

Fabby Tumiwa

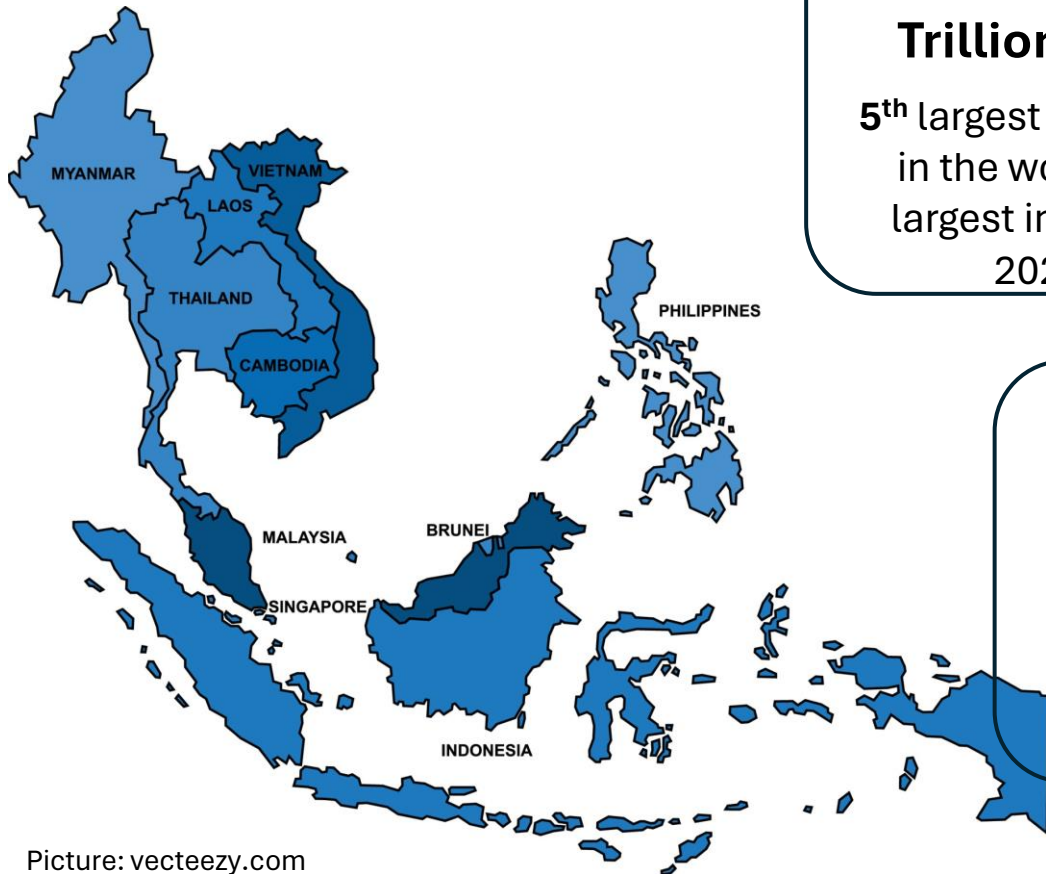
Institute for Essential Services Reform (IESR)

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Accelerating Southeast Asia's Energy Transition with Renewables



Southeast Asia is one of the largest economies in the world and is projected to grow its energy demand by **44%** and emissions by **60%** in 2050



3.6

Trillion USD

5th largest economy
in the world, 3rd
largest in Asia in
2022

4%

Average annual
GDP growth 2015-
2022

685.15

million

Total population in
2023

1.6

Gt CO₂

Total region's CO₂
emission

1060

TWh

Total electricity
consumption in
2021

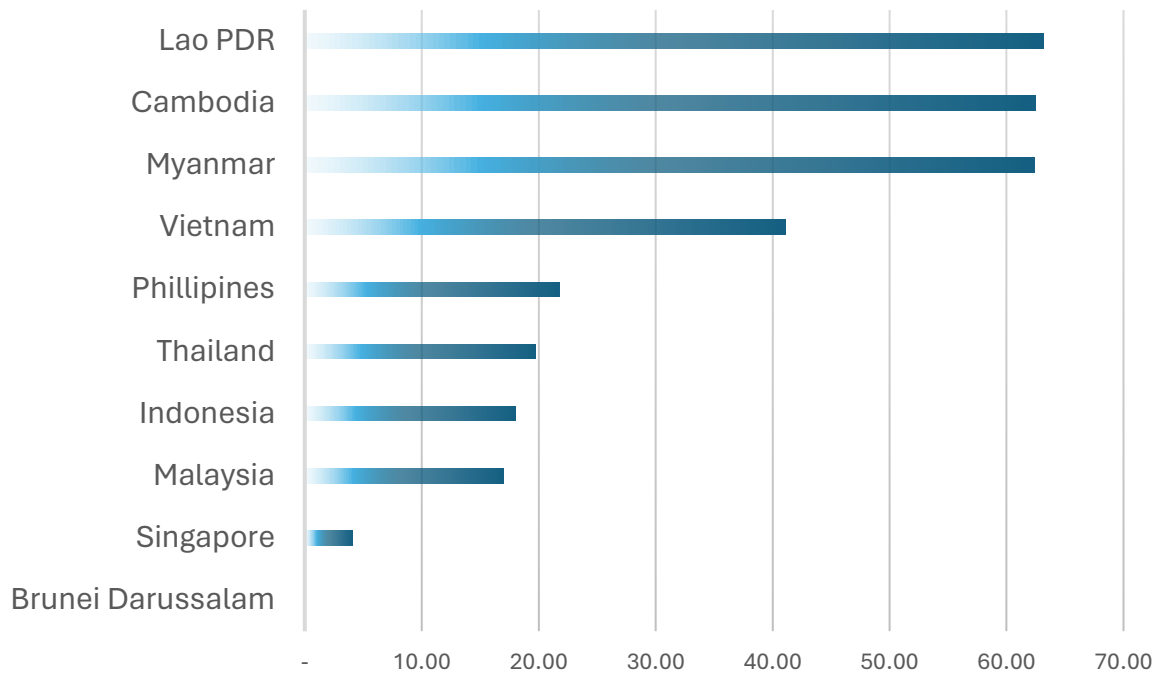
6.07

Thousand USD

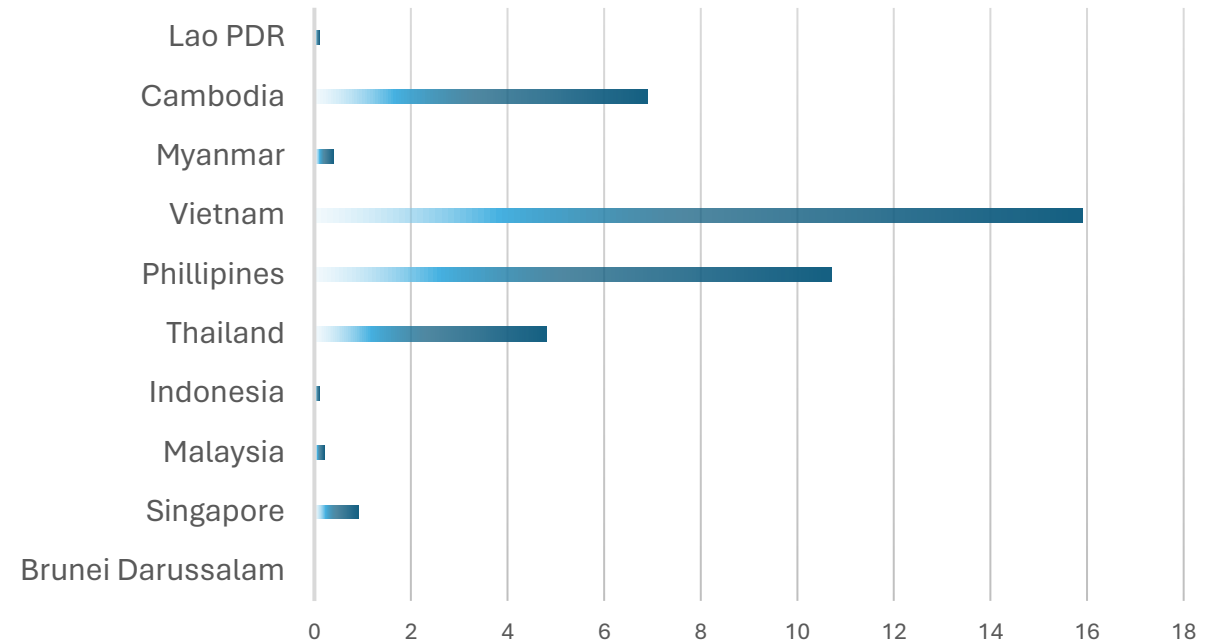
GDP per capita,
current price

Southeast Asia countries have a sizeable renewable energy share, but variable renewables (solar and wind) must rapidly increase to meet mid-term decarbonization goal.

SHARE OF RE 2021 (IN %)



SHARE OF VRE 2021 (IN %)



Source: IRENA (2023), IEA (2023)

- To be aligned with 1.5 C, RE must account for 55% of the region's energy mix, of which VREs contribute around 42% (IRENA, 2023).
- Except for Vietnam, Cambodia, and the Philippines, others have yet to reach 5% VRE penetration.

Southeast Asia has vast renewable energy resources that 40-50x larger than today energy demand, sufficient to reach decarbonization by renewables and storage.



Picture credit: ASEAN Post (2017)

Country	Potential Opportunities ¹ LCOE of Less Than \$150 USD/MWh	
	Solar PV Capacity (GW) (suitable land area [km ²])	Wind Capacity (GW) (suitable land area [km ²])
Brunei	16 GW (431 km ²)	0.02 GW (6 km ²)
Burma	7,717 GW (214,347 km ²)	482 GW (160,564 km ²)
Cambodia	3,198 GW (88,830 km ²)	69 GW (23,082 km ²)
Indonesia	1,052 GW (29,228 km ²)	50 GW (16,551 km ²)
Lao PDR	1,278 GW (35,496 km ²)	13 GW (4,344 km ²)
Malaysia	1,965 GW (54,575 km ²)	2 GW (526 km ²)
Philippines	1,910 GW (53,062 km ²)	217 GW (72,337 km ²)
Singapore	2 GW (60 km ²)	0.02 GW (7 km ²)
Thailand	10,538 GW (292,713 km ²)	239 GW (79,718 km ²)
Vietnam	2,847 GW (79,069 km ²)	311 GW (103,591 km ²)

Source: NREL (2020)

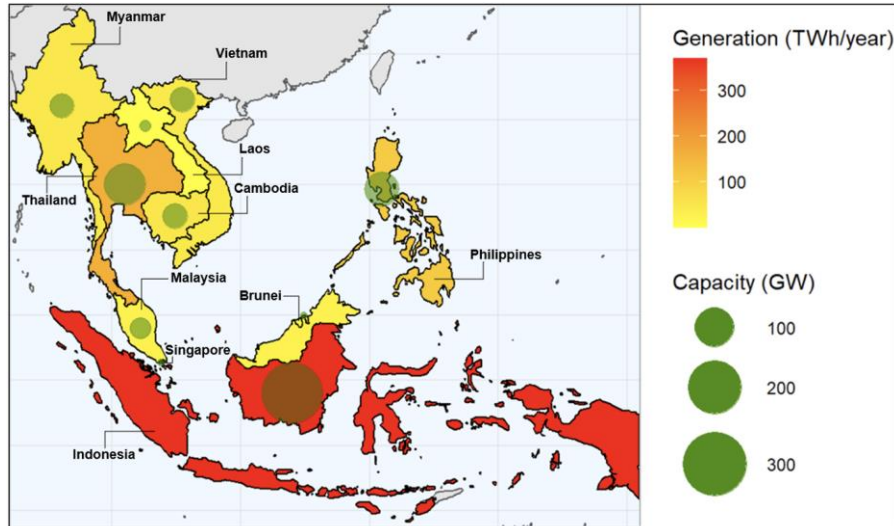
13 sustainable biomass potential in 5 countries

Type of feedstock	Type of process	Total applicable potential bioenergy equilibrium (2050)
Agricultural residues from major crops, rubber and acacia	Direct combustion for industrial heat generation	696 PJ
	Direct combustion for combined heat and power generation	1065 PJ
Palm oil mill effluent (POME) and cassava pulp	Anaerobic digestion to generate biogas for both heat boilers and combined heat and power (CHP) plants	32 PJ
	Direct combustion for industrial heat generation	8 PJ
Agricultural residues from major crops, rubber and teak	Direct combustion for industrial heat generation	8 PJ
	Direct combustion for combined heat and power generation	449 PJ
Cassava pulp	Anaerobic digestion to generate biogas for both heat boilers and CHP plants	6 PJ
	Sugarcane molasses and cassava starch and chips to bioethanol	98 PJ
Agricultural residues from major crops, rubber and eucalyptus	Direct combustion for industrial heat generation	188 PJ
	Direct combustion for combined heat and power generation	145 PJ
Cassava pulp	Anaerobic digestion to generate biogas for both heat boilers and CHP plants	4 PJ
	Sugarcane molasses to bioethanol	4 PJ
Acacia and rubber	Direct combustion in CHP for heat and power generation	106 PJ
Woody residues	Direct combustion for industrial heat generation	17 PJ

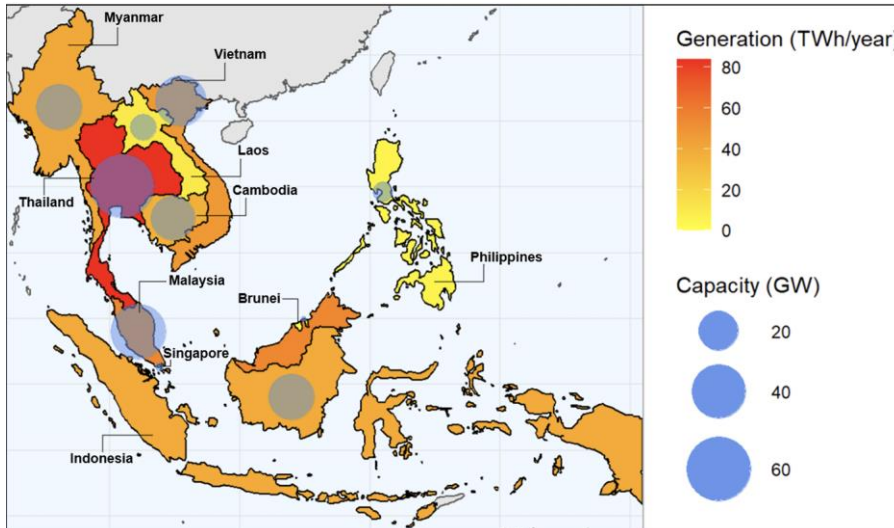
Note: PJ = Petajoules

Source: IRENA (2022)

Floating PV can play important role in the region's renewable energy build-up, lead to decarbonization



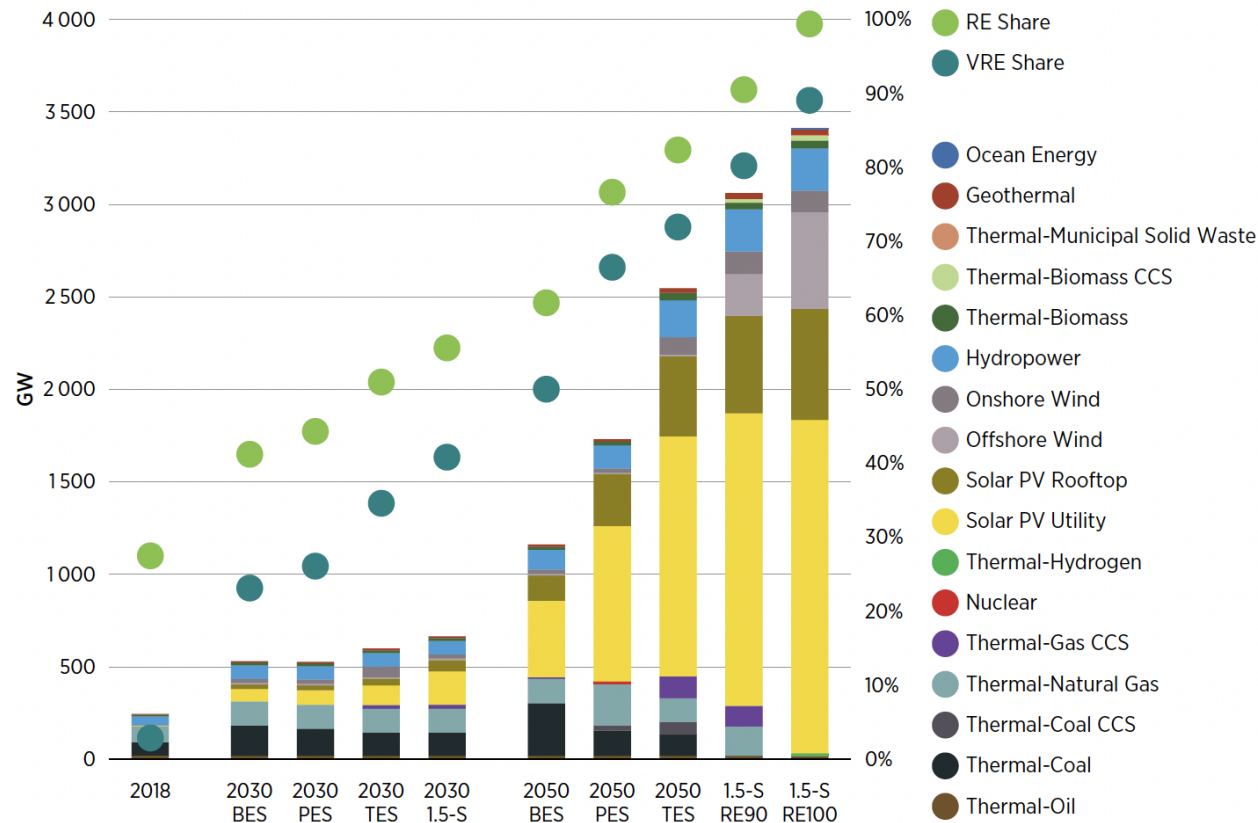
- Technical potential for FPV in 7301 water bodies: 88 reservoirs, 7213 natural waterbodies.
- Technical potential of 134 – 278 GW for reservoirs, 343 – 768 GW for natural waterbodies, vary by country.
- Median case: 825 GW all across Southeast Asia.
- Detailed market and economic technical potential assessment must be carried out, and site-specific techno-economics potential



FPV Cirata Indonesia, 145 MWac



Southeast Asia can meet the Paris-aligned decarbonization target by 2050, with renewables and electrification as the main drivers.



Note: RE = renewable energy; VRE = variable renewable energy.

- The Association of Southeast Asian Countries (ASEAN) aspires to reach **23%** renewables in primary energy supply and **35%** in installed capacity by 2025.
- ASEAN members have an aspirational goal to achieve the decarbonization of energy by 2050 and 2060.
- International Renewable Energy Agency (IRENA) model indicates that ASEAN can reach 1.5°C by 2050 with **90-100%** renewables.
- Direct use of renewables and electrification by renewables will make up **two-thirds** of energy demand.
- Electricity constitutes **52%** of the final energy demand.
- Energy intensity improvement rate must reach 1.9%/yr.
- Average annual investment in renewable energy capacity must be scaled up 5 times to **USD 73 billion/yr.**

Current power market structure in ASEAN poses barriers to VRE's investment and system integration; structural reform of the electricity market is required to mobilize more investment into the region.

System integration

- Heavily regulated market, monopoly by state-owned utility (except PH and SIN).
- Power system planning discourages DER (IDN, TH).
- Contractual inflexibility - long-term PPA, take-or-pay, must run thermal power (IDN, TH).
- Electricity pricing discourages system flexibility and more efficient dispatch.
- Infrastructure deficiency

Investment

- Long-term political commitment.
- Untransparent planning and procurement mechanism.
- High cost of capital due to financial structure and prevailing risk perception.
- Regulatory uncertainty (i.e. , discontinued of FiT in VIE, IDN)
- Local content obligation (i.e., IDN)

Scaling up financing and investment for energy transition in the region requires improvement to reduce risks and uncertainty for investors

- Greater transparency and the wider availability of data around the financial performance and cost of capital for clean energy projects.
- Enhance role for DFIs and blended finance.
- Greater access to risk-hedging tool to address credit and currency risks for private investors.

Market	Recent Policy Changes	Investment Priorities			
		Power sector sustainability	Project bankability	Financing	Integrated approaches
Indonesia	Planning for NZE by 2060. More renewable power in long-term plan, though coal still represents almost 65% of generation by 2030.	●	●	●	●
Malaysia	Government announced goal to become carbon neutral by 2050 and stop building new coal-fired plants.	●	●	●	●
Philippines	Updated nationally determined contribution in 2021	●	●	●	●
Singapore	Government announced Net-Zero Emissions by 2050 target in October 2022	●	●	●	●
Thailand	Announced intention to develop plan for NZE by 2065. Updated power expansion plan has reduced dependency on coal in favour of natural gas.	●	●	●	●
Vietnam	NZE by 2050 target announced at COP26. Substantial capital is mobilised to renewable power, especially solar, while coal capacity is still planned to expand by 2030.	●	●	●	●
Cambodia	Cambodia's Basic Energy plan recommends renewable power make up 65% of total generation by 2030.	●	●	●	●

- Low risk/supportive factor for investment
- Potential risk factor/barrier for investment
- High potential risk factor/barrier for investment

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