Southeast Asia's Energy Transition:

Policy and Deployment – Drawing policy recommendations from an analysis of renewables deployment in the 21st century

Introduction

The race for renewables continues. Growing energy demand, climate risks, and potential economic opportunities are driving countries to reduce reliance on fossil fuels and diversify their energy mix through investing in renewable energy (RE). In Southeast Asia, the landscape for RE presents significant opportunities for both sustainable development and economic growth, particularly as the region seeks to benefit from its natural abundance of renewable sources while aligning with global energy transition efforts.

This report looks at the deployment of renewables in five Southeast Asian markets since the beginning of the 21st century and identifies the key policy changes that have driven change and supported Southeast Asia's energy transition. Based on this analysis, we can draw conclusions about what kind of policy change works, and what kind of policy Southeast Asian countries may consider to support their energy transitions moving forward.

Our analysis is based on data from the International Energy Agency (IEA), supported by data from various studies. The data is presented in the two graphs below, which show gigawatts of renewable energy added per year from 2000 to the present, with projections to 2028. The first graph shows data from all five countries, while the second shows data from all the markets except for Vietnam, whose significant track record in RE deployment can obscure trends in the other markets.

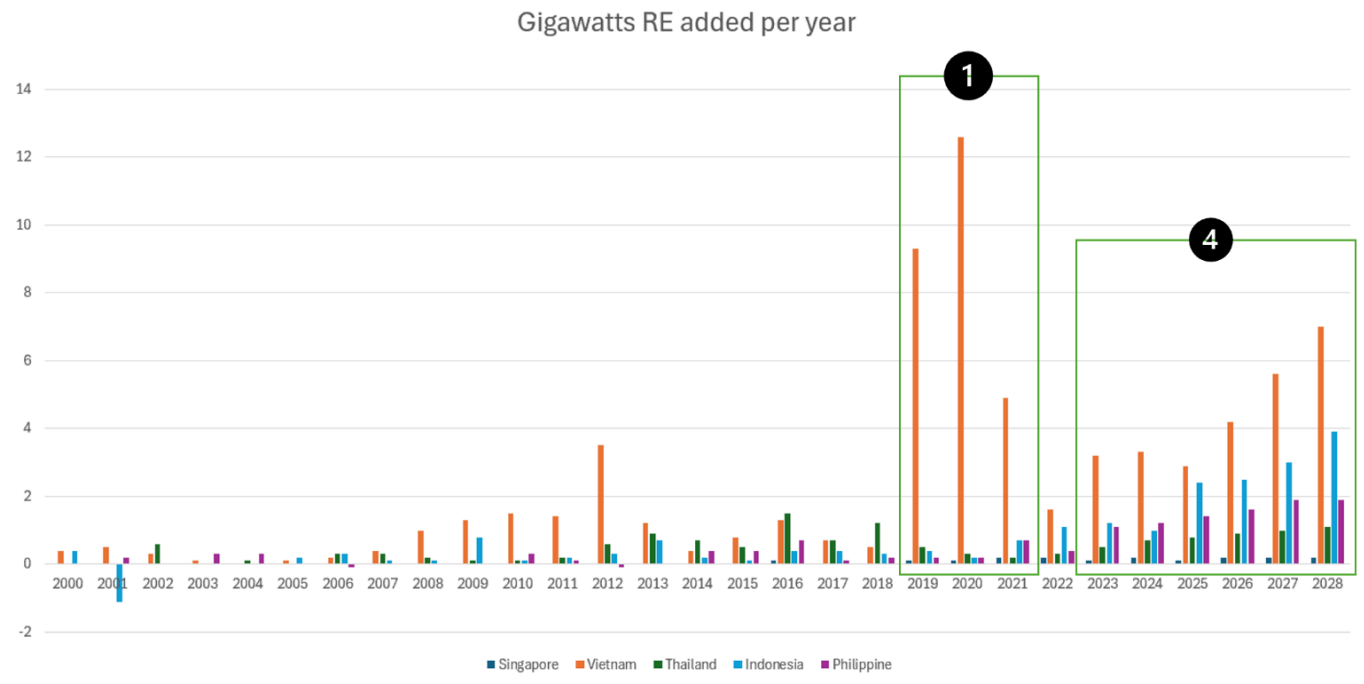

Figure 1: RE deployment per year 2000-2028 (SG, VN, TH, ID, PH)

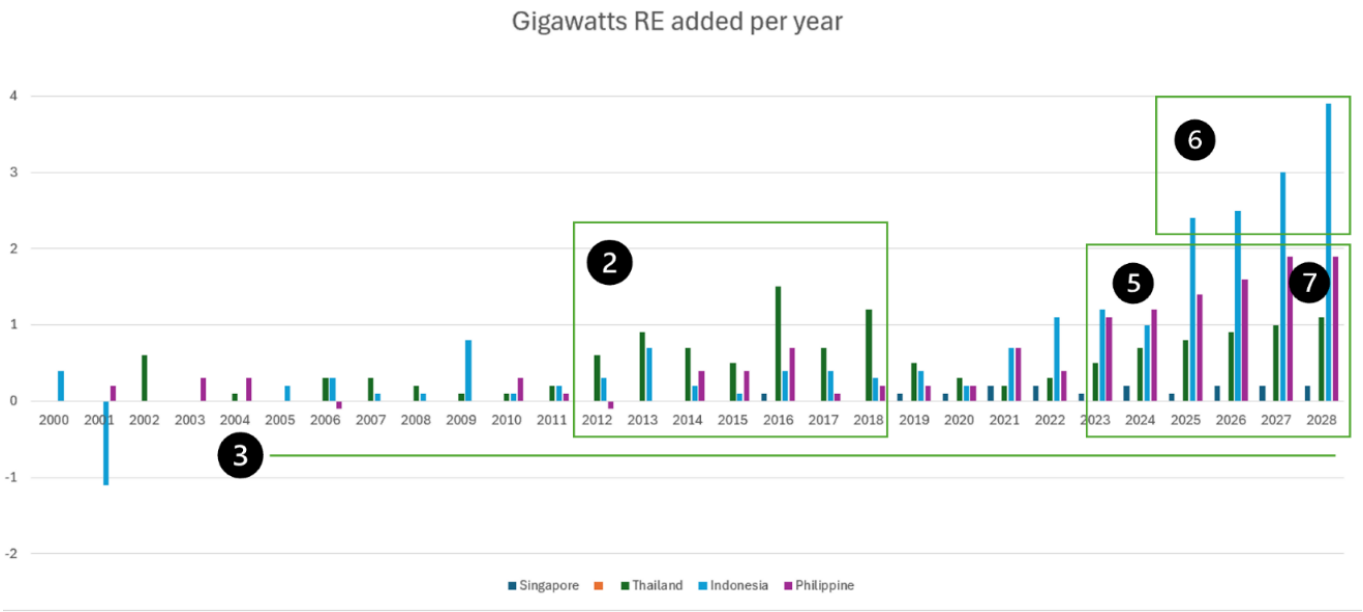

Figure 2: RE deployment per year 2000-2028 (SG, TH, ID, PH)

Key takeaways*

Looking back...

1. Vietnam leads the region in renewables capacity additions, driven by a boom in solar – first utility-scale, then distributed solar. Policy changes, including tax breaks and a generous feed-in tariff (FIT), drove this growth.

2. Thailand added moderate capacity in bioenergy, utility-scale solar and onshore wind between 2012-2018, driven by high-level planning that prioritized alternative energy, tax and non-tax incentives, research support, and the political and economic salience of conglomerates behind power plants.

3. Indonesia has made consistent, if low, capacity additions since the 2000s. The Philippines has added some solar capacity in the past 20 years but otherwise has made limited renewables capacity additions. Given both countries' renewables potential, these are examples of general policy failure primarily due to a lack of political will.

Looking ahead...

4. Vietnam will continue to add significant renewables capacity for the rest of the decade, driven by distributed PV and some utility PV, as well as onshore and offshore wind. While previous capacity growth was driven from FITs, future developments will be further supported by marine spatial planning proposals and direct power purchase agreements (PPAs).

*Each takeaway corresponds to the number in the graphs

5. The Philippines is set to ramp up renewable energy (RE) deployment with significant increase in utility PV, distributed PV and onshore wind. The government has committed to improving the investment regime through regulatory reforms that streamline the approval process, attract competitive bids, and offer tax breaks and incentives.

6. Indonesia has the potential to become much more ambitious, with significant additions in utility and distributed solar and onshore wind. Its success, however, will hinge on the policy priorities of the new Prabowo administration as it seeks to balance competing ambitions in food security and energy.

7. Thailand will add capacity in distributed solar, driven by a 2024 rule change in reducing red tape on distributed solar capacity and incremental changes to FIT and PPA regimes.

Past Capacity Additions

Solar capacity development in Vietnam, enabled by past feed-in-tariff (FIT) programs

Vietnam, a frontrunner in the region's renewable transition, consistently leads in total renewable energy (RE) capacity addition per year. Current projections also indicate that Vietnam will continue to lead other ASEAN countries in net RE additions each year towards 2030, as well as absolute capacity.

While Vietnam's RE capacity growth has dropped off since 2022, yearly RE additions remain significantly higher than other ASEAN countries and are expected to grow at a faster rate in 2025.

So far this century, Vietnam has had two significant spikes in annual capacity additions, the first in the few years leading up to 2012 and the second in the years 2019-2021 including the highest yearly RE addition for Vietnam (or any other ASEAN country) to-date in 2020.

The capacity increases around 2012 were primarily due to hydropower projects coming online, such as Southeast Asia's largest hydropower plant at the Son La Dam. The increases around 2019 were driven by the addition of solar capacity – both PV distributed systems and utility-scale systems. Vietnam's feed-in-tariff (FIT) programs for solar and then onshore wind implemented between 2017 and 2020 propelled these initiatives and resulted in a massive capacity increase in 2019, from zero to 6.5 GW.[1] By 2021, the country had added over 12 GW of utility-scale solar capacity. Solar development led to a massive increase in the country's RE output from a mere 997 GWh in 2018 to 37,865 GWh in 2022.[2] Meanwhile, onshore and offshore wind capacity also grew significantly in 2021, from a mere 0.6 GW the previous year to 3.9 GW.[3]

Various supporting policies played a big role in Vietnam's solar boom. These include net metering systems[4] and income tax exemption for developers for the first four years of the project with further reductions in the following years of operations.[5] Solar PV projects also received land-lease payment exemptions. Meanwhile, delays in new coal and other power projects in the face of rising electricity demand prompted the government to prioritize new electricity generation sources.[6]

Nevertheless, the rapid expansion of solar has raised some grid and distribution challenges. A huge proportion of rooftop solar installations and utility-scale solar plants were connected to the grid in a short space of time. Inter-region transmission remains limited due to the lack of lines connecting the power-hungry north of the country with power sources in Central and Southern Vietnam. Infrastructure development is also lagging in other parts of the country, with some regions experiencing an energy surplus while others facing shortages due to inefficient transmission.[7]

In addition, the national grid as a whole lacks the flexibility to manage a huge surge of variable power coming on- and offline. There is also an imbalance between the location of power generation and demand. While some transmission lines, such as the Quang Trach-Pho Noi line, have helped with these challenges, future investments will be needed to bring more power to the population and industrial centers.

Due to the expiration of the FIT programs, among others, Vietnam has experienced a slower growth in RE capacity addition since 2020. Increasing transmission and distribution grid investments will be necessary, as is new policy support (e.g. competitive auctions).[8]

However, solar capacity is projected to continue increasing in the coming years, although reaching the government's ambitious solar capacity goal of almost 20.6 GW by 2030 will require significant investments and further policy reforms.[9]

Thailand – making the switch from bioenergy to solar

Thailand saw moderate but meaningful increases in renewables capacity deployments between 2012 and 2018, driven by parallel increases in bioenergy, PV utility-scale systems, and onshore wind.

Bioenergy, specifically biomass, contributes the largest portion of RE in Thailand, accounting for almost a third of its renewables mix, with low but steady growth between 2000 and 2020 that is projected to continue at a slower pace to at least 2028. There has simultaneously been a range of policy support, including the first National Alternative Energy Development Plan (2004–2011)[10], a promotion campaign for biodiesel in 2005, and required compulsory production of B2 biodiesel in 2008.[11] The government also initiated the Committee on Biofuel Development and Promotion (CBDP) to expand domestic production of palm oil.[12]

The Second Alternative Energy Development Plan (2008–2022) further targeted the expansion of alternative energy through tax incentives and subsidies to ethanol producers, gasohol refineries, and automobile manufacturers.[13] Since 2013, the government has also been offering voluntary emissions reduction and cap-and-trade schemes, including the Voluntary Emissions Trading Scheme (V-ETS) and the Thailand Voluntary Emissions Reduction (T-VER) Program. The significant contribution of biomass to Thailand's energy mix can also be attributed to the political and economic influence of large sugar milling, rice milling, and rubber processing conglomerates that own many power plants.

Meanwhile, there has been more rapid growth in solar starting in 2012 with more than 2.5 GW of utility scale PV added between 2012 and 2017 and more than 2 GW of distributed PV by the end of 2024. Similarly, 1.5 GW of onshore wind capacity was added in the five years leading up to 2019. Overall, the main catalyst for this growth is a combination of preferential power purchase agreements (PPAs), tax

breaks, and clean energy development funds. Between 2006 and 2010, the Adder scheme, Thailand's feed-in-tariff (FIT) program, triggered a market expansion for PV.[14] The Energy Regulatory Committee also initiated the Solar Incentive Program for Government Building and Agricultural Cooperatives in 2015. Solar PV cost has thus decreased over the years and become a more cost-effective choice for end-users.

After identifying wind energy as a feasible alternative energy source for substituting fossil-based energy, Thailand has seen an exponential increase in wind turbine installations, with a growth rate of around 70% annually since 2017.[15] In 2015, the government launched a FIT program for wind energy subsidy for 20 years, successfully attracting developers with a cumulative generation output of more than 1.5 GW.[16]

While bioenergy, hydropower, utility solar, and wind energy are all projected to remain relatively stagnant, there is significant growth in distributed solar PV with a further 4 GW projected between 2024 and 2028.

Thailand enjoys fiscal incentives, including accelerated depreciation, income tax exemptions, import duty waivers, and green bonds, for renewable energy projects. The government has implemented a new FIT regime until 2030 and introduced higher remuneration through the distributed PV net billing scheme. Meanwhile, commercial and industrial electricity consumers are expected to invest in rooftop PV. Grants, low-interest loans, and credit guarantees are also available, complementing cuts on red tape for rooftop solar.

However, the country is still grappling with high energy storage costs, land and space constraints, lengthy permitting procedures, and high financing costs. It remains to be seen how the new Paetongtarn administration will redirect the country's RE ambitions. Recently, it has pledged to negotiate with Cambodia on new sources of natural gas in their overlapping claimed area in the Gulf of Thailand.

Varied energy mix in Indonesia reflects geographic diversity

In contrast to Thailand and the Philippines, Indonesia's capacity growth has been consistent, but low, with an increase in ambitions from the beginning of this decade.

Like many of its neighbors, hydropower remains one of Indonesia's most significant contributors to RE production, comprising half of its renewables generation. However, Indonesia is one of the few countries where hydropower has continued to grow and will be responsible for a significant amount of renewables capacity addition.[17] The country enjoys abundant hydropower resources, over half a century of hydropower projects and infrastructure development, and potential to improve energy access even in remote regions. As of end 2023, Indonesia's hydropower-fueled power plants had a total installed capacity of 7.4 GW with a further 0.5 GW to be added by the end of 2024.[18] Bioenergy and geothermal energy also play a significant role in the renewables mix with around 3 GW each in 2024.

Of the 3.3 GW of RE capacity growth between 2018 to 2023, the largest additions were in bioenergy (+1.3 GW), hydropower (+1 GW), solar (+0.5 GW), geothermal (+0.5 GW) and wind (+0.01 GW). Meanwhile, Indonesia added 26 GW of fossil fuel capacity in the same period.[19]

There are few policy insights to be drawn from Indonesia's renewables landscape so far this century other than one of general failure, especially in the context of significant, if not evenly distributed, solar and wind potential.

Competitive tariffs remain a challenge. Amid the constitutionally guaranteed monopoly position of national utility PLN, price regulations such as premium prices or feed-in-tariffs (FIT) are nearly impossible as PLN is not in a financial position to do so.[20] Local content regulations also make it more costly to develop solar projects as most components still depend on imports. Meanwhile, the local solar industry still lags its foreign counterparts. Further, the significant reserves of oil and gas, coupled with little incentive to divest from coal due to the powerful extractive industry lobby, have resulted in the lack of political will to harness on its solar and wind potential.

Projections For Capacity Addition

Future growth in wind capacity in Vietnam, driven by favorable topography and conducive investment ecosystem, hinges on regulatory and policy reforms

Thanks to its topography and climate, Vietnam also has the largest potential of wind in the region. Current proposed wind projects in Vietnam have a combined capacity of 156 GW, far exceeding the government's target of 6 GW offshore wind capacity by 2030.[21] The country's human resources, local financing efforts, and conducive foreign investment ecosystem create a promising future for wind power development, especially as wind is fast and cheap to deploy. Vietnam has thus emerged as the region's leader in renewables, accounting for 69% of Southeast Asia's solar and wind power generation.[22]

Vietnam's notable progress in wind capacity development, particularly for offshore wind, can be attributed to the government's commitment to RE development and focus on solar and wind capacity additions. While the government has done little to further develop human resource capacity for RE development, it has benefited from implementing a favorable feed-in-tariffs (FIT) level early on. The first surge in RE capacity additions also enjoyed a more flexible approach to planning that supported RE coming online, although it also resulted in overbuilding.

Despite Vietnam's huge wind potential, the government's target 2030 target for offshore wind capacity will fall short, and the government is shifting its focus on capacity additions for onshore winds and other areas. Insufficient regulatory clarity, uncertain conditions for foreign investors, and lack of developer support and electricity price policies have put offshore wind projects to a halt. As with solar, attractive FITs resulted in fierce competition between local investors to develop wind capacity, but most had no track record in RE development. Due to pandemic-induced restrictions, 62 wind projects failed to start operations before their FIT deadlines, while some RE projects have been curtailed due to insufficient grid infrastructure.[23] Given an offshore wind scheme could take up to 6-8 years to set up under current conditions, the first pilot project might not be ready until 2032.[24] Meanwhile, Vietnam needs USD 134.7 billion of funding for new power plants and grids, part of which is expected to come from foreign investors.[25]

Yet, while capacity additions will not surpass the 2020 record level, Vietnam's yearly RE additions will continue rising, albeit at a

slower pace. In November 2023, the Ministry of Industry and Trade issued new rules for determining the maximum range of possible prices for new wind and solar projects. Marine spatial planning proposals have been approved and will allow developments to progress, although they only apply for offshore wind developments for the long term. In July 2024, the government notably approved of a decree that allows large corporations to purchase electricity from RE generators under direct power purchase agreements (DPPAs).[26]

Still, Vietnam's onshore wind capacity growth will depend on further reforms. In addition to a price framework, the country needs adequate regulations on marine spatial planning and a simplified, transparent permitting process. Engaging international finance will be key, which will entail defining a clear auction timeline, enhancing power purchase agreement (PPA) bankability for foreign financial actors, and addressing challenges with the PPAs.

Solar and wind growth in the Philippines driven by relaxed investment and foreign ownership rules

Solar and wind capacity in ASEAN increased by 20% in 2023 to a total of more than 28 GW, supporting 9% of electricity generating capacity in the region.[27]

Amid this growth, the Philippines is increasingly dominating prospective wind and solar development in ASEAN. It ranks third in utility-scale solar and wind capacity in the region with 3 GW of operating capacity each behind Vietnam and Thailand.[28] Of 222 GW in announced, pre-construction, and construction stage utility-scale wind and solar capacity in ASEAN, more than 185 GW, or 80%, consists of pipeline projects in the Philippines and Vietnam.

In recent years, the Philippines has relaxed investment and foreign ownership restrictions in the renewables sector, released an offshore wind development strategy, and offered tax incentives. Unlike Vietnam and many ASEAN countries, the Philippines allows private firms to be involved in electricity generation and sale, instead of the national utility. Landmark policies include the Renewable Energy Act of 2008, which introduced incentives for RE development and the creation of "Green Lanes" that speeds up licensing and permitting for strategic investments on sustainability.[29]

The Blue Economy Act, awaiting the bicameral conference, will introduce regulatory mechanisms that streamline approval of offshore wind energy projects and offer tax incentives for investments in marine energy. The Department of Energy (DOE) has also created the Green Energy Auction Program (GEAP) to attract competitive bids for RE projects.

While there are existing initiatives to promote RE production, the country has yet to expand its RE capacity in terms of offshore wind resources. In this virtue, the DOE has been awarding wind energy service contracts since the recent year for offshore wind technologies, totaling over 20 GW in capacity. Prioritizing the enhancement of grid connectivity across the country supplements further these investments and integrate new renewable energy sources. The National Grid Corporation of the Philippines (NGCP) has invested in upgrading the grid, as aligned with President Marcos's recent national address boasting the connection of Luzon, Visayas, and Mindanao.

The DOE is additionally making a bold promise to power plant investors to extend utmost help so they can secure warranted permits with the national government agencies (NGAs) as well as with their host-local government units (LGUs) so that the P1.29 trillion (USD 22.8 billion) worth of energy investments listed by the Board of Investments will truly advance to commercial developments.

Combined, all these initiatives will support the Philippines' emergence as an upcoming RE powerhouse in the region. For this reason, the Philippines, previously an underdog, is expected to lead the growth in RE capacity investment, while Vietnam is expected to see a slowing down

Indonesia's renewables future requires political attention

According to the Electricity Supply Business Plan (2021–2030) of state-owned utility PLN, the country will meet its renewables target with new hydropower, geothermal, and biofuel-firing capacities. Although solar PV has become more competitive in the region, Indonesia's plan projects little use of solar PV due to its higher costs in Indonesia. Nonetheless, global developments and competitiveness of solar PV have prompted the government to draft a new regulation on promoting rooftop solar.

Still, despite its formal ambitions, Indonesia needs approximately USD 285 billion to meet its 2030 climate targets, with private investments expected to contribute around USD 146 billion. [30] However, investment in RE has stagnated, attracting only USD 1.5 billion in 2023.[31]

Meanwhile, ambitious hydropower projects are underway, but not without their challenges. With a target to reach 10 GW of hydropower capacity by 2030 from the current 6.6 GW, Indonesia has planned 61 dams for construction by 2025. The USD 17.8 billion Kayan Cascade project is a planned series of five dams along the Kayan River in North Kalimantan. Touted to be Southeast Asia's largest hydroelectric project, the project aims to generate up to 9 GW of electricity which would support Indonesia's electricity demand and the new capital city. However, Kayan Hydro Energy, which spearheads the project, is seeking new partnerships after its agreement with Japan's Sumitomo Corp. reached a stalemate.[32]

To ensure that its RE capacity growth is on track to meet its clean energy targets, Indonesia must also focus on addressing existing policy gaps. For one, the government must address the often-overlapping authorities and regulations governing RE project development at both the national and local levels.

The new government must also create a more favorable investment climate for investors, such as through increased regulatory and permitting transparency, incentives, and easing local content requirements. The dominance of coal- and gas-fired power plants has also proven to be a hindrance to RE capacity growth, especially amid contractual constraints. Overly optimistic expectations for electricity demand have led to significant overcapacity in the power system, leaving very limited room for new RE until at least 2030.

Looking ahead, Indonesia's RE capacity growth will also be determined by the priorities of the new Prabowo administration. It remains to be seen whether Indonesia will continue investing in large hydropower projects or shift more attention to solar development as

its neighbors have done. In either case, alleviating existing regulatory and policy barriers remains key to success.

Conclusions

Southeast Asia's renewables landscape has seen significant strides in RE capacity growth, showcasing diverse growth patterns and challenges across the region. The success of countries like Vietnam and upcoming frontrunner Philippines is not only due to geographical advantages and delays in coal and traditional power projects, but deliberate policy reforms and conducive investment environments.

The region's story also highlights the role of political will for RE development and capacity growth. Indonesia has seen setbacks due to the lack of political will and incentives, whereas Vietnam has experienced the opposite. Nonetheless, improvements seen in the Philippines' investment regime for clean energy projects and the potential of the incoming Prabowo administration to support RE reforms in Indonesia signal some optimism for the future.

Meanwhile, the potential of traditional powerhouses such as Indonesia and Thailand will depend on addressing existing policy gaps and high investment costs. For all countries, investing in the right grid infrastructure will also be key to remain on target for 2030.

- **Policy changes can make a real difference.** The success seen in the region can be attributed to limiting bureaucratic and investment red tape, a government-led strategy, and investing in the supporting infrastructure. Vietnam, for instance, has benefited from a solar boom through feed-in-tariff (FIT) programs and mobilizing foreign funding through tax incentives and payment exemptions. In Thailand, changes to reduce red tape may help facilitate the growth of distributed solar PV. The Philippines relaxed investment rules and streamlined project processes, rightly positioning itself to emerge as a key player in the region's RE landscape. Thailand, which is shifting its attention to solar development, has also implemented fiscal incentives and a new FIT regime.
- **Technological advancement and prices matter greatly.** The uptick in solar and wind development in Vietnam and other countries can be attributed to significantly lower prices compared to a decade ago. The cost of coal and fossil-fuel can also incentivize the search for alternative energy, as in the case of Vietnam's solar boom.
- **Furthermore, international political pressure – at international negotiations and from investors demanding green energy – can help create the space for change.** Grassroots pressure and public opinion also help. Concerns over air quality, for example, continue to be an important driver for the energy transition in urban Southeast Asia. Across the region, public health issues have shed light on the urgency of transitioning away from coal.

Amid the progress, key challenges to RE capacity growth remain. Vietnam has seen a slowing down of RE capacity growth following the expiration of its FIT programs and amid insufficient grid infrastructure. The country's enormous wind potential remains underutilized, as investors wait for a more transparent procurement regime, reforms to investment barriers, and incentives to speed up offshore wind development.

It is important to keep infrastructure investments up with RE deployment. As seen in the challenges faced by Vietnam, infrastructure-related issues and overbuilding can be framed as an argument against further RE development.

High energy costs also remain one of the biggest risks for RE capacity growth across the region— a significant problem given the reliance of many governments in the region on private investment. Some countries, like Indonesia, have enjoyed a varied RE mix and a consistent growth in RE capacity. Yet, significant hurdles have emerged due to regulatory complexity, high costs, and entrenched competition with fossil fuel— issues that could be resolved only through political will and streamlined policy coordination across government institutions.

About the Southeast Asia Public Policy Institute

The Southeast Asia Public Policy Institute is a research institute based in Bangkok and Singapore, working across the region. Our mission is to support the development of solutions to the most pressing public policy challenges facing Southeast Asia in the 21st century.

The Institute works on a range of issues across sustainability, technology, public health, trade, and governance.

We convene dialogues with stakeholders and decisionmakers to drive discussion on the challenges and opportunities facing markets in the region. The Institute draws on a network of in-market researchers, advisors, and partners to provide insights and recommendations for governments, policymakers, and businesses.

We work with partners on projects to explore and drive discussion on policy challenges through:

Research and policy development – in-depth research providing insights and actionable policy solutions aimed at policymakers looking to move the needle on key issues.
Policy dialogues and roundtables – to present policy ideas and start a dialogue with the most relevant stakeholders holding the pen on policy development in markets across the region.

The Institute is founded on the premise that direct connection and candid, informed dialogue is crucial for both policymakers and business leaders operating in the region's changing economic and public policy landscape.

Disclaimer

This is a policy note developed by the Southeast Asia Public Policy Institute exploring policy developments in markets in Southeast Asia. It aims to provide an overview or highlight activity in the region relevant to a specific policy area and is based on public information and the insights of Institute officers that may be gathered from stakeholders working in the relevant policy space. It does not contain any confidential or business sensitive information. It is not an exhaustive study of policy, legislation or regulation and should not be used to inform investment or other business decisions.

References

1 Do, T. N., Burke, P. J., Baldwin, K. G. H., & Nguyen, C. T. (2020). Underlying drivers and barriers for solar photovoltaics diffusion: The case of Vietnam. *Energy Policy, 144*, 111561. https://doi.org/10.1016/j.enpol.2020.111561.
2 Hiep, L. H. (2024, January 8). The unexpected twist in Vietnam's renewable energy saga. *Eco Business*. https://www.eco-business.com/opinion/the-unexpected-twist-in-vietnams-renewable-energy-saga/
3 IEA. (2024). *Renewables 2024*. International Energy Agency (IEA). https://www.iea.org/reports/renewables-2024
4 Bellini, E. (2023, May 16). Vietnam's solar development moves to rooftops, net metering. *PV Magazine*. https://www.pv-magazine.com/2023/05/16/vietnams-solar-development-moves-to-rooftops-net-metering/
5 Do et al. (2020)
6 Do, T. N., & Burke, P. J. (2021, March 11). Vietnam's Solar Power Boom: Policy Implications for Other ASEAN Member States. *ISEAS Perspective, 2021* No.28 https://www.iseas.edu.sg/articles-commentaries/iseas-perspective/2021-28-vietnams-solar-power-boom-policy-implications-for-other-asean-member-states-by-thang-nam-do-and-paul-j-burke/
7 Climate Chance. (2022, April). *Vietnam's Solar Boom*. Climate Chance. https://www.climate-chance.org/wp-content/uploads/2022/04/bs2021_cas-detude_energie_vietnam_eng.pdf
8 IEA. (2024)
9 As laid out in Vietnam's Power Development Plan VIII
10 Wattana, S. (2014). Bioenergy Development in Thailand: Challenges and Strategies. *Energy Procedia, 52*, 506–515. https://doi.org/10.1016/j.egypro.2014.07.104
11 Ibid.
12 Ibid.
13 Ibid.
14 Potisat, T., Tongsopit, S., Aksornkij, A., & Moungchareon, S. (2017). To buy the system or to buy the service: The emergence of a solar service model in Thailand. *Renewable Energy Focus, 21*, 1–10. https://doi.org/10.1016/j.ref.2017.06.002
15 Vangtook, P., Suwicharcherdchoo, P., & Vorasee, J. (2023, May 10). Thailand Harnesses Wind Energy Potential. *T&D World*. https://www.tdworld.com/renewables/article/21263029/thailand-harnesses-wind-energy-potential
16 Ibid.
17 Ardiansyah, H. (2022). Hydropower technology: Potential, challenges, and the future. In H. Ardiansyah, & P. Ekadewi (Eds.), Indonesia post-pandemic outlook: Strategy towards net-zero emissions by 2060 from the renewables and carbon-neutral energy perspectives (89–107). BRIN Publishing.
18 IEA. (2024)
19 Setyawati, D., & Setiawan, D. (2024). *Indonesia's expansion of clean power can spur growth and equality*. Ember. https://ember-energy.org/latest-insights/indonesias-expansion-of-clean-power-can-spur-growth-and-equality
20 Roesad, K. (2023, April 1). Indonesia's underwhelming renewable energy reform. *East Asia Forum*. https://eastasiaforum.org/2023/04/11/indonesias-underwhelming-renewable-energy-reform/

21 Dung, P. X. (2023, November 2). Can Vietnam Reach Its Offshore Wind Power Goals? *Fulcrum.* https://fulcrum.sg/can-vietnam-reach-its-offshore-wind-power-goals/
22 Ibid.
23 Singh, A. (2024, June 26). Vietnam Leads Southeast Asia in Solar and Wind Power with 19.5 GW. *Mercom India.* https://www.mercomindia.com/vietnam-solar-wind-power
24 VIR. (2024, June 24). Measures for offshore wind must be carried out rapidly. *Vietnam Investment Review - VIR.* https://vir.com.vn/measures-for-offshore-wind-must-be-carried-out-rapidly-112089.html
25 Vu, K., & Guarascio, F. (2023, May 16). Vietnam approves plan to boost wind, LNG by 2030. *Reuters.* https://www.reuters.com/business/energy/vietnams-pm-approves-135-billion-power-plan-2030-2023-05-15/
26 Moncrieff, A., Tran, D., & Ho, K. (2024, July 19). Direct PPAs – A new opportunity in Vietnam? *A&O Shearman.* https://www.aoshearman.com/en/insights/direct-ppas-a-new-opportunity-in-vietnam
27 Lempriere, M. (2024, January 17). Wind and solar capacity in south-east Asia climbs 20% in just one year, report finds. *Carbon Brief.* https://www.carbonbrief.org/wind-and-solar-capacity-in-south-east-asia-climbs-20-in-just-one-year-report-finds/
28 Ibid.
29 Philippines Executive Order No. 18
30 Yustika, M., & Setyawati, D. (2024, September). *Policy gaps challenge Indonesia's $146B investment goal for renewable energy* [Video]. https://asian-power.com/videos/policy-gaps-challenge-indonesias-146b-investment-goal-renewable-energy
31 Ibid.
32 Koswaraputra, D. (2024, June 16). Kayan hydropower project forges ahead despite setbacks, director says—Archipelago. *The Jakarta Post.* https://www.thejakartapost.com/indonesia/2024/06/16/kayan-hydropower-project-forges-ahead-despite-setbacks-director-says.html