org/kp/2023/closing-gap-sdg-7-asia-pacific-region
iii) International Energy Agency (2024), Southeast Asia Energy Outlook 2024. https://www.iea.org/reports/southeast-asia-energy-outlook-2024

Why This Report Matters

This report provides a clear review of Southeast Asia's energy transition. It begins with historical progress since 2015, the year the Paris Agreement came into force. It then outlines the current status of clean energy policies, finance, socio-economic trends, and technology deployment across the region. The report also identifies key challenges in the three focus countries and offers practical recommendations for how different stakeholders can contribute.

By delivering this information in a comprehensive and visually accessible manner, this Stocktake Report can serve as a practical tool to help readers understand, plan, and support the acceleration of Southeast Asia's energy transition.

Alignment of ETP with ASEAN and national strategies

This Stocktake Report is framed within the strategic priorities of the Southeast Asia Energy Transition Partnership (ETP) and provides a high-level overview of how regional energy-transition efforts across ASEAN align with national strategies, the Paris Agreement, and the SDGs.

Alignment of Energy Policy with Climate Goals: Supports governments in developing and implementing coherent policy and regulatory frameworks for sustainable energy.

De-risking Clean Energy and Transition Investments: Reduces investment risks and links renewable energy, energy efficiency, and fossil fuel phase-down projects with financing institutions.

Sustainable and Resilient Energy Infrastructure: Advances resilient energy systems through development of smart grids and innovative technologies.

Just and Inclusive Energy Transition: Promotes a fair energy transition by integrating social, economic, and environmental considerations into the shift to a green economy.

Disclaimer

List of Abbreviations

A-C

3R reduce, reuse, reconcile
ACCF ASEAN Common Carbon Framework
ADB Asian Development Bank
ASEAN The Association of Southeast Asian Nations
AI artificial intelligence
AIMS III ASEAN Interconnection Masterplan Study Phase 3
APG The ASEAN Power Grid
ASP ancillary services procurement agreement
AWD alternate wetting and drying (rice cultivation methane reduction)
BAU business as usual
BEC building energy code
BESS battery energy storage system
BEV battery electric vehicle
BIDV Bank for Investment and Development of Vietnam
BIMP Brunei–Indonesia–Malaysia–Philippines
BNI Bank Negara Indonesia
CAM cathode active material
CCUS carbon capture, utilization and storage
CES-1 clean energy scenario 1 (Philippines)
CES-2 clean energy scenario 2 (Philippines)
CFPP coal-fired power plant
CIT corporate income tax
COP Conference of the Parties (UNFCCC)
CREVI Comprehensive Roadmap for the Electric Vehicle Industry (Philippines)
CREZ Competitive Renewable Energy Zones (Philippines)

D-E

DER demand-side energy response
DFI development finance institution
DOE Department of Energy (Philippines)
DPPA direct power purchase agreement
EE energy efficiency
EE&C energy efficiency and conservation
EMDE emerging market and developing economies
ESCO energy service company
ETM energy transition mechanism
ETP The Southeast Asia Energy Transition Partnership
ETS emissions trading system
EU European Union
EU CBAM EU Carbon Border Adjustment Mechanism
EV electric vehicle
EVIDA Electric Vehicle Industry Development Act (Philippines)
EVN Electricity of Vietnam

F-K

FDI foreign direct investment
FiT feed-in tariff
FOLU forest and other land use
FY fiscal year
GDP gross domestic product
GEA Green Energy Auction (Philippines)
GEAP Green Energy Auction Program (Philippines)
GEMP Green Energy Market Program (Philippines)
GEOP Green Energy Option Program (Philippines)
GFANZ Glasgow Financial Alliance for Net Zero
GFPP gas-fired power plant
GHG greenhouse gases
GIZ Deutsche Gesellschaft für Internationale Zusammenarbeit
$GtCO_2$ gigatonnes of CO_2
GOI government of Indonesia
GW gigawatt
GWh gigawatt-hour
HEV hybrid electric vehicle
ICE internal combustion engine
IDR Indonesian rupiah
ILO International Labour Organization
INA Indonesia Investment Authority
IPG International Partners Group (JETP)
IPP independent power producer
IPPU industrial processes and product use
IRP integrated resource planning
IRESS integrated renewable energy and energy storage system
JETP Just Energy Transition Partnership
JICA Japan International Cooperation Agency
koe kilograms of oil equivalent
koe /$ kilograms of oil equivalent per USD of GDP
$ktCO_2/\$$ kilotonnes of CO_2 per USD of GDP
kWh kilowatt-hour
kgCO2 kilograms of carbon dioxide

List of Abbreviations (continued)

L-O

LCOS levelized cost of storage
LPG liquefied petroleum gas
LTMS Lao–Thailand–Malaysia–Singapore
LTMS-PIP Lao–Thailand–Malaysia–Singapore Power Integration Project
LULUCF land use, land-use change and forestry
MAE Ministry of Agriculture and Environment (Vietnam)
MEMR Ministry of Energy and Mineral Resources (Indonesia)
MEPS minimum energy performance standard
MOC Ministry of Construction (Vietnam)
MOIT Ministry of Industry and Trade
MOU memorandum of understanding
MRV measurement, reporting and verification
$MtCO_2e$ million tonnes of CO_2 equivalent
Mtoe million tonnes of oil equivalent
MW megawatt
MWh megawatt-hour
NDC nationally determined contribution
NMC Nickel-Manganese-Cobalt
NGCP National Grid Corporation of the Philippines
OECD Organisation for Economic Co-operation and Development
OSW offshore wind

P-R

PDP 8 Power Development Plan VIII (Vietnam)
PEP 2023–2050 Philippine Energy Plan 2023–2050
PELP Philippine Energy Labeling Program
PHEV plug-in hybrid electric vehicle
PHP Philippine peso
PHS pumped hydropower storage
PLN Perusahaan Listrik Negara (Indonesia's utility)
PPA power purchase agreement
PPP public–private partnership
PR presidential regulation (Indonesia)
PSF Philippines' People's Survival Fund
PV photovoltaic
RE renewable electricity
REC renewable energy certificate
REF reference scenario (Philippines)
RES-SKILL Renewable Energy Skills Development Initiative (European Union)
RPS renewable portfolio standard (Philippines)
RTS rooftop solar
RUPTL electricity supply business plan (Indonesia)

S-Y

SCT special consumption tax
SEA Southeast Asia
SIPP Strategic Investment Priority Plan (Philippines)
SMR small modular reactor
SOE state-owned enterprise
STAMEQ Directorate for Standards, Metrology and Quality (Vietnam)
SUV sport utility vehicle
TDP transmission development plan (Philippines)
TKDN domestic content requirement (Indonesia)
TOE tonnes of oil equivalent
TPA third-party access
UAE United Arab Emirates
UKPACT UK Partnering for Accelerated Climate Transitions
UNDP United Nations Development Programme
UNOPS United Nations Office for Project Services
USD United States dollar
V2G vehicle-to-grid
VAT value-added tax
VDB Vietnam Development Bank
VEPF Vietnam Environment Protection Fund
VET vocational education and training
VIP Vietnam, Indonesia, Philippines
V-LEEP Vietnam Low Emission Energy
VMS Vietnam-Malaysia-Singapore
VNEEP Vietnam National Energy Efficiency Program
VRE variable renewable energy
WACC weighted average cost of capital
WESC wholesale electricity spot market
YTD year to date

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Executive Summary

ASEAN needs more renewable electricity (RE) to meet its targets and more investment to scale clean energy.

Target of RE share in grid

45%

by 2030

Percent of RE share in ASEAN grid in 2024

24%

of total electricity generation

31%

of total installed capacity

Hydro has the highest installed capacity

58 GW

15 GW was added from 2015 - 2024

Solar PV saw the highest level of growth

24 GW

2015 – 2024

As energy demand keeps on increasing, coal remains a major source of power in ASEAN.

48% of ASEAN's electricity mix came from coal in 2024.

Laos has the highest share of RE in the grid.

77%

Laos is a major electricity exporter due to its abundant hydropower resources.

ASEAN needs more investment in clean energy

Vietnam has the highest volume of RE installed.

48.7 GW

Vietnam added 31.9 GW of new RE installed capacity between 2015 and 2024.

Energy investment in ASEAN

2%

ASEAN shared 2% of the global clean energy investment

$ 47 billion

was invested in clean energy in 2024

$ 50 billion

was invested in fossil fuel energy in 2024

The ASEAN Interconnection Masterplan Study (AIMS) III estimates a requirement of $764 billion in investment to build the transmission and power generation necessary to accommodate high levels of variable renewable energy adoption.

Renewable energy is a priority for ASEAN, as reflected in the power plans of Vietnam, Indonesia, and the Philippines. Each country targets around 30% RE share by the 2030s.

Vietnam

28 - 36% by 2030s

28-36% of the power generation mix is targeted to come from variable renewable energy (excluding hydro power) by 2030.

PDP 8, issued in April 2025, plans to double the renewable power installed capacity by 2030s.

54.8 GW in 2024

Hydropower holds the largest share of installed renewable capacity, followed by solar PV.

111 – 163 GW by 2030s

The installed capacity will be led by solar PV and wind technologies.

$ 266 billion from 2026 - 2035

Vietnam requires $266 billion for developing the RE power plants, storage, and grids under PDP 8.

Indonesia

According to the RUPTL, RE is projected to reach 70% of installed capacity by 2034. The Asta Cita mission will add a further 100 GW of solar PV to strengthen energy self-sufficiency in Indonesia.[1]

Indonesia's RUPTL (2025 – 2034) expects to boost solar PV and hydro capacity by 2034.

13.2 GW in 2024

Hydro and bioenergy share more than 80% of the total RE installed capacity.

52.9 GW by 2034

Solar PV will be the dominant power source, followed by hydro power.

$ 128 billion from 2025 - 2034

Indonesia needs $128 billion for RE power investment, and the private sector should be the main contributor.

Philippines

30 % by 2030

30% of power generation is targeted from renewables by 2030, rising to 50–70% by 2050 depending on the scenario.

PEP 2023–2050 projects hundreds of GW of new RE installed capacity by 2050.

9.3 GW in 2024

Hydro and solar PV are top two technologies sharing 65% of the total RE installed capacity.

107 – 115 GW by 2050

Solar PV leads under REF and CES-1 scenarios, while offshore wind dominates under CES-2 scenario.

$ 146 - 256 billion from 2023 - 2050

The Philippines requires USD 146–256 billion, depending on the scenario, under its PEP.

Upcoming energy transition trends also bring economic opportunities.

Socio-Economic Opportunities

ASEAN has significant opportunities in clean-tech, low-carbon mobility, and high efficiency buildings.

Clean-Tech Economic Opportunities

Clean technologies and e-mobility offer major economic opportunities for ASEAN, with an estimated USD 90–100 trillion in potential revenue.

Countries can capture value across clean-energy supply chains—for example, Vietnam in EV and solar manufacturing, Indonesia in two-wheeler EVs and batteries, and the Philippines in solar modules.

RE Employment Potential

Renewable energy employment in Southeast Asia exceeded one million jobs in 2023, primarily in bioenergy, solar, and hydropower.

The total number of RE-related jobs is projected to approach 2 million by 2030, with these sectors remaining dominant.

High Efficiency Buildings

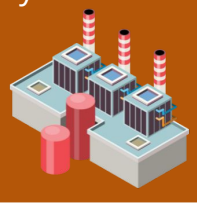
Energy-efficient buildings, building electrification, and on-site clean energy could mobilize USD 20–25 billion in investment.

This signals the need for ASEAN governments to update and enforce energy conservation and efficiency regulations.

The energy transition should be implemented carefully, considering economic, environmental, and technical factors.

Considerations during the Energy Transition

Energy transition activities can affect jobs, the environment, and electricity reliability.



Jobs in Coal-Related Industries

The energy transition, particularly coal phase-down, will significantly affect coal-dependent countries such as Indonesia, potentially leading to the loss of hundreds of thousands of jobs.

Mining of Minerals for Battery Production

Battery production, mining, and processing can increase incomes and improve living standards; however, poorly managed mining can cause significant negative impacts, including air and water pollution and deforestation.

Grid and System Flexibility

Grid capacity and operational constraints make it harder to integrate higher shares of variable renewables. Addressing this will require integrated resource planning, grid upgrades, investment, and greater system flexibility, while managing fiscal and financial constraints.

ASEAN needs holistic approaches to enable an accessible, sustainable, and resilient energy transition.

Policies and investment are prioritizing renewables, but coal phase-down, grid development, energy efficiency and demand-side management need stronger support to address grid challenges under high-renewables scenarios.

1 Transitioning power generation through the phase-down of coal power plants

Coal power plants should be phased down to deliver environmental and public health benefits. As renewable energy shares increase, coal plants, designed for baseload operation with limited flexibility, face growing operational challenges.

Achieving a coal phase-down requires strong collaboration among governments, the private sector, and international partners to establish clear roadmaps and provide technical and financial support for coal power plants early retirement.

2 Transition in the grid to improve capacity, flexibility, and reliability

Power grids must be expanded and made more flexible to integrate variable renewables while maintaining system reliability, to support several ASEAN countries' ambitions to reach over 50% renewable energy.

Achieving this requires alignment between governments and the private sector, including policies that enable private investment in critical infrastructure such as energy storage systems and transmission networks.

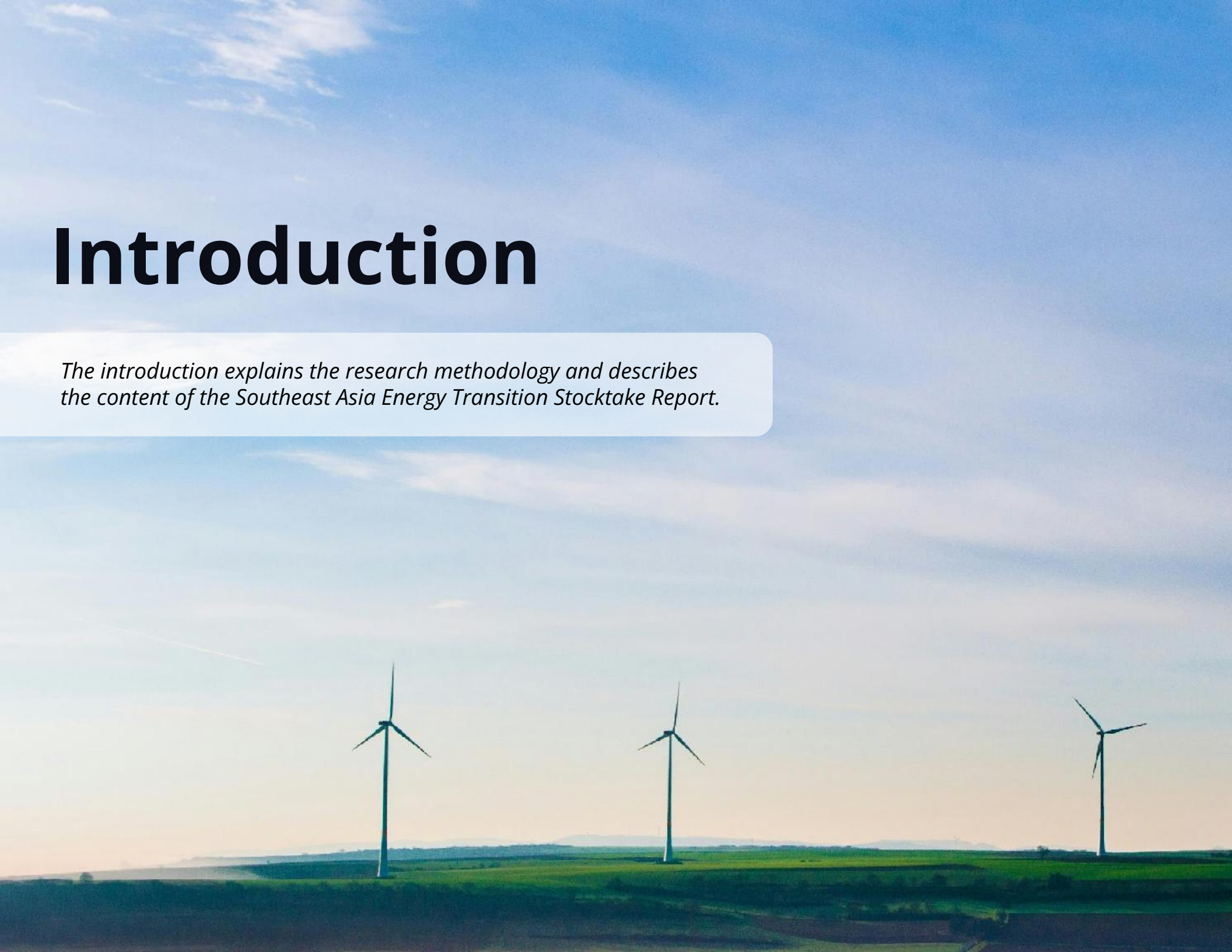
3 Transition in demand to optimize load through demand-side management

Energy efficiency, demand-side management, vehicle-to-grid (V2G), and smart grid solutions can optimize grid loads and enhance system capacity and flexibility from the demand side.

Government may update and enforce policies beyond current minimal energy efficiency and conservation frameworks. Public and private sectors can pilot and scale solutions such as demand-side management, V2G, and smart grids.

Introduction

The introduction explains the research methodology and describes the content of the Southeast Asia Energy Transition Stocktake Report.



Methodology

This report explores the energy transition in Southeast Asia, with a focus on Vietnam, Indonesia, and the Philippines, structured around three key questions.

1 WHAT is changing in Southeast Asia energy systems?

Energy Transition Statistics

- **Key indicators** have been collected including GHG emissions intensity, installed renewable capacity, renewable and coal shares in the electricity mix, and EV market share from high-credibility sources, including the World Bank, UN agencies, and official national reports, with data provided by Enerdata.
- **Quantitative analysis** is conducted based on historical trends and changes (increases, decreases, and structural shifts).

2 WHY are these changes occurring?

Systematic Review of Policies and Studies

- **Review of past and current energy and climate policies** to explain observed trends and government priorities and intended transition pathways.
- **Needs and impacts** associated with energy transition dynamics across countries identified.

3 HOW can clean energy transitions be accelerated?

Insights from Energy Sector Experts

- **Interviews with energy sector experts conducted.**
- **Insights** from implementing projects across Southeast Asia.
- **Opportunities for addressing information gaps**, improving policy effectiveness, and strengthening energy transition outcomes.

Inside the Report

Chapter 1: Energy Transition Progress in Southeast Asia

Descriptive analytics to understand the energy transition progress

Progress being made by Southeast Asian countries in achieving their energy transitions has been assessed using four key energy transition indicators: (i) electricity use to understand demand characteristics; (ii) GHG emissions per USD GDP to gauge efficiency relative to economic size; (iii) renewable installed capacity to reflect the scale of project development; and (iv) electricity mix to indicate the pace of shift from fossil fuels to renewable sources of electricity

These indicators, together with an analysis of domestic and international energy policies and investment trends, help explain what is driving the region's energy transition and how it is evolving.

Chapter 2: The Energy Transition Landscape

Systematic review of energy transition drivers

The year 2025 marks a highly active period for energy transition efforts across Southeast Asia. This report highlights the most impactful national and regional drivers across three themes.

Key policies such as power development plans, low-emission transport strategies, energy efficiency measures, and carbon pricing frameworks in the three focus countries are reviewed.

Financing including regional needs, historical financial flows, and existing instruments are analyzed to determine if funding is sufficient and accessible for energy transition initiatives.

Socio-economic insights to highlight other opportunities for job creation and clean-tech investment across the region.

Chapter 3: Key Findings and Energy Transition Trends

Expert insights that lead to action

Readers can learn from expert insights and recommendations. Each Southeast Asian country has its own strategic plan, and the interviewed experts in policy, finance, and regional collaboration from Vietnam, Indonesia, and the Philippines provide valuable country-specific perspectives.

Their inputs have been converted into a consolidated list of recommendations and next steps for governments, the private sector, and development partners to accelerate renewable energy expansion, address grid challenges, and promote low-emission transportation.

CHAPTER 1

Energy Transition Progress in Southeast Asia

This chapter highlights regional energy transition efforts through a descriptive analysis of the data. It examines GHG emissions, NDCs, energy consumption, renewable power capacity, and the electricity mix in ASEAN and the three focus countries, Vietnam, Indonesia, and the Philippines, starting from 2015, when the Paris Agreement took effect, until end of 2024 (and where data are available through 2025).

ASEAN's carbon dioxide (CO_2) emissions intensity is rising even as Asia's overall intensity declines

Between 2015 and 2024, Asia's CO_2 emissions intensity (per unit of GDP) declined, largely due to reductions in China, which accounts for half of the region's GDP. In contrast, the GHG emissions intensity in ASEAN **rose by 15%,** although it still remains below the Asia average.

Percent Changes of CO_2 emission per GDP

From 2015 - 2024

Asia
-10%

ASEAN
+15%

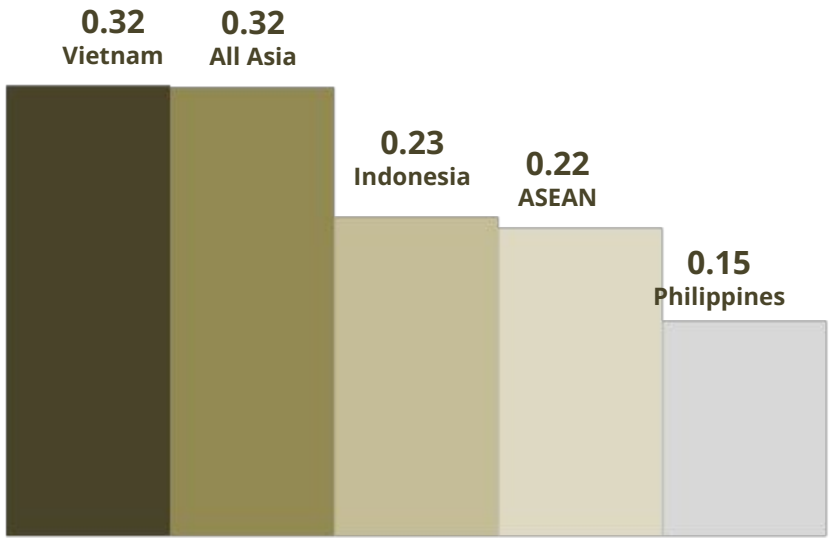
Vietnam
+ 44%

Indonesia
+23%

The Philippines
+10%

In 2024, among the three focus countries, Vietnam recorded the highest CO_2 emissions per unit of GDP ($ktCO_2$/ constant 2015 USD), followed by Indonesia, while the Philippines reported the lowest intensity.

CO_2 Emissions per 2015 USD GDP*
in 2024



* CO_2 = $kgCO_2$; GDP = GDP expressed in constant 2015 USD, using the purchasing power parity (PPP) method, to avoid the effect of inflation.

ASEAN's CO_2 emissions continue to rise in line with growing energy demand, particularly the industrial sector, with coal maintaining a significant share in the energy mix

ASEAN energy use increased from 412 Mtoe in 2015 to 522 Mtoe in 2024 (x1.3), with industry as the largest consuming sector.

However, energy intensity (energy use per USD GDP) declined in 2023–2024 compared with pre-2020 levels, indicating improvements in equipment and appliance efficiency, electrification and fuel switching, and structural economic shifts, despite higher total energy consumption.[2]

Final energy consumption increases from 2015 - 2024

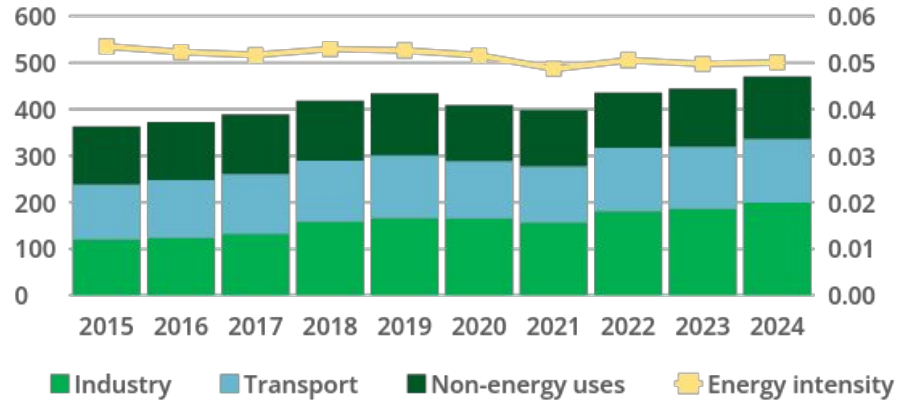
Industrial
x1.66

Transport
x1.16

Agriculture
x1.07

Energy Use (Mtoe)
From 2015 - 2024

Energy Intensity (koe / constant 2015 USD)*
From 2015 - 2024



* kilograms of oil per constant 2015 USD.

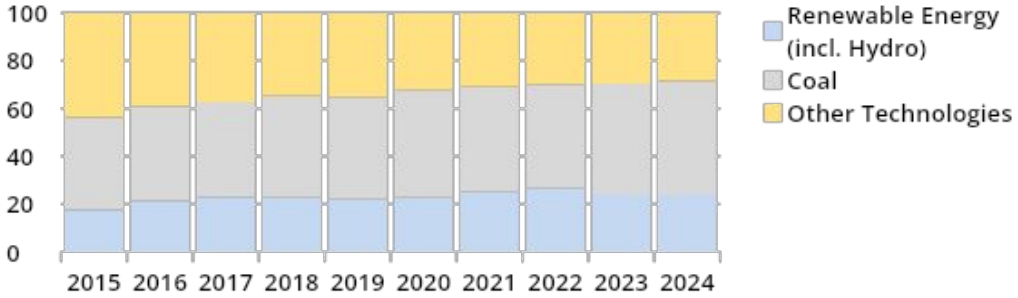
CO_2 emissions are also driven by the energy supply mix. CFPPs dominate electricity generation in ASEAN. Electricity output from CFPPs grew from 39% to 48% of the electricity mix between 2015–2024 while electricity output from RE power plants grew from 17% to 24% over the same period.

Electricity generation by source in 2024

Renewable
24%
The RE share increased gradually from 17% in 2015 to 24% in 2024.

Coal
48%
Coal shared approximately 48% in ASEAN grid in 2024, up from 39% in 2015.

Share of Electricity Generation (%)
From 2015 - 2024

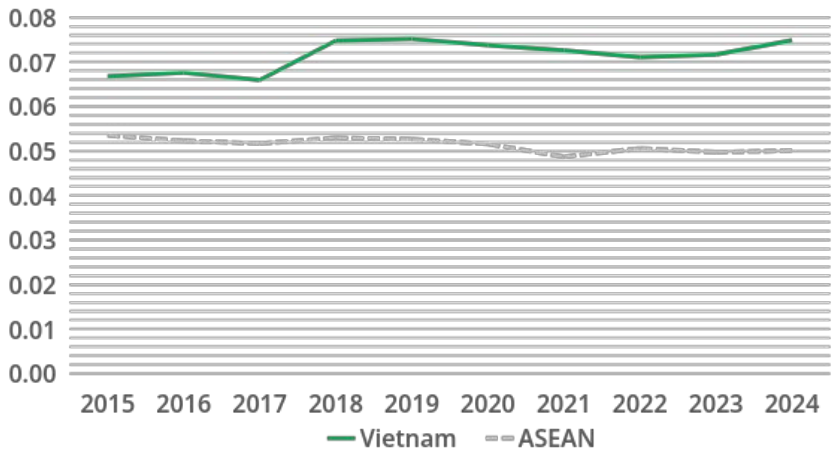


Vietnam

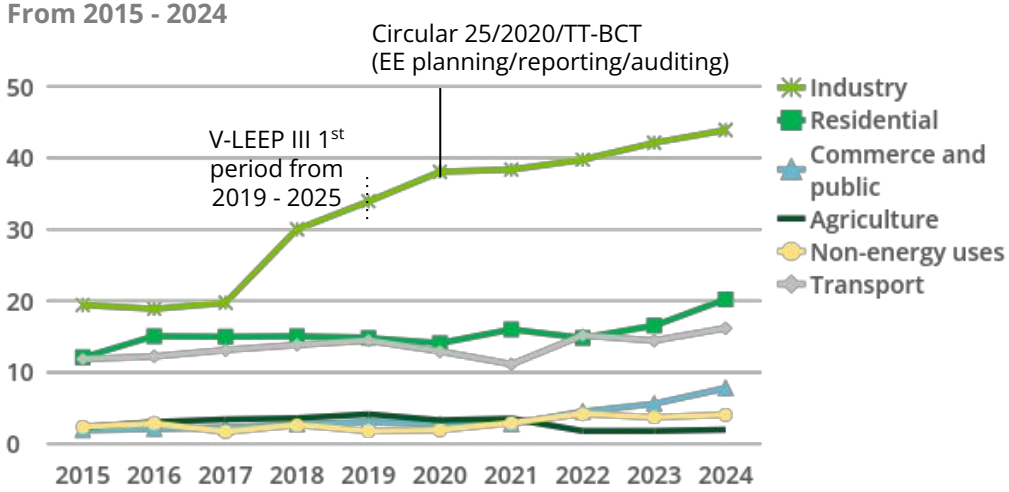
Vietnam's energy intensity is higher than the ASEAN average, and energy consumption has increased, driven mainly by the industrial sector.

Vietnam's energy intensity (energy use per USD GDP) has increased since 2017, with a notable jump in 2018, in line with the rising share of industrial energy use. Between 2015 and 2024, energy intensity rose by 12%, while energy use increased by 89%.

Energy Intensity (koe / constant 2015 USD)
From 2015 - 2024



Energy Consumption (Mtoe)
From 2015 - 2024



Industrial energy use increased 2.3 times between 2015 and 2024, in line with rapid manufacturing and industrial-park expansion driven by industrialization policies supported by investment incentives.

Consumption in the residential, commercial, and public sectors increased over the same period. Notably, energy use of these sectors rose more than 20% between 2023 and 2024, potentially influenced by heatwaves that increased cooling demand and pushed power use to new highs.[3]

Current industrial decarbonization efforts

Direct use of coal remains a major energy source in the industrial sector. However, coal use declined by 14% in 2023 from its 2020 peak, while electricity consumption continued to increase.[4]

Vietnam (continued)

Vietnam emerged as a regional leader in RE power, driven by FiTs, while the power sector continued to rely on CFPPs for a substantial share of the country's electricity generation.

Installed capacity additions from 2015 – 2024:

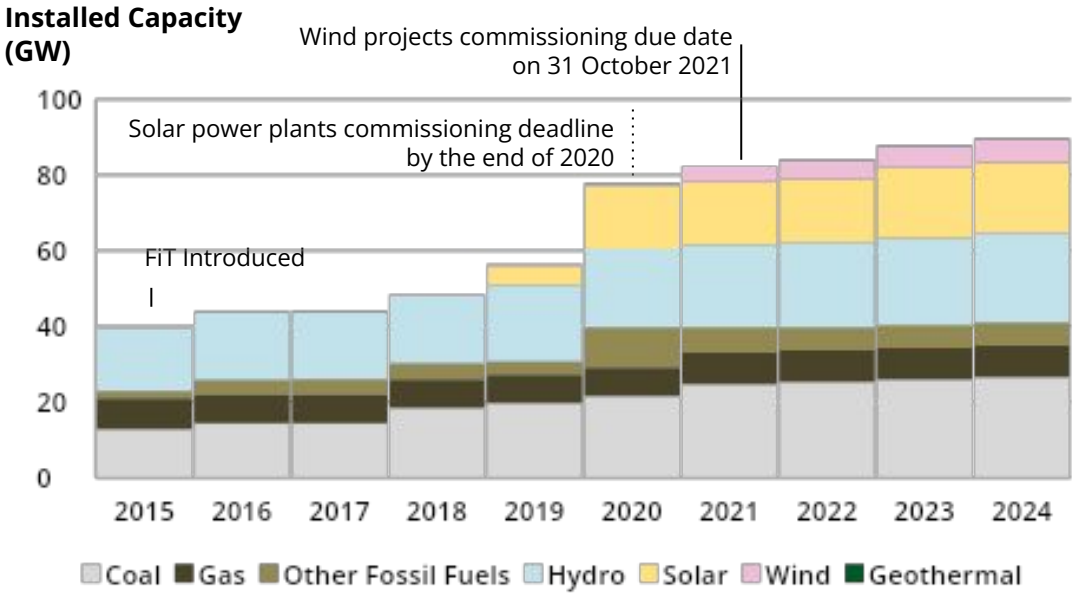
Solar	Wind	Hydro	Coal
+19 GW	+6 GW	+7 GW	+14 GW

Vietnam's attractive feed-in tariffs (FiTs) drove rapid solar and wind growth through 2021. Since the FiT schemes ended, RE power capacity has stagnated as investors await clearer guidance under the new ceiling price mechanism.

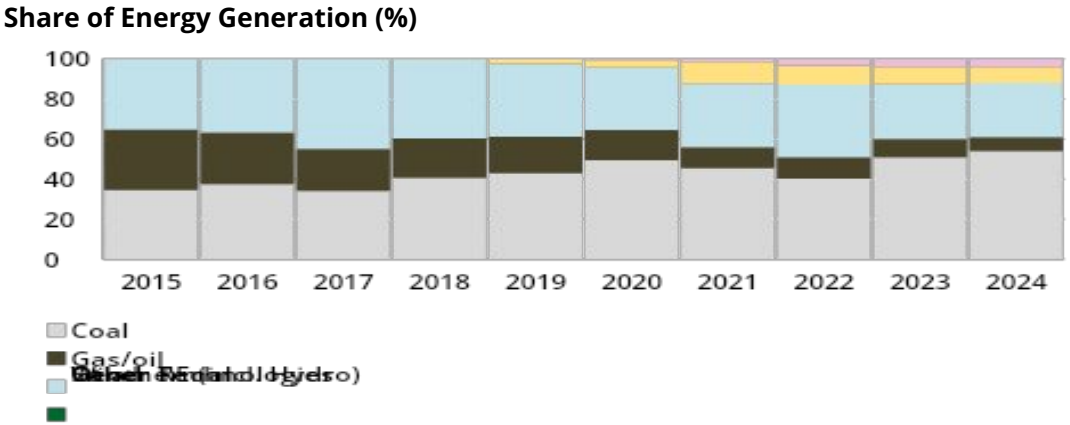
Rapid renewable deployment also led to grid congestion and curtailment, highlighting the need for grid and energy storage expansion to transmit power from the resource-rich central and southern regions to demand centers in the south (Saigon) north (Hanoi).[5]

Meanwhile, the installed capacity of CFPPs, and their share in electricity production have continued to rise to meet growing electricity demand. CFPPs supplied over 50% of Vietnam's electricity production in 2024.

Installed capacity grows significantly from additional capacity of solar PV, wind, and CFPPs.



Electricity produced from RE accounted for more than 30% of Vietnam's electricity generation in 2024, well above the ASEAN average. However, most is generated by hydroelectric plants, which have limited expansion potential.

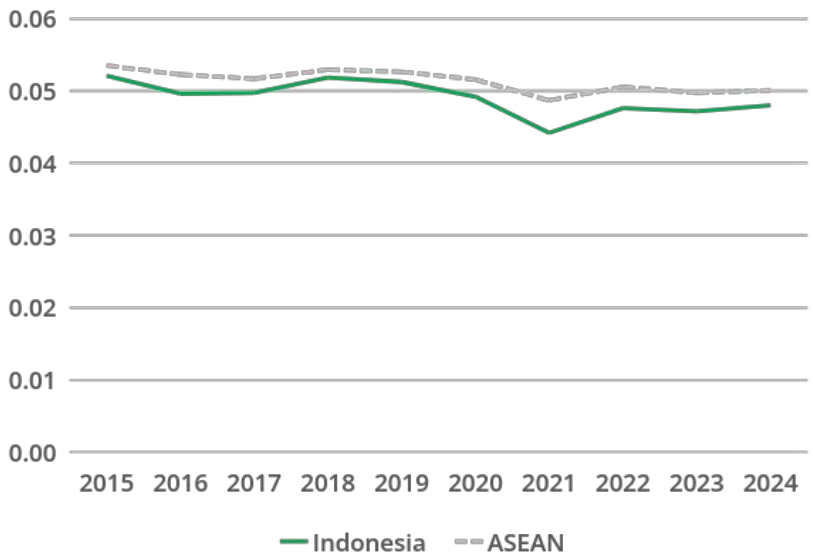


Indonesia

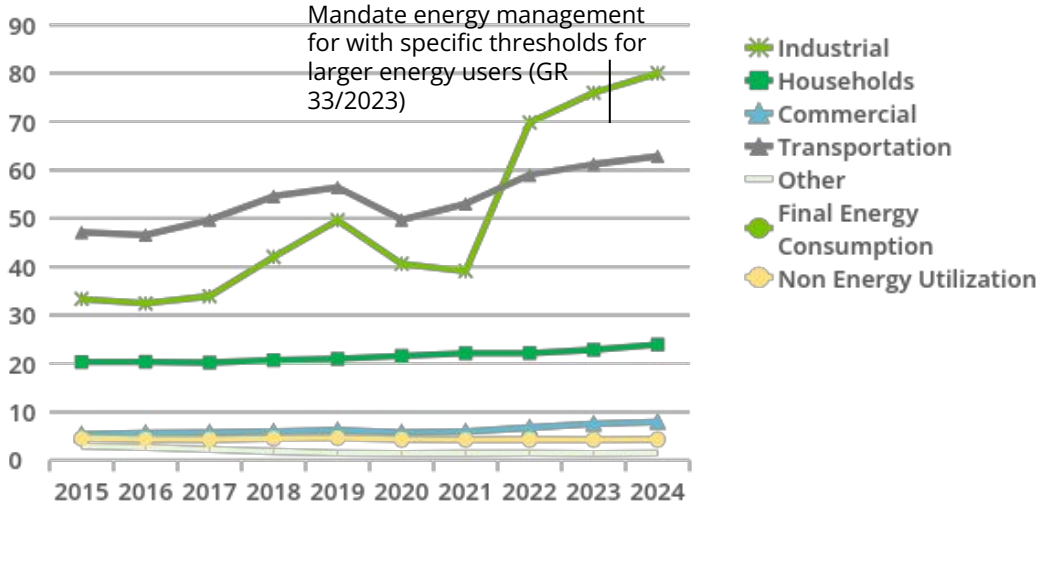
Indonesia's energy intensity has remained below the ASEAN average, while energy use has continued to increase.

Indonesia's energy use per GDP fluctuated over time but was 11% lower in 2024 than in 2015. Over the same period, energy use increased by 32%. Although energy use increased, the decline in energy intensity indicates more efficient energy use per unit of economic output.

Energy Intensity (koe / constant 2015 USD)
From 2015 - 2024



Energy Use (Mtoe)
From 2015 - 2024



The industrial sector has been the largest energy-using sector since 2022, with faster growth after 2017 driven by economic expansion. Energy use temporarily declined in 2020–2021 due to COVID-19 but rebounded thereafter. Although energy-management requirements were mandated in 2023, their impact on energy use has been limited. By 2024, industrial energy use was approximately 2.4 times its 2015 level.

The transport sector was the largest energy-using sector until 2021, and its energy use increased by 33% over the decade.

Indonesia (continued)

The 35 GW Program + Captive Coal expanded CFPP capacity, despite the cancellation of some projects.

Installed capacity additions from 2015 – 2024:

Solar	Geothermal	Hydro	Coal
+1 GW	+2 GW	+1 GW	+28 GW

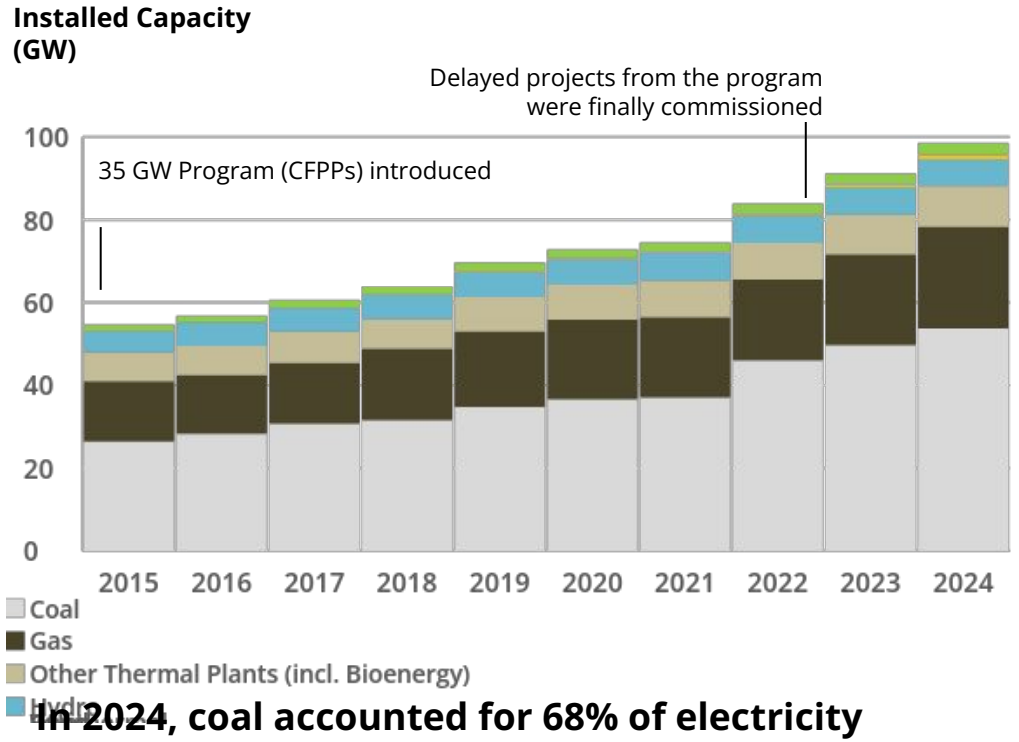
CFPPs accounted for 35% of total electricity generation in the early 2000s, increased to 50% in 2014 and then reaching 62% after 2020.[6] The GOI and PLN launched a program in 2015 to add 35 GW by 2019–2020. However, financing and construction delays resulted in only 8.2 GW being added by 2022. The GOI also cancelled 13.3 GW of planned coal projects from PLN's RUPTL 2019–2028.[7] Coal capacity continued to increase after 2022 through additional captive, off-grid coal-fired power plants for industrial use. [8]

Renewable power capacity grew relatively slowly during this period due to the lack of supportive public policies and insufficient financial incentives.[9] **Solar PV and wind capacity together reached about 1 GW** due to intermittency challenges, while **hydropower and geothermal added around 3 GW**.

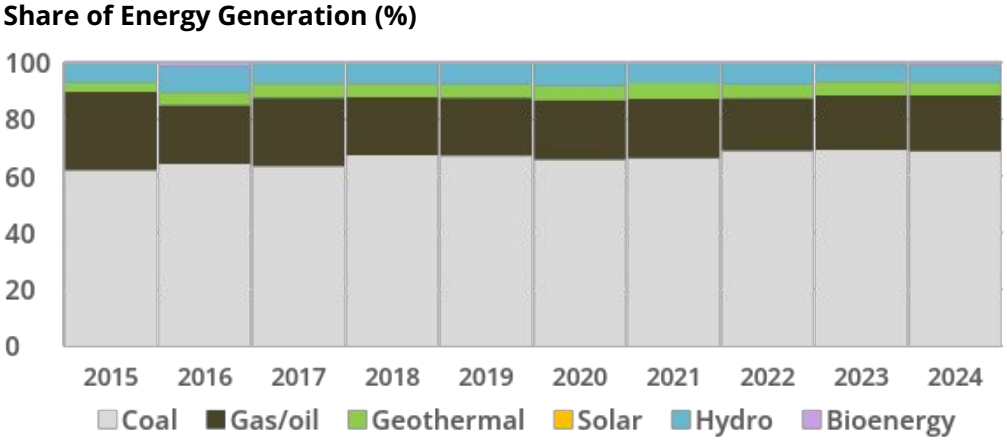
Examples of grid investments in Indonesia

Indonesia faces an aging and fragmented grid. Investments such as upgrading the Java–Madura–Bali electricity control center were undertaken to enable higher variable renewable electricity (VRE) integration. [10]

Installed capacity (GW) is dominated by CFPPs, with only a few gigawatts coming from RE power plants.



In 2024, coal accounted for 68% of electricity generation in Indonesia, while renewables contributed 12%, including 7% from hydropower.

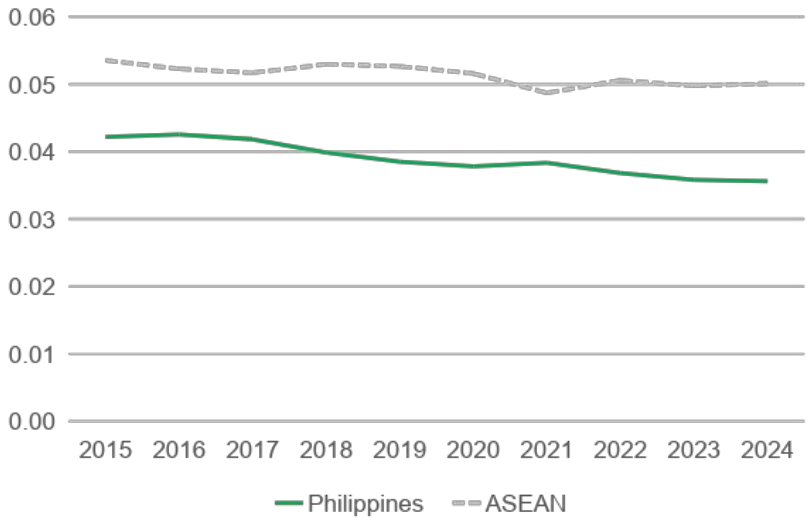


Philippines

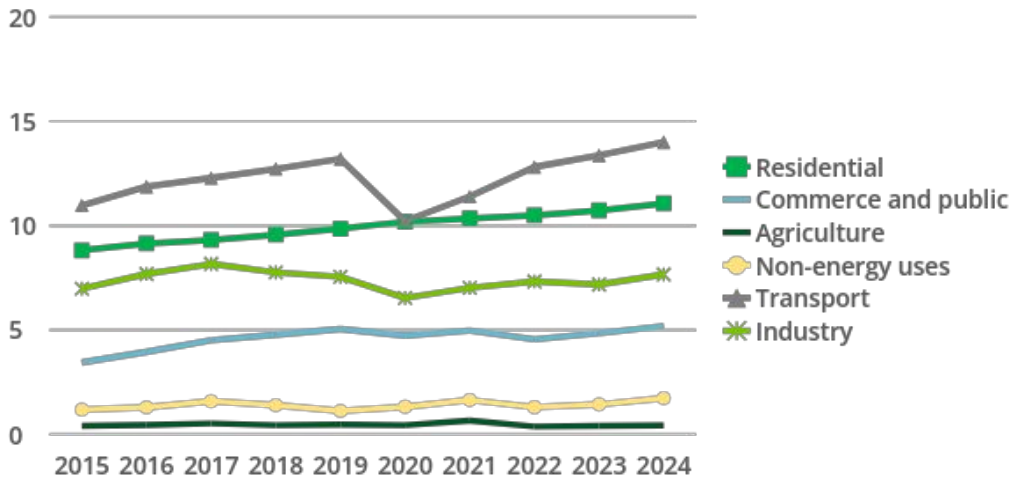
The Philippines' energy intensity has been declining and remains below the ASEAN average, while energy use has gradually increased

The Philippines' energy intensity declined by 14% between 2015 and 2024 and is, on average, 24% lower than the ASEAN level. Over the same period, energy consumption increased by 26%. Unlike Vietnam and Indonesia, energy use in the Philippines is dominated by the transport sector, followed by the residential sector.

Energy Intensity (koe / constant 2015 USD)
From 2015 - 2024



Energy Use (Mtoe)
From 2015 - 2024



Transport energy use has steadily increased over time. A temporary decline occurred in 2020 due to reduced mobility during COVID-19 lockdowns. By 2024, energy use exceeded pre-pandemic (2019) levels.

Household energy use has also increased, averaging about 2.5% per year. This trend is continuing due to growth in air-conditioning demand and other cooling needs.

Philippines (continued)

No new CFPPs are expected after 2027. Meanwhile, significant RE power capacity from GEAP is expected to come online.

Installed capacity additions from 2015 – 2024:

Solar	Wind	Coal
+2 GW	<1 GW	+7 GW

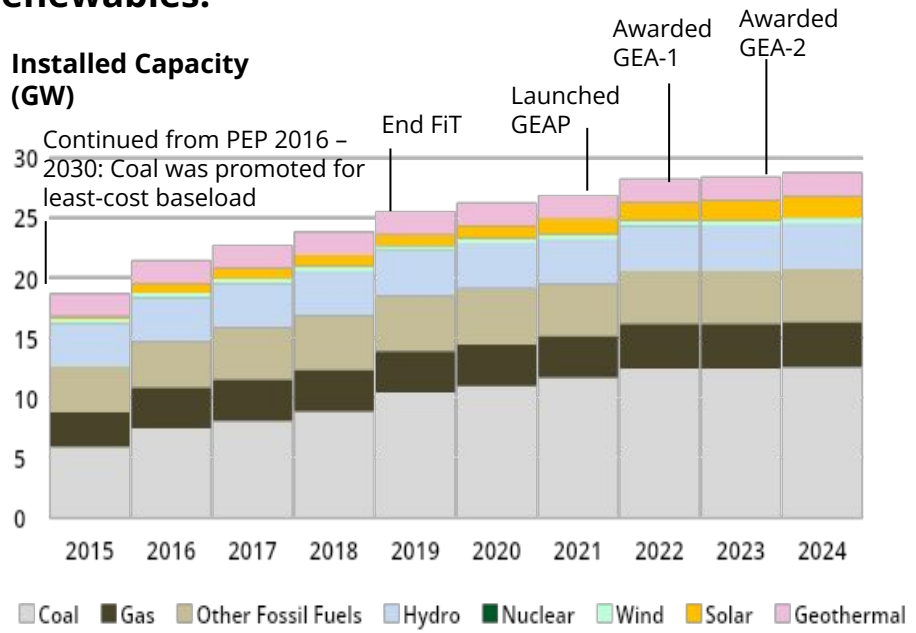
Coal power capacity in the Philippines has increased significantly, driven by the previous Philippine Energy Plan (PEP 2016–2030), which promoted the use of low-cost fuels such as coal to provide least-cost baseload power.[11] However, following the enforcement of the 2020 coal moratorium [12] and the current Philippine Energy Plan (2023–2050), together with market developments, no additional greenfield coal capacity is projected beyond 2027 under the REF and CES-1 scenarios, and beyond 2025 under the CES-2 scenario.

The Green Energy Auction Program (GEAP) has since become the main driver of renewable power growth. By 2025, 1.8 GW from GEA-1[13] and by 2026, 3.6 GW from GEA-2[14] and **9.4 GW from GEA-4[15], awarded in 2025 as the country's largest renewable capacity additions, will be added**, mainly from solar PV.

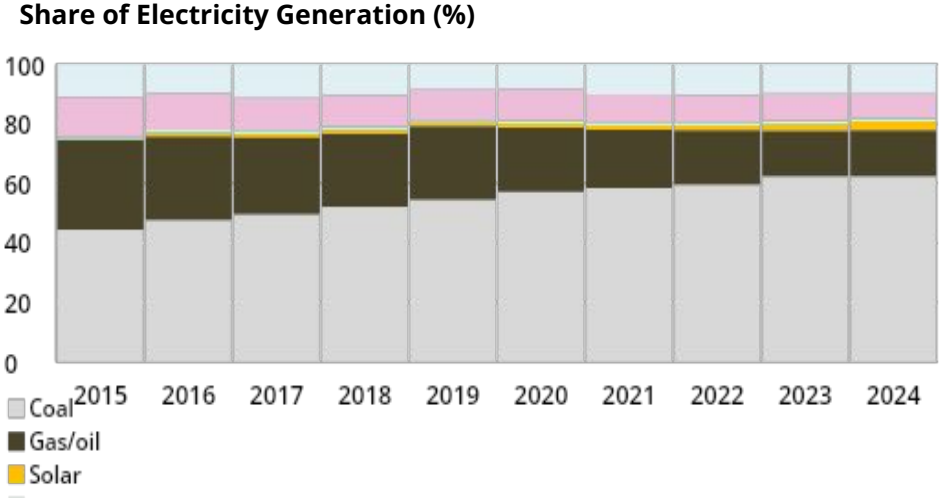
Examples of grid planning in the Philippines

While GEAP accelerated renewable energy investment, the Philippines has faced grid reliability challenges due to inadequate network expansion and limited smart grid investment over the past decades. Strategic plans, such as *smart grid roadmap* and *energy transition roadmap*, aim to prioritize grid and digital investments and enhance renewable integration.[16]

In the past decade, 10 GW of installed capacity was added, 24% of new capacity from renewables.



Coal's share in the generation mix rose from 44% to 62% while gas declined, keeping the share of fossil fuels around 70%.



Strengthened international cooperation and energy transition policies will be key for the three focus countries to achieve their climate ambitions.

In their updated 2030 NDCs, the three focus countries commit to reducing their GHG emissions below BAU levels across key sectors—particularly energy due to its high abatement potential—with targets set at two levels: unconditional reductions achievable through domestic efforts and conditional reductions dependent on international support.

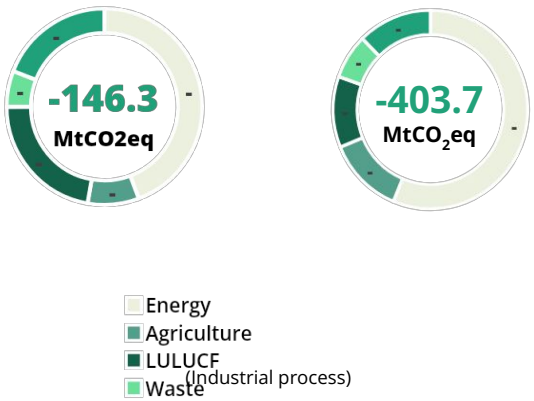
Key energy-sector mitigation policies include accelerating clean energy deployment, phasing down coal, improving energy efficiency and conservation, promoting e-mobility, and introducing carbon pricing, as discussed in Chapter 2: The Energy Transition Landscape.

GHG emission reduction targets by country and sector

Vietnam

Unconditional
-16 %
From BAU

Conditional
-44 %
From BAU

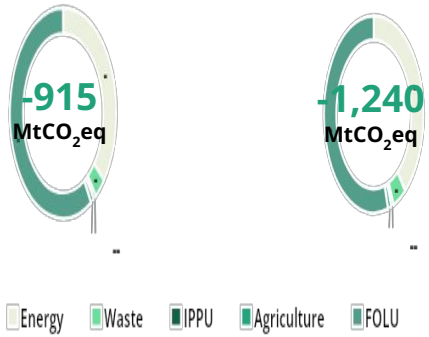


- Largest reductions are expected from the energy sector, ranging from 64 to 227 $MtCO_2e$.
- Conditional target (-44%) nearly triples the unconditional (-16%), underscoring the need for global cooperation.

Indonesia

Unconditional
-32 %
From BAU

Conditional
-43 %
From BAU

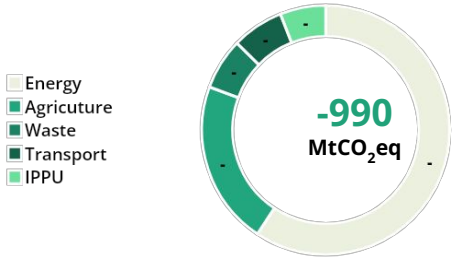


- Revised NDC raised the BAU baseline, leading to higher absolute emissions than in the previous plan.
- Majority of reductions are expected from forestry and land use (FOLU), followed by the energy sector.

Philippines

Unconditional
-3 %
From BAU

Conditional
-72 %
From BAU

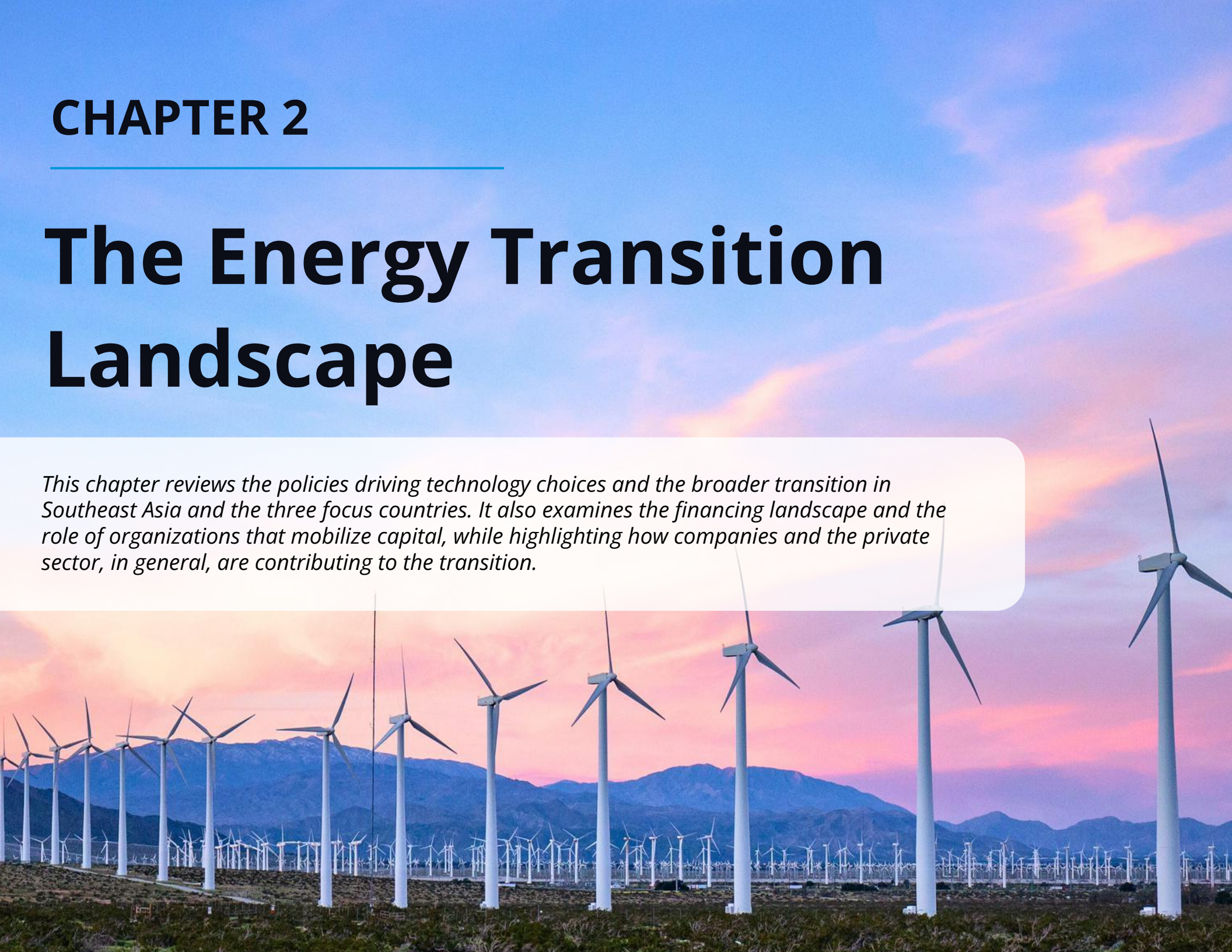


- Targets a 75% reduction in GHG emissions by 2030, mostly conditional (72%).
- Energy and transport sectors contribute the largest shares of planned reductions under the NDC Implementation Plan.

CHAPTER 2

The Energy Transition Landscape

This chapter reviews the policies driving technology choices and the broader transition in Southeast Asia and the three focus countries. It also examines the financing landscape and the role of organizations that mobilize capital, while highlighting how companies and the private sector, in general, are contributing to the transition.



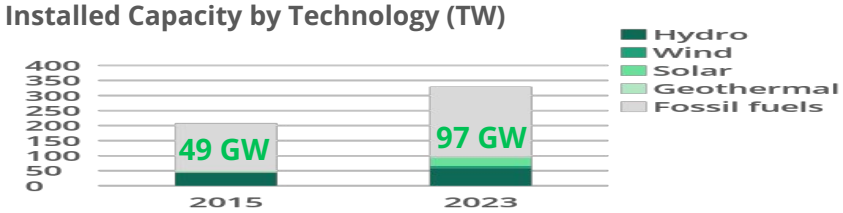
2.1 Key Forces Shaping ASEAN's Energy Transition

This section outlines the status of key energy transition drivers, including renewable energy development, power planning, coal phase-down, electric vehicle support, energy efficiency, and carbon market initiatives across Southeast Asia and the three focus countries: Vietnam, Indonesia, and the Philippines.

ASEAN's energy transition is being shaped by four forces: RE expansion, coal phase-down, EV promotion, and carbon pricing — all requiring flexible grids

Increasing renewable electricity generation

ASEAN has set a collective target of renewable power plants accounting for at least 45% of ASEAN's installed capacity by 2030[17], positioning renewables to both (a) replace coal capacity and (b) drive a broader decarbonization of the power sector.



Installed RE power plants doubled from 2015 to 2023, from 49 GW to 97 GW, reaching 31.4% of total ASEAN power capacity. However, most of this comes from hydropower, while only about 10% from wind and solar.

Adopting e-mobility

Promoting EVs is an increasingly important strategy in ASEAN to reduce transport emissions and support domestic industries. Driven by government policies and growing environmental awareness, EV sales in ASEAN-6 increased from 9% of total car sales in 2023 to 13% in 2024.[18]

Reducing reliance on coal for electricity generation

ASEAN countries have set different milestones for reducing their dependence on coal. **Phasing out** refers to a complete exit. For example, Vietnam has committed under the JETP to phase down unabated coal and move toward a full exit closer to 2050. **Phasing down** means reducing reliance without complete elimination, as in Indonesia and the Philippines, where some plants are expected to remain operational into the 2050s.

Implementing carbon pricing

ASEAN countries are adopting carbon taxes, emissions trading systems (ETS), or cap-and-trade schemes to regulate private sector emissions. A carbon tax increases costs for carbon-intensive activities, while the ETS allocates tradable emission allowances. Vietnam is currently piloting an ETS covering power plants and emissions-intensive industries. Similarly, Indonesia has introduced a cap-and-trade scheme for CFPPs. The Philippines is still awaiting approval of a national emissions cap-and-trade system.

Grid reliability and flexibility are critical in the energy transition.

To achieve their NDCs, ASEAN countries must reduce GHG emissions in the energy and transport sectors by expanding renewable energy and electrifying industry and transport. This transition requires reliable and flexible grids, supported by investment in grid development and complementary measures such as energy efficiency and demand-side management, BESS, and the ASEAN Power Grid (APG) to enhance cross-border trade and system flexibility.

Vietnam's power demand is expected to grow rapidly, driven by data centers, EV adoption, and decarbonization-led industrial electrification. Combined with a rising share of solar PV and wind, this will require greater grid flexibility, including BESS and smart-grid development.

Electric Vehicles

While the government offers incentives and regulations for EV users, the country also has a strong EV manufacturing base. VinFast, the national champion, delivered over 100,000 units in 2025, leading the domestic market.[19]

Demand Growth from Data Centers

Peak demand is projected to reach 90 –100 GW,[20] with data centers emerging as a major growth driver. Data center demand alone is expected to increase from around 525 MW in 2025 to about 950 MW by 2030.[21]

Energy Efficiency for Industrial Decarbonization

Vietnamese industries face growing pressure to decarbonize from global supply chains, reinforced by domestic climate policies including GHG MRV and energy efficiency programs under the EE Law and VNEEP3.[22]

Solar and Wind

More than 100 GW of installed capacity from solar PV and wind are expected by 2030s[23]. The government is developing clean-tech hubs building from their strong manufacturing capacity.

ETS Carbon Trading

Emissions-intensive sectors such as steel and cement face additional pressure from market mechanisms, notably the EU CBAM (effective 2026) and Vietnam's ETS roadmap (full implementation by 2029). [22]

Battery Storage

BESS is accelerating, with EVN's 50 MW pilot underway[22] and PDP 8 setting interim 300 MW and revised 10–16 GW targets by 2030.[23]

Smart Grid Development

Smart-grid development is highlighted in PDP 8 and its revised version as a priority for enhancing grid flexibility. ETP assessed Vietnam's smart-grid readiness against Decision 1670/QD-TTg (2012) and recommended updates to regulations and technologies, including real-time monitoring and control of distributed energy resources (DER), substation automation, communications infrastructure, and cybersecurity.[24]

Vietnam's energy transition focuses on RE power expansion, coal phase-down, EV promotion, and carbon pricing supported by policy and finance frameworks.

Policies Driving Vietnam's ET

Clean Energy Acceleration
- Ease RTS installation process
- Announce DPPAs
- Implement RE ceiling prices

Coal Repurposing
- Ban new CFPPs by 2030
- Phaseout CFPPs by 2050

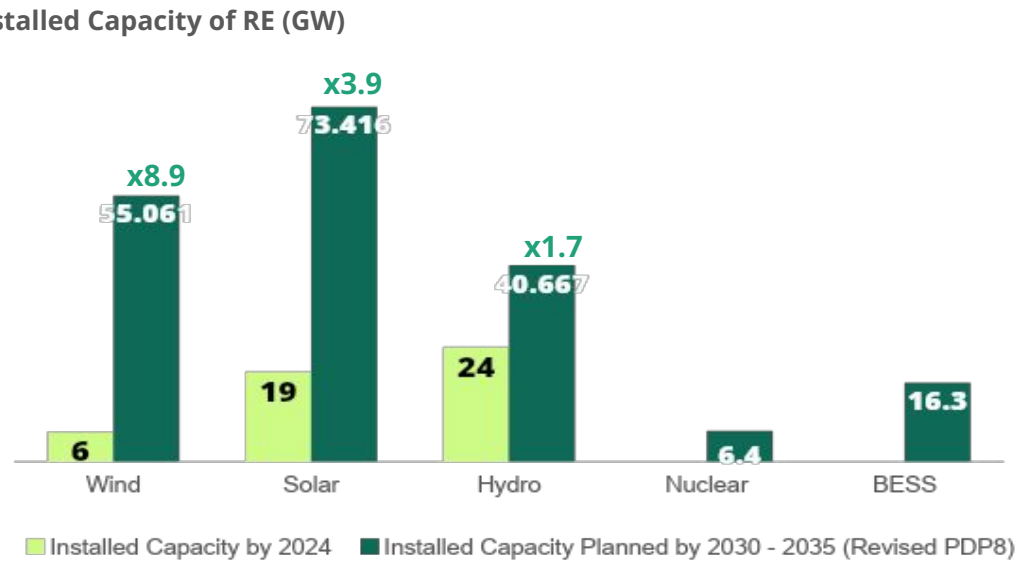
Energy Conservation & Efficiency
- Enforce energy management laws
- Mandate BECs & target green buildings
- Request MEPSs before market entry
- Support ESCO model

Electric Mobility
- Tax incentives for EV users
- Ban ICE motorcycles in Hanoi
- Request compliance with emission standards for petrol cars

Carbon Pricing
- Develop Emission Trading Scheme (ETS) and monitoring, reporting and verification (MRV) system
- Pilot period focusing on high-emitting sectors
- Full-scale market launch (2029)

The Revised PDP 8 boosts RE Power and BESS capacity, targets major wind and solar PV additions, and introduces nuclear power for the first time.

Solar, wind, hydropower, biomass and waste-to-energy will be 56–64% of total installed capacity in 2030s.



Renewable energy capacity targets for 2030 are set within low–high ranges: 46–73 GW of solar PV, 26–38 GW of onshore wind, and 33–35 GW of hydropower. Energy storage targets are 10–16 GW of BESS (battery energy storage systems) and 2.4–6 GW of PHS (pumped-storage hydropower). Offshore wind (6–17 GW) and nuclear power (4–6 GW) are planned to be operational by 2035, with potential for earlier deployment. [23,25]

The revised PDP 8 steers Vietnam's power sector toward a coal-free system by 2050.

Along with the Revised PDP 8, rooftop solar and DPPA policies were also updated in early 2025 to set a clearer direction for RE investment.

Vietnam's RE-related Policies

Rooftop solar (RTS) under decree 58/2025/ND-CP

Installing rooftop solar PV in Vietnam is relatively straightforward, but selling surplus power to the grid remains restricted and complex. The national target aims for 50% of office buildings and residential homes to use rooftop solar.[26]

Decree 57/2025/ND-CP supports direct renewable electricity sales from independent power producers (IPPs) to private buyers under Vietnam's DPPA program.

Vietnam has introduced two DPPA schemes: **private-grid DPPAs** for a wide range of renewable sources, and **third-party access (TPA)** for large grid-connected solar PV, wind, and biomass projects above 10 MW. Large consumers (≥ 200,000 kWh per month) can contract directly with producers, while smaller users purchase renewable power through retail channels. In the TPA scheme, EVN is involved in approving grid interconnection and leasing the grid infrastructure for power transmission.[27]

Coal Repurposing

The direction of coal phasing down and repurposing is formalized in **Decision 266/QĐ-TTg** (2025), which requires all coal plants to shift to clean fuels or adopt carbon capture solutions by 2050, as shown in the timeline below.[28,29]

2030

No new coal-fired power plants (CFPPs) will be approved after 2030

- Pilot carbon capture at selected older CFPPs
- Gradually convert existing plants to biomass and ammonia co-firing, and eventually to fully biomass- or ammonia-fueled plants.
- Retire about 540 MW of coal capacity at Pha Lai and Ninh Binh

2045

Over 25,000 MW of coal capacity to be converted to biomass and ammonia.

2050

All CFPPs must either switch to clean fuels or adopt carbon capture, leading to the complete elimination of coal in power generation.

CFPPs over 20 years should convert to biomass wherever it is economically viable.

Plants reaching their economic life must be retired if conversion is not feasible.

BESS and energy efficiency can mitigate grid stress and enhance system reliability.

BESS capacity is targeted to reach 16 GW by 2030[23]

The rapid growth of solar power in Vietnam has raised concerns around grid flexibility and system reliability. To support better integration of variable renewables, **Decision 988/QD-BCT**[30] introduces technology-specific ceiling prices. **Solar PV projects with BESS are eligible for an additional premium of 1–2 US¢/kWh**, while no such premium applies to wind projects with BESS.

BESS is a strategic priority, with policies favoring RE power projects that include BESS. EVN and ADB are developing Vietnam's first grid-connected BESS project in the North, which is expected to reduce emissions by 23 $ktCO_2$ over its lifetime.[31]

VNEEP targets an 8–10% reduction in total national energy consumption by 2030[32]

NATIONAL ENERGY EFFICIENCY PROGRAMME

VNEEP3 (2019–2030), is a strategic programme that operationalizes the Law on Economical and Efficient Use of Energy (Law No. 50/2010/QH12, Energy Efficiency Law) to reduce energy use across all sectors. It includes policies (I) mandating **energy management systems**, (ii) enforcing **MEPSs** and **energy labeling**, (iv) requiring **Building Energy Codes that** promote green buildings, and (v) strengthening the capacity of **ESCOs**.

Current Utility-Scale BESS Status in Vietnam

Deployment of utility-scale BESS in Vietnam is progressing slowly due to two main challenges.

Regulatory framework: National standards and legal guidelines are still under development. However, key stakeholders such as the Commission for Standards, Metrology and Quality of Vietnam (STAMEQ), in collaboration with UNDP, are actively drafting BESS standards.[33]

High investment cost: BESS significantly increases project costs. For example, the LCOE for a solar PV plant with BESS is roughly twice that of a standalone solar PV plant.[34]

EV adoption and carbon pricing in Vietnam are expected to increase private-sector financing and awareness for GHG reduction.

Electrical Vehicles

Vietnam targets 30% electric cars and 22% electric motorbikes by 2030.[35]

2022: Strong EV tax incentives

- **Law No. 03/2022/QH15[36] set lower special consumption tax (SCT) rates for EVs**, with 1 - 3 % until February 2025 and 4 - 11% from March 2025 to February 2027**.**
- **Decree 10/2022/ND-CP[37] exempted EV from first-time registration fees for 3 years.** After that, they pay 50% of the fee applied to gasoline cars and **extended EV registration fee exemptions under Decree 51/2025/ND-CP[38]** until 28 February 2027.

EV market share rose from 6% in 2022 to 25% in 2025.[18]

2024: Propose an emission reduction roadmap for Vietnam's transportation sector

The MAE proposed emission standards and the MOC is expected to oversee vehicle certification.

2026–2029: ICE cars must meet increasingly strict emission standards based on their manufacturing year, with even tighter requirements in Hanoi and Ho Chi Minh City[39]

- **2026**: ICE cars produced between 2017 and 2021 must meet Euro 3 emission standards.
- **2027**: Hanoi and Ho Chi Minh City require ICE cars from 2017–2021 to comply with Euro 4.
- **2028**: ICE cars manufactured from 2022 must meet Euro 5 when operating in these two major cities.
- **2029**: All ICE cars in Hanoi and Ho Chi Minh City must comply with at least Euro 2 emission standards.

Carbon Pricing

Vietnam will pilot its ETS in 2025 and targets a full national carbon market by 2029.[40,41]

The ETS will encourage enterprises to invest in low-carbon technologies and processes. Vietnam is also aligning with international standards and engaging with Article 6.2 and 6.4 mechanisms.

January 2025
Approval of Decision No. 232/QD-TTg to develop ETS

June 2025 - 2028
Pilot ETS trading system launched

Piloting ETS
focuses on high-intensity GHG emission industries such as fossil fuel power plants, cement, and iron and steel

2029
Full ETS operation

Indonesia's EV industry offers strong growth potential. While fossil fuels remain dominant, the government is targeting emissions reductions through greater biofuel use, solar-BESS expansion, grid development, and CCUS deployment.

EV and Battery Industries

Exponential growth in EV sales in Indonesia signals strong economic opportunities for the EV and battery industries. The country has significant potential to become a Southeast Asian battery manufacturing hub, supported by nickel abundance and also two-wheeler EV production. These industries could add billions of USD to their GDP and create new jobs.

Solar PV

Indonesia operates the largest floating solar in SEA, PV Cirata Floating Solar Plant (~145 MW_{AC}).[42] 500 MW of the expansion phase is under construction.[43] The green-corridor agreement between Singapore and Indonesia is driving the development of solar or solar-plus-BESS systems designed for cross-border clean-energy supply.[44]

Smart Grids

RUPTL 2025–2034 outlines three phases of smart-grid deployment: Phase 1 (2027–2028), Phase 2 (2029–2030), and Phase 3 (2031–2033).[45] This blueprint builds on lessons from earlier grid-modernization efforts for integrating variable solar PV and wind, implemented in collaboration with PLN and UNOPS.[46]

Indonesia

Bioenergy for Electricity

Biofuels provide about 5% of Indonesia's installed capacity, increasing by 1.4 GW from 1.9 GW in 2020 to 3.4 GW in 2024.[6] An additional 0.8 GW of bioenergy capacity is expected to be installed by 2030,[23] supported by a more favorable ceiling price for small-scale projects.

Carbon Capture

Indonesia is positioning itself as Southeast Asia's CCUS hub, supported by a potential estimated 680 $GtCO_2$ storage potential in saline aquifers, strong regulations, and flagship projects such as BP's Tangguh CCUS.[49]

Potential Decarbonization of Indonesia's Industrial Sector

Decarbonization is needed in Indonesia's industrial sector, particularly in mineral smelting (e.g., nickel smelting for the battery supply chain).[47] Optimizing energy sources is a key decarbonization pathway; for example, replacing captive coal with cost-competitive solar-plus-storage offers a major opportunity.[48]

Indonesia is advancing its energy transition through increased RE power capacity, coal repurposing, strong policy and incentive support for EV manufacturers and buyers, and a pilot carbon ETS in the power sector.

Policies Driving Indonesia ET

Clean Energy Acceleration and Slowdown
- Clear RE ceiling prices

Coal Repurposing
- Coal plant operations restricted to economic-priority uses.
- Exploring early retirement
- Non-renewal of CFPP's PPAs

Energy Conservation & Efficiency
- Implement and enforce energy management regulations
- Apply building energy codes in major cities
- Require MEPSs compliance prior to market entry
- Promote the ESCO model

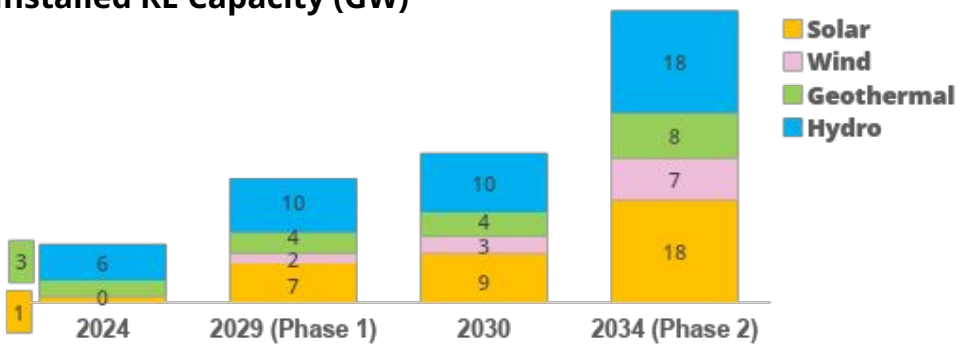
Electric Mobility
- Tax incentives for EV users
- Import tax exemption for EV manufacturers

Carbon Pricing
- Carbon trading is being phased in, expanding from coal-fired power plants to all fossil-fuel power plants.

The ambitious RE power plan aims to keep pace with economic growth and reduce fossil fuel use.

The RUPTL 2025–2034 plans to add 70 GW of capacity, with 61% coming from renewable energy.

Installed RE Capacity (GW)



Indonesia's RUPTL 2025–2034 outlines two phases of power development: 28 GW of total capacity and 12.2 GW of renewables added in 2025–2029, followed by 42 GW and 30.4 GW in 2030–2034. Solar PV will add 17 GW (40% of planned renewables), followed by 12 GW of hydropower (27%) and 6 GW of BESS. Nuclear power is also included in the plan for the first time.[23]

Indonesia RE-related policies

Ceiling prices were introduced in 2022 under Presidential Regulation No. 112/2022. **Smaller projects (≤ 1 MW) receive higher tariff caps**, while larger projects have lower caps. **Biomass gets the highest maximum benchmark prices, followed by solar, and wind**. **For most technologies, the tariff also drops after 10 years** when the location factor is removed.[50,51]

Although net metering has been cancelled, demand for RTS remains high, and effective EE measures can help reduce grid stress. CFPPs will be repurposed or phased down

Indonesia RE-related policies (cont.)

Net metering incentives for rooftop solar have been canceled and shift to quota-based deployment. New users no longer receive credits for exporting excess electricity to the grid. However, existing users are allowed to retain the previous scheme for up to 10 years from their approval dates. But the industrial sector continues to invest in RTS to reduce electricity costs.[52] PLN controls RTS quotas to maintain grid stability.

Energy Efficiency

The country targets a 1% annual reduction in energy intensity, as announced in the enhanced NDCs.

In Indonesia, energy management is mandatory for energy providers and energy users under GR 33/2023 requiring designated managers, conservation programs, and audits.[53]

The consumption threshold (TOE)

- **6,000 TOE** — **Energy providers**
- **4,000 TOE** — **Transportation sectors**
- **4,000 TOE** — **Industrial sector**
- **500 TOE** — **Commercial buildings**

- **Major cities such as Jakarta, Bandung, and Semarang enforce local green building codes,** but Indonesia does not yet have a national building energy code.
- **MEPSs and energy labels are mandatory for eight appliance categories**, including air conditioners, refrigerators, LED lamps, and others.
- ESCOs are promoted to support conservation, but investor uptake remains limited due to perceived risks.

Coal Repurposing

Indonesia's **MEMR Regulation 10/2025**[54,55] outlines a strategic roadmap for energy transition, including **coal plant retirements**, renewable energy expansion, and supergrid development.

Key GHG reduction measures from CFPPs include

2025

Prohibiting new CFPPs according to PR 112/2022

- New CFPPs not included in the RUPTL before the issuance of PR 112/2022 are not permitted.
- Exemptions may be granted if plants achieve at least 35% GHG reduction and cease operation before 2050.

Early or natural CFPP retirements

- Natural retirement occurs when coal-fired power plants reach zero book value. The number of CFPP units potentially retiring naturally is projected at 13 in 2030–2039, 119 in 2040–2049, and 36 in 2050–2059.[56]

2031

Co-firing of biogas/biomass and deployment of CCUS technologies in CFPPs

2046

Retrofitting CFPPs for green ammonia

Indonesia can attract financial investment by advancing its EV and battery industries and developing carbon pricing.

Electrical Vehicles

Accelerated EV adoption in Indonesia targets 2 million cars and 13 million motorbikes by 2030.[57]

Presidential Regulation No. 79/2023 establishes the legal framework for Indonesia's EV development,[58] promoting electric vehicles and batteries while strengthening local content requirements.

Indonesia holds 42% of global known nickel reserves,[59] **providing a key advantage for its EV economy**, with plans covering nickel and cobalt sulfate production, cathode and battery cell manufacturing, and future battery recycling.

Tax incentives have driven strong FDI growth in the EV sector since 2019.[18] However, several incentives expired on 31 December 2025. The following EV regulations and incentives have been introduced from 2026 onward:

Focus on Domestic Content

- **EV tax incentives are granted if local content (TKDN) meets set thresholds** of 40% in 2026, 60% from 2027 to 2029, and 80% from 2030 onward.[58]
- **The import tax exemption for fully built EVs has expired.** Automakers must produce at least one locally manufactured EV of equal or higher specification for each imported EV. Bank-guarantee penalties will apply from 2028 for non-compliance.[60]
- **The VAT reduction from 11% to 1% has also expired.**[60]
- **Corporate income tax exemptions and tax holidays are provided to eligible battery manufacturers.**[58] Additionally, the government aims to strengthen the competitiveness of nickel-based batteries, including NMC, to expand Indonesia's nickel downstream industry.[61]

Carbon Pricing

Indonesia has launched a hybrid carbon market since 2023 focusing on powerplants.

The National Energy Policy (Government Regulation No. 40/2025) includes carbon pricing as one of its key policy options and will gradually implement a carbon tax on non-renewable energy.[62] Meanwhile, Indonesia's hybrid carbon market combines emission-intensity caps for CFPPs with a trading system that allows them to buy and sell carbon credits, as shown in the timeline below.[63,64]

Phase 1: 2023 - 2024

2023

Indonesia launched an ETS for CFPPs connected to PLN's grid, covering units with capacities of 25–100 MW and mine mouth or non-mouth mine CFPPs with capacities ≥100 MW. This phase includes 99 CFPPs with a total installed capacity of 33.6 GW.[62]

2025

Presidential Regulation No. 110/2025 was issued,

- providing the legal basis for voluntary and international offset markets
- recognizing international standards
- **enabling international carbon trading**
- clarifying NDC accounting
- integrating the national MRV system

Phase 2: 2025 - 2027

The ETS will expand to CFPPs below 25 MW, GFPPs, CFPPs, and off-grid CFPPs. It will also include all non–mine-mouth CFPPs with capacities of 25 MW and above.

Phase 3: 2028 - 2030

This phase covers all fossil-fuel plants from Phases 1–2, plus: CFPPs <25 MW, GFPPs (all sizes), CCPPs <300 MW, and diesel plants >2 MW.

Philippines' competitive power market and relaxed foreign-ownership rules are attracting more clean-energy investment and aligning the country with global renewable energy trends.

Competitive RE Procurement and Development

GEAP is a competitive procurement strategy that offers price certainty and contracted offtake, enhancing project bankability and prioritizing renewable energy technologies in line with the Philippine Energy Plan (PEP). In addition, the Philippines has identified Competitive Renewable Energy Zones (CREZ) with high-potential solar and wind areas to inform transmission planning, thereby accelerating renewable energy deployment.[65]

Energy Storage

Energy storage systems are now part of the national energy plan. Grid-integrated BESS projects, such as the Kabankalan and Lamao BESS, are already in place.[66]

Grid Development and Investment Plan

The Transmission Development Plan (TDP) outlines key principles but requires a clear investment roadmap to build flexible and reliable grids for VRE integration. Network constraints should be identified and addressed by 2035, with policy support for smart technologies sustained through 2035 to ensure long-term grid flexibility and reliability.[67]

Solar PV

Large solar PV projects in the Philippines are increasingly integrated with BESS. The Meralco Terra Solar Farm, now under construction, will include 3.5 GW of solar PV and 4.5 GWh of BESS, with the first phase of 2.5 GW solar and 3.3 GWh BESS expected by 2026.[68] In parallel, a USD 15 billion MoU with Masdar (UAE) aims to develop 1 GW of solar PV, wind, and BESS capacity by 2030.[69]

Offshore Wind

Offshore wind development in the Philippines is expected to accelerate under the GEA-5 auction in 2025, with project implementation from 2026 onward. This marks the first inclusion of offshore wind in the country's renewable energy auction program.[70] Several developers already hold Wind Energy Service Contracts (WESC) across multiple sites in preparation for GEA-5. For example, BlueFloat Energy holds WESCs totaling up to 7 GW of potential offshore wind capacity.[71]

The Philippines supports clean energy through GEAP auctions, pilot energy efficiency programs in public buildings, a moratorium on new coal plants, and promotion of the EV industry.

Policies Driving the Philippines ET

Clean Energy Acceleration
- Enforce RPS to raise RE share of power companies
- 2022 RE law amendment allows 100% foreign ownership of RE projects.
- GEAP auctions renewable energy capacity, awarding offtake agreements at fixed contracted prices
- GEOP allows large consumers to directly buy green electricity from generators.

Energy Conservation & Efficiency
- Mandate EE & EC for commercial, industrial, and transport sectors to be designated establishments
- Apply DOE building energy codes to large new or renovated buildings
- Require PELP compliance before products enter the market
- Pilot programs and financing support for EE and ESCO-implemented projects

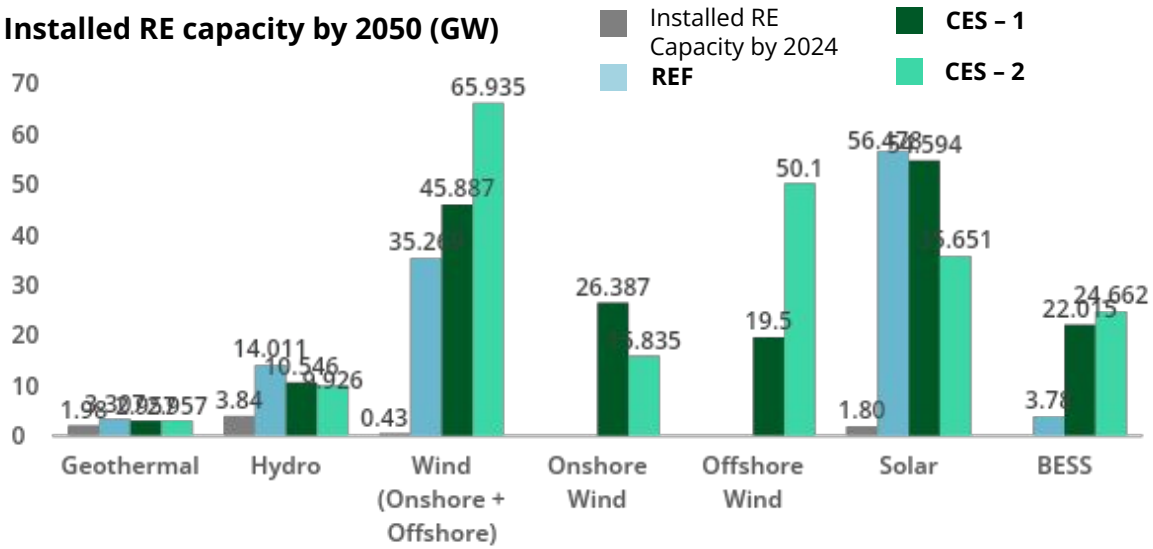
Coal Phasing-Down
- Ban new CFPP construction

Electric Mobility
- EVIDA & CREVI promote EV adoption and support domestic supply chain development.

Carbon Pricing
- The proposed cap-and-trade system is still awaiting approval.

PEP 2023 – 2050 is accelerating progress toward CES 1 and CES 2.

Power generation mix aims at 35% RE by 2030, 50% by 2040, over 50% by 2050.



The Philippines models three scenarios: a Reference Scenario (REF) and two clean energy scenarios, CES 1 and CES 2. REF shows higher hydropower and lower wind development, with a 71% RE share by 2050. CES 1 and CES 2 reflect a more progressive transition with stronger demand-side policies and a more diversified supply mix. CES 1 includes 19 GW of OSW, while CES 2 assumes 55 GW. By 2050, the Philippines installed power capacity is forecast to reach 154–156 GW, with 74% from renewables and growing BESS installations. All scenarios rely heavily on solar, reaching 36 to 56 GW by 2050.[72]

The Philippines has an OSW **technical potential of 178 GW**. As of June 2025, **92 contracts have been awarded for 65 GW**,[73] with projects distributed across Luzon, Mindoro, and Antique.

RE investment in the Philippines is largely private-led but enabled by policies that allow 100% foreign ownership and include RPS, GEAP, GEOP, and the CFPP moratorium. Energy efficiency is supported by the government through public-sector building programs.

The Philippines RE-related policies

- **Green Energy Auction Program (GEAP)**: A competitive auction program, replacing FiTs with a more market-based system. **GEA-4 in 2025** includes solar PV farms, rooftop solar, onshore wind, floating solar PV and, for the first time, solar projects integrated with BESS (IRESS).[74]
- **Green Energy Option Program (GEOP)**: Enables large consumers (≥100 kW demand) to directly source renewable power from licensed generators through the national grid.
- **Renewable Portfolio Standard (RPS)**: Mandates grid-connected companies to increase renewable energy in their supply portfolios by 2.52% annually,[75] ensuring steady RE growth.
- **Foreign Ownership**: Since 2022, international investors have been allowed full ownership of RE projects. The DOE reports that 20 GW has been awarded to fully foreign-owned companies, including 13.2 GW of onshore wind, 5.5 GW of off-shore wind, and 1.3 GW of solar PV.[76,77]
- **Net Metering**: Allows users to install up to 100 kW rooftop solar and receive credits for exporting excess electricity to the grid.[78]

Energy Efficiency

PEP 2023 – 2050 targets to save the oil products and electricity consumption of 10% in 2040 – 2050[72]

The Philippines' Energy Efficiency and Conservation Act mandates energy managers for large users, requires annual reporting and audits, and enforces building energy codes for large new or renovated buildings at the national level. Appliances must meet MEPSs under PELP, while the ESCO sector is emerging but facing financing and policy challenges.

The Philippines requires all government agencies nationwide to cut their electricity and fuel use by at least 10 % through renewable energy adoption, energy efficiency measures in buildings, and better vehicle fuel management under the Government Energy Management Program (GEMP).[79]

Coal Phasing-Down

The Philippines Coal Moratorium, initiated in 2020, bans new CFPP construction.[80] But the country has no clear phase-out timeline yet. According to the PEP 2023 – 2050 ,coal is still projected at about 9.8% of the power mix by 2050.[72]

2020 Coal Moratorium on New Plants
The moratorium bans new greenfield CFPPs.

Existing Projects Proceed
Projects already permitted or under construction are exempt and may continue.

No New CFPPs Added After 2027
No additional coal capacity is expected beyond the current pipeline finishing in 2027,[72] although this is not a formal mandate. CFPP capacity plateaus at 14.7 GW in the REF, 11.1 GW in CES 1, and 9.9 GW in CES 2.

The first half of 2025 marked the first decline in coal power *on the Philippine grid, driven by plant outages and rising renewable generation, with LNG providing supplementary growth.[81]*

The Philippines has EV frameworks to cut GHG emissions in the transport sector and help reduce future cost risks when carbon pricing is introduced.

Electrical Vehicles

The Philippines targets 50% EV fleet share by 2040[72]

The government is incentivizing both buyers and factories under Electric Vehicle Industry Development Act (EVIDA), Strategic Investment Priority Plan (SIPP), and Tax Reform for Acceleration and Inclusion Act.

Incentives for Buyers[82]

- discounts of the road user's tax (Motor Vehicle Charge) for 8 years
- priority registration and coding exemption for owners

Incentives for Manufacturers [82,83]

- 4–7 year income tax holiday
- 5% special corporate income tax rate after the holiday period
- Up to 8 years duty-free imports of equipment and parts
- Production-based incentives under the Electric Vehicle Incentive Strategy

Carbon Pricing

Philippines' hybrid carbon pricing, carbon tax and ETS, awaits final approval

November 2024
COP29 Commitments: National registry and market blueprint commitments were made at COP29.

February 2025
House Approval: House Bill 11375 (Low-Carbon Economy Investment Act) **passed second reading**, establishing a hybrid carbon pricing model and requiring decarbonization plans for large emitters. [84]

June 2025
Implementing Article 6.2 Agreement: The Philippines reaffirmed the MOU with Singapore for Article 6, signed in August 2024, both sides began to negotiate a legally binding implementation agreement under Article 6.2.[85]

September 2025
Official guideline launched: Department Circular No. 2025-09-000 for the generation, management, and monitoring of carbon credits.[86]

> *The first carbon market transaction in the Philippines has happened, showing interest, though the framework is still developing to support a functioning market.*
>
> —**Ingo Puhl**
> *Founding Partner, South Pole Group*

2.2 Financing The Transition

This section presents the current status of energy investment in Southeast Asia, with a focus on Vietnam, Indonesia, and the Philippines. It outlines power-sector investment needs, historical investment trends, and investment breakdowns to highlight key characteristics across the region.

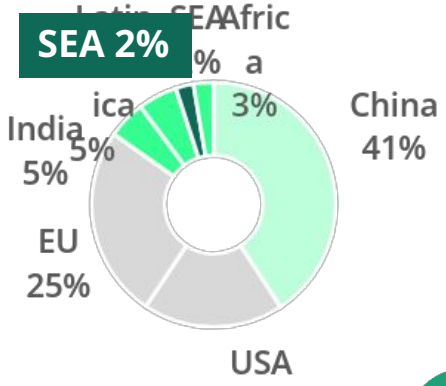
SEA receives the smallest share of global clean energy investment, resulting in a significant funding gap and continued higher investment in fossil fuels.

The region received only 2 % of global clean energy investment in 2024.[87] Emerging Markets and Developing Economies, including China, India, Africa, and Southeast Asia, accounted for 56 % of global clean energy investment, with China alone contributing 41 %.

USD 150 billion annually is required for ASEAN to meet its clean energy investment needs by 2030. [88]

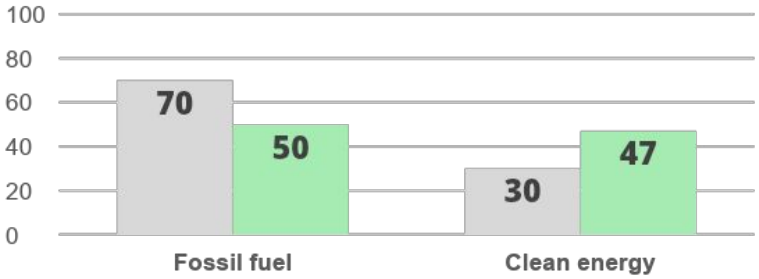
After a decade, fossil fuel investment has declined from around USD 70 billion to USD 50 billion, while clean energy investment has increased from USD 30 billion in 2015 to about USD 47 billion today.[81] However, clean energy spending still remains below fossil fuels.

Other EMDEs except China and SEA 13%



High capital cost could widen the financial gaps.

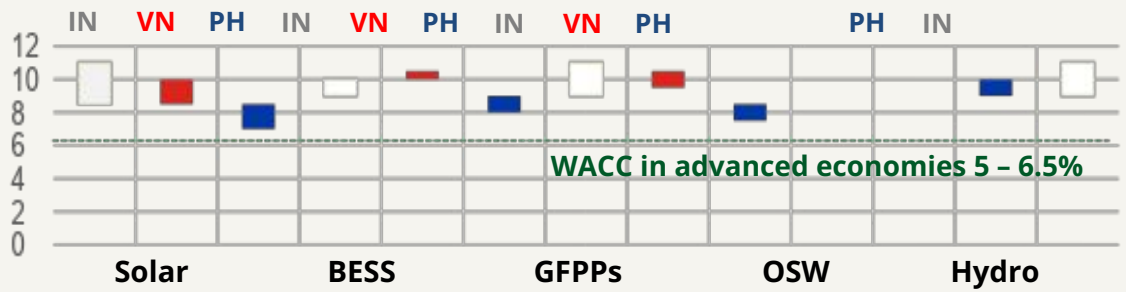
Energy Investment in SEA (billion USD)
in 2015 and 2025



USD 100 billion was invested in fossil fuel and clean energy in 2015

USD 97 billion was invested in fossil fuel and clean energy projects in 2025

WACC in Power Generation Projects (%)



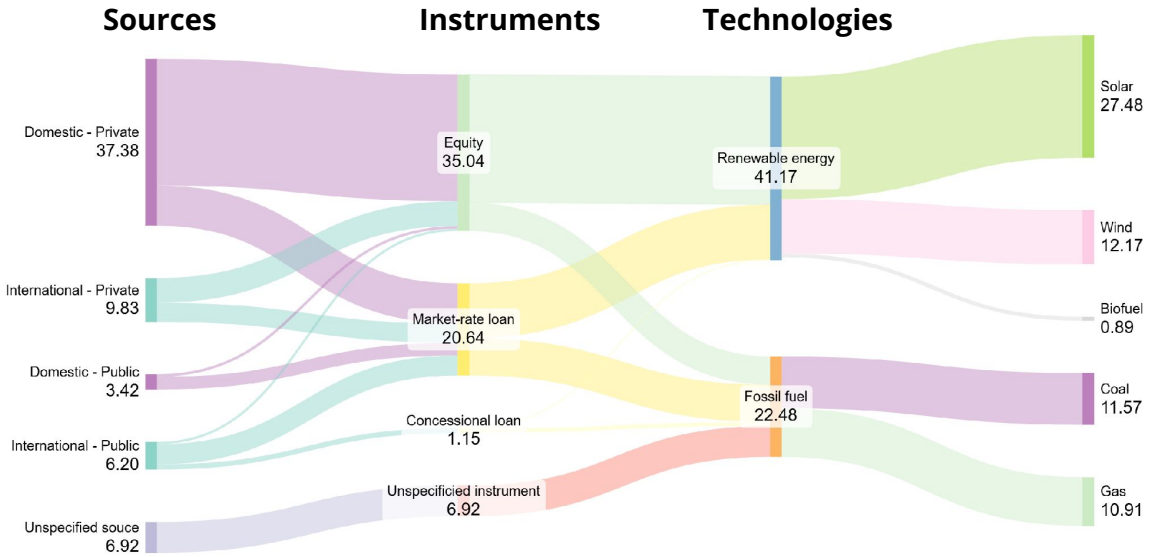
A high weighted average cost of capital reduces the attractiveness of renewable energy investment in Southeast Asia. In the three focus countries, WACC for renewable energy and gas-fired power plants ranges from 7.5 to 12.5 %, higher than in advanced economies where it is around 5 to 6.5 %. [89] Solar PV has the lowest capital cost, but higher WACC still forces developers to devote a larger share of revenue to debt and equity payments, making renewable projects more expensive and less competitive.

Highlights of Energy Investment in Southeast Asia

Sources	Financiers	Instruments
Private and international energy finance	Project developers, Commercial banks, Institutional investors	**Private debt, including green loans and selected green or sustainability bonds and sukuk, accounted for 60% of energy investment in SEA.**[90]
		90% of investment in clean fuels and emerging technology (e.g. BESS and hydrogen supply) is equity.[91]
		The Just Energy Transition Partnership (JETP) can be considered both international public and private finance and is active in Vietnam and Indonesia.
	Philanthropic agencies	**Grant shares the smallest portion in SEA energy investment.**
Domestic public energy finance	National and local governments	**Governments invest mainly in fossil fuels and grid infrastructure.**[91] They fund state-owned utilities and public energy assets and support clean energy through fiscal incentives and technical assistance.
		Governments offer concessional loans, grants, and guarantees through national climate funds such as Vietnam Environment Protection Fund (VEPF).
International public energy finance	Bilateral or multilateral development agencies and banks	**Development agencies (e.g., ETP, GIZ, JICA, UK PACT) and development banks (e.g., ADB) provide technical assistance, financial support, and capacity building.** An example is ADB's Energy Transition Mechanism (ETM).
	Financial development institutions (FDI)	**Around 18% of Southeast Asia's energy investment comes from bilateral and multilateral lenders.** [90]

Domestic private investment is the main funding source behind Vietnam RE expansion.

Financing in Power Sector (USD billion)
From 2017 - 2022

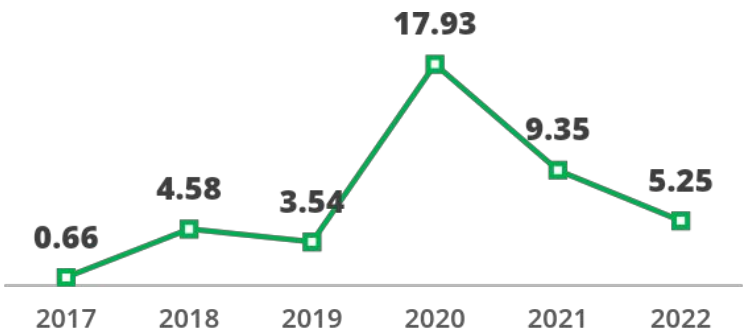


Source: Adapted from Climate Policy Initiative

Total investment in Vietnam's power sector reached approximately USD 64 billion between 2017 and 2022 [92], with the breakdown shown below.

- ✓ **Domestic private investors** provided USD 37.4 billion, accounting for 58% of total energy investment, with most of it contributed as equity to renewable energy projects. An additional USD 9 billion was supplied through market-rate loans, mainly supporting wind and fossil-fuel projects.
- ✓ **International private investors** provided USD 9.8 billion in equity and loans to support both renewable energy and fossil-fuel projects.
- ✓ **Domestic and international public sectors** invested mainly through loans to support energy sector development.

Investment in RE Power (USD billion)



USD 41.2 billion attracted during 2017 - 2022

Vietnam has attracted more than USD 41 billion in renewable energy investment. Between 2017 and 2022, renewables received 1.8 times more investment than fossil fuels, led by solar at USD 27.5 billion and wind at USD 12.2 billion.[92]

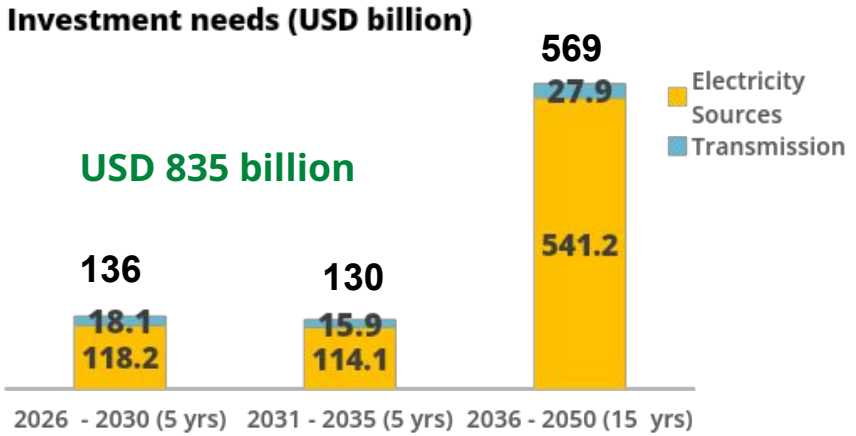
Energy policies influenced Vietnam's RE investment

The FiT drove investment to a peak of USD 18 billion in 2020. After the solar PV FiT expired in December 2020, solar investment fell significantly but this decline was partially offset by increased wind investment. When the wind FiT ended in October 2021,total renewable energy investment dropped to about USD 5 billion[92].

Vietnam will need USD 835 billion by 2050 to expand electricity sources and networks under the revised PDP 8.

Most investments will go to developing electricity sources, including coal co-firing with biomass, greenfield renewable power plants, BESS, and pumped hydro storage (PHS). Funding needs are estimated at USD 118 billion in the next five years and USD 114 billion during 2031–2035, rising to USD 541 billion between 2036 and 2050 (around USD 180 billion every five years on average).[23]

Investment in the transmission system accounts for about 8% of total needs, reaching USD 18 billion in the first five years and USD 44 billion between 2031 and 2050. [23]



Examples of Available Instruments

Domestic banks have started offering sustainability-linked products. Examples include:

- BIDV[93] pioneered with USD 104 million in green bonds (2023) and USD 122 million in sustainability bonds (2024).
- Green credit expanded from USD 24 billion in March 2024 to USD 27 billion in 2025 (up 11% YTD), making up 4 % of total credit.

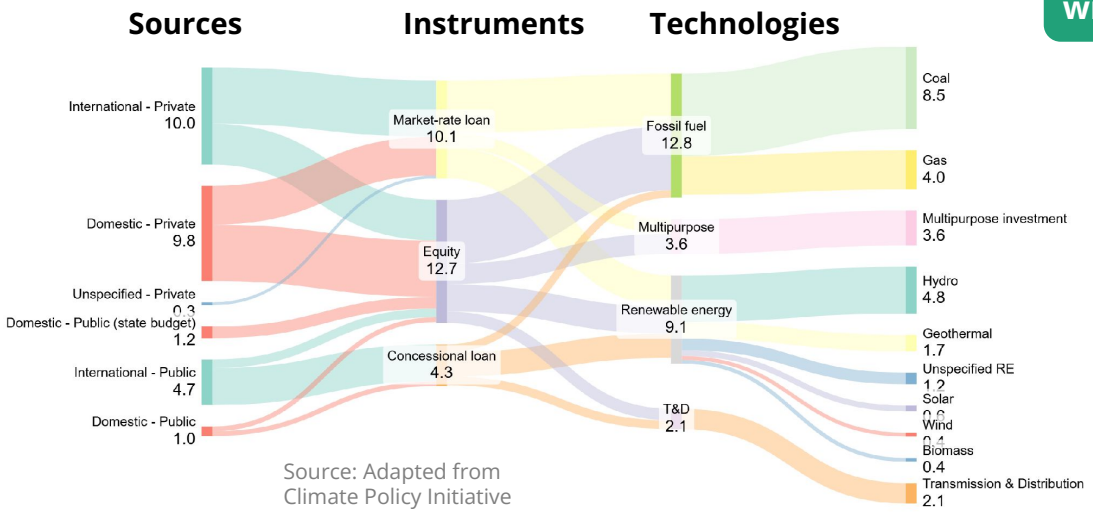
Public investment plays a limited role in Vietnam's energy transition as policymakers seek to limit public debt and fiscal risk**.** Instead, they leverage policy instruments like DPPAs, relaxed rooftop solar PV regulations, and premium tariffs for solar-plus-BESS, and reduce the lending rate to attract renewable energy investment.

Vietnam Development Bank (VDB) and state-owned banks have lowered lending rates, contributing to a reduction in the WACC for utility-scale solar PV projects from 9.8% in 2022 to 9.0% in 2024. [89]

The JETP targets USD 15.5 billion[88], of which USD 8.1 billion is committed public finance from the International Partners Group (IPG). The remaining USD 7.4 billion is expected from private finance but is not guaranteed. [94] Within the IPG package, grants amount to USD 321.5 million (around 4% of the public finance), sovereign and non-sovereign loans total USD 2.7 billion, and about USD 5 billion comes in the form of commercial DFI loans, equity, and guarantees. [94]

The private sector is the main driver of energy investment in Indonesia. Between 2019 and 2023, coal received the largest share of funding.

Financing in Power Sector (USD billion)
From 2019 - 2023

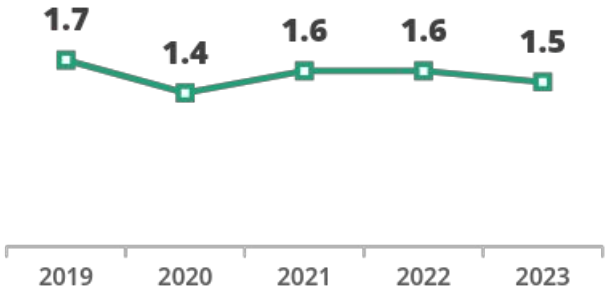


Source: Adapted from Climate Policy Initiative

Total investment in Indonesia's power sector between 2019 and 2023 reached approximately USD 38 billion[95] with the details below:

- ✓ **Private investors**, both domestic and international, contributed around USD 10 billion each in fossil fuel, RE, multipurpose (e.g. green credit portfolios, result-based lending), and grid investments.
- ✓ **Equity was the largest source of energy investment**, followed by market-rate loans, which were mainly directed toward fossil fuel-fired power plants, particularly CFPPs.
- ✓ **Public financing**, especially from international public institutions, played a key role in providing concessional loans targeted at renewable energy development.

Investment in RE (USD billion)



USD 9 - 11 billion attracted during 2019 – 2023

Renewable energy investment in Indonesia during 2019–2023 is estimated at USD 9–11 billion

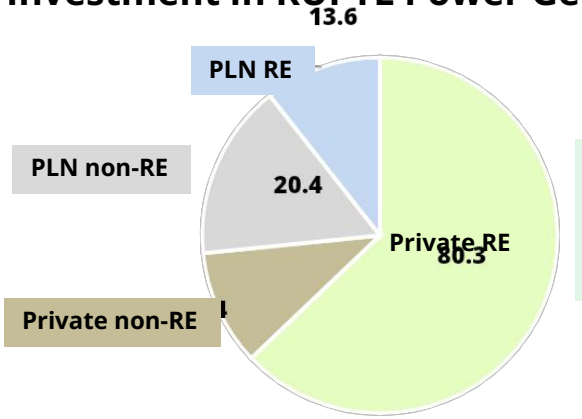
Depending on the source [95,96], accounting for about 23% of total power-sector investment. More than half of this went to hydropower and geothermal, reflecting Indonesia's strong resource potential, with an estimated 27–29 GW of geothermal capacity (around 40% of global resources) and significant hydropower potential from its major river systems.

Power-generation investment opportunities total around USD 128 billion (IDR 2,134 trillion), with 63% allocated to private-sector renewable energy investment.[97]

According to RUPTL 2025 – 2034, the private sector is expected to be the main financing source, providing 73% of total power-generation investment and 63% of renewable energy financing. While the plan still requires some private investment in non-renewable technologies, this accounts for only about 10%. In contrast, PLN will contribute 27% of total investment, with 16% directed to non-renewable technologies.[97]

USD 93.9 billion in RE power investment is required from the private sector and PLN over 2025–2034.

Investment in RUPTL Power Generation (USD billion, %)



Renewable power is the priority in the plan, accounting for 74% of total power-generation investment needs.

Examples of Available Instruments

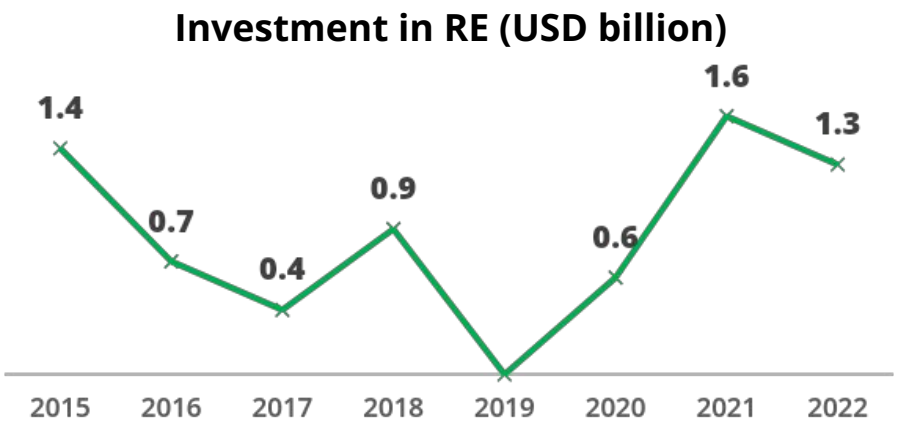
Domestic banks such as Bank Negara Indonesia (BNI) reported that, as of December 2024, they had allocated USD 119.8 million (IDR 2,008 billion), or about 40% of their green bond portfolio, to finance and refinance renewable energy projects, including solar PV, wind, and hydropower.[98].

Public investment

- **Indonesia Government** has advanced green and Sharia-compliant finance. Between 2018 and 2024, the Ministry of Finance issued about USD 6 billion in global sovereign green sukuk, along with approximately USD 2.78 billion in retail and USD 2.11 billion in wholesale domestic green sukuk.[99]
- **INA** (sovereign wealth fund) collaborates with SOEs and foreign investors to fund large-scale infrastructure. As of mid-2025, renewable energy accounts for approximately USD 480 million. [100]

Indonesia's JETP commitment increased to USD 21.6 billion in 2023 from the initial USD 20 billion,[101] This includes USD 11.6 billion in public finance from the IPG and USD 10 billion from the GFANZ working group to mobilize private investment. Public finance is dominated by loans and guarantees, accounting for about 80–85% of JETP's investment funds, while grants represent only 1–2%.[102]

Achieving CES 1 and CES 2 in the Philippines will be challenging unless renewable energy investment accelerates beyond current levels.



USD 6.9 billion attracted during 2015 - 2022

From 2015 to 2022, investment in new renewable energy projects ranged from USD 0.4–1.6 billion, except in 2019 when no new capacity was added. [103] If this annual RE investment, roughly USD 1 billion per year, continues, it will fall below the levels required in the PEP.

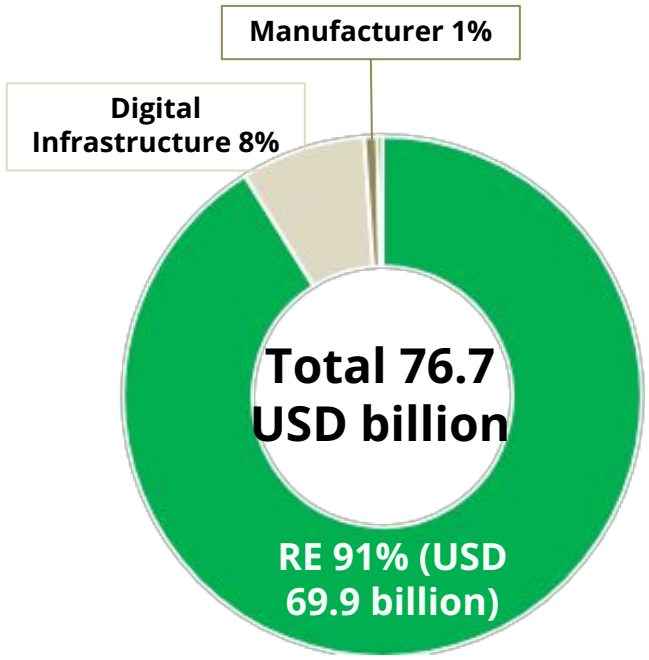
The Green Lane Initiatives

The Green Lane for Strategic Investments is a one-stop action center established under Executive Order 18 (2023) to fast-track FDI in strategic sectors, including clean energy, EVs, PPPs, other infrastructure projects, and other priority industries under the SIPP. [104]

As of December 2024, renewable energy investments totaled USD 69.9 billion (PHP 4.13 trillion), out of Green Lanes' overall certified investments of USD 76.6 billion (PHP 4.54 trillion). [105]

In 2025, four renewable energy projects worth PHP 14.7 billion became operational out of the 12 Green Lanes projects announced in June. [106]

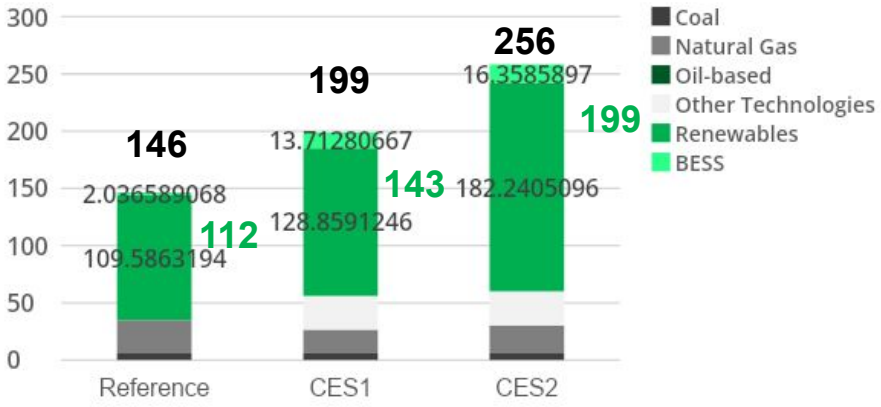
Approved RE Investment Pipeline under the Green Lane Initiative (USD billion)



The Philippines requires USD 146–256 billion in power sector investment, depending on the chosen power-development scenario.

The PEP 2023–2050 outlines investment projections across three energy scenarios. The two clean-energy scenarios, CES 1 and CES 2, require USD 31–87 billion more than REF, the reference scenario. CES 2 also includes a higher offshore wind expansion target than CES 1, requiring more than USD 56 billion in additional investment.[72]

Investment in PEP Power Sector (USD billion)



Reducing capital cost can boost OSW development

The cost of capital is a key driver for high–upfront-cost technologies such as OSW. Lowering capital costs can significantly improve project viability. As noted in OECD developer consultations, *"a 1% change in the cost of capital could change electricity costs (LCOE) by 8% for certain projects."*[103]

Examples of Available Instruments

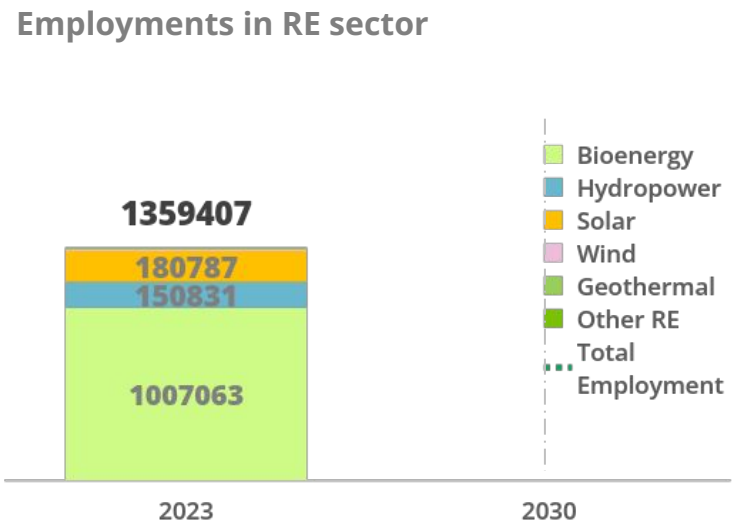
Domestic banks
From 2020 to 2023, local banks invested USD 3.7 billion in renewable projects,[107] twice the amount for coal, and in 2024 for the first time provided no financing for new coal, signaling a decline in coal investment.

Public investment in the Philippines includes CIF concessional funds for a just coal-to-clean transition, World Bank loans supporting offshore wind and renewable expansion, and domestic sovereign financing through the Maharlika Investment Fund for the national grid and infrastructure projects.

2.3 Socio-Economic Impacts of Energy Transition

This section highlights the potential employment demand and economic growth from the energy transition, focusing on opportunities in Southeast Asia, Vietnam, Indonesia, and the Philippines.

The renewable energy sector is projected to generate more than one million additional jobs in Southeast Asia by 2030 compared to 2016.



The total renewable energy employment in Southeast Asia more than doubled from 2016[108] to 2023.[109] Jobs are projected to reach 2.2 million in 2030.[108]

- Bioenergy, including liquid biofuels and biogas, contributed the highest share of employment during this period.
- Solar jobs increased from 60,000 in 2016 to 180,000 in 2023, becoming the second largest source of renewable energy employment and surpassing hydropower.
- Hydropower ranked third, but its employment levels declined.

Shifting toward RE and reducing coal use in SEA benefits the environment by cutting up to 50% of GHG emissions in the region and accelerating renewable energy-driven economic growth. However, it also threatens the GDP contribution and jobs in coal-related industries, especially countries such as Indonesia that have large coal industries and/or power sectors reliant on coal.[110]

Just Transition meets the climate goal without any industries, workers, or social group being left behind. The World Bank provides the 3R framework to smooth the coal phasing down in developing countries as outlined below.[111]

Reducing

Reduce the risk of stranded costs by avoiding new CFPP investments and by establishing clear transition strategies and plant-level criteria.

Reusing

Reuse the existing CFPPs by repurposing them to co-firing biomass or supplementing the operations of the RE.

Reconciling

Reconcile the CFFP's stakeholders by assessing and managing systemic risks to balance stranded-asset impacts of CFPP stakeholders with consumer affordability and the public tax burden.

Clean energy and low-carbon mobility could generate an estimated USD 90–100 trillion in revenue opportunities for Southeast Asia.[112]

Potential SEA's manufacturing capacity in clean technologies by 2030

125 – 150 GW

of PV cell and module capacity potentially to be achieved

In 2022, Southeast Asia could manufacture approximately 55 GW of PV wafers and assemble around 70 GW of PV modules, led by Vietnam, Malaysia, and Thailand.

- In the same year, SEA shared 9 – 10% of global PV cell and module production capacity
- Malaysia, supported by its silica reserves, has capabilities across the full solar PV manufacturing chain—from polysilicon production to wafering, cell manufacturing, and module assembly.
- Vietnam has strong capacity in wafer, cell, and module manufacturing, making it a key player in the region's PV supply chain.

60 GWh

of battery capacity is committed to be produced in SEA.

The region has capacity in both critical minerals and battery cell production, holding strong critical-mineral resources—nickel in Indonesia and the Philippines, and manganese in Vietnam and Malaysia. By 2030, Vietnam and Indonesia are expected to lead in cathode production of around 130 GWh, while Indonesia, the Philippines, Vietnam, and Thailand together can produce about 60 GWh of battery cells.

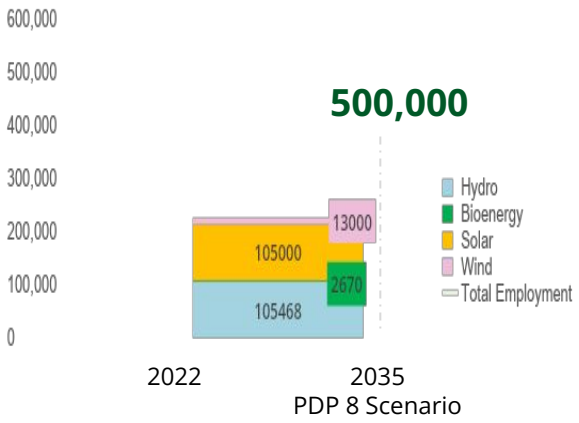
4 million units

of two-wheelers assembly capacity per year are expected to be reached by 2030.

The region assembles 1.4–1.5 million electric two-wheelers annually. Indonesia and Vietnam lead the region, together accounting for 6–10% of global two-wheeler assembly capacity.

Vietnam is well-positioned for energy transition, with clean-energy jobs projected to reach 500,000 by 2030 and a strong foundation in clean-tech manufacturing.

Employments in RE sector



Projected renewable energy employment under the PDP 8 scenario could reach 500,000 jobs by 2035.[113]

The solar sector was the second largest employer in renewable energy in 2022, behind hydropower. [109] Employment in the solar sector will grow the most, with about 140,000 jobs expected from utility-scale solar PV by 2030, alongside a continued increase in rooftop-solar jobs. [113]

Employment in the wind sector is expected to fluctuate during the 2020s but increase significantly after 2030. [113]

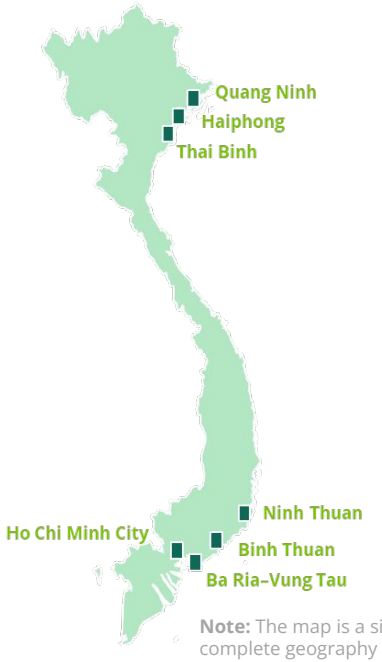
Vietnam is emerging as one of the leading producers of solar PV cells and electric two-wheelers in SEA.

PV Solar

Vietnam has manufacturing capacity across wafers, cells, and PV module assembly. In 2022, it accounted for about 90% of SEA's ingot production and nearly half of the region's PV module assembly.[112]

Two-Wheeler

The country also produces around 600,000–900,000 two-wheelers annually, representing approximately 38–50% of SEA's total output — the highest share in the region. [112]

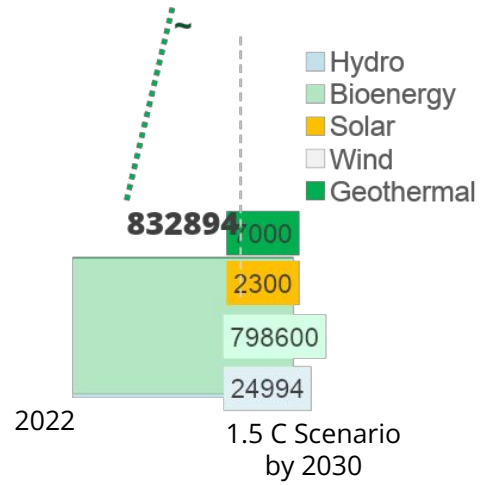


Note: The map is a simplified illustration and may not represent the complete geography of the country.

MOIT plans to transform Vietnam into a regional renewable energy hub by developing industrial centers in the north and south at cities, focusing on value chains, services, and skilled workforce development.[114]

Indonesia's economy stands to gain from the growth of RE and EVs industries.

Employments in RE sector



The employment in RE sector in Indonesia could reach 2 million by 2030 under 1.5 scenario.[115]

The bioenergy sector is the largest source of renewable energy employment in Indonesia, providing about 798,600 jobs—roughly 30 times more than hydropower, the second-largest employer.[109] Bioenergy jobs are projected to rise to 1.1 million by 2030. [116]

In 2022, wind and solar together employed fewer than 10,000 workers. [109] Under a 1.5°C-aligned scenario, solar employment is expected to increase sharply, reaching about 565,000 jobs by 2030.[116]

Impacts from Coal Transition

About 240,000 premature deaths could be avoided through a coal transition. [117]

Approximately 250,000–300,000 jobs could be affected by the shift away from coal. [117,118]

Indonesia's abundant resources and strong domestic demand can act as key tailwinds supporting the country's growth in battery and electric two-wheeler manufacturing.

Battery

Battery manufacturing can add USD 8–10 billion to Indonesia's GDP and create around 530,000–540,000 new jobs.[112]

Nearly all cathode active materials (CAM) produced in Southeast Asia are expected to come from Indonesia, with announced production reaching 130 GWh by 2030. The country is strongly competitive, able to produce CAM at approximately 3–6% lower cost than China, the current global leader.[112]

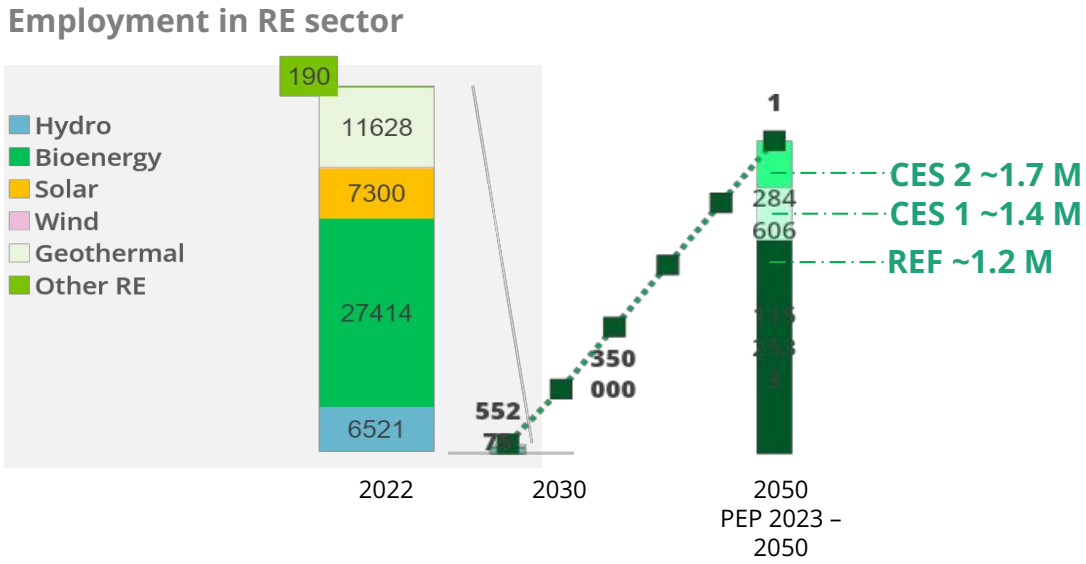
Indonesia has also announced 35 GWh of battery-cell manufacturing capacity by 2030, accounting for more than half of the region's total planned production. [112]

Two-Wheeler

Indonesia produced around 430,000 electric two-wheelers in 2022. By 2030, domestic demand is expected to surge, with production projected to reach about 2.5 million units [112]. This growth could add USD 3.5 - 4 billion to GDP and generate 355,000 – 375,000 of new jobs.[112]

RE employment in the Philippines will rise with the rise in RE installed capacity. CES 2, with its larger RE expansion, will generate significantly more jobs.

RE employment could rise to 350,000 workers by 2030 and expand to around 1.7 million under CES 2 by 2050.[66]



Renewable energy employment in the Philippines reached 55,275 workers in 2022[102].It is projected to grow about sevenfold to 350,000 by 2030[66].

By 2050, RE-sector jobs are expected to reach 1.2 million under REF, 1.4 million under CES 1, and around 1.7 million under CES 2 [66].

Bioenergy power provided the largest share of RE jobs in 2022, employing about 27,000 workers, followed by geothermal, solar, and hydropower [102].

Solar and wind jobs are expected to grow the most, consistent with Southeast Asia's broader trend and the large planned capacity additions under PEP 2023–2050.

PV manufacturer can add a hundred million to the country's GDP

PV Solar

The Philippines currently manufactures PV wafers, producing around 1 GW of wafers and cell assemblies in 2022. [105]

By 2030, PV module assembly capacity could rise to 3–50 GW, generating an estimated USD 100–175 million in GDP and creating 8,000–12,000 new jobs. [105]

International Case Study: EU's Reskilling Coal Industries Workers to RE

Reskilling programs such as the RES-SKILL project,[112] which bring together VET providers, industry, and social partners, help coal-sector workers develop green career pathways and transition into RE, EE, and grid technologies. These programs also enhance inclusivity across age and gender groups and support national environmental policies.

CHAPTER 3

Key Findings and Energy Transition Trends

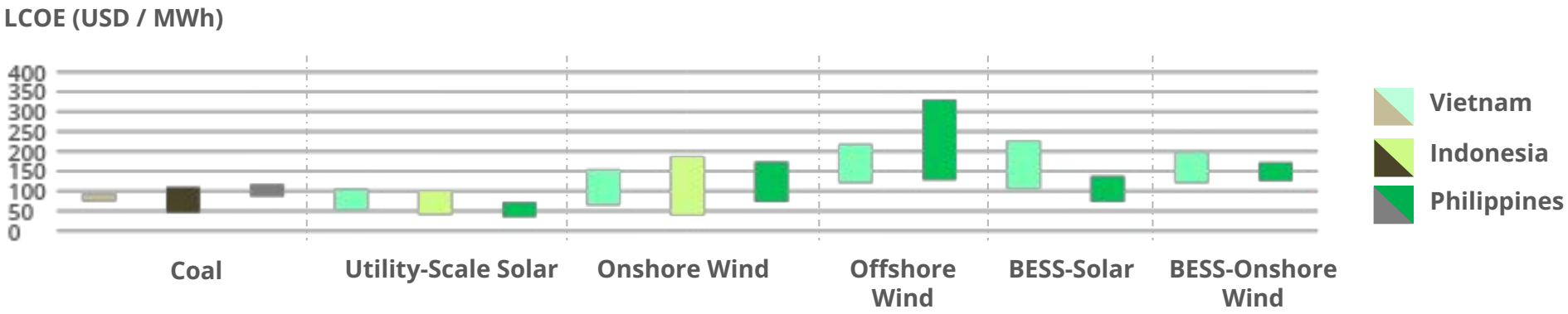
This chapter summarizes current efforts and gaps in the energy transitions of Vietnam, Indonesia, and the Philippines, highlighting common issues and opportunities for governments, the private sector, and development partners to help bridge the gaps.

Vietnam has reached the ASEAN average RE share in the power generation mix. RE shares in the three focus countries are expected to rise, while coal capacity is projected to decline.

	Vietnam	Indonesia	Philippines
2024 Renewables Share in the Electricity Generation Mix	**39%**	**15%**	**22%**
Renewable Electricity Progress Outlook	**++** **RE capacity is growing, but at a slower pace,** due to less attractive policies & unclear mechanism	**+** **RE capacity growth remains slow**. Lower coal LCOE may favor coal over renewables.	**+++** **RE capacity is expected to grow faster.** 65 GW of OWS has been committed to be added
2024 Coal Share in the Electricity Generation Mix	**54%** Increased 19.5% from 2015 – 2024	**69%** Increased 6.6% from 2015 – 2024	**62.3%** Increased 17.9% from 2015 - 2024
Future of CFPP Installed Capacity	**CFPP capacity expected to decline** due to the 2050 phaseout target and the ban on new CFPPs confirmed by Decision 266/QĐ-TTg.	**CFPP capacity expected to decline** driven by the partial ban on new CFPPs under PR 112/2022, early retirement plans, and the shift toward biomass co-firing.	**CFPP capacity expected to decline** following the 2020 moratorium on new CFPPs, but the official coal phase-out year is not set.

Southeast Asia is rolling out plans to expand energy storage systems to prepare power grids for higher shares of renewable energy

Utility-scale BESS is growing across the region, but high investment costs and higher LCOE remain major challenges for investors. However, BESS-solar systems in Vietnam and the Philippines are becoming cost-competitive with onshore wind.[34,121,122]



All three countries are prioritizing energy storage to provide firm power from intermittent renewables and are introducing incentives to attract investments in BESS.

Vietnam is targeting 10–16.3 GW of large-scale BESS by 2030, has set higher ceiling prices for solar-plus-storage projects, and is developing a pricing framework for stand-alone storage.

Indonesia is targeting 4 GW of BESS and 4.3 GW of pumped-hydro storage by 2034 and is procuring storage through ceiling-price renewable tenders, while dedicated incentives are still under consideration.

In 2024, the Philippines operated about 1 GW of BESS, with capacity projected to reach 23–25 GW by 2050 under CES 1 and CES 2. Government support includes a solar-plus-storage category in GEA-4 and the Ancillary Services Procurement Agreements (ASPAs), the primary framework enabling BESS to earn revenues through ancillary services.

Under low, medium, and high scenarios, the outlook for the levelized cost of storage (LCOS) for a 4-hour lithium ion battery is that LCOS could fall by 16%–49% by 2030 and 28%–67% by 2050.[123]

Coal transition in the region remains slow due to legal, contractual, technical, and financial barriers

CFPPs have historically supported developing economies by supplying reliable, 24/7 baseload electricity , which has often been enabled by regulations subsidizing the price of coal or electricity, as seen in Indonesia.

The technical and economic issues below are the main factors slowing the process of transitioning from CFPP dominant power sector to one based on RE power plants:

1 Lack of holistic power system planning limits coal replacement

The power systems of ASEAN countries lack a holistic integration approach, which constrains VRE integration. Dispatchable generation, smart grids, BESS, and demand management should be fully integrated into the operations of each ASEAN country's power system operations[124] CFPP phase-down is further hindered by fuel subsidies and long-term contracts that distort cost comparisons with renewable alternatives.

2 Early-retirement of CFPPs need more financing supports

The average age of coal-fired power plants in Southeast Asia is only 8–13 years, far younger than their technical lifespan of around 40 years. Long-term power purchase agreements and fixed baseload, intermediate, and peak-load roles further limit operational flexibility, making it harder to integrate more renewable energy.[125] The cost of early-retirement of CFPPs in developing countries is high, around USD 1 trillion for retirement CFPPs by 2040.[125] For instance, retiring 18 GW of CFPP in Vietnam may cost USD 12 billion.[125] Given these risks, governments may adopt phase-down alternatives to retirement, such as biomass co-firing; however, these approaches may extend the lifetime of coal assets.

> *"Coal retirement framed by reliability: "Keep-the-lights-on" politics dominate—retirements stall without credible replacement and grid readiness.*
>
> **Lawrence Ang**
> *Climate Smart Venture*

An example of financial mechanisms in Southeast Asia to accelerate coal phase-down: the ADB-led ETM. ETM supports early coal retirement through technical assistance and blended finance.

Eliminating the negative economic impact of retiring a coal plant early is key to phasing down coal. Some potential financing solutions include: (1) discounted corporate loans tied to coal-retirement commitments and (2) direct stewardship/ownership of coal assets by investors to manage phase-down.

EV penetration is rising, with broad acceptance and policy support

EV share in the three countries' car markets in 2024

EV penetration is driven by the private sector, supported by enabling policies such as:

Projected EV and HEV sales in 2030 focal year. [18]

Consumers are willing to buy EVs, according to the 2025 Global Automotive Study. [126]

Vietnam

25%

The sales of EV and HEV increased from 11% in 2023.[18]

- Lower SCT and vehicle registration fee exemption for EV buyers.
- Stricter emission standards for ICE vehicles

40%
of total car sales by FY2030

45% of people in the survey plan to buy an HEV, PHEV, or BEV by 2030.

Indonesia

15%

The sales of EV and HEV increased from 9% in 2023. [18]

- Luxury tax reduction and VAT exemption for EV buyers
- Reduced CIT for EV and battery manufacturers and Incentives for manufactures using local contents

29%
of total car sales by FY2030

46% of people plan to buy an HEV, PHEV, or BEV by 2030

Philippines

1%

EV and HEV sales rose from 2023 to 2024, increased by 3,000 units. [18]

- Road tax reduction for buyers
- Income tax holidays, special CIT rate, and duty-free import of parts and machinery for manufacturers

15%
of total car sales by FY2030

29% of people in the survey plan to buy an HEV, PHEV, or BEV by 2030

Three countries show an increase in EV demand.

E-mobility is on a strong growth trajectory, but charging infrastructure remains the key challenge

EVs are a flagship mitigation measure in the transport sector, cutting CO_2 emissions by 52–65% for SUVs and 34–51% for scooters, while offering a supply-chain opportunity valued at USD 50–55 billion. Adoption, however, is hampered by limited charging infrastructure, high costs, and battery concerns.

Vietnam

EV sales reached about 97,000 units in 2024, with nearly 90% coming from domestic brands.[127] The country reportedly has around 150,000 charging stations,[128] but an additional 100,000–350,000 are likely needed over the next 15 years to align with EU benchmarks.[129]

Indonesia

EV sales grew to over 100,000 units in 2024 .[18] with over half from Chinese imports and under 20% from local production. There are over 20 light-duty EVs per charging point[131]—twice the number of EV per charger than the EU recommends; highlighting concerns about insufficient stations.

Philippines

EV adoption is more modest in the Philippines than it is with its peers. The Government's CREVI calls for the deployment of 7,300 EV charging stations by 2028.[132]

> *The European Alternative Fuels Infrastructure Directive (2014/94/EU) defines sufficient charging infrastructure as having an optimum ratio of one charging point for every ten electric vehicles.[130]*

Although targets are set at ambitious levels, the supporting policies for energy efficiency and industrial decarbonization require stronger efforts.

	Vietnam	Indonesia	Philippines
Energy efficiency targets	**8-10%** Energy savings by 2030	**1%** Annual reduction in energy intensity	**10%** Save electricity and oil products by 2040 – 2050
	All three countries focus more on supply-side policies than on EE&C, maintaining only a minimal EE&C framework: mandatory energy management, MEPS, and BEC.[91] EE incentives remain limited—mostly donor-driven in Vietnam and inconsistently applied in the Philippines.		
BECs and MEPSs ensure minimum energy consumption	BECs are mandatory for commercial, and public buildings[133] and MEPSs are applied for industrial, household, commercial applications.[134]	BECs are mandatory for large commercial and residential buildings, [135] and MEPS for motors are being strengthened toward 2026.[136]	BECs are mandatory for all building types [137] but MEPSs are limited for industrial equipment and largely exclude motors.[138]
	++	=	+
Industrial decarbonization measures lead to energy savings and GHG emission reduction	**Comprehensive** Vietnam has a comprehensive industrial decarbonization framework, including programmes like VNEEP, pilot ETS for industries, DPPA scheme and a circular economy strategy.	**Developing** Foundational EE measures exist, but a comprehensive industrial decarbonization strategy is under development,[139] with challenges remaining in monitoring captive coal emissions and limited renewable procurement.	**Moderate** The Philippines lacks dedicated industrial decarbonization policies, with only basic EE requirements in place; however, mechanisms like GEOP offer strong mitigation potential for industries.

> *Efficiency targets are too high-level (energy intensity) with no sectoral detail, making translation into action difficult*
> **Iqlima Fuqoha**
> *SEforAll*

The demand side plays a significant role but is often overlooked

The three focus countries usually have these issues:

1 They set ambitious targets without integrated resource planning

Policymakers often rely on outdated models. For example, building energy codes and MEPSs in Vietnam and Indonesia have not been updated since 2022, while only the Philippines has introduced recent improvements.[91] These countries lack an integrated approach to EE, RE, and grid development, and their policies overwhelmingly favor the supply side. A holistic framework, such as Integrated Resource Planning (IRP), can enhance energy resilience, reduce grid stress, and defer or avoid the need for new power plants.

2 Lack of policy and financing supports

Energy efficiency remains underdeveloped: while policies exist on paper, they lack strong institutions, financing, and political commitment. Few development partners are active compared to renewable energy, and there are no meaningful incentives to implement efficiency measures. In 2023, the investment in energy efficiency and end-use electrification in SEA was USD 7 billion that will need to more than double by 2030 to align with the stated policy scenario requiring USD 19 billion by 2030. [91]

3 They underestimate the impacts of cooling and building load

SEA cooling load was around 80 TWh in 2020 and is projected to quadruple to 333 TWh by 2040.[140] Stronger enforcement of building energy codes and efficiency standards is essential. Adopting technologies like passive cooling (e.g., shading, cool roofs) and AI-driven building management can significantly reduce energy use and costs.

> *"As costs fall, households and businesses will pair PV with batteries, reducing visible load on the grid. EV batteries can serve as storage through bidirectional charging (V2G).*
>
> — **Michael Williamson**
> *UNESCAP*

Demand-side energy response (DERs) can reduce consumption and ease grid congestion. Rooftop PV, batteries, and V2G can reshape demand and lower costs for both building owners and grid operators.

The three focus countries are increasingly adopting carbon pricing to incentivize low-emission businesses

	Vietnam	Indonesia	Philippines
Carbon pricing mechanism	**ETS** All sectors in 2029	**ETS** Focusing on power sector until 2030	**Cap-and-trade** Under consideration
International collaboration	Article 6.2 with Singapore	MOU support domestic carbon trading from Singapore	Article 6.2 with Singapore

Article 6 of the Paris Agreement allows countries to trade mitigation outcomes (ITMOs) with corresponding adjustments to avoid double counting. Singapore is the most active buyer in ASEAN, with bilateral agreements to source carbon credits from Vietnam, Indonesia, Cambodia, the Philippines, and Laos.

The ASEAN Common Carbon Framework (ACCF) was advanced at COP29, where carbon-market associations from Indonesia, Malaysia, Singapore, and Thailand signed a Memorandum of Collaboration. The initiative aims to harmonize carbon-market methodologies, standards, MRV systems, and future mechanisms for market interoperability across the region. As of December 2025, ACCF has been reflected in discussions under the ASEAN Strategy for Carbon Neutrality and the ASEAN Economic Strategic Plan 2026–2030. Further coordination is required to develop a unified regional framework and expand participation among all ASEAN member states.[141]

The APG enables cross-border electricity trade, including the export of renewable-rich power among ASEAN member states and enhancing regional grid resilience and flexibility.

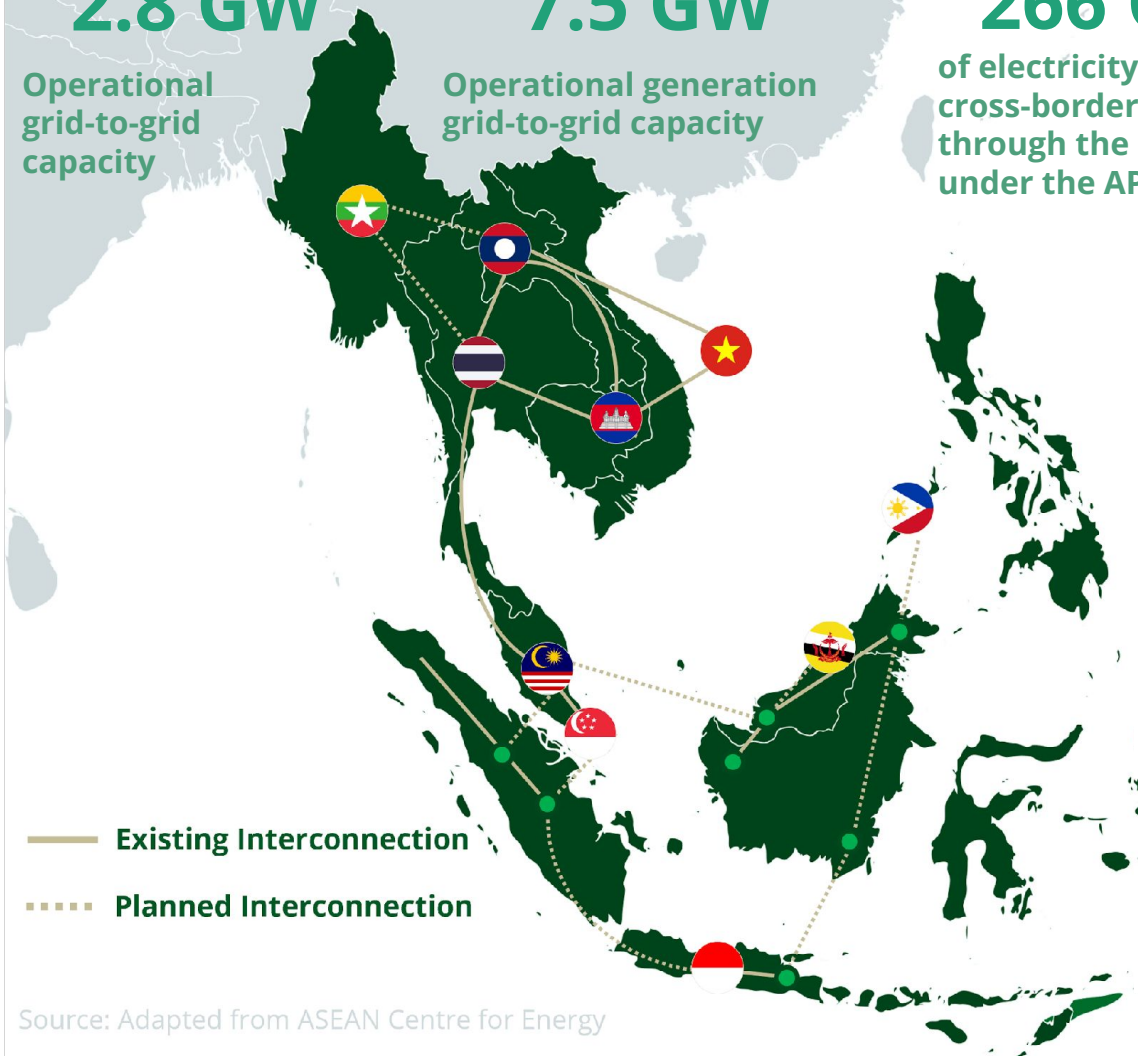
The APG has identified 18 interconnection projects, of which around 8 are currently operational.[142] These interconnections enable cross-border electricity trade, particularly hydropower exports from Lao PDR, with Vietnam expected to play a larger role in future regional power exports.

Key Figures in 2024[127]

2.8 GW
Operational grid-to-grid capacity

7.5 GW
Operational generation grid-to-grid capacity

266 GWh
of electricity was cross-border traded through the LTMS-PIP under the APG



Source: Adapted from ASEAN Centre for Energy

The Lao PDR–Thailand–Malaysia–Singapore Power Interconnection Project (LTMS-PIP), ASEAN's first multilateral cross-border power trade, entered Phase 2 in 2025, doubling transmission capacity from 100 MW to 200 MW to expand electricity exports from Lao PDR to Singapore.

Tenaga Nasional Berhad (TNB), Petroliam Nasional Berhad (Petronas), PetroVietnam Technical Services Corporation (PTSC), and Sembcorp Utilities Pte Ltd signed a Joint Development Agreement to conduct a feasibility study on exporting 6 GW of renewable energy from Vietnam to Singapore.

TNB announced the completion of a pre-feasibility study for the Peninsular Malaysia–Singapore interconnection, with potential to expand existing capacity from 1,000 MW to 2,000 MW and enable bidirectional power flows with operational targeted around 2030.

Singapore and Indonesia signed a Memorandum of Understanding on the Singapore–Indonesia Power Interconnection.

Emerging technologies such as AI, batteries, EVs, and solar PV require careful management of supply chain issues and potential energy and environmental impacts

AI growth could supercharge renewable energy demand

The energy demand from AI applications and data servers is growing exponentially and is projected to reach around 945 TWh by 2030, nearly double today's level. Southeast Asian countries like Vietnam, Singapore, Malaysia, and Thailand are positioning themselves as data center hubs by ensuring secure and clean power. Governments support this with policies such as Vietnam's Direct PPA pilot and the Philippines' GEOP, enabling data centers to source renewables directly. This trend is spurring RE expansion, BESS integration, and grid modernization across the region.

The energy transition can have negative consequences when mining activities are not managed responsibly.

Nickel is a critical mineral for battery supply chains, and ASEAN members such as Indonesia and the Philippines are leveraging it for economic growth. The global rise of batteries is fueling high demand for nickel, which in turn requires extensive mining and processing, activities that cause deforestation, air and water pollution. Governments in the region are introducing policies to strengthen environmental safeguards regarding mining and processing of ores.

Clean-tech is facing supply risks from critical mineral needs

EV, PV cells, and wind turbines rely on critical materials concentrated in a few regions. Countries are adopting policies to secure supply, build domestic value chains, and enforce sustainability standards. Indonesia, for example, banned raw nickel exports in 2020 and is developing midstream and downstream industries, despite ASEAN not yet establishing a regional framework for collaboration.

Key stakeholders can contribute more to...

	Governments	Private Sector	Development Partners
RE **Stakeholders can support the scale-up of RE**	**Governments** can: • Establish independent energy regulators. • Ensure transparency in RE auctions and billing • Enable flexible access to RE (e.g., aggregation models). • Align transmission planning with RE zones. • Streamline permitting across ministries to support CREZ-style financing.	**Commercial and industrial enterprises** can adopt suitable RE mechanisms, such as aggregation models for small-load facilities where applicable. **Private banks** could expand access to financing and diversifying renewable energy investment options.	**Development partners** can: • De-risk high upfront costs of small and medium-scale RE power project in remote areas. • Build capacity for advanced technologies (e.g., solar thermal) to enhance RE utilization. • Promote RECs and MRV tools.
Coal Phase-Down **Stakeholders can contribute to acceleration of coal phase-down.**	**Governments** can: • Set a clear and binding coal phase-out year. • Develop detailed roadmaps and implement regulations for coal phase-down. • Reduce subsidies and other supportive policies for coal use.	**The CFPPs owners** can: • Plan transmission ahead of coal replacement. • Explore coal-retirement financing and more flexible operation approaches. • Manage stewardship models.	**Development partners** can: • De-risk high CFPP early retirement cost. • Build capacity to re-skill coal-related industry workers to clean technology industries.
JETP **Stakeholders can help advance JETP initiatives beyond the pilot stage.**	**Governments** can help clarify governance and coordination.	**The private sector** can advocate for inclusion in JETP templates.	**The JETP development partners** can provide fund transaction templates and risk frameworks.

Key stakeholders can contribute more to...(continued)

	Governments	Private Sector	Development Partners
EE **Stakeholders can increase efforts in energy efficiency and conservation.**	**Governments** can: • Set integrated RE-EE goals and practical sectoral goals. • Provide clear M&V framework and a more holistic approach between EE to scale up RE. • Establish EE authority with mandates.	**Private companies** can: • Build in-house EE capacity and integrate efficiency in operations. • Adopt EE as investment; sustainably reduce energy and environmental costs. **Financial institutions** can support ESCO models.	**The development partners** can: • support creation of EE regulators and institutions.
Industrial decarbonization **Stakeholders can implement integrated renewable energy and energy efficiency strategies to reduce industrial GHG emissions.**	**Governments** can: • Set clear sector targets and roadmaps for industrial decarbonization including energy efficiency, electrification, and sustainable fuels. • Strengthen enforcement and regularly update energy efficiency standards (e.g., MEPS for industrial applications) • Catalyze investment through incentives and de-risking mechanisms	**Private companies** can: • Reduce fossil fuel use and increase renewable energy use through on-site investment and available procurement mechanisms • Support SMEs in the supply chains to reduce GHG emissions • Adopt high-efficiency equipment such as motors, air conditioners and lighting • Electrify low-temperature heat applications where feasible • Improve thermal insulation for industrial processes	**The development partners** can: • Provide technical assistance and de-risking mechanisms to advance energy efficiency, including policy support for governments • Support the deployment of advanced technologies, such as electrified heating and decarbonization solutions for hard-to-abate sectors like steel and cement

Key stakeholders can contribute more to...(continued)

	Governments	Private Sector	Development Partners
EV economy **Stakeholders can encourage the transition to low-carbon transport.**	**Governments** can: • Mandate e-mobility for public fleets and promote adoption in the private sector. • Align upstream and downstream incentives to support the entire EV value chain.	**Project developers** can: • Invest in EV charging infrastructure to alleviate charging-infrastructure bottlenecks. **Manufacturers** can: • Sustainably invest in batteries, nickel value chain, and vehicle-to-grid pilots while considering the lowest environmental impact approaches. **Private car owners** can: • consider switching to energy-efficient vehicles or EVs for their next purchase.	**The development partners** can: • Support EV manufacturing and downstream processing with fiscal tools.
National grid **Stakeholders can strengthen grid resilience and flexibility.**	**Governments** can: • Provide incentives for energy storage or RE-BESS integration initiatives. • Establish rules and revenue models for energy storage and ancillary services. • Upgrade and modernize grids to reduce curtailment.	**Private power developers** can: • Procure renewable energy together with storage or other firming solutions to deliver reliable power. • Prioritize bankable RE–storage hybrid projects. • Leverage joint ventures and PPPs in T&D.	**The development partners** can • Use blended finance for feasibility and preparatory work. • Support investment, interconnection, and bankability.
Regional grid **Stakeholders can promote cross-border power trade within the region**	**Governments** can: • Harmonize electricity regulatory frameworks and tariffs across countries • Upgrade regional lines and interconnection. • Coordinate regionally (LTMS, Borneo/BIMP, VMS). • Clarify undersea cable rules.	**Private power developers** can: • Target subregional deals with clear offtake (e.g., Singapore, Brunei)	**The development partners** can • Support subsea cables and hydro imports • Build regulator capacity • Align on regional roadmaps (AIMS III)

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