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Integrated Policy Strategies and Regional Policy Coordination for Resilient, Green and Transformative Development: Supporting Selected Asian BRI Partner Countries to Achieve 2030 Sustainable Development Agenda

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Energy Transition Challenges in Malaysia: A focus on Peninsular Malaysia's power sector

This paper provides a comprehensive analysis of Malaysia's electricity sector within the context of its broader macro-economic and governance frameworks. It begins by outlining the current energy landscape, including the generation mix and institutional structure, with a focus on Peninsular Malaysia. The discussion then shifts to the country's transition toward clean energy, evaluating existing policies, emerging opportunities, and persistent challenges. The paper also situates Malaysia within the regional energy context, examining renewable energy developments in Southeast Asia, the ASEAN Power Grid initiative, and lessons from international case studies. Finally, it presents four policy recommendations aimed at enhancing coherence, encouraging clean energy investments, promoting equitable pricing, and fostering innovation and sustainable consumption. These insights are intended to inform policymakers and stakeholders seeking to drive an inclusive and effective energy transition in Malaysia.

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KEYWORDS: Energy, Renewable energy, Green transition, Decarbonisation, Malaysia

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Overview

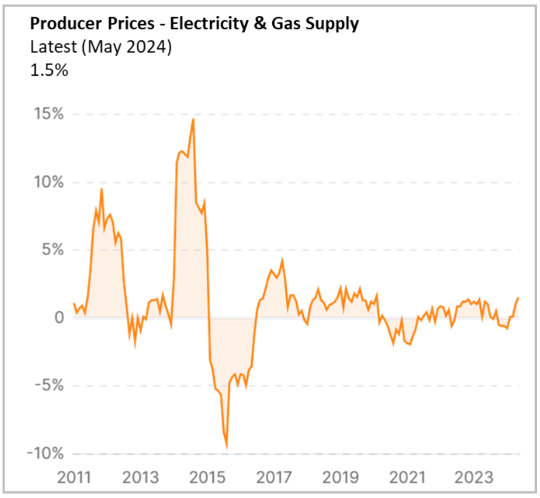
Malaysia's electricity energy sector comprises 3 distinct geographical regions and separate power systems. The largest, based on consumption, is Peninsular followed by Sarawak and Sabah in East Malaysia. It is important to note the differences in geographical, governance and socio-economic contexts in assessing Malaysia's energy transition challenges, as national level statistics may not represent an accurate picture of the regional variations. This chapter will provide a broad overview of the regions and subsequently focuses primarily on Peninsular in the following chapters.

Macro-economic landscape

Key statistics	Malaysia	Peninsular	Sarawak	Sabah
Population (mil)	32.7	26.8	2.5	3.4
GDP per capita (RM '000)	54.8	126.4 – 16.6	80.8	35.8
Land size (sq. km)	330,803	132,732	124,450	73,621
Median household income (RM '000)	6.3	10.2 – 3.6	4.9	4.5
Electrification rate (%)		~100	98.4	~80

Source: Department of Statistics, 2022; respective state reports

While most investments in the power sector are domestically funded, the foreign currency exchange rate, particularly the USD, has a significant impact on the production and supply of electricity with a high import factor due to fuel (100% imported coal), materials and equipment (power plant components, solar PV panels, machinery, etc.) and some services.



Source: Department of Statistics Malaysia

The weakening Ringgit has affected new development plans with delays in several power generation projects which have insufficient or no mechanism to adjust for these unexpected increases, both conventional and renewable, particularly utility-scale solar. On the other hand, fuel coal and imported liquefied natural gas (LNG) have minimal impact to existing producers as the costs are passed on to consumers in a cost pass-through mechanism, further elaborated in the economic regulation section.

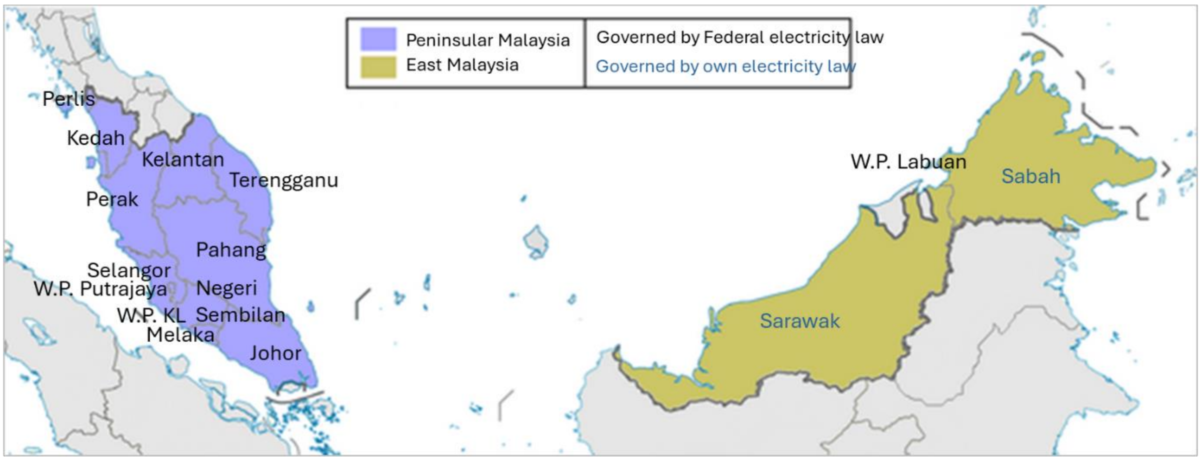
Consequently, energy inflation has been controlled despite the surge in fuel prices. This is largely a result of the fuel adjustment portion in the electricity bills being subsidised by the

Government in the initial period, gradually reducing to a portion of the domestic consumer segment consuming below 1,000 kwh per month. Nevertheless, on a regional comparison basis, the tariff in Peninsular Malaysia remains one of the most competitive on a PPP-adjusted basis, while Sarawak and Sabah have lower tariff rates.

Governance of the electricity sector

Electricity supply is highly regulated in Malaysia, albeit with different legislations in each region. Peninsular Malaysia electricity sector and Labuan in East Malaysia is primarily governed by the federal constitution, namely the Electricity Supply Act 1990 (Amendment 2015) and the Renewable Energy Act 2011, which gives wide ranging powers to the Minister in-charge of electricity. The regulating authorities are the Energy Commission, established by law under the Energy Commission Act 2010 and the Sustainable Energy Development Authority under the SEDA Act 2011 to specifically oversee the special tariff system for renewable energy (feed-in tariff).

Sarawak is governed by its own Electricity Ordinance 1956 (Amendment 2023), with the Ministry of Public Utilities as the main regulator, while Sabah recently obtained autonomy under the Electricity Supply Enactment 2024, regulated by the Energy Commission Sabah in a structure similar to Peninsular Malaysia.



In general, all regions undertake a planning process to determine the electricity requirements based on medium to long-term demand projections and retirement of capacities. The requirements translate in policy decisions on adding new capacities in the most cost-efficient approach, concurrently meeting other goals such as renewable or clean energy targets, diversification and specific technology plans. Infrastructure requirements are also planned based on locational demand and supply factors. In Peninsular Malaysia, the planning process results in a Power Development Plan comprising the Generation Development Plan and Grid Infrastructure Development Plan, for a period of 10 to 20 years, approved by the Planning and Implementation Committee for Electricity Supply and Tariff under the Ministry of Energy Transition and Water Transformation (PETRA). The same committee also consolidates the plans from Sabah and Sarawak.

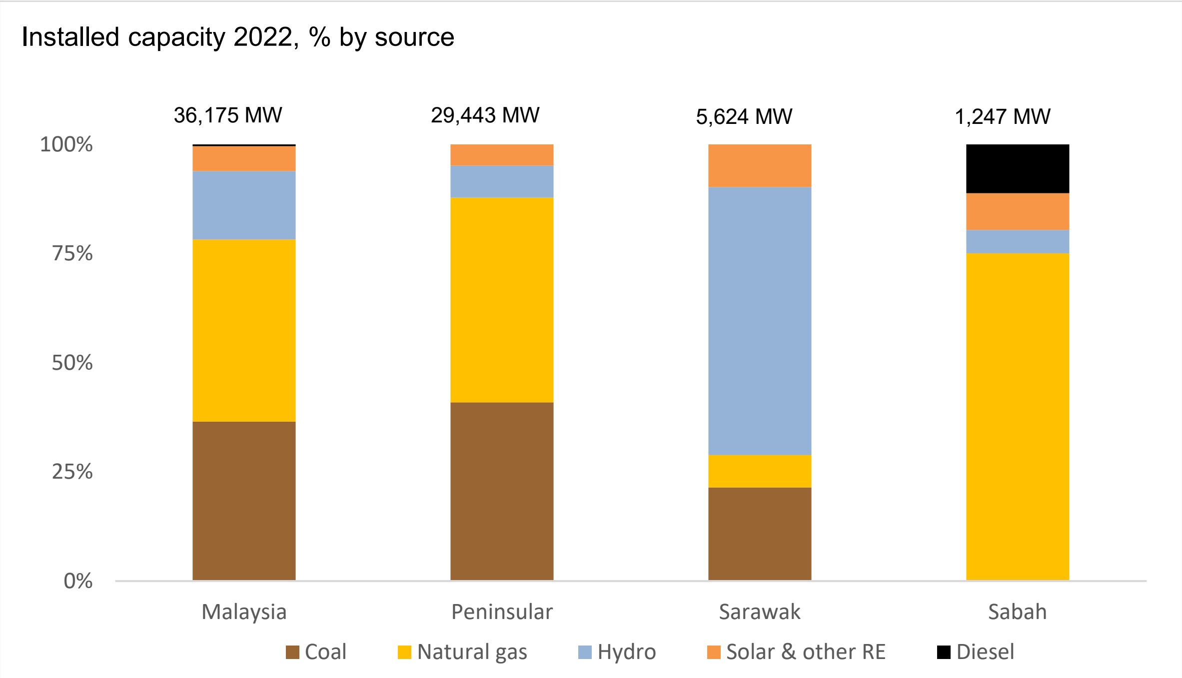
While each region is governed separately, the policy on industry structure is similar in that the Single Buyer model has generally been adopted. Nevertheless, Peninsular is reviewing the current model to assess suitability for the future landscape given the growing demand for direct procurement of green energy from large consumers as part of the initiatives recommended under the "Future-proofing Peninsular Malaysia's Electricity Supply Industry" study in 2022.

The current electricity mix

Power generation in Malaysia is primarily from coal, gas and hydro, with the remaining from other renewable energy sources comprising solar and bioenergy (i.e. biomass, biogas, waste-to-energy). The composition in each region varies according to the availability of cost-efficient supply which for renewable energy, including hydro, is subject to locational factors – such as body of water, rainfall and elevation; solar irradiance; wind speed; geothermal reservoir and so on.

Total Installed Capacity

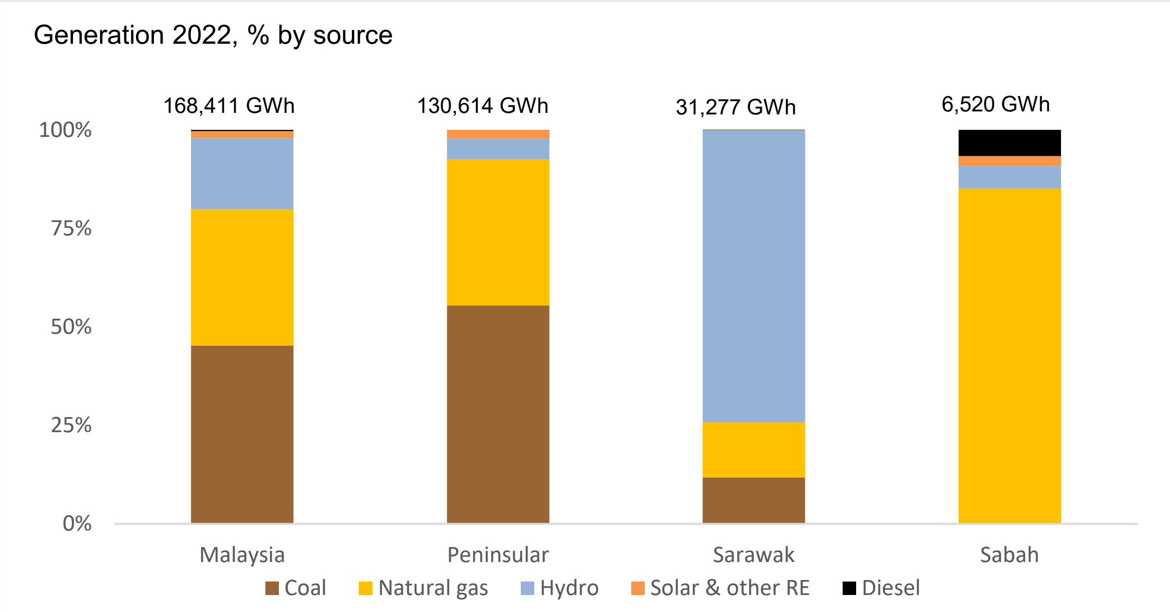
The installed capacity (also known as nameplate or nominal capacity) is the maximum amount of electricity that can be generated by all power plants or generating facilities, in accordance with the specific design conditions. In Malaysia, most of installed capacity is grid connected and in line with the contractual specifications of the power purchase agreements (PPA) and associated licenses. Off-grid capacity is small and limited to locations such as remote islands and villages.



Source: Various including Energy Commission, Energy Commission Sabah, Sarawak Energy (estimates where figures are not clearly available)

Total generation

The amount of electricity produced in operations is based on several factors, primarily availability and actual demand. The capacity factor of production facilities in Malaysia depends on the technology efficiency (e.g. newer plants are more efficient than older ones) and other aspects such as fuel availability, costs (merit order dispatch rule) or climate conditions (particularly for solar), which vary according to situation.



Source: Various including Energy Commission, Energy Commission Sabah, Sarawak Energy (estimates where figures are not clearly available)

Actual generation generally tracks installed capacity ratios in most cases expect when capacity factors are low. Solar power generation for instance, has a lower capacity factor compared to thermal generation (which can be as high as 80% for the most efficient gas plants and 40% for coal power plants). Hydropower generation depends on the capacity of available water, which in Sarawak's case is highly stable. Although installed capacity of solar in Peninsular is rising, the average capacity factor is only about 16%, thus requiring higher generation from thermal and hydro power plants.

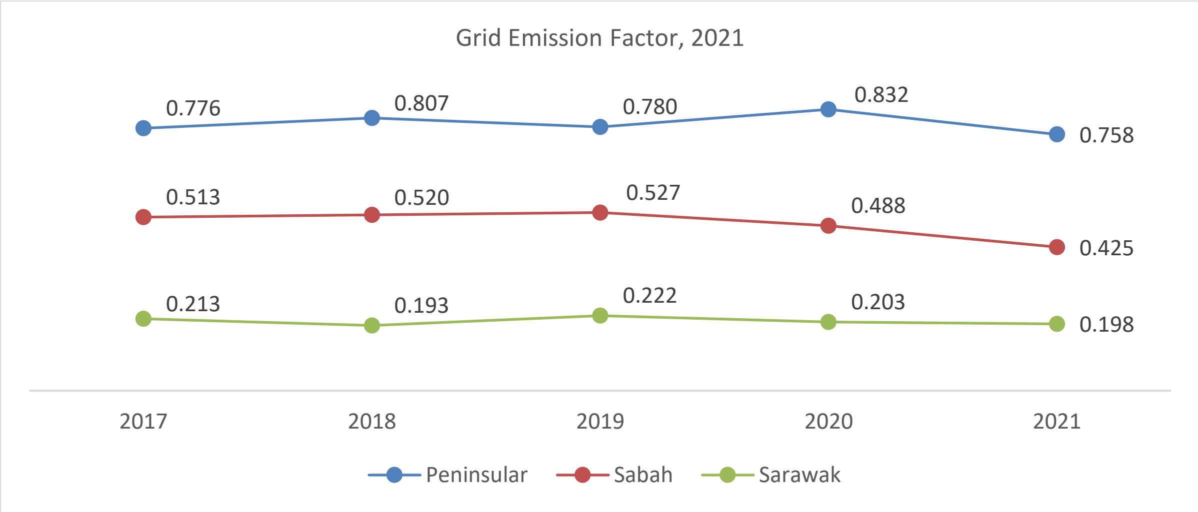
GHG emissions

Greenhouse gas emissions are positively correlated to the level of demand and composition of generation mix, with coal burning releasing approximately double the amount of CO2 compared to gas.

	GHG Emission (Gg CO2e), 2021				Grid Emission Factor (Gg CO2e/GWh)
	Coal	Natural gas	Diesel&MFO	TOTAL	
Peninsular	79,163	18,453	206	97,822	0.758
Sabah	0	2,303	985	3,288	0.425
Sarawak	0	Na	Na	Na	0.198

Source: Energy Commission

Given the high volume of fossil fuel generation primarily from coal, Peninsular has the highest amount of GHG emissions at 97,882 Gg CO2e, while Sabah and Sarawak have a significantly lower amount. Similarly, the grid emission factor (amount of emissions per unit of electricity generated) for Peninsular is the highest at 0.758, almost twice the factor of Sabah (0.425) and four times higher than Sarawak (0.198). Essentially, Sarawak is leading in terms of providing clean energy via its grid given the sizeable hydro resources.



Source: Energy Commission

Industry and regulatory structure (Peninsular)

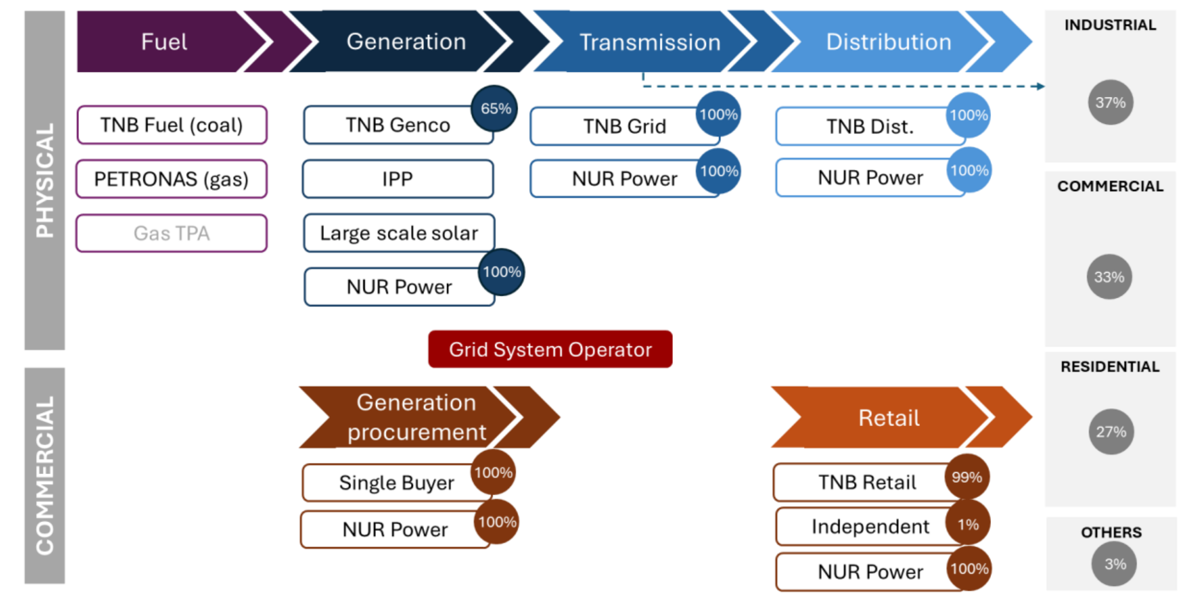
Peninsular's electricity industry structure is considered partially liberalised given the following characteristics in each segment:

Generation: A competitive segment where the incumbent utility, TNB (public listed) competes with other independent power producers (IPPs) for long-term power purchase agreements to Single Buyer as a bulk system supply. The largest IPPs are Malakoff (public listed) and Edra-CGN (private). Capacity decisions made by the Minister (in-charge of electricity) based on the recommendation of the regulator, Energy Commission. Single Buyer is a ring-fenced entity within TNB which is responsible for managing almost all contracts, excluding a small number of RE at distribution level, and directly regulated by the Energy Commission.

Transmission and distribution: The T&D assets are owned and managed by TNB and considered a natural monopoly given its huge capital requirements. This includes all interconnections, with Thailand and Singapore. The capital investments and return that are incorporated into the tariff, are regulated by the Energy Commission. The Grid System Operator, another ring-fenced entity within TNB directly under the regulatory supervision of the Energy Commission, controls the dispatch of electricity to ensure no discrimination between TNB and non-TNB generating entities based on fair and transparent regulatory rules.

Retail: TNB has the sole right and supplier of last resort responsibility by law to sell electricity to consumers in Peninsular of approximately 9 million, except for a small number within the independent distributor licensee (IDL) area such as KLCC and KL Sentral, as well as Kulim Hi-tech Park.

Industry value chain in Peninsular Malaysia



Source: Author's illustration; TNB, Energy Commission

Fuel: The purchase and supply of coal for all power plants is centralised and managed by TNB Fuel, via a policy directive created to lower cost from economies of scale and ensure security of supply. Most of coal is procured from Indonesia, being the lowest in total cost (shorter shipping distance) while efforts are in place to enhance diversification of sources. For natural gas, all power plants have an existing Gas Supply Agreement with Petronas's retail arm, Petronas Energy and Gas Trading. The primary source is the domestic piped gas. Similar to coal, a standing policy directive consolidates the gas volume requirement under an overarching time limited Gas Framework Agreement for security of supply, following a domestic gas outage crisis.

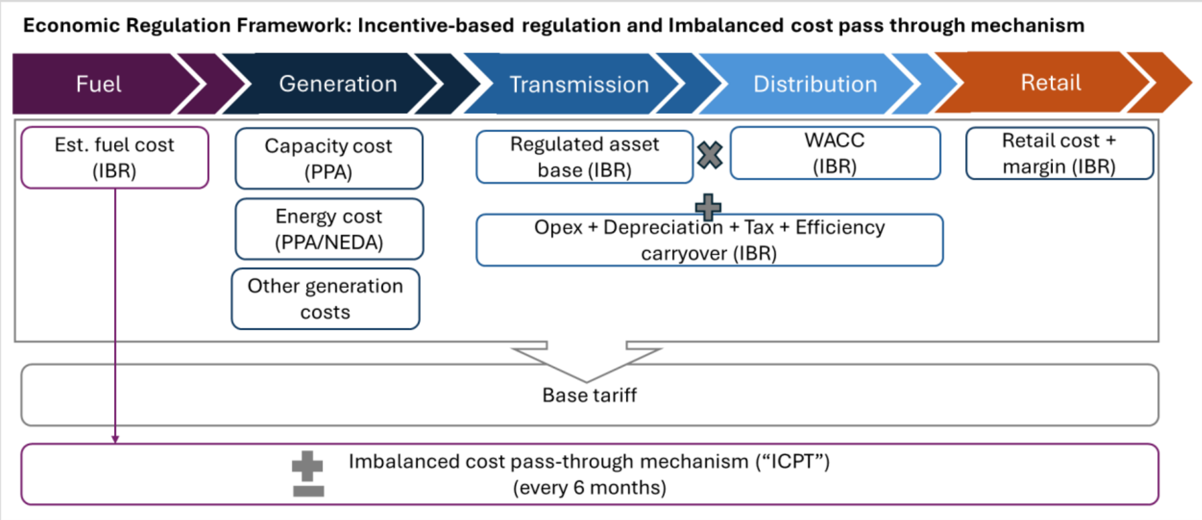
Kulim Hi-tech Park (KHTP): A special high-tech industrial zone in northern Peninsular established in 1996 as a national project. The designated area is served exclusively by NUR Power, a vertically integrated utility that owns and operates all power assets from generation (natural gas power plant), transmission and distribution, and selling rights to customers within. NUR transmission is still connected to TNB's grid, drawing power during periods of shortfall. KHTP is a working model of a self-contained area with a standby supply. While it has the option to operate on a standalone basis, it is unlikely to happen as the reliability requirements are higher.

Regulatory structure

As mentioned, the electricity industry is a highly regulated sector. Technical regulation requirements ensure that all entities within the system are licensed in accordance with specific functions, e.g. generation license, transmission license, etc.

In terms of economic regulation, the main objective is to ensure fair and equitable pricing for consumers as well as companies, while promoting innovation for enhanced efficiency that ultimately benefits consumers in the long run. As the generation segment is open, there can be competition leading to efficient price discovery. The transmission, distribution and retail as monopolistic and capital intensive is subject to an economic regulatory framework based on an incentive-based regulation (IBR) which is undertaken every 3 years, i.e. regulatory period. The generation plus IBR and estimated fuel costs make up the base tariff which is fixed in the same regulatory period. To cater for fuel price volatility, the imbalanced cost pass-through tariff mechanism (ICPT) shields the supplier from unexpected fuel costs or distributes the savings on lower fuel costs to consumers, to achieve a net neutral position over a 6-month adjustment period.

The same IBR process also determines the allowable return for the transmission and distribution, providing a level of certainty in TNB's main revenue stream.



Source: Author's illustration

The IBR, ICPT and base tariff determination method was established during an era of high marginal fuel cost in generation, primarily coal and natural gas, locking in most costs in long-duration power purchase agreements (25 years for coal and 21 years for gas power plants). Total costs were aggregated and reallocated to consumers in a regulatory review process, in a system cost-sharing principle. The energy transition is now challenging this economic regulatory approach, among others with zero cost marginal fuel (solar), increasing time profile variation and niche green consumers.

The ownership paradox

TNB is a corporation that is publicly listed on the KL Stock Exchange. Most of its shares (>60%) are held by government-linked entities including Khazanah Nasional, Permodalan Nasional Berhad (PNB), Employee Provident Fund (PNB), and Kumpulan Wang Amanah Pencen (KWAP), while the Government via the Ministry of Finance holds one special share, giving it the right to appoint the Chairman and Chief Executive Officer. TNB is considered a stable income stock, and the dividends are important to the majority shareholders who in turn distribute the returns to their contributors or the Government.

TNB: Dividend to shareholders, 5-year history

	2023	2022	2021	2020	2019
Net profit (RM bil)	2.77	3.46	3.66	3.59	4.53
Payout ratio	92%	63%	63%	67%	67%
Dividend yield	4.38%	3.95%	4.28%	4.03%	4.00%

Source: TNB annual statements

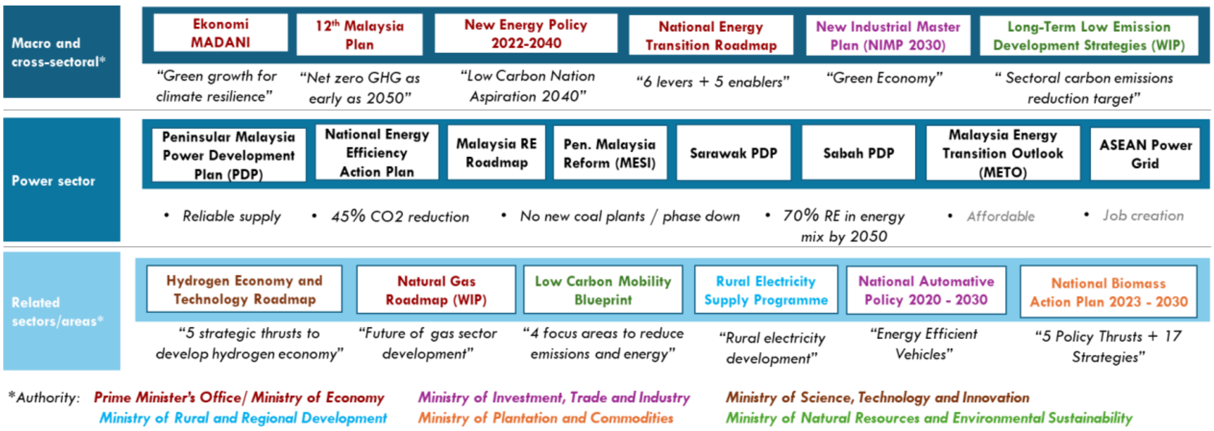
Given the special share and its strategic role in the provision of a critical public service at affordable rates, the Government also generally views TNB as a government-linked company (GLC) as opposed to a purely commercial entity. This view can sometimes be paradoxical to the commercial return expectations and the necessary transformation required in the energy transition. Nevertheless, there has been better clarity at the policy level on considering TNB's strategic and commercial role based on each segment of the value chain, shifting away from the perspective as a vertically integrated utility; as the economic regulatory framework has been positive step in accounts unbundling.

Transitioning to Clean Energy

There are several opportunities brought about by the transition to clean energy, and equally, many challenges. The Peninsular electricity industry had already begun to observe a decoupling demand and GDP growth, with the latter growing at a much higher rate than electricity consumption (around 1-2% p.a.), typical of an economy entering developed status as energy intensive industries start to decrease and higher growth in services-based sectors. However, electricity prices had not followed the same trend of economic growth as depressed average income perpetuated affordability concerns.

Furthermore, since the first hydropower station in 1900 and the initial plan to develop a National Grid was tasked to the Central Electricity Board of Malaya in the 1940s, the electricity industry has generally been a steady progress of carefully designed plans based on a centralisation planning policy without much technology disruption. The landscape is inevitably changing with increasing decentralised energy resources, compelling a significant shift in strategy.

Current policies and strategies



Source: Selected compilation; Author's illustration

The government recognizes the urgent need to decarbonise energy and has set ambitious targets to achieve the goal of a low-carbon economy. Policies relating to electricity in both supply and demand aspects have been sufficiently developed demonstrating this commitment, particularly post Covid, as a lever for economic recovery. Essentially, policies cover:

Macro and cross-sectoral policies which broadly provide long-term targets and principles of strategy that provide guidance on the future direction relating to economic and social development. The principles are typically thematic based on the agenda of the government-of-the-day, nevertheless a closer examination of the different governments in the past years indicates similarities in fundamentals with variances in priorities.

Sectoral policies are essentially based on jurisdictional authority as provided under the constitutional framework. As stated earlier, Peninsular (and federal region), Sabah and Sarawak each have specific policies and power development plans according to their unique demand and supply contexts. There can be standard elements adopted across regions such as the energy trilemma (reliability of supply, environmental sustainability and affordability), energy efficiency and statistical frameworks which are consolidated into the national report.

Policies in related sectors are also important to consider as the progress affects either the demand or supply aspects of the power sector. For example, the hydrogen economy and technology roadmap outlines a goal of cost-efficient hydrogen production, which if achieved would be a viable source for power generation. Nevertheless, many of these policies are long-term aspirational plans.

Electricity is a key enabler to economic development and quality of life, and generally viewed as a public good thereby resulting in a high level of government oversight to control costs and maintain security, as opposed to being left to market forces entirely in a fully liberalised, competitive model. Policies are interlinked across several Ministries, which also have different priorities and strategies between economic, social and fiscal goals, as illustrated below and discrepancies arise in timeline and targets as some policies are reviewed and updated more frequently than others.

Ministry	Priorities	Key Strategies
Economy	GDP growth; strong currency; job creation; quality of life	Competition; targeted subsidies; improve economic development ecosystem
Finance	Fiscal stability; good governance; efficient expenditure	Reduce inefficient spending (broad-based subsidies); increase revenue; prioritise federal budget allocation
Investment, Trade and Industry	Private sector investments (FDI/DDI); industry growth; bilateral and multilateral trade	Attract high value investments; competitive costs (low electricity tariffs); competition; increase productivity; new sources of growth
Energy Transition and Water Transformation	Reliability and quality; reduce GHG emissions; affordability; access to electricity; sustainable investments	Diversification of supply; affordable tariffs; increase clean energy; efficient use of energy
Natural Resources and Environmental Sustainability	Low-carbon economy; efficient utilisation of resources	Accelerate GHG emissions reduction; sustainable consumption
Science, Technology and Innovation	New sources of growth for future economy; bridge innovation ecosystem gaps; sufficient skills in science and technology	Industry-academia collaboration; technology sandbox; capacity and capability development

Opportunities

Opportunity 1: Increasing demand from shift to electrification and ESG corporations

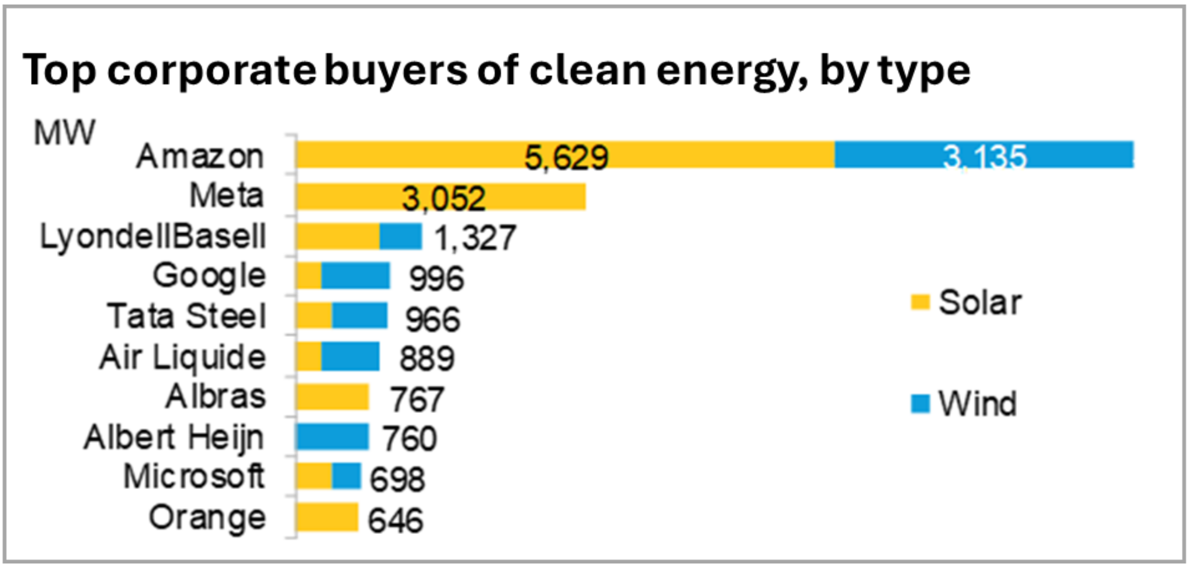
Electricity demand is expected to increase primarily in the following areas:

First, industrial development from new industries and companies in as part of the strategy to attract direct investments in the New Industrial Masterplan (NIMP);

Second, existing industries, especially those that directly use oil and gas as a primary energy input are compelled to reduce their scope 1 GHG emissions. Nevertheless, they would also need to adhere to the Energy Efficiency and Conservation Act obligations once it comes into effect;

Third, transport electrification as consumers increasingly chooses electric vehicles and commercial vehicles also have similar options at a competitive cost, particularly as the prices of diesel and petrol become unsubsidised;

Notably, the influx of data centres in Peninsular from 2023 will be the single largest demand driver in the next 3 years and beyond and slated to change the growth trend from an average of 1.2% p.a. to 3-4% p.a. Between 2021 to 2023, data centres comprised 80% of the approved digital investments (RM114.7 bil of a total 144.7 bil) with 39,231 potential job opportunities. This would potentially shift the demand composition of Peninsular back to the 90s industrialisation era, where the commercial and industrial segment comprised more than 50% of demand. Data centres alone would spur clean energy investments opportunities in the entire value chain of the power sector, particularly in renewable energy as many have ESG targets to meet either due to shareholders or customer expectations. Corporates have emerged as the main buyers of clean energy globally, under variations of corporate power purchase agreements, and the trend is expected to continue.

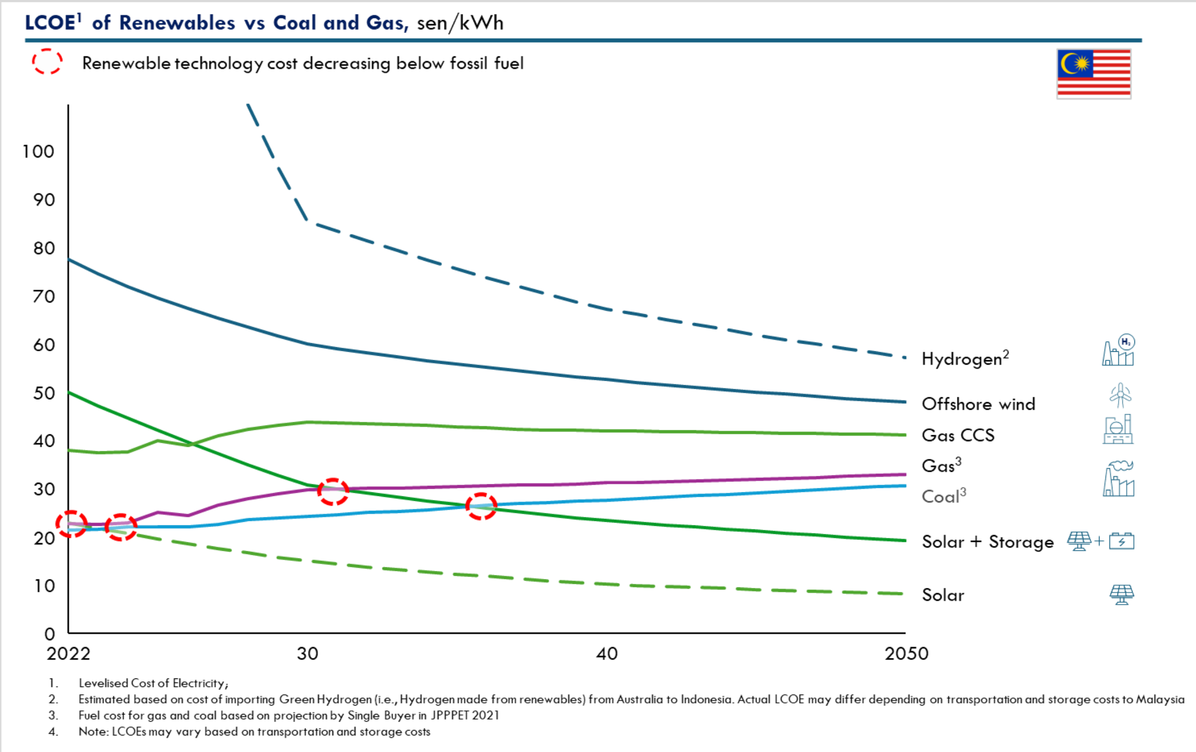


Source: BloombergNEF, 2024

Opportunity 2: Unlocking new technology and innovation

The commitment to decarbonise has brought about a wave of innovation in power technologies as developers recognise the long-term growth opportunities. Although some power generation technologies such as solar PV panels and wind turbines are not novel, having existed for decades, innovation has and is continuing to enhance the efficiencies to cost-competitive levels. Enabling innovations like long-duration battery energy storage and hydrogen, as well as other carbon mitigations like carbon-capture-utlisation-and-storage (CCUS) have seen significant developments in the past 5 years, even mass commercial viability is yet to be achieved. Nuclear has also seen a revival with over 60 Small Modular Reactors technologies in various stages of development. Despite the different policy views on nuclear in country energy mix, it has been globally acknowledged that nuclear will play an important role in clean energy transition.

The rapid rise in RE deployment globally has brought down the costs of technologies, particularly solar PV panels which make up the bulk of development costs. Similarly, the simple generation cost or levelised cost of energy of RE in Peninsular is at a competitive level relative to fossil fuel generation, particularly with the rising prices of coal and gas. Solar with storage is projected to be comparable to conventional generation in the next decade, depending on fossil fuel prices.



Source: Future-proofing MESI; MyPOWER and McKinsey

On the consumer side, smart meter technology, rooftop solar adoption and energy efficiency services are still at early stages in Malaysia and expected to grow further. Investments in clean energy surged in the past 10 years and created new job opportunities. Increased efficiency in conventional thermal power plants had seen a reduction in jobs, for example an ultra-super critical coal power plant of 2x700 MW can be operated by a workforce of approximately 250, compare to an older technology which requires over 400 people. Clean energy developments have enabled jobs to transition from conventional areas, including creating new vocational-skilled jobs such as rooftop solar installers (averaging 8-10 per installation).

Opportunity 3: Improving security through diversification

The growth of clean energy provides an opportunity to enhance diversification of electricity supply, reducing reliance on fossil fuels particularly coal and gas for Malaysia. Currently the energy mix concentration for peninsular is almost at 0.5 for coal (the lower the better), and even higher for fuel supply concentration. Other measures of diversification also include HHI, or market supply diversification. In terms of HHI, Pensinsular's generation market share (by installed capacity) is more than 80% collectively held by TNB, Malakoff, Edra CGN while the remaining shared among several smaller industry players namely utility-scale solar.

In terms of fuel supply sourcing, Peninsular imports 100% of coal for power generation, with Indonesia accounting for approximately 70% of supply. Natural gas, on the other hand, is largely from domestic resources, produced mostly in Kerteh. However, these natural resources are limited and projected to begin declining in 2029, after which Peninsular would also have to import natural gas and process through the regasification terminals. Increasing import dependency leads to exposure to the global market and geopolitical risks. In 2022, Peninsular was affected by a coal export ban imposed by the Indonesian government in a move to prioritise domestic needs and protect its economy. Furthermore, the energy crisis in Europe has also demonstrated the implication of over reliance on few sources.

Challenges

Challenge 1: Growing complexity in matching demand and supply
While demand growth is positive for the power sector, there is increasing uncertainty in the demand and corresponding supply, posing a challenge in planning for sufficient and efficient capacity.

Profile, pace of growth and location of demand: The anticipated surge in demand from industries that require huge amounts of power (especially AI data centers) in a continuous time profile (24/7 reliable basis). Data centers (DC) on average do not require a long time for development and could be set up in months in an existing building while the capacity for baseload profile is insufficient. Additionally, DC demand growth is concentrated in Johor (south) and Selangor (central), leading to congestion challenges. In the case of Johor, there is currently about 4GW of installed capacity at a maximum demand of 2GW with the remaining transmitted to the central Peninsular while there are already data centers requesting 1GW of capacity, leaving insufficient energy for other potential investments such as biotechnology and semiconductors. A shortfall would mean a technical strain on a national scale. Similarly, if there were a sudden surge in EV fast-charging consumption in a concentrated time period and area, it could also lead to similar issues.

Mismatch in supply profile: In Peninsular, only solar has the potential to provide large amounts of clean energy as the region is not blessed with wind speed and geographically lacking in further large hydro potential. However, solar has a variable time profile (an average 4-6 hours, on an intermittent basis) and the irradiance is highest in northern Peninsular, the distance translating into increasing transmission losses. Intermittency can be mitigated through energy storage solutions (e.g. battery or pumped hydro), only for daily intervals and therefore longer-term solutions are still necessary. Notwithstanding, storage mitigations work on the basis on surplus for charging to be discharged in times of need, therefore requiring development of additional generation capacities, approximately at a ratio of 1:6 (i.e. 600MW solar capacity for 100MW of generation). Generating capacities on a firmer basis is still expected to be necessary over the long run or until the system is able to achieve a high degree of flexibility both in supply and demand.

Lead time for capacity development: Utility-scale solar requires about 6 months of development following land, financial and connection approvals, which can vary from less than a year to more than 2 years based on prior track record of LSS programmes. Battery energy storage necessary as a complement, is expected to take about the same time, however, could also be developed concurrently. A 100MW pilot battery energy storage system (BESS) to support the grid has been announced in 2023, and still in early stages. At the distribution level, rooftop solar requires much less time to develop (less than 6 months) however at a capacity constrained by space and distribution technical limits. Natural gas power plants require a 5-year lead time (green field) or slightly less if developed as a repowering project in an existing facility. Clean nuclear energy is still far from a feasible operational date, generally requiring 10-15 years depending on technology type.

Managing demand offsets: Increasing distributed generation and energy efficiency is a good thing as consumers are increasingly able to manage their own demand which tend to lead to responsible consumption. The technical challenge is technical as distribution network lacks the readiness to manage bi-directional flows and conventional generation plants are unable to respond to the fast-changing consumption profile. Coal power plants for example, are developed as baseload (table, always running) and cannot ramp up or down easily. Gas power plants have a slight advantage, especially open cycle gas turbines, however there are limitations. Peninsular is mindful of the case in South Australia where during an extremely high inflow of power from distribution level, the grid operator had to impose the last resort measure of curtailment to maintain stability and the ongoing challenges in managing unpredictable loads.

Challenge 2: Pricing in a shifting cost structure and contractual model
The existing pricing structure in Peninsular was designed for the traditional marginal cost based on consumption, i.e. volumetric basis, which was suitable for a fairly simple system of shared cost and benefit easily managed in a Single Buyer model. Revenue is based on volume of consumption in this design, which matches with the nature of fossil fuel (the higher the consumption, the more fuel is burned). While renewable energy has zero marginal fuel cost, the reliability mitigation cost is higher and depends on conventional generation or energy storage from surplus which leads to a higher total cost. Thus, the ratio of variable to fixed cost switches to a higher fixed cost ratio in a high RE system.

Electricity tariff, Regulatory Period 3 (2022 – 2024)

Avg. base tariff by sector	Sen/kwh
Industrial	37.91
Commercial	47.42
Domestic	35.40

Tariff = average base tariff: 39.95 sen/kwh + fuel surcharge (ICPT)

Source: Single Buyer, TNB

In the current market model where the majority of capacity is procured through long-term PPAs include capacity payments that cover the capital costs of the generation plants, the fixed costs already make up around half of the base cost structure at approximately 21.5 sen/kwh. Nevertheless, a surge in fuel costs would see the fixed ratio at about 36%.

Main component	Sub-component	Estimation (sen/kwh)
Generation cost	Energy (70%)	18.45
	Capacity (30%)	7.9
T&D	Transmission (33%)	4.16
	Distribution (66%)	8.28
Retail		1.16
ICPT surcharge (in 2023)	Coal and gas (variance from base fuel cost)	Up to 20.0

Fixed cost

Furthermore, the socialised cost principle requires a rethink as broadly there are now 3 types of consumers emerging; a) those who exclusively consume from the grid, b) those who produce and only use the grid when required and c) an upcoming group of those who only want to utilise the grid as an infrastructure service when clean energy producers are allowed to contract directly with consumers and deliver power using the existing TNB grid network in a third-party access mechanism.

Currently, in the second group, the adoption rate of distributed generation in particular rooftop solar is driven by government renewable energy initiatives particularly feed-in tariff and net energy metering schemes. However, these schemes are not reflective of the actual costs, where the avoidance of certain costs such as transmission and distribution which becomes subsidy imposed on other non-solar consumers. In addition, the cost of capacity would also need to be reallocated to avoid stranded costs inequitably spread to the remaining consumers within the system. Rooftop solar marketing often cite up to 80% savings in electricity bill due to the cost avoidance.

Challenge 3: Financing limitations

In the generation segment, there is a restriction on foreign ownership of companies, with rare exceptions made in the past. Renewable energy projects are largely funded by domestic capital largely via the debt market. The federal government does not fund any projects directly as government-linked institutional investors are already significantly present in Malaysia's investment landscape. State governments sometimes have a minority stake, either in the form of capital injection or provision of land. The remaining are private investments.

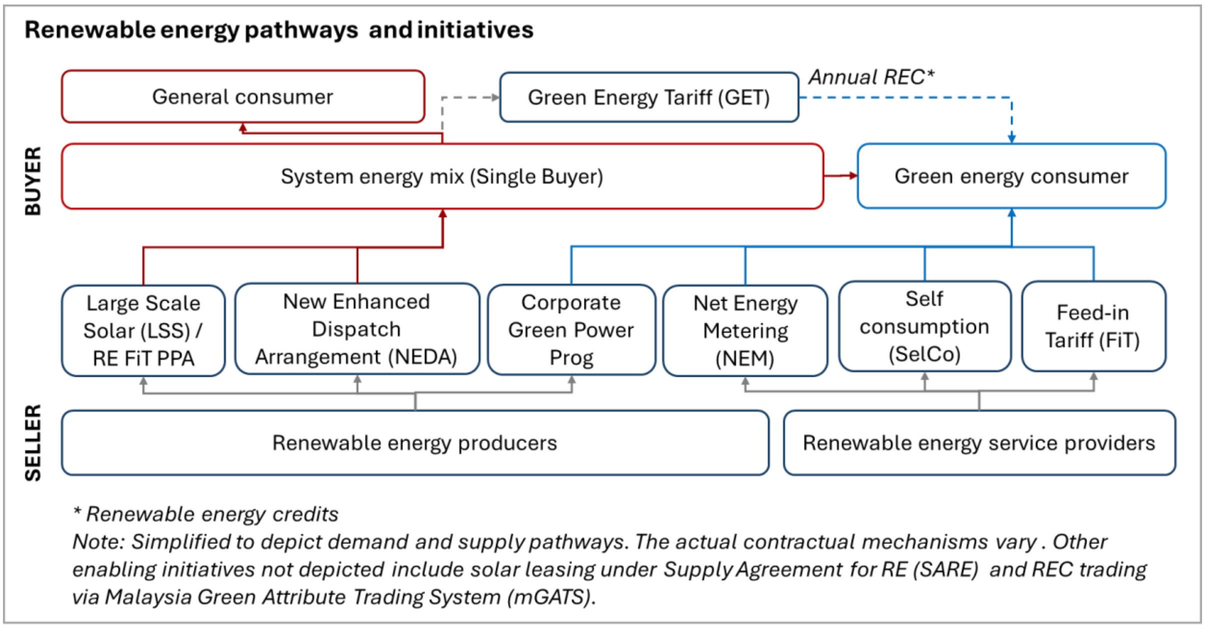
Grid network investments are entirely undertaken by TNB, and contracts generally benefit local players as well. Nevertheless, as TNB is also the off taker for all Single Buyer managed contracts, this exposes the sector to a concentrated liability risk. Furthermore, TNB faces the challenge of single counterparty exposure limit (SCEL), a financial sector risk policy imposed by the Central Bank, constraining its debt raising efforts.

Financing for the consumer segment is small and limited to rooftop solar largely under specific initiatives such as NEM (refer to the next section) while some energy efficiency incentives funded by the Government are also available. Additionally, most banks have also begun to offer financing packages for residential solar at interest rates comparable to asset leasing (e.g. hire purchase financing). Companies looking to undertake green projects and service providers developing green projects have been able to take advantage of incentives such as the Green Investment Tax Allowance and Green Income Tax Exemption introduced in 2016. However, these are provisional and subject to tax and budgetary policies.

To encourage public-private partnership, the Ministry of Natural Resources and Climate Change through its agency, Malaysian Green Tech Corporation, also offers a Green Technology Financing Scheme where the government offers a 2% p.a. interest/profit rate subsidy for the first seven years and 60% government guarantee of green component cost to financial institutions for qualified investors, among others, having a minimum 60% Malaysian shareholding. The scheme covers several sectors, including energy, up to a tenure of 15 years and has been instrumental in alleviating the financial risks and building confidence among financiers, especially in the early Large Scale Solar programme auctions.

Renewable energy development

RE development strategy can be described as a 2-prong approach – 1) greening the grid by incentivising cost-competitive RE generation that improves GHG emissions in the system, benefitting all consumers; and 2) tailored to specific consumer requirements, with distinct offerings for industrial, commercial and residential segments thereby providing choice. There are several pathways for consumers and providers in each strategy. The contractual mechanisms and thus complexity, risks and costs vary, and typically the main factors in the choice of either party.



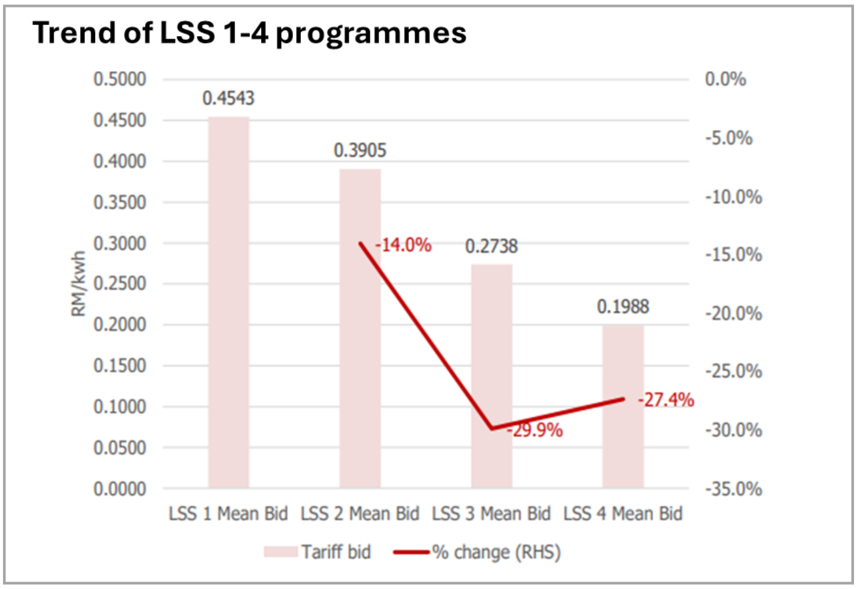
Source: Various; Author's illustration

Building a base of prosumers

The initial scheme offered is the Feed-in Tariff scheme introduced in 2011, which sets an attractive purchase price to consumers for the electricity generated by rooftop solar installations due to the prohibitive costs of solar PVs. As those costs started to become more affordable, mainly driven by the low-cost China solar PV, the FiT scheme for solar was phased out and replace by the Net Energy Metering scheme in 2016. FiT still remains instrumental to encourage development of other types of renewable energy that have yet to be commercially competitive, including bioenergy, mini hydro and geothermal. Both FiT and NEM schemes have been largely successful in boosting the growth of RE, particularly rooftop solar.

Scaling up supply, fast and cost-efficiently

The bulk of renewable energy capacity to-date has been achieved through the Large-Scale Solar (LSS) programme, where auctions are held to allow producers to sell solar energy into the system. LSS1 was introduced in 2016, and the most recent and largest round, LSS5 was recently opened in April 2024.



Source: MIDF Research, April 2024

LSS has been effective in incentivising a low-risk option to producers where long-term power purchase agreements (PPA) guarantee the offtake of energy at competitive prices that benefit consumers. Unlike conventional PPAs which have capacity and energy payments, LSS PPAs only have energy payments at fixed prices. In LSS1-3, a total 1,458MW of capacity was auctioned at a maximum bid limit of 100MW and allowed foreign participation up to 49%. LSS4 was held in 2021 to boost economic recovery, with a 1,000MW capacity at a maximum of 50MW only for Malaysian-owned or public listed companies, therefore increasing the number of companies in the pool.

LSS5 is expected to award a total of 2,000 MW with the largest scheme allowing up to 500MW and allowing foreign participation. Analyst estimates that LSS5 will generate “RM7.2 billion worth of engineering, procurement, construction and commissioning (EPCC) jobs, based on RM3.6 million per mw work value”, this also means significant high-value job opportunities during the development phase and an increase in the importation of solar PV panels, the majority likely from China.

Environmental and economic tradeoffs

In terms of environmental impact, utility-scale solar plants are by design built on large tracts of land based on the target energy generation and solar panel capacity factor. A 500MW is generally about 1,500 to 2,000 acres in size. Land use is one of the considerations in the LSS evaluation, for example the conversion of palm oil plantation which does not contribute to the carbon sink is favourable to agriculture and arable land or forests. This ensures that the overall target of reducing carbon emissions is not compromised, nevertheless there is increasing competition between land use for palm oil plantation industry which is a sizeable in trade and renewable energy largely for domestic consumption.

Conversations with existing palm oil plantation players indicate that the willingness to convert a portion of the land as a) some trees are old with low yield and land rejuvenation and replanting costs are high; 2) renewable energy prices are competitive and more attractive to the fluctuating cyclical price of palm oil and a source of revenue diversification; 3) improve corporate ESG profile; and 4) plantation land is sizeable and some close to transmission lines. This is among the strategies considered in designing the LSS5, in addition to providing smaller packages to provide opportunities to smaller players which also encourage the development of more local capabilities.

LSS5 Packages	Capacity allocation (Mwac)	Min. bid (Mwac)	Max. bid (Mwac)	Installation Type	Shareholding condition
Package 1	250	1	10	Rooftop/Ground Mounted	100% Bumiputera
Package 2	250	10	30	Rooftop/Ground Mounted	Min. 51% Bumiputera & 100% Domestic
Package 3	1000	30	500	Rooftop/Ground Mounted	Min. 51% Domestic
Package 4	500	10	500	Floating Solar	Min. 51% Domestic

Source: MIDF Research

Expanding offerings under constraints
As the existing Single Buyer model is essentially a supply aggregation, it is limited in differentiated offerings and pricing transparency. Nonetheless, new initiatives as a work around have been introduced in recent years in response to demand from industry players and corporate customers, particularly to flexibly meet their clean energy targets and ESG commitments, through offsets or annual consumption load on a partial or full basis. Among others:

Green energy tariff: Enables corporates to purchase renewable energy bundled with renewable energy certificates for one year at a premium on top of the standard electricity tariff, allowing for carbon offsets

Net Offset Virtual Aggregation (NOVA): A variation of the NEM allowing corporates to develop own solar and share among different premises (electricity accounts) to optimise excess generation

Corporate Green Power Programme (CGPP): Enables corporates to directly purchase RE from producers through contract-for-difference (CfD) type mechanism based on the difference between regulated tariff and system price of the NEDA market

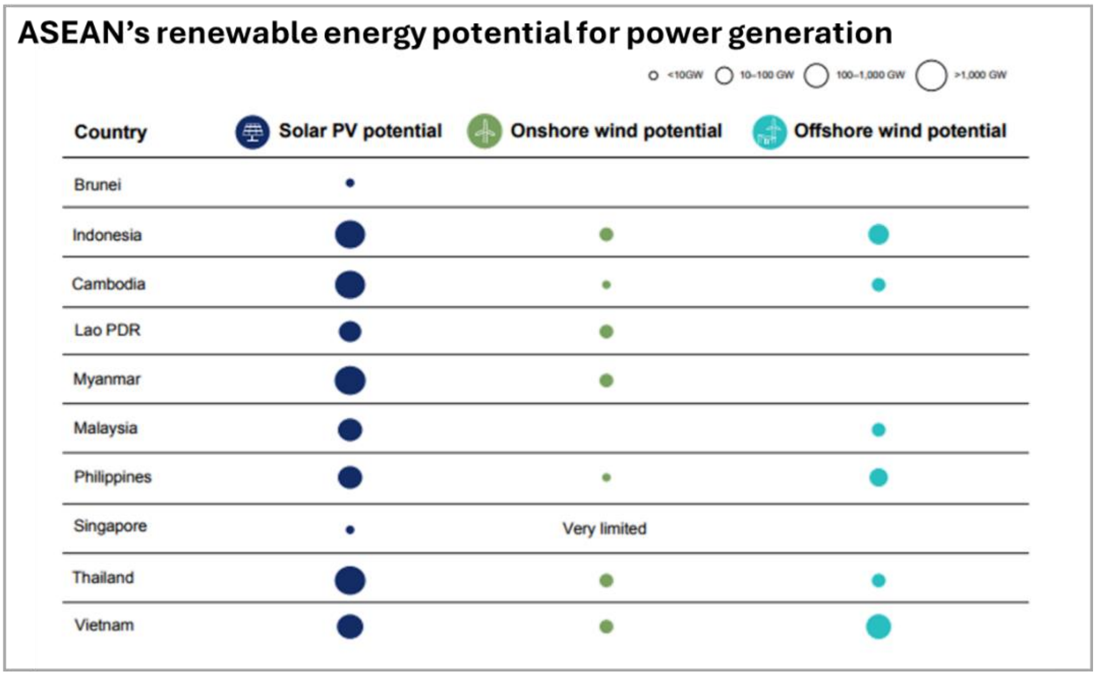
Corporate Renewable Energy Supply Scheme (CRESS): Soon to be introduced in September 2024, to allow corporates to enter into direct power purchase agreements as corporate off takers for a specific amount of RE and utilise the grid with defined network charges.

Looking Beyond Malaysia

RE demand and supply development in Southeast Asia

According to the International Energy Agency (IEA), Southeast Asia is one of the fastest-growing regions globally in terms of electricity demand, which has grown by more than an average of 6% annually over the past 20 years. Indonesia (26%), Vietnam (22%), Thailand (19%) and Malaysia (15%), made up more than 80% of total regional demand in 2020, and the growth trend is expected to be primarily contributed by the same countries driven by the growth and shift towards electrification in industrial and transport sectors. Most countries focus on meeting the demand through domestically generated and managed resources placing emphasis on energy sovereignty and maintain a certain level of independence, particularly countries which have indigenous fuel resources.

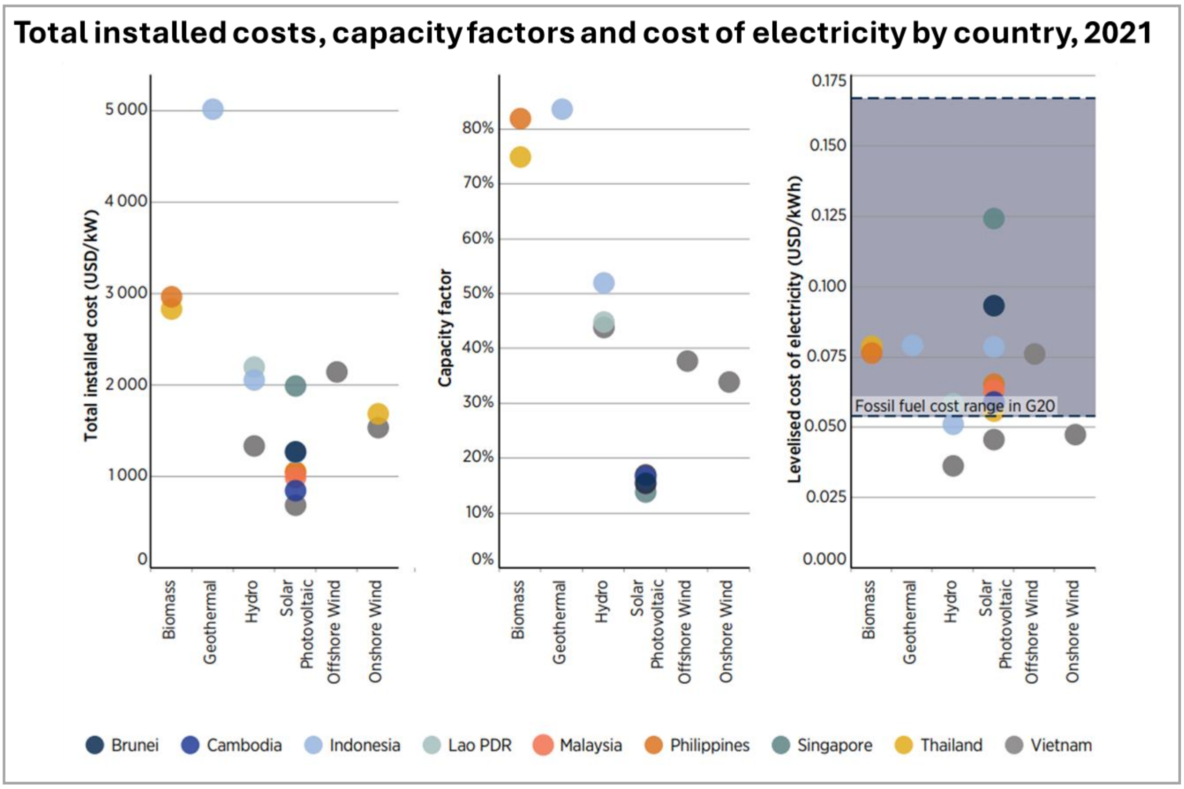
Renewable energy is changing these policy perspectives. As a tropical climate region surrounding the Equator, Southeast Asia has significant renewable energy potential particularly in solar and hydro power, with the exception of Singapore and Brunei. Offshore wind energy potential is limited to countries with open coastlines towards the South China Sea, particularly Vietnam, Indonesia and the Philippines, while onshore wind has lower potential. In certain countries such as Lao, Myanmar and Cambodia, the potentials outweigh the projected demand in the near to medium term, thus creating the opportunity for exporting surplus energy. Lao has expressed its ambition to be the "battery of Southeast Asia" with its vast hydropower potential.



Source: McKinsey; adapted from IRENA Renewable Energy Outlook 2022

Undoubtedly, sharing of power resources can provide security, diversification and system cost optimisation benefits, reducing the need for high reserve margins, in addition to economic opportunities for producing countries. Nevertheless, the potential to trade power depends on a combination of several factors, primarily:

Comparative cost advantage: A significant portion of renewable energy development cost is the equipment (solar PV panels and wind turbines), land and labour. Solar PV development costs are lowest in Vietnam and Cambodia, and highest in Singapore while Malaysia lies in the mid-range. Hydro development is also cost competitive in Vietnam and almost twice as high in Laos which is at a level comparable to offshore wind in Vietnam, although data for Malaysia (Sarawak has untapped hydro potential) is not available. Vietnam and Thailand onshore wind have similar investment costs, both only slightly higher than solar and lower than hydro. Other cost variables include the difference in currency exchange between potential supplier and buyer countries. At current, Singapore's currency is an incentive for other countries to export clean energy, however potential players should also include currency exchange risk. For Peninsular, given the projected demand growth and cost levels, it would likely need to be a net importer of clean energy, especially if the Ringgit strengthens.



Source: IRENA Renewable Energy Outlook based on IRENA Renewable Cost Database

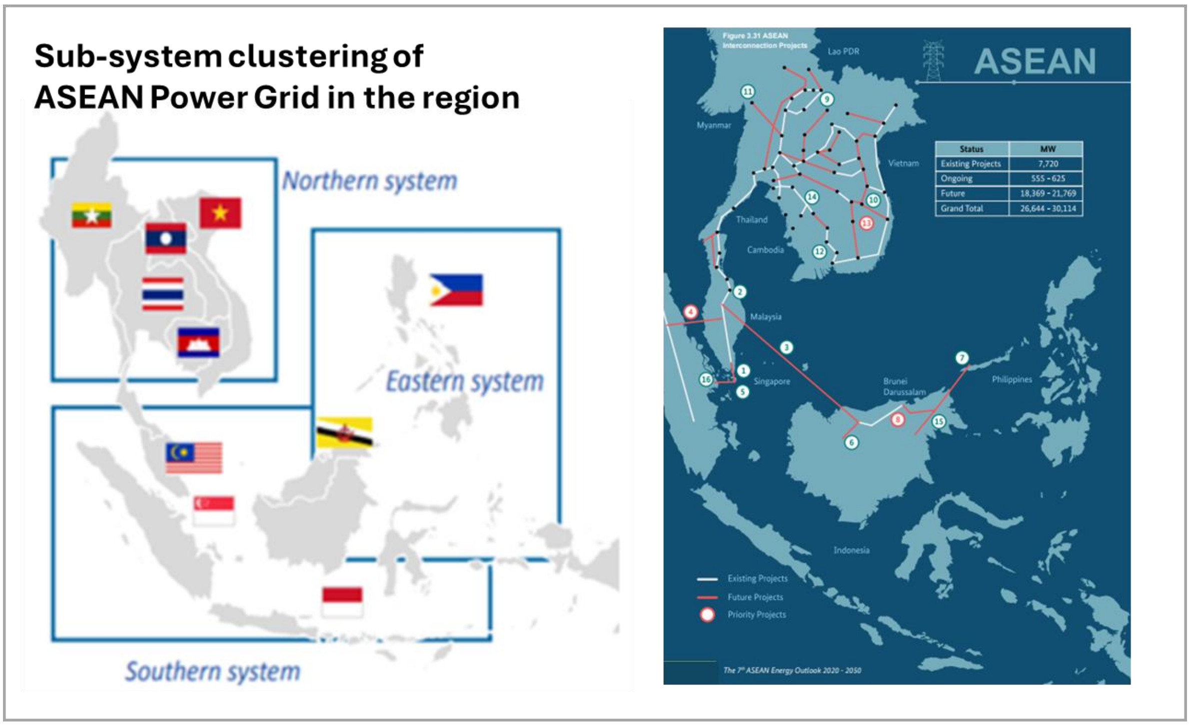
Matching renewable production to demand profile: The differences in demand profile of each country's system will is a key factor in determining the optimal sharing of excess renewable energy generation, among others the peak(s), volume over time intervals and remaining shortfall considering domestic generation production based on dispatch regulations. In addition to zero marginal fuel cost, given the intermittency nature of solar and wind, firming and flexibility sources could also be traded to meet system balancing needs which occur at different times. As renewable production profiles may not exactly match, battery energy storage is a potential mediator to store excess production which can be dispatched as and when required. Additionally, some production may also be affected by seasonal patterns, as in the case of Lao hydropower which runs low around 6 months of the year during the dry season.

Investment to develop generating facilities: To-date only a fraction of the potential has been realised. In study by McKinsey, unlocking solar PV potential to meet growing demand would require 7-fold capacity increase from current plans in this decade (2022-2030), at an approximate USD400b in investments, onshore wind requires 12-fold increase at USD280b, while offshore wind while only a 5-fold increase requires USD250b in investments. The ability to attract investments depend on the investment policy and regulatory landscape particularly openness to foreign capital and stability of policies and regulations.

Readiness of domestic and regional grid network: This is a major factor in trading as the excess electricity generated must be able to reach the demand locations that could also several borders away. Most of the high RE potential is in countries where the domestic grid infrastructure is insufficiently connected, unstable and/or unable to integrate variable renewable energy. In the Vietnam experience, while RE development surged over the past 5 years, often quoted as a model development in the region, its infrastructure was not well-prepared resulting high curtailment and losses. Furthermore, unlike Europe, parts of Southeast Asia are separated by sea, requiring costly undersea power cables to deliver electricity; Indonesia is an archipelago with its own internal connectivity challenges. The investment cost to prepare the grid network is yet to be determined but likely even much higher than generation supply development.

ASEAN Power Grid

Malaysia is one of the founding members of the Association of Southeast Asian Nations (ASEAN) with the objective of cooperation in the economic, social, cultural, technical, educational and other fields, and in the promotion of regional peace and stability. In 1999, the ASEAN Power Grid (APG) initiative was identified to enhance greater economic integration through the development of regional infrastructure, among others energy infrastructure (APG and the Trans-ASEAN Gas Pipeline initiative). The APG has evolved since then, driven by shifting geopolitical dynamics and the interplay between national priorities, regional trade cooperation and global climate commitments.



Source: ASEAN Centre for Energy

Interconnections enabling cross-border sharing of power exists between Peninsular-Thailand-Singapore and Thailand-Lao-Cambodia allowing wheeling of hydropower from Laos to Singapore under the Lao-Thailand-Malaysia-Singapore pathfinding project. Power purchase agreements are typically bilateral, and each country maintains its sovereignty rights to determine wheeling charges. On an ongoing basis, the APG aims to resolve integration challenges, including technical harmonisation, regulatory standards, data sharing and multilateral market development. Given the geopolitical nature of Southeast Asia, ASEAN is the best platform to develop a regional market. However, the pace is slow given the national complexities, particularly in industrial and socio-economic policies. In the meantime, bilateral arrangements continue to be an alternative option.

Peninsular Malaysia recently launched ENEGEM, a cross-border green energy trading platform. The mechanism is based on auctioning surplus renewable energy assured with RECs to foreign buyers that are licensed and registered in the receiving country's system. The pilot phase with a 1-year tenure, set out a reserve price set at a lower rate than Singapore's wholesale energy market prevailing price and bids primarily from Singapore purchasers. Future phases will be enhanced based on the learnings and eventually integrated into the future power market design.

Selected lessons from other countries

Turkiye: Renewable Energy Resource Areas (YEKA)

Turkiye achieved 55.2% of renewable energy in its capacity mix in 2023, attributed primarily to growth in wind and solar development, and aims to increase to 64.7% RE by 2035. One of the successful government initiatives is the Renewable Energy Resource Areas (YEKA) introduced in 2016. YEKA is designed as "a new investment model for harnessing renewable energy resources… to enhance the effective and efficient utilization of renewable energy resources". YEKA designated areas are on public and treasury-owned properties, as well as privately owned properties, thereby reducing the lead time to obtain government approvals for development. This enables developers to focus on the design and construction and meeting the additional requirement of high domestic content and advanced technology. The government holds auctions for development of capacities within each area, with willingness to adjust the terms depending on prevailing conditions to continuously solicit competitive bids.

YEKA is a showcase model of effective public-private partnership risk sharing where each party focuses on the role that they have authority and capability to manage (best owner of risk), combining commercial incentives with multiple national policy objectives, including creating the local supply chain ecosystem.

California: Integrated resource planning

California's current law requires 60% of electricity to come from renewable energy sources and recently passed a law a goal for 'all electricity sold to customers to be 100% carbon-free by 2045'. In 2015, the state mandated integrated resource planning requiring utilities to submit plans that meet energy goals every 2 (investor owned utilities, community choice aggregators, and almost all electric service providers) approved by California Public Utilities Commission (CPUC) or 5 years (public utilities) approved by the California Energy Commission (CEC). An "umbrella" planning proceeding is held publicly to consider all procurement policies and programs, including the policy on Loading Order, which mandates that energy efficiency and demand response be pursued first, followed by renewables and lastly clean-fossil generation.

The integrated plans incorporate aspects such as a) system needs (reliability needs of the overall electric system); b) local needs (reliability needs specific to areas with transmission limitations); and c) flexibility needs (such as the resources needed to integrate renewables). The collaborative and transparent approach of the integrated planning process and final approvals provide a signal for investments into RE generation and transmission planning. Challenges exist in implementation, as transmission planning generally lags the RE projects causing delays in generation plans. Nevertheless, this is a model approach to incorporating policy targets into a liberalised market industry structure by sending information signals to investors.

Brazil: Dual market enabling corporate PPAs

Despite a strong domestic oil and gas sector that contributes 11% of its economy, Brazil has achieved more than 46% renewable power in its energy mix. Brazil has a dual market structure – regulated and free, where consumers above 500kW can opt into the free market to purchase energy directly from generators and brokers. Within the free market structure, corporate power purchase agreement (PPA) model for renewable energy has grown exponentially where the main offtakers are energy-intensive industries, such as mining, steelmakers, and petrochemical companies, as well as large telecom operators. The unregulated nature of the market allows the companies flexibility in designing the long-term contract arrangements according to their specific needs, with variations in negotiated volume, tenure, pricing structure, supply profile and locations.

The rise in RE supply and technology advancements, natural geographical advantages (hydro, solar irradiance, strong winds), have led to increasingly competitive prices, making it more attractive for corporate consumers to replace or expand power supply agreements with more renewable power. This has also contributed to diversification of players, business models and risk appetites.

China: Renewable energy law, market reforms and strategic RE incentives

China's 14th Five-Year Plan sets out implementation targets to peak carbon emissions by 2030 and achieve carbon neutrality by 2060. Replacing coal with clean energy is an enormous task as it comprises 56% of the mix, nevertheless it has already begun making inroads into increasing renewable capacity. Over the long-term, share of renewables is expected to grow from 30% today, to 55% by 2035, and 88% by 2050. The growth has been enabled by a fairly complete renewable energy law and policy framework to promote renewable energy development, increase energy supply, improve the energy structure, ensure energy safety, protect the environment, and attain the sustainable development of the economy and society, enacted in 2005. The RE law covers aspects relating to access, prioritisation, standards and incentives, pricing, investments, governance as well as technology, promoting domestic innovation and capacity building.

Government policies have also been supportive at reducing barriers relating to land development rules and financing. While public incentives have been instrumental in spurring early developments, market-oriented reforms are concurrently undertaken to further streamline administration, decentralize power, and drive competitive, subsidy-free renewable growth. In 2002, the grid and generation businesses were separated creating 2 separate power grid companies and 5 major power generation groups. In 2015, pricing mechanism was improved, and a market trading system established and continued to evolve since including interprovincial and regional markets. Recent changes have been made to encourage the developments of green power trading and energy storage participation.

China also has a concerted policy focus on clean energy technology and innovation, providing state incentives for local technologies. Among others, the "Photovoltaic+" agenda focuses on functional integration of distribution generation for agriculture, transportation, and information industries. Examples include agri-photovoltaics which optimize land resources by integrating farming practices with solar power generation. Other initiatives include integrating solar PV panels along high-speed rail lines and within 5G base stations.

Given the complexities within a large region, collaboration between central and local governments are observed to be critical to effectively achieve national objectives, while accounting for local contexts. As financing strategic investments is key to unlocking new technologies and innovation, collaboration between governments provides a common approach to revenue-prioritization in deployment of RE development fund and optimising existing funding channels for new ventures. There are also specialized financial policies that integrate financing into local government subsidy and incentive programs, as well as funding support mechanism for distributed RE initiatives on the consumer end.

Policy Recommendations

Recommendation 1: Enhance policy coherence and implementation coordination

The direction of industrial development is critical to ensure resources are sufficient to meet the demand and costs are allocated appropriately. Investment strategies need to more holistic taking into account enabling factors including resource availability, to determine both the right value target and also the pace of growth, which is not the case currently in Peninsular Malaysia. Data centres are considered energy guzzlers. While considered an opportunistic move to take advantage of Singapore's data centre moratorium in 2021, it would be judicious to evaluate and learn to avoid the same pitfall by being selective and adopting strategies that are still comparatively advantageous.

Development of electric vehicles while encouraging, should also be based on 'smart, evidence-based policy design', to determine implementation strategies that provide the most impactful outcomes. For example, development of different types of EV charging systems according to usage potential and collaborating with highways and town councils. In both examples (DCs and EV chargers), a lower electricity tariff is generally desired investment policy tool to attract investments without recognising the implication of the cost variance transferred to other consumers.

There should also be clarity on cross-border trading policies to achieve security, commercial and regional collaboration objectives that would guide a concerted effort across relevant Ministries (including Ministry of Foreign Affairs). For example, the EU energy guideline provides a recommendation of working towards an average of 15% shared capacity across member states, ASEAN could start with approximately 5% subject to a regional cost-benefit assessment and demand-supply profile analysis, nevertheless commercial terms should be market-driven. Malaysia could provide leadership in terms of showcasing ENEGEM as a trading exchange platform that can be replicated in multiple areas, in a trusted and reliable manner.

Recommended policy action plan:

In short, government policies are critical to achieve clean energy goals, however the approach to policy design requires a significant shift

Revise the Renewable Energy Act 2011 to become a comprehensive legal instrument that sets out the parameters for development, access integration, pricing and governance

Enhance coordination of information, regulation and incentives incorporating inputs from stakeholders for a coherent policy development process at both national and regional levels

Provide clarity on policy principles and determine national targets based on a system-design method, with both bottoms-up and top-down inputs and incorporate triggers for a review and update of interlinked policies

Revise national investment approval frameworks to include a comprehensive cost-benefit and probability factors to investment realisation assessments

Establish a policy implementation coordination platform to provide a balanced review and make decisions on policy tradeoffs, particularly relating to incentives

Recommendation 2: Reform industry to encourage clean energy investments

The current single buyer model has advantages in reducing costs with economies of scale and controlling development plan. However, the growing risks of liability concentration, the increasing complexity of centralised planning and unique demands from corporate customers are imperatives to redesign the market to a fit-for-purpose model suitable to the Peninsular context. Among the major changes required is to address inflexible power purchase agreement regime where conventional capacities are procured based on specific fuel type, with standard locked-in tenures (21 years for gas and 25 years for coal), as well as limited market avenues for contractually expired but operational-worthy power plants to provide different services, thus losing options to optimise existing resources.

Fundamentally, the market should be designed to provide appropriate and sustained investment signals to private investors which can develop at a faster rate. The policy on market structure could provide flexibility based on demand requirements which could be defined beyond energy and incorporate service-type elements such as capacity as security insurance, balancing for flexible reliability, and cross-border trading to tap in wider markets. A dual market model could also be developed to provide options for consumers who want to be regulated or willing to take additional risks in an open market or bilateral contracts, thereby shifting some risks of the single buyer offtaker and indirectly government while encouraging private sector-driven innovation.

Finally, the government's coordinating and facilitating role will be increasingly important, in addition to ensuring security of supply. The current approach of centralised planning should be maintained and enhanced towards an integrated system planning methodology that holistically incorporates RE development at both transmission and distribution levels, transmission planning, cross-border flows, fuel adequacy and resilience assessments. This will require enhanced collaboration among stakeholders including generation and fuel companies, transmission owner, operators and regional entities.

Recommended policy action plan: *The market policy should focus on enabling growth of clean energy sources particularly leveraging on demand from corporate consumers*

Establish a market with different components for specific requirements including capacity for system adequacy and security, energy for time interval demand, ancillary for flexibility and support, cross-border trading, clean energy credits and bilateral contracts

Ensure stability, transparency and independence of the market to attract investors and facilitate lower-risk financing

Develop a policy for regulated consumers, particularly in respect mitigating potential risks from the market and protecting vulnerable consumers

Adopt integrated planning and scenario-based methods that incorporate optimization of resources both central and decentralised, changing demand profile, grid network development and resilience assessments

Establish platforms to monitor sectoral implementation (power development plan), coordinate information and seek feedback from various stakeholders, including states and regional counterparts

Recommendation 3: Develop a differentiated and equitable pricing policy

The existing volumetric tariff requires a significant shift to address the future consumer profile and cost structure in the clean energy transition. Fundamentally, the overarching pricing principle should be value additive (increase in total intra-segment) as opposed to value transfer (redistribution inter-segment), therefore must be carefully redesigned. This requires a revision of several elements, including:

Price transparency: Differentiated by energy (price of generation), grid network, customer service and other policy charges

Consumer classification: Differentiated not only by consumption profile and voltage level, but other considerations such as dedicated grid capacity, quality and reliability

Fuel cost adjustments: To strike a balance between opacity and stability in the current 6-months ICPT mechanism and market-reflective predictability support

Time factors: To better reflect the variance between demand and supply profiles at time intervals, thus providing signals that encourage investments in flexibility services such as battery energy storage and pumped hydro

Subsidies: To reduce distortion in providing cost-reflective pricing signals, while protecting vulnerable consumers through more efficient methods

Tariff reforms are always challenging, especially when the immediate outcome is an increase in the final electricity bill. Notwithstanding, attempting to explain any increase that could be caused by different reasons for different consumers. It requires massive political will and close engagement with consumers, many of whom have limited understanding to begin with. If done right, tariff is a powerful tool and enabler for clean energy transition.

Recommended policy action plan:

Electricity tariffs need to be updated adapting to the changing demand and supply dynamics in the clean energy transition:

Develop a clear policy and specific regulation on tariff ensuring prices reflect unbundled pricing based on differentiated elements of production and consumption

Enhance tariff setting mechanism by setting the fixed component based on the periodic IBR framework with the floating component in line with the market prices or regulated consumer policy

Introduce time-based dimensions gradually in the grid network to reflect congestion periods and providing optimal signals for demand reduction, production location or infrastructure enhancements

Develop a stakeholder-focused transition plan for tariff reform including communication, mitigation and changeover options

Recommendation 4: Increase incentives for technology innovation and sustainable consumption

Clean energy development in Malaysia has on a positive trajectory however it will require a sustained momentum to meet growing demand and ensuring a reliable supply. Investments will continue to be important not only in the development of clean energy generation, but also in the grid network and energy efficiency in tandem, the last an area that is deemed as less commercially attractive. Incentive policies could be better designed to shape investments in ways that deliver the most efficient outcome where risks are also allocated to the most suitable parties. These outcomes could be clearly defined in the policy to include socio-economic objectives such as skills development, transitional jobs, new technology that enhance efficiency, local content and others. The government can consider advocating for a regional incentive fund to promote regionally beneficial projects, including interconnection or technology collaboration.

Incentives can be fiscal and non-fiscal such as facilitating approvals and designating land. Where public finances are involved, whether federal or state, central coordination provides funding optimisation. Fiscal incentives should be carefully designed to ensure it is tied to the value-added outcomes, on a project basis determined rate that ultimately lowers cost of capital translating to consumer benefits and structured equitably depending on regulated or commercial market. In addition, the status of incentives given should be closely monitored while being open to enhancing where necessary as there is no perfect solution for countries in energy transition – adopt and adapt seems to be the best option.

Recommended policy action plan:

Review and enhance incentive policies that address the most pressing challenges and deliver outcomes at the desirable pace

Develop a clean energy transition fund with financing structures tailored to bridge any financing gap, incentivise strategic outcomes and ensures equitability

Establish a clean energy incentives coordination platform between federal and state entities encompassing fiscal and non-fiscal measures

Establish an ASEAN clean energy transition fund supported by governments that can be in partnership with other multilateral development banks and additional injection from global financing initiatives to accelerate collaborative efforts such as the APG and innovation funding for common solutions tailored to Southeast Asian regional climate and needs