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Challenges and Opportunities for the Southeast Asian Solar Market

Lessons From Vietnam and Malaysia

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This policy brief was written by Emily Burlinghaus. It was adapted from research conducted in fulfilment of requirements for the Johns Hopkins MS in Energy Policy & Climate course, 'Solar Energy: Science, Technology & Policy' and written during her time as a German Chancellor Fellow of the Alexander von Humboldt Foundation.

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The table on page 9 utilizes data sourced from:

- Vietnam's Ministry of Industry and Trade via Vietnam+
- Muhammad-Sukki et al. (2014)
- SEDA Malaysia

Introduction

Southeast Asia is one of the fastest growing regions worldwide by both gross domestic product and electricity demand. Solar photovoltaics (PV) will play an increasingly important role as the region strives to decarbonize and meet rising energy demand. High solar resource potential, a significant cost drop for installed PV in the region (about 45 percent between 2012 and 2016), and favourable policies have allowed Southeast Asia to surpass other regions in solar capacity growth, from approximately 23 GW in 2020 a projected 241 GW by 2030. The International Renewable Energy Agency (IRENA) deems solar "the flagship resource for ASEAN's decarbonization".

Two countries in particular–Vietnam and Malaysia–have led the way in solar offtake in recent years and installed more new PV capacity than others in the region in 2020. They are the world's second and third largest manufacturers of solar PV modules and have significantly lowered barriers to utility-scale and residential solar adoption. However, their diverging approaches to electricity markets, renewables integration, and distributed energy resources have resulted in very different outcomes for solar growth. In many respects, Malaysia's holistic approach to solar pricing, grid modernization, and regional interconnectivity provides lessons for both Vietnam's solar market and the broader ASEAN region.

- **Recommendation 1:**
  Prioritize grid modernization
  Vietnam's decision to stall solar project approval in 2022 is a repercussion of grid undercapacity. Upgrades to transmission and distribution infrastructure, digital solutions to monitor and automate data collection, and connectivity with neighbouring grids all help mitigate this risk.

- **Recommendation 2:**
  Implement and update solar incentives in response to market and technical realities
  Competitive bidding processes, fair net energy metering (NEM) rates, and distributed generation and trading are key to building a fair, accessible, and cost-competitive solar market.

- **Recommendation 3:**
  Promote equity and transparency in the solar market
  Most power markets in Southeast Asia are vertically integrated. Malaysia is no exception, and Vietnam has only undergone partial liberalization. Power sector deregulation, complemented by competitive solar tenders, clear central-provincial alignment, consumer protection measures, and transparent quota systems can build trust and transparency in solar markets.

Background and context

Vietnam's favourable regulatory and fiscal policies have propelled investment in its solar sector. Its first long-term Renewable Energy Development Strategy, passed in 2015, aimed to raise solar power generation from 10 GWh to 210 TWh by 2050, and the government's top-down planning aided in initial rapid solar adoption. Prime Minister Nguyễn Xuân Phúc's Decision No. 11/2017/QD-TTg on the Mechanism of the Development of Solar Power Projects in Vietnam introduced the country's first solar FiT and rooftop NEM mechanism, outlined the binding terms of a standard Power Purchase Agreement (PPA) from the government, and required Electricity of Vietnam (EVN)—the country's sole power purchaser—to buy all power output generated by any given solar PV system. Additional incentives included reforms to ease the mobilization of investment capital and exemptions on import duties, corporate income tax, and land use fees. Later updates to the Mechanism in 2019 and 2020, as well as national energy development planning in recent years, have all prioritized solar deployment or distributed energy resources (DERs).

These incentive schemes allowed Vietnam to overtake Thailand as the country with the most installed solar PV capacity in the ASEAN region in 2019. The following year, the country installed over 100,000 rooftop PV systems and connected at least 15 solar plants to the grid. By the end of 2020, it had achieved 16,504 MW of installed solar capacity, almost 20 times the 850 MW solar capacity target the government set for 2020 when it approved its seventh Power Development Plan in 2011. However, new solar capacity dropped in 2021, and in January 2022, the National Load Dispatch Center (NLDC)—the entity responsible for maintaining power system safety and stability—announced that it would not approve any new wind or solar projects that year. Key roadblocks include undercapacity, inflexibility in the national grid, limited connectivity with neighbouring countries' grids, and regulatory and policy uncertainty.

As Vietnam embraces wind power over the short term, power sector reforms can help the country prepare for a longer-term renewable energy future with a robust solar market. Technologies like battery storage and others that provide ancillary services like frequency regulation, dispatch scheduling, and load following could improve the dispatchability of solar. Updates to transmission and distribution infrastructure—as well as regulations that support system flexibility, resilience, and DER capacity—can also help the country manage new power demands. As the central government develops new financial tools to support solar, transparent application of regulations and pricing mechanisms is vital. Vietnam's top-down approach to energy planning can be useful in this regard as long as there is sufficient central-provincial policy alignment. Broader regional efforts to import and export energy from neighbouring grids can likewise alleviate strains that arise from high variable renewable penetration.

While Malaysia's solar sector has not seen the same level of growth as Vietnam (growing from 32 MW in 2011 to 1,787 in 2021 compared to Vietnam's 5 MW to 16,660 MW growth in the same period), it has undertaken more deliberate steps to sustainably grow its solar capacity. Unlike Vietnam, whose lack of pricing mechanism is in part responsible for its stalled solar projects, Malaysia has phased out FiTs in favour of NEM, implemented competitive bidding through its Large Scale Solar (LSS) programme, and experimented with distributed generation and trading. Likewise, regulatory reforms, investor incentives, and partial market liberalization have helped it seize the number four spot on the World Bank's Ease of Getting Electricity Indicator in 2019. It is also mitigating grid infrastructure challenges through its participation in the Lao-Thailand-Malaysia-Singapore Power Integration Project. Along the way, it became the world's second largest PV manufacturer, as well as the ASEAN region's top solar PV employer in 2019, with the country's Sustainable Energy Development Authority

(SEDA) estimating that over 54,300 people worked in PV-related jobs in 2018.

Malaysia's shrewd planning for solar adoption and grid capacity ensure that solar will play a strong role in the country's short- and medium-term energy future. In fact, it will likely be the main driver of renewables growth alongside large hydropower. With SEDA aiming to increase Malaysia's solar capacity to 4,706 MW (or 24% of peak demand) by 2025 and 7,280 MW (or 30% of peak demand) by 2035, solar is expected to comprise the largest share of renewable energy after large hydropower. As the country works to achieve its target of 31% renewables penetration in installed capacity by 2025, further market reforms (beyond decoupling generation assets) and promotion of rooftop PV could bring Malaysia closer to achieving its solar goals.

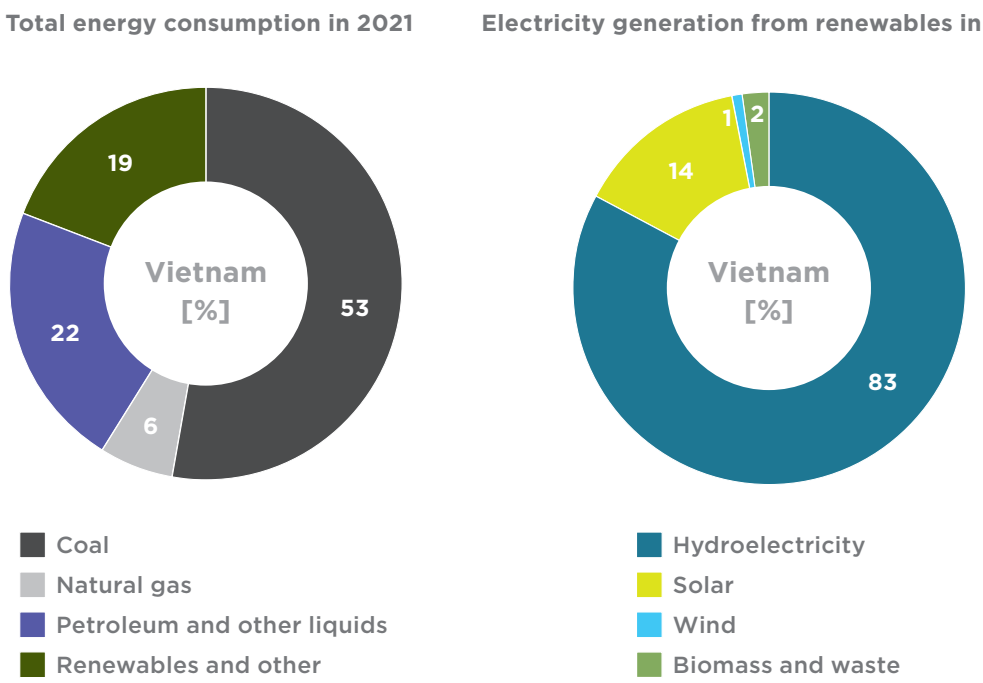

Figure 1:
Total energy consumption and electricity generation from renewables in Vietnam, 2021.

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Prioritize grid modernization

The largest roadblock to solar adoption in Vietnam—and an impediment to scaling solar in any major economy in Southeast Asia—is grid undercapacity. Malaysia's comprehensive approach to grid modernization offers a useful roadmap for Vietnam and other Southeast Asian economies. Key recommendations applicable to Southeast Asia at large include upgrades to and expansion of transmission and distribution infrastructure; digitalization; and greater connectivity to neighbouring grids.

Upgrades to transmission and distribution infrastructure

Malaysia's extensive long-term grid planning (paired with comparatively low solar penetration) has helped it avoid some of Vietnam's challenges with grid congestion and undercapacity. For countries in Southeast Asia aiming to meet ambitious solar deployment goals in coming years, upgrades to transmission and distribution infrastructure will be critical to accommodating new solar capacity and other variable renewable energy (VRE). Investment to build new transformers and boost the capacity of existing infrastructure will be crucial to limiting the risk of overloading transmission lines and substations. Construction of cross-country high-voltage transmission lines will likewise contribute to the dual goals of rural electrification and high efficiency VRE utilization. As Southeast Asian economies work to reach increasingly ambitious levels of solar and VRE penetration, efforts to improve the efficiency, operations, and strategic planning of network operators (such as Vietnam's National Power Transmission Corporation or Malaysia's Tenaga Nasional Berhad's (TNB) Transmission Division) will aid in the achievement of grid modernization and capacity building. Cooperation with multilateral organizations such as the Asian Development Bank and World Bank, as well as national development organizations invested in renewable energy deployment, can be useful in accelerating relevant upgrades and boosting investor and developer confidence.

Digitalization initiatives

Tenaga Nasional Berhad's 'Grid of the Future' programme illustrates how digital technology can improve management of an increasingly renewable grid. In an effort to become one of the world's top ten utilities by 2025, TNB has begun deploying distribution automation, geospatial information systems (GIS), and advanced metering technology to improve network reliability and flexibility. Such efforts to deploy digitalization solutions can help Southeast Asian economies manage the intermittency challenges of solar, which is uniquely suited to distributed generation and 'prosumer' relationships with the grid. Software solutions that automate power system data collection and monitor the health of transmission and distribution assets can improve power system stability and help operators more efficiently manage intermittency. Likewise, digital platforms that connect consumers, contractors, and banks and provide clear information on regulations and standards for rooftop solar PV can reduce uncertainty along the solar supply chain. Such platforms can address roadblocks that both Vietnam and Malaysia face in scaling rooftop solar PV—namely, lack of awareness among consumers and uncertainty around legal and regulatory requirements for investors, lenders, and developers. Vietnam's EVNSOLAR platform tackles some of these problems, which are also addressed through the country's broader strategy to deploy digital solutions through the Smart Grid Roadmap and EVN's digital transformation programme.

Interconnectivity with neighbouring grids

Interconnection projects to build out cross-border power trade with neighbouring countries are a key facet of mitigating undercapacity in increasingly renewable grids. Malaysia, for example, is partaking in the Lao-Thailand-Malaysia-Singapore Power Integration Project (LTMS-PIP). The initiative, which was launched in 2014 and commenced trading in June 2022, is a step in the right direction toward improving system flexibility and making progress on larger multilateral projects, including the development of the ASEAN Power Grid. Vietnam has also undertaken efforts at regional interconnection and cooperation. It currently imports limited amounts of electricity from China and Lao PDR, and exports to Cambodia, and the government is boosting cooperation with Lao PDR on projects to expand cross-border power trade and pursue bilateral investment in renewable energy projects. However, much of the cooperation between regional partners, including Vietnam, Lao PDR, and Cambodia, has focused on hydropower, which poses risks for the Sekong and Mekong River basins. Projects that prioritize lower-impact renewable energy—such as floating solar—could help avoid damaging fisheries and sediment deposits while strengthening clean energy cooperation in shared ecosystems. Meanwhile, policy and regulatory cooperation coordinated through regional bodies such as ASEAN can help facilitate competitive cross-border trade and address the dual challenges of curtailment in periods of overproduction and blackouts in periods of underproduction. Such solutions will be critical to managing the transition to VRE alongside complementary innovations such as energy storage, NEM, and peer-to-peer (P2P) electricity trading.

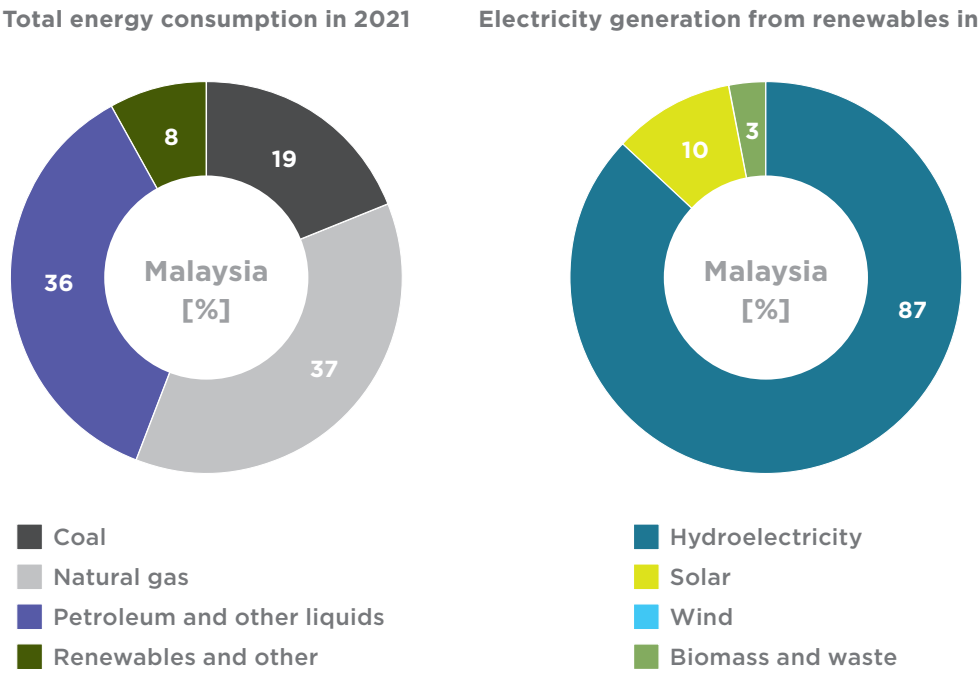

Figure 2:
Total energy consumption and electricity generation from renewables in Malaysia, 2021.

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Implement and update solar incentives in response to market and technical realities

Vietnam's experience with solar incentives has revolved primarily around FiT schemes. The country has undergone multiple (enacted and proposed) iterations of a solar FiT programme in recent years. In 2017, the Mechanism of the Development of Solar Power Projects in Vietnam introduced the country's first FiT at a rate of 0.0935 USD/kWh for rooftop and grid-connected projects. Following its expiration in June 2019, a new FiT was adopted, with lower rates for floating, ground-mounted, and rooftop projects. This second FiT expired in December 2020 and a new mechanism has not been adopted, despite recent proposals from the Ministry of Industry and Trade. This lack of pricing mechanism has both deterred investment in new solar projects and restricted EVN's ability to pursue solar PPAs with developers. As a result, only behind-the-meter solar projects are moving forward. Furthermore, because many existing projects under previous FiT regimes were added quickly in places without nearby grid connections, between 3 and 3.5 GW of solar projects are either not connected or operating at limited capacity.

The Malaysian approach

Malaysia, on the other hand, took a different approach to solar incentives. It implemented its first FiT programme in 2011—six years before Vietnam. However, after encountering early challenges—namely the quick attainment of its quota limit and depletion of the Renewable Energy Fund responsible for supplying capital for the FiT—the government phased out its FiT regime in favour of new programmes to spur residential and utility-scale solar. For residential, Malaysia's Sustainable Energy Development Authority (SEDA) launched the 2000 Solar Home rooftop programme, which raised the quota for rooftop solar PV. The government also replaced its FiT regime with an NEM scheme. For utility-scale, SEDA launched its LSS bidding programme, which serves as a model for competitive tenders. It also initiated a peer-to-peer (P2P) energy trading pilot to test how a new form of energy consumption and trading could improve power system flexibility, mitigate strains on the electric grid at the distribution level, and empower consumers.

Malaysia's iterative approach to solar incentive schemes has ultimately helped open its market to foreign investors and the Malaysian public. As solar PV installation costs have dropped and guaranteed prices offered under FiTs became less feasible, Malaysia's transition to—and updates of—its NEM scheme have helped the government manage the costs of its solar incentives. Its LSS programme has also increased investor interest through its efficient and transparent bidding process, while residential programmes have improved access to rooftop solar, reportedly accelerating the application process for the public and removing consumer financial hurdles to installation. Finally, the country's commitment to system stability and flexibility in its Renewable Energy Roadmap—through energy storage and other ancillary services—indicates a commitment to long-term planning that will help it reach its goal of 30% solar generation during peak demand by 2035.

Lessons for sustainable solar development

The respective histories of solar incentive schemes in Vietnam and Malaysia offer lessons for the sustainable scaleup of utility-scale and residential solar

projects. While Vietnam once surpassed any other country in the ASEAN region for solar capacity additions, Malaysia ultimately pursued a more sustainable development pathway, allowing it to avoid Vietnam's regulatory, policy, and infrastructure challenges. For ASEAN countries aiming to use solar to drive economic decarbonization, Malaysia's strategic long-term planning serves as a useful guide for updating solar pricing and incentive schemes. *A transition away from FiTs*—especially in countries struggling with solar pricing or whose governments do not have the funds to continue providing above-market prices to producers—paired with *updated NEM* and *novel approaches to distributed generation and trading* can help solar thrive. Furthermore, *PPAs that prioritize ancillary services* like battery storage and frequency regulation can likewise improve the dispatchability of solar resources.

FiT1 (2017)	Details		EOY Solar Capacity (IRENA)
Vietnam			
FiT1 (2017)	Rate of 0.0935 USD/kWh for rooftop and grid-connected projects; expired June 2019		2017: 8 MW
FiT2 (2019)	Rate of 0.0769 USD/kWh for floating solar projects, 0.0709 USD/kWh for ground-mounted, and 0.0838 USD/kWh for rooftop; expired December 2020		2019: 4993 MW
	Note: Ninh Thuan Province received an exception, continuing to receive a FiT of 0.0935 USD/kWh for all projects up to a cap of 2,000 MW		
Current status (January 2023)	No new solar support mechanism, but EVN able to enter tariff negotiations with developers under the following price ceilings: ■ 1,184.90 VND (0.0505 USD) per kWh for ground-mounted solar projects ■ 1,508.27 VND (0.0643 USD) for floating solar projects		2020: 16,660 MW 2021: 16,660 MW 2022 (based on 2021 estimate and NLDP's cancellation of approval for new projects in January): 16,660 MW *net capacity change in 2021: 0
Malaysia			
FiT (2011)	Variable rate based on capacity of project; between 0.85 and 1.78 RM/kWh; expired 2017		2011: 1 MW
NEM1 (2016)	Rate of RM 0.31 (0.07 USD)/kWh for low-voltage, grid-connected customers and RM 0.238 (0.054 USD)/kWh for medium-voltage customers; 500 MW quota2; expired 2018		2016: 344 MW
NEM2 (2019)	one-on-one offset basis; 500 MW quota; expired December 2020		2019: 894 MW
NEM3 (2020)	NEM Rakyat; 100 MW quota	one-on-one offset basis (i.e. producers receive same credit value when exporting to the grid as they pay per kWh for consuming electricity); all expire December 2023	2020: 1483 MW 2021: 1787 MW 2022 (from Apricum Group): 2,165 MW *net capacity change in 2021 (most recently available data): 304 MW
	NEM Government Ministries & Entities; 100 MW quota		
	Net Offset Virtual Aggregation; 600 MW quota		

Table 1:
Notable solar pricing mechanisms and support schemes.

Sources:
See note on inside cover

Promote equity and transparency in the solar market

Equity and transparency in Southeast Asian solar markets is key to ensuring investor and consumer confidence. Both Vietnam and Malaysia have struggled in different ways to ensure competitive, equitable processes for utility-scale and residential solar projects. *Transparency in incentive allocation (including through policy and regulatory alignment between central and provincial governments) and competition through deregulation* are crucial to building trust between the public sector, investors, consumers, and other stakeholders.

When it comes to utility-scale solar, Malaysia's LSS programme ensures transparency and competition through its bidding process. However, while the introduction of independent power producers has liberalized the generation subsector, Malaysia's power sector remains largely vertically integrated. On the residential side, citizens criticized the transparency of the initial electronic FiT application system after discovering that over 30% of the quota was awarded to 12 companies linked to the daughter of the chairman of the national oil and gas company.

Vietnam, meanwhile, has come a bit further than Malaysia when it comes to liberalization, undertaking plans (albeit slowly) to transition to a wholesale power market. Equity and transparency in the solar market is hindered by poor policy and regulatory alignment between the central and provincial governments. One key challenge is the differing solar FiT rates set by the central government for different provinces. For example, when the central government enacted its second solar FiT at a lower rate in 2020, the province of Ninh Thuan received an exception, continuing to receive a higher FiT than the rest of the country up to a cap of 2,000 MW.

A second challenge for Vietnam is the lack of clarity on solar procurement from the central government, particularly on issues that affect national entities operating at the provincial level. Notably, despite EVN's obligation to buy power generated from PV systems, the lack of competitive bidding meant that above-market rates (designated by solar FiTs) could be given to solar producers on the basis of non-transparent decisions, such as relationships with provincial officials. Such a FiT scheme (especially one with limited oversight at the provincial level) in any country context would risk forcing a power purchaser into subpar PPAs with producers.

In countries with vertically integrated power systems (especially where one entity is obligated to purchase most of the electricity produced in the country), clear alignment on solar procurement can help ensure fair and transparent allocation of incentives. Furthermore, a transition to competitive bidding can ensure greater transparency in the procurement process (since rules and requirements are clearly defined before a contract is awarded), while greater monitoring and evaluation at the provincial level can ensure fair solar procurement mechanisms. Likewise, greater overall liberalization of the power sector in Southeast Asian countries could open the market to more competition and aid in the achievement of renewable goals, such as those laid out in Malaysia's Renewable Energy Roadmap and Vietnam's National Energy Development Strategy. Finally, strong implementation and enforcement of consumer protection regulations can help build public trust in companies operating along solar supply chains, especially at the residential PV level.

Conclusion

Both Vietnam and Malaysia have made significant strides in recent years to scale their renewable capacity, and solar has played a cardinal role in both contexts, with Vietnam leading regional deployment and Malaysia positioning solar as the central strategic pillar in its Renewable Energy Roadmap. While both countries are guided by internal and external pressure to decarbonize their economies and scale renewables to meet global climate goals and improve the quality of life for citizens, much of their ambition is closely linked to raising their socio-economic status. Both countries have reached middle income status according to the World Bank, and as they push to achieve high income status in coming years, the ways in which they transform their energy systems will play an enormous role. The uptake of renewable technologies and phasing out of fossil fuels will drive economic development and energy access at the same time as it facilitates the adoption of new forms of generation and ownership of energy assets.

Broad strategic approach needed to scale up solar

When it comes to strategic planning relevant to solar PV, Vietnam and Malaysia have taken somewhat divergent paths. Vietnam undertook a rapid expansion of its solar capacity by offering attractive incentives for rooftop and utility scale solar. Multiple iterations of the country's FiT programme allowed a significant scaleup of solar PV in a relatively short time. However, the lack of coordinated effort to address grid undercapacity, implement a new pricing mechanism after the expiration of the latest FiT, and connect Vietnam's national grid to regional neighbours has severely constrained the addition of new solar capacity. Vietnam's recent history with solar provides a lesson for other countries that fail to pair solar incentives with crucial upgrades to grid infrastructure, operations, and regulations. Even as Vietnam continues its path toward decarbonization, much of its new solar deployment will need to be delayed until it addresses challenges with its critical infrastructure.

Malaysia's approach, on the other hand, has focused less on rapid deployment of solar and more on the frameworks and incentives that facilitate sustainable investment. Power sector liberalization, a transition from FiTs to NEM, competitive bidding and, to a limited extent, P2P energy trading, have encouraged domestic and foreign investment in its solar sector while offering more sustainable mechanisms for future growth. Its participation in the Lao-Thailand-Malaysia-Singapore Power Integration Project (LTMS-PIP) and contributions to the development of the ASEAN Power Grid have provided the country with further security and flexibility to better balance supply and demand.

Ancillary services crucial for sustainable growth

Finally, prioritization of crucial ancillary services such as battery storage technology will help the country manage the variability of solar PV at a measured pace. However, Malaysia still has a long way to go in truly reforming its energy sector to encourage competition and phase out investment in fossil fuels. A more comprehensive unbundling of its generation, transmission, and distribution assets—paired with a phasing out of fossil fuel subsidies—would stimulate greater competition and increase the attractiveness of solar PV. Likewise, despite a series of successful incentive programmes for solar PV, SEDA's lack of follow-up to its P2P energy trading pilot programme has stalled progress on new forms of energy distribution and trading that are uniquely suited to residential and commercial solar PV. Implementation of recommendations made on the basis of the pilot programme will help facilitate beneficial distributed generation projects and encourage greater awareness of the benefits of solar PV for households and businesses.

Grid development and energy storage solutions

As both countries move toward cleaner energy futures, growing penetration of variable renewable energy—especially solar PV for residential, commercial, and even industrial uses—is already posing new challenges to their respective power grids. New technologies, regulatory frameworks, and utility operation models will be essential to adapting both countries' respective energy systems. Solutions that offer energy storage, frequency regulation, and flexibility are crucial to keeping pace with global trends. Fortunately, both Vietnam and Malaysia are in economically—and geographically—favourable positions when it comes to clean energy technology. Their existing industrial prowess, leadership in the manufacturing of solar PV, proximity to East Asian clean energy manufacturing powerhouses, and competitive export advantages position them well to lead the adoption and export of clean energy technologies, and solar PV in particular, over the long term.

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Research Institute for Sustainability (RIFS)

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