

# PENINSULAR MALAYSIA ELECTRICITY SUPPLY INDUSTRY *OUTLOOK 2019*



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# PENINSULAR MALAYSIA ELECTRICITY SUPPLY INDUSTRY *OUTLOOK 2019*





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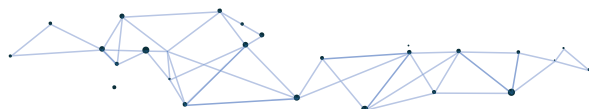
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# INTRODUCTION









## ABOUT THE ENERGY COMMISSION

### Vision

The Energy Commission is a world-class energy regulator that is effective and authoritative.

### Mission

The Energy Commission aims to balance the needs of consumers and providers of energy to ensure safe and reliable supply at reasonable prices, protect public interest, and foster economic development and competitive markets in an environmentally sustainable manner.

A statutory body established under the Energy Commission Act 2001, Suruhanjaya Tenaga (ST) or the Energy Commission is responsible for regulating the energy sector, specifically the electricity and piped gas supply industries, in Peninsular Malaysia and Sabah.

Taking over the role of the Department of Electricity and Gas Supply, the Energy Commission started its operations on January 1, 2002. The main focus of the Commission are reliable electricity and gas supply, reasonable costs and safety.

The Energy Commission has three primary roles, namely:

#### Economic Regulation

To promote economy in the generation, transmission, distribution, supply and use of electricity and in the reticulation and use of gas; promote competition; enable fair and efficient market conduct and prevent the misuse of monopoly or market power in the electricity and piped gas supply industries.

#### Technical Regulation

To ensure security, reliability, efficiency and quality of supply and services in the electricity and piped gas supply industries.

#### Safety Regulation

To protect industry, consumers and the public from dangers arising from the generation, transmission, distribution, supply and use of electricity and the distribution, supply and use of piped gas.



# ORDERLY SUPPLY AND USE OF ENERGY

Suruhanjaya Tenaga, a statutory body established under *the Energy Commission Act 2001*, is responsible for regulating the energy sector, specifically the electricity supply and piped gas supply industries in Peninsular Malaysia and Sabah.



## ABOUT THIS REPORT

Since 2013, the Commission has published the "Peninsular Malaysia Electricity Supply Outlook" report to share the industry's actions and projections in realising the national energy aspirations and targets. A similar report is published for Sabah.

Historically, electricity supply policies, its implementation and regulation focused on electricity availability, reliability and affordability. In recent years, environmental protection has become a priority, more so after the 2015 Paris Agreement, when signatories committed themselves to specific decarbonisation targets. Malaysia pledged to reduce its greenhouse gas (GHG) emission intensity of Gross Domestic Product (GDP) by 45% by 2030, relative to the emission intensity of GDP in 2005.

This report focuses on the Commission playing its part to establish a world-class energy sector in Malaysia, balancing economic and social needs with environmental priorities in the electricity and gas supply industry. It also shows how these goals are aligned to the World Energy Trilemma, the global benchmark for sustainable energy systems.

## MALAYSIA AND THE ENERGY TRILEMMA

Global energy systems are being restructured in response to climate change, digitalisation and changing consumer behaviour. The World Energy Council (WEC) analyses this transition across three (3) core dimensions called the Energy Trilemma, which spans Energy Security, Energy Equity and Environmental Sustainability.

Every year, the WEC publishes the Energy Trilemma Index that measures the overall performance of countries in achieving a sustainable mix of policies and the balance score highlights how well a country manages the trade-offs in the Trilemma.

In 2018, Malaysia moved up four (4) places to rank 37 in the index. It is ahead of Australia (38) and Qatar (39) and is behind Hong Kong (34), South Korea (35) and the UAE (36).

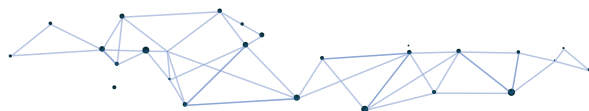
It must be noted that this ranking is based on the performance of the energy sector as a whole, in which the electricity and gas supply industry is a key player. The other influential player is the oil and gas industry, a pillar of the Malaysian economy.

In its analysis, the WEC noted: "Malaysia scores well across all Trilemma dimensions, with a slightly lower score received on environmental sustainability. Malaysia also continues to face challenges when it comes to developing renewable energy."

Malaysia recognises the energy sector as one of the major contributors of climate change, and the 11<sup>th</sup> Malaysia Plan (2016-2020) gives major focus to the prudent and efficient management of energy resources. More specifically, the National Energy Efficiency Action Plan (NEEAP) (2016-2035)<sup>1</sup> sets out to tackle issues pertaining to energy efficiency (EE). Built upon experiences and knowledge of past programmes and projects, the plan proposes instruments for the successful implementation of EE strategies over a 10-year period. Among its recommendations are the implementation of EE measures that involve "harvesting the low hanging fruits" and can be acted upon with relative ease.

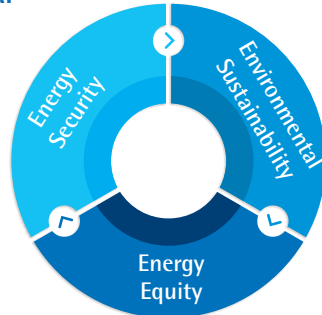
As a key player in the energy sector, the Commission is implementing several strategies to realise the above-mentioned plans. It is also committed to realising the Government's aspiration for environmental sustainability in the electricity and gas supply chain. For this, the Commission has developed its own action plan in the context of the Energy Trilemma.

<sup>1</sup> <https://policy.asiapacificenergy.org/node/1269>





## THE ENERGY TRILEMMA PENINSULAR MALAYSIA'S ROAD MAP



### Energy Security

Resource Diversification

HHI Index

Fossil Fuels

Non-Fossil Fuels

### Environmental Sustainability

COP21 Target

Green Technology Master Plan

Government Aspirations

### Energy Equity

Cost Effective

Optimal Generation Expansion Plan

Least Cost Dispatch

Fuel Portfolio Diversification

## Energy Security

**Goal:** To enhance reliability, availability, efficiency and quality of electricity supply to meet demand and boost economic growth

**Actions:**

- Resource diversification with an energy mix consisting of five (5) fuels: oil, gas, coal, hydro electricity and renewable energy (RE)
- Herfindahl-Hirschman Index (HHI)<sup>1</sup> target of 0.4 by 2025, reducing to 0.38 in 20 years with fuel diversification in the grid system
- Energy mix based on a 20-year forecast, comprising of coal (46%), gas (40%), hydro (3%), interconnections (3%) and RE (8%) by 2037
- 20% RE capacity by 2025

## Environmental Sustainability

**Goal:** To accelerate the decarbonisation of the electricity and gas supply chain

**Actions:**

- GHG intensity reduction by 45% by 2030 relative to emission intensity in 2005
- Focus on RE - 20% of capacity mix will be from RE by 2025
- Green Technology Master Plan (GTMP) prescribes embedding modern technologies in planned developments to reduce GHG emission

## Energy Equity

**Goal:** To ensure electricity and gas supply is reasonably priced and benefits both consumers and producers

**Actions:**

- Incentive-Based Regulation (IBR) - a price-setting mechanism for reasonably priced and secure energy supply in a deregulated market
- Optimal generation expansion plan - to improve service reliability at minimal cost
- Least cost dispatch - to promote market liberalisation to reduce transmission and distribution costs.
- Fuel portfolio diversification - to balance affordable electricity and energy security

<sup>1</sup> HHI shows the diversity in fuel generation whereby the lower the score, the greater the diversity and better the fuel security.



# ENERGY OUTLOOK









## GLOBAL – AN ELECTRIFYING FUTURE

Major transformations are underway in the global energy sector, from growing electrification to the expansion of renewables, upheavals in oil production and globalisation of natural gas markets, states the International Energy Agency's (IEA) "World Energy Outlook (WEO) 2018" report. "Across all regions and fuels, policy choices made by Governments will determine the shape of the energy system of the future," it adds.

What is significant is that for the first time this IEA flagship publication includes a section entitled "Special Focus on Electricity" that says the future is electrifying, with low-carbon technologies on the rise and electricity demand set to grow at twice the pace of energy demand as a whole. It also sheds light on what tomorrow's power sector could look like, highlighting key uncertainties that have implications for energy security, investment and environmental concerns.

According to WEO 2018, oil markets are entering a period of renewed uncertainty and volatility, including a possible supply gap in the early 2020s. Demand for natural gas is on the rise, erasing talk of a glut as China emerges as a giant consumer. Solar photovoltaic (PV) is charging ahead, but other low-carbon technologies and especially efficiency policies still require a big push.

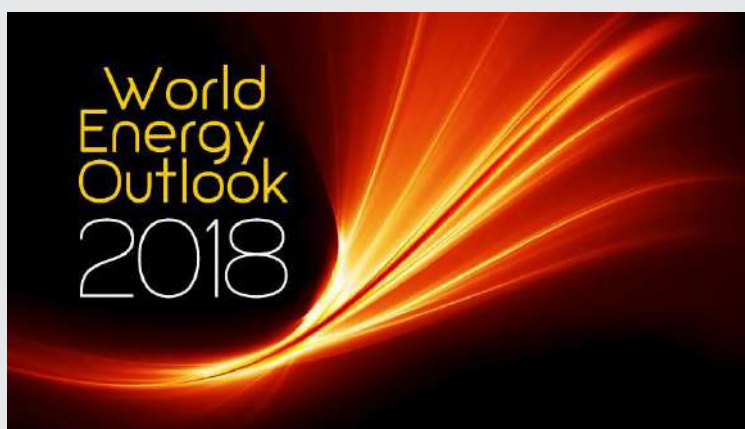
"In all cases, Governments will have a critical influence in the direction of the future energy system. Under current and

planned policies, global energy demand is set to grow by more than 25% by 2040, requiring more than \$2 trillion a year's worth of investment in new energy supply."

A WEO-based analysis went on to show that oil consumption will be growing in the coming decades, due to rising petrochemicals, trucking and aviation demand. But meeting this growth in the near term means that approvals of conventional oil projects need to double from their current low levels.

In power markets, it says that "renewables have become the technology of choice, making up almost two-thirds of global capacity additions to 2040, thanks to falling costs and supportive Government policies. This is transforming the global power mix, with the share of renewables in generation rising to over 40% by 2040, from 25% today, even though coal remains the largest source while gas is the second-largest."

The report also cautions that while the expansion brings about major environmental benefits it also creates a new set of challenges that policy makers need to address quickly. It points out that with "higher variability in supplies, power systems will need to make flexibility the cornerstone of future electricity markets in order to keep the lights on. The issue is of growing urgency as countries around the world are quickly ramping up their share of solar PV and wind, and will require market reforms, grid investments, as well as improving demand-response technologies, such as smart meters and battery storage technologies."



*World Energy Outlook 2018 released in November 2018*



Electricity markets are also undergoing a unique transformation with higher demand brought by the digital economy, electric vehicles and other technological changes, says the WEO 2018. As part of its deep-dive into the electricity sector during the year, the WEO 2018 examined the impact of higher electrification in transportation, buildings and industry. The analysis finds that higher electrification would lead to a peak in oil demand by 2030, and a reduction in harmful local air pollution. But this impact would be negligible on carbon emissions without stronger efforts to increase the share of renewables and low-carbon sources of power.

## MALAYSIA FORECAST

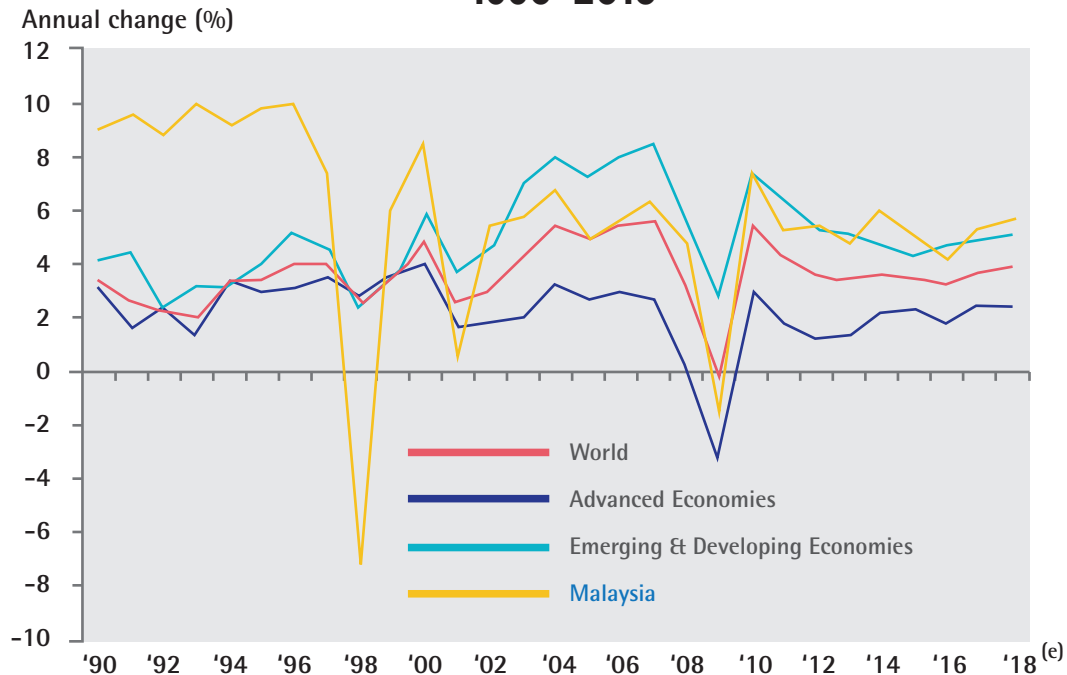
As an energy-dependent, export-oriented manufacturing economy, Malaysia is affected by the state of the global economy. According to the World Bank's "Global Economic Prospects 2019", global growth is expected to slow down to 2.9% in 2019. Downside risks have become more acute. Financial market pressures and trade tensions could escalate, potentially denting global activity.

Against this backdrop, East Asia and the Pacific region remains one of the world's fastest-growing developing regions, says the World Bank report. "Regional growth is expected to moderate to 6% in 2019, assuming broadly stable commodity prices, a moderation in global demand and trade, and a gradual tightening of global financial conditions. Growth in China is expected to slow down to 6.2% this year as domestic and external rebalancing continues. The rest of the region is expected to grow at 5.2% in 2019 as resilient demand offsets the negative impact of slowing exports," it notes.

Despite global and regional slowdown forecasts, Malaysia is expected to remain on a growth path all the way through to 2019, supported by its diversified economy and nature of exports, says the "Bank Negara Malaysia Report 2018". "Malaysia's policy stability and deep financial markets also allow the country to withstand external shocks and ensure growth," says Bank Negara, Malaysia's Central Bank.



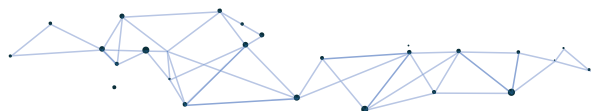
## GROSS DOMESTIC PRODUCT (GDP) 1990-2018



The 2018 Bank Negara report also notes: "The domestic economy is likely to remain positive, spurred by robust private sector activity and moderate inflation. Favourable labour market conditions, namely a robust private sector with high employment growth and significant improvement in consumer sentiments, will underpin private consumption for the year."

On downside risks, Bank Negara says ongoing trade tensions between the USA and China (Malaysia's largest investor and trading partner) that could potentially disrupt global trade and growth will affect Malaysia's economy, but noted that financial intermediation is still at a healthy level. The country has the policy tools to liquidity in the financial system that is adequate to support intermediation activities, and the current monetary stance is appropriate, conducive and supportive to growth.

Moody's Investors Service Hong Kong Ltd is also positive about Malaysia's prospects. In its *Power-Asia: 2019 Outlook report*, it notes that the Asian power sector in 2019 is seen as stable on steady cash flows, gradual pace of regulatory changes, a gradual transition to a low-carbon economy and sufficient mitigants against capital market volatility. It also notes that the power sector, which has been stable since 2009, reflects its expectations for stable business conditions in countries such as Malaysia, among others.





## MALAYSIA ENERGY TRENDS

The Malaysian energy industry has started to embrace Industry 4.0 to transition into a clean energy, low-carbon future. The long-term goal is for the industry to evolve into one where customers are not only consumers, but also generators and retailers of electricity that can be bought and sold to the national grid.

*In Energy Malaysia (Vol. 16/2018)*, the Commission's Chairman, Datuk Ir. Ahmad Fauzi Hasan, notes that in the energy sector, Industry 4.0 is being led by Artificial Intelligence (AI) and the Internet of Things (IoT). "These technologies leverage the internet and computing infrastructure to connect smart meters, smart appliances and people to manage the supply and use of energy more efficiently and effectively. It is also altering the basis of competition, redrawing industry boundaries and creating a new wave of firms to serve changing needs in the energy sector. The challenge lies in ensuring that these changes occur in a well integrated and orderly manner to deliver the anticipated leap in performance whilst ensuring that affordability and sustainability is not compromised.

"Undoubtedly, there will be regulatory, financial and capacity challenges that need to be addressed through policy framework development based on international good practices," he adds. "Industry players need to undertake the requisite cost-benefit analysis so as to achieve optimum benefits from Industry 4.0 initiatives. The Commission will continue to work with all stakeholders to capitalise on game-changing digital technologies offered by Industry 4.0 to help raise the energy sector's development and performance to the next level."

The energy sector's digital journey started with the rollout of digital and technological innovations for generation and grid operations. In 2014, Tenaga Nasional Berhad (TNB) trialed the smart metering system following the implementation of the Advanced Metering Infrastructure (AMI). AMI is the stepping stone to realise various other solutions for the energy sector such as Time-of-Use (ToU) tariffs, smart pre-payment and demand response. These smart applications will not only improve grid efficiencies and reliability but also improve customer service. For consumers, the smart grid gives them greater control of their electricity usage.

Meanwhile in 2018, *The Star (May 15, 2018)* reported that TNB will be investing RM2.7 billion for "Grid of the Future" technologies to improve the national grid's reliability and efficiency. This is part of the RM18.8 billion capital investment for the transmission and distribution grid secured under the Second Regulatory Period (RP2) (2018-2020).

TNB, which is the largest public listed power producer in Southeast Asia and the largest electric utility in Malaysia, hopes to improve its performance and reliability by continuing to invest in digitalisation and automation. This includes the scheduled deployment of 340,000 smart meters in Melaka and subsequent deployment of another 1.2 million smart meters in the Klang Valley by 2020.

*The Star (May 15, 2018)* also quoted TNB Chairman Tan Sri Leo Moggie, who said, "Inefficient ageing plants are to be decommissioned and replaced with more efficient and economical plants. The current gold standard in coal-fired power plants is ultra-supercritical technology that is being used for newer plants. By using the ultra-supercritical technology, coal-fired power plants will see an improved efficiency of 40%, compared with 36% efficiency from conventional pulverised coal firing systems.

"TNB's Jimah East Power Plant, which uses ultra-supercritical technology, is scheduled to begin operations in 2019. It will generate 2,000MW of electricity. This will increase TNB's share of Malaysia's generation capacity to 53.2% from the present 51.8%, thus contributing towards the stability of the National Grid system."



Green growth has become the rallying call of Malaysian policymakers. The 11<sup>th</sup> Malaysia Plan (2016-2020) is set within this context, and includes strategies to realise the national decarbonisation agenda of 45% carbon emission reduction by 2030. Its follow-up GTMP proposes mainstreaming green technologies into planned developments in six carbon-intensive sectors. Among other things, by 2030, GTMP targets 30% RE in the energy mix, 15% electricity intensity reduction, 17,000 manufacturers of green products, energy efficient public transportation systems (40% in cities and 100% for private vehicles) among other thrusts.

Like in other parts of the world, the transformation of Malaysia's transportation sector with energy efficient vehicles is going to become a major cause for a spike in electricity consumption. National news agency *Bernama* reports that the *Electric Mobility Blueprint* targets Malaysia to have 100,000 electric cars, 100,000 electric motorcycles, 2,000 electric buses and 125,000 electric vehicle charging stations by 2030. The national goal is to leverage on this Electric Vehicle (EV) capacity to become the regional marketing hub of EVs by 2030 (*2017 news report below refers*).

## ELECTRIC MOBILITY BLUEPRINT

# Plan targets to make Malaysia marketing hub for EVs by 2030

**JOHOR BARU:** Malaysia is expected to become the marketing hub for electric vehicles (EVs) by 2030, which is the country's main target under the National Electric Mobility Blueprint (EMB).

Energy, Green Technology and Water Ministry secretary-general Datuk Seri Dr Zaini Ujang said the plan focused on three main sectors, namely EV development for transport and private ownership, EV ecosystem and EV economy.

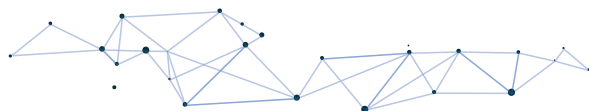
"EMB is part of the government's efforts to introduce EVs to replace diesel or

petrol (vehicles) to reduce dependency on fossil fuel as well as greenhouse gas emission," he said during his speech at Universiti Teknologi Malaysia, Skudai, near here, yesterday.

"It is also aimed at making Malaysia the marketing hub for electric vehicles, with a target of 100,000 electric cars, 125,000 charging stations, 2,000 buses and 100,000 motorcycles on the road by 2030, and indirectly reduce carbon dioxide emission in the transportation sector."

**Bernama**

Source: Malaysia Investment Development Authority









# 2018

## THE YEAR THAT WAS

### OVERALL

#### SHARE OF SALES BY SECTOR

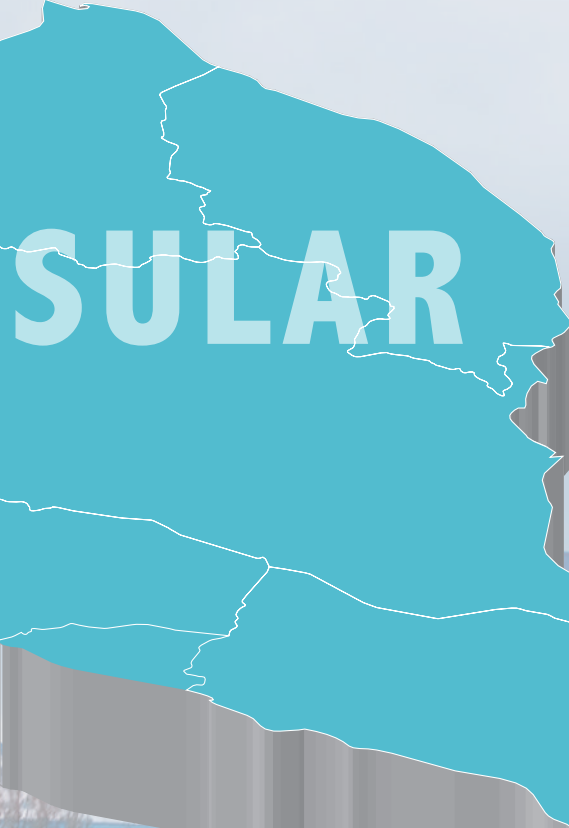
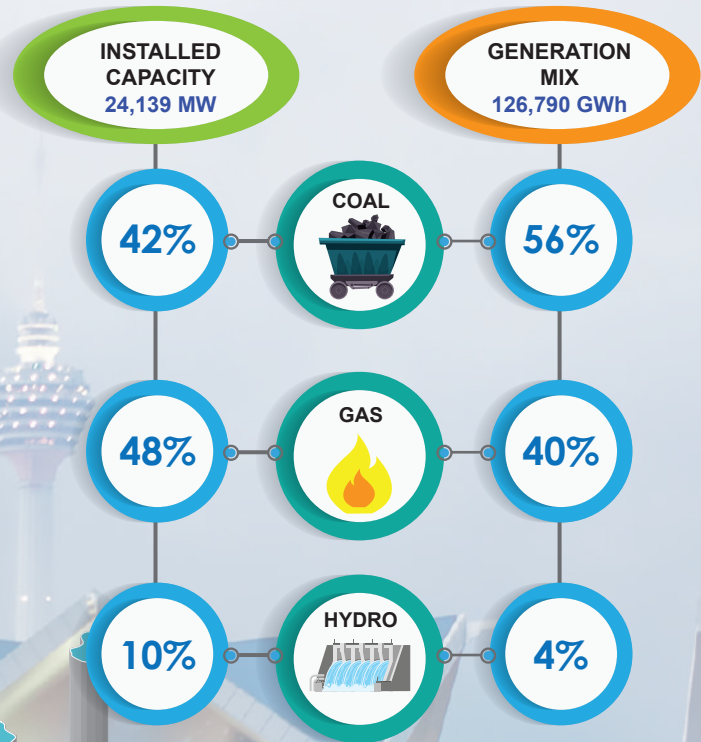


**Installed Capacity: 24,139MW**  
**Maximum Demand: 18,338MW**  
**Generation: 126,790GWh**

### DEMAND

- Electricity sales grew 2.6%, a variation of 0.3% from the 2.3% forecast
- Peak demand was recorded in August, growing to 18,338MW, an increase of 3.1% (from 17,790MW). This was due to hot weather and high consumption by industries
- Major consumers were industry (40%), commercial (35%) domestic (23%) with 2% coming mainly from mining, public lighting and agriculture
- The year saw the average daily gas consumption decrease by 1.5%, from 993 mmscdf to 840 mmscdf due to the retirement of several gas power plants
- Coal consumption increased by nearly 5%, from 30.5MT in 2017 to 32MT in 2018

## ELECTRICITY SUPPLY



### LAOS-THAILAND-MALAYSIA (LTM) INTERCONNECTION



### SUPPLY

- RE reached 8% of the energy mix. Nine Large Scale Solar (LSS) farms were operationalised to produce 260.5MW of RE. Eight of them are winners of the LSS competitive bidding process introduced in 2016
- 436MW of RE was released to Feed-in Tariff (FiT) developers introduced under the Renewable Energy Act 2011
- 10MW of RE from the 500MW quota allocated to the Net Energy Metering (NEM) system for households was taken up
- The ASEAN Power Grid saw the transfer of more than 10GWh of power from Lao PDR via the Lao PDR-Thailand-Malaysia (LTM) Interconnection

Energy Purchase and Wheeling Agreement  
1 January 2018 - 31 December 2019





# PENINSULAR MALAYSIA ELECTRICITY SUPPLY INDUSTRY OUTLOOK 2019







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## ENVIRONMENTAL SUSTAINABILITY - 20% RE BY 2025

At the 21st Conference of Parties (COP21) in 2015, Malaysia pledged to reduce its carbon emission intensity per GDP by 35% in 2030 relative to the 2005 levels, or 45% with support from developed countries. This Nationally Determined Contribution was ratified at the 2015 Paris Agreement, overwhelmingly adopted by United Nations member states to counter the damaging impacts of climate change.

To support the Nationally Determined Contribution, the 11th Malaysia Plan (2016–2020) established more pathways for green growth in the country. In 2017, the GTMP created the framework for mainstreaming green technologies into planned developments. It called for green technologies to be embedded in six carbon-intensive sectors, and by doing so, change the trajectory of the nation's growth. One of these sectors is Energy.

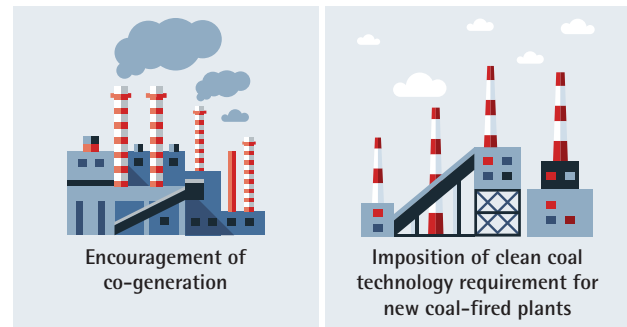
The GTMP's direction for the energy sector is shown in the diagram below:

### CREATING A SUSTAINABLE POWER GENERATION MIX AND ENERGY EFFICIENCY AS THE NEW SOURCE OF ENERGY

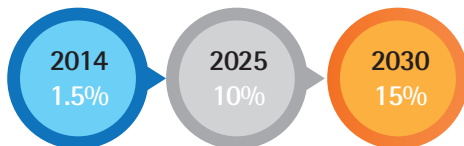
#### 1. RE in Total Installed Capacity



#### 3. Efficiency in Power Generation



#### 2. Reduction of Electricity Intensity



Co-generation or Combined Heat & Power (CHP) is the production of electricity using waste heat (as in steam) from an industrial process. Producing power from natural gas, biomass, coal or oil.

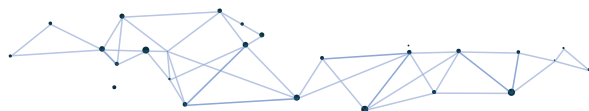
Clean coal technology is burning coal without adding to global carbon dioxide - involves using coal to make hydrogen from water, then burying the resultant carbon dioxide by-product and burning the hydrogen.

Meanwhile, in 2018, the ambit of the Ministry of Energy, Green Technology and Water was expanded to include Environment and Climate Change. By interlinking these functions, the Ministry can push harder towards a low carbon green economy.

Clean energy has become its priority, and the Government targets a capacity mix of 20% RE by 2025. As at 2018, the capacity mix was dominated by two (2) fossil fuels: gas (48%) and coal (41%), with hydro a distant third at 10%. The contribution of RE is 1%.

With a target of 20% RE by 2025, Malaysia will potentially reduce up to 20 million tonnes of carbon dioxide. It will also result in a diversified energy mix that will bode well for the establishment of a world-class sustainable energy system. Besides the accelerated drive to increase RE, the Government has a wide range of EE initiatives to reduce the nation's carbon footprint.

Malaysia is against the use of nuclear power to generate electricity because science has not been able to provide a safe way to dispose of the generated radioactive waste.

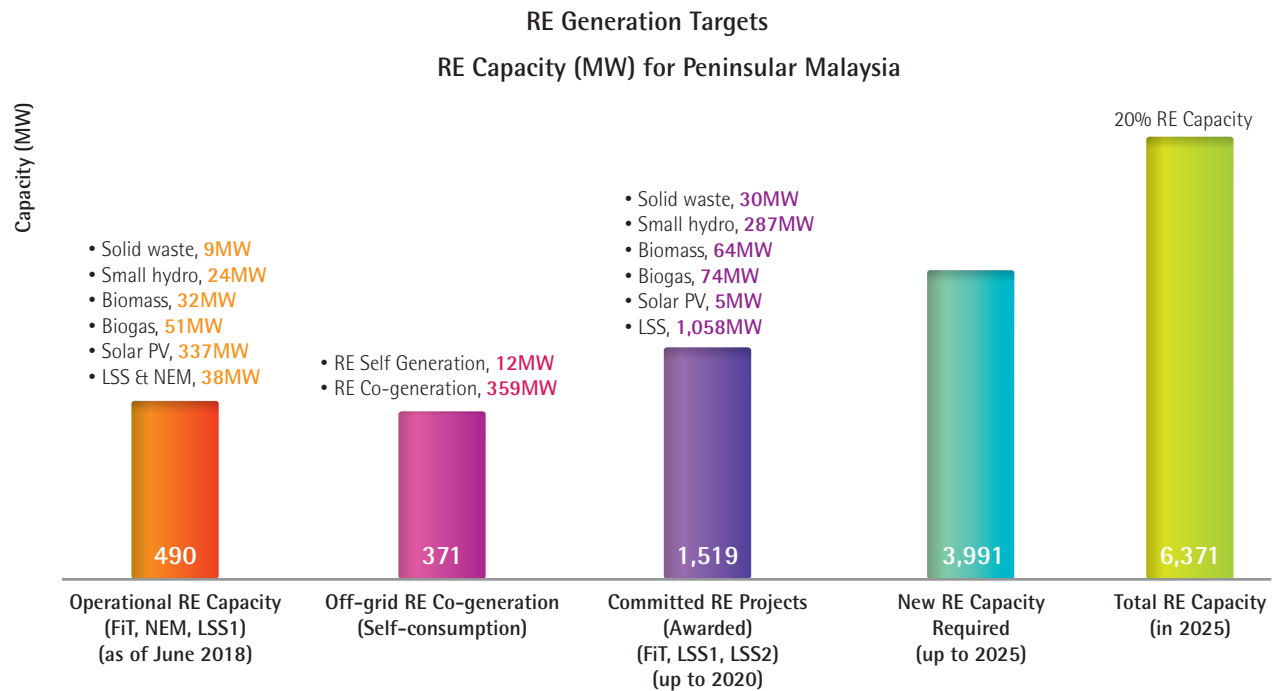




## RAMPING UP RE

RE generation in Peninsular Malaysia covers solid waste, small hydro, biomass, biogas, geothermal and solar. Large hydro plants with the capacity of more than 100MW are not considered as RE.

The 20% RE target by 2025 focuses on increasing solar energy generation capacity, and along the way create new business opportunities for big companies, SMEs, microbusinesses and households.



The above diagram shows the targeted RE capacity to be achieved by 2025 based on a preliminary analysis by the Commission, Sustainable Energy Development Authority (SEDA) and the Single Buyer (SB). The final targets will be published in the Renewable Energy Transition Roadmap (RETR) prepared by SEDA. As of 2018, RE capacity stood at 490MW, generated by LSS farms; NEM and FiT developers. There was also a 371MW off-grid capacity from co-generation plants and self-generation. RE capacity must be ramped up to 6,371MW to deliver the 20% target by 2025. This plan is reviewed periodically, subject to changes in demand forecast, generation requirement, completion of committed projects and government policies.

By 2020, with a committed RE capacity of 1,519MW, Peninsular Malaysia will have nearly 40% RE in operation, with the bulk of capacity coming from LSS. The analysis also took into consideration the solar penetration limit to the grid without jeopardising the system's stability and security.



## LSS TO BOOST RE

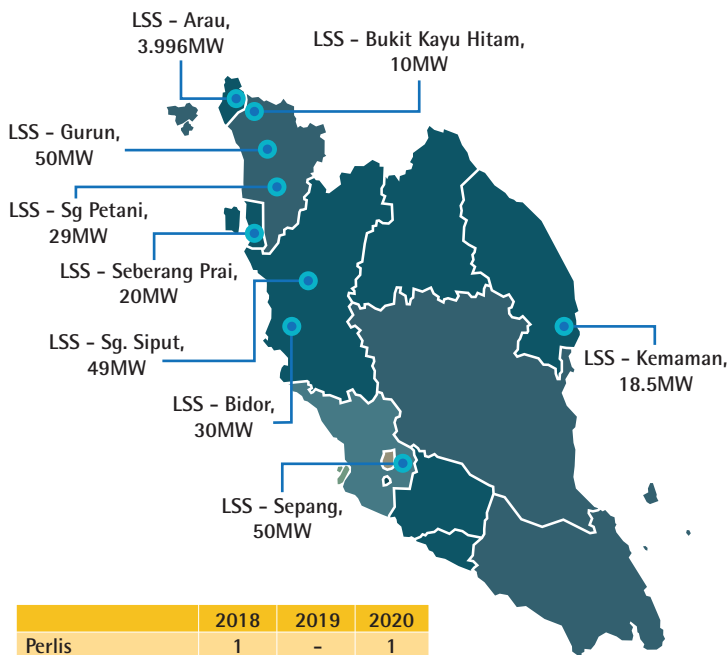
The Commission's LSS programme, which covers the period of 2017 to 2020, with the aim to accelerate Malaysia's RE production capacity, was approved by the Planning and Implementation Committee of Electricity Supply and Tariff (JPPPET).

Total capacity allocated for this programme is 1,000MW by 2020, with annual capacity capped at 250MW throughout the 4-year period. The staggered inclusion of LSS into the system allows the Commission to monitor LSS' technical performance and market impact.

To date, there have been two bidding cycles that attracted hundreds of applications. The Commission selected 14 applicants, who were awarded contracts to design, build, operate, supply and maintain solar farms in Peninsular Malaysia. Eight LSS projects that secured licence to build solar farms under the first bidding process began operations in 2018, adding 210.5MW RE capacity.

In 2019, the Commission will announce the LSS Bidding Cycle 3 to attract more participants and RE capacity.

### 260.5MW LSS IN OPERATION



	2018	2019	2020
Perlis	1	-	1
Kedah	2	2	4
Terengganu	2	1	1
Perak	2	4	1
Negeri Sembilan	3	-	2
Pahang	1	1	1
Selangor	1	3	-
Pulau Pinang	1	-	1
Johor	1	2	1
Melaka	-	-	1
Kelantan	-	-	1

Note: Data as of December 2018

### LARGE-SCALE SOLAR

	Direct Award	Bidding Cycle 1	Bidding Cycle 2
Capacity Awarded	250MW	401MW	557MW

LSS Bidding Cycle 3 to be announced in 2019

Nine solar farms have been fully operationalised in Peninsular Malaysia as of 2018 :

Project	Size (MW)
IL Solar Sdn Bhd	10
SBU Power Sdn Bhd	3.996
Eastern Pacific GD Solar Sdn Bhd	18.5
Gading Kencana Development Sdn Bhd	30
Leader Solar Energy Sdn Bhd	29
Sinar Kamiri Sdn Bhd	49
TNB Sepang Solar Sdn Bhd	50
PLB Green Solar Sdn Bhd	20
Quantum Solar Park (Kedah) Sdn Bhd	50





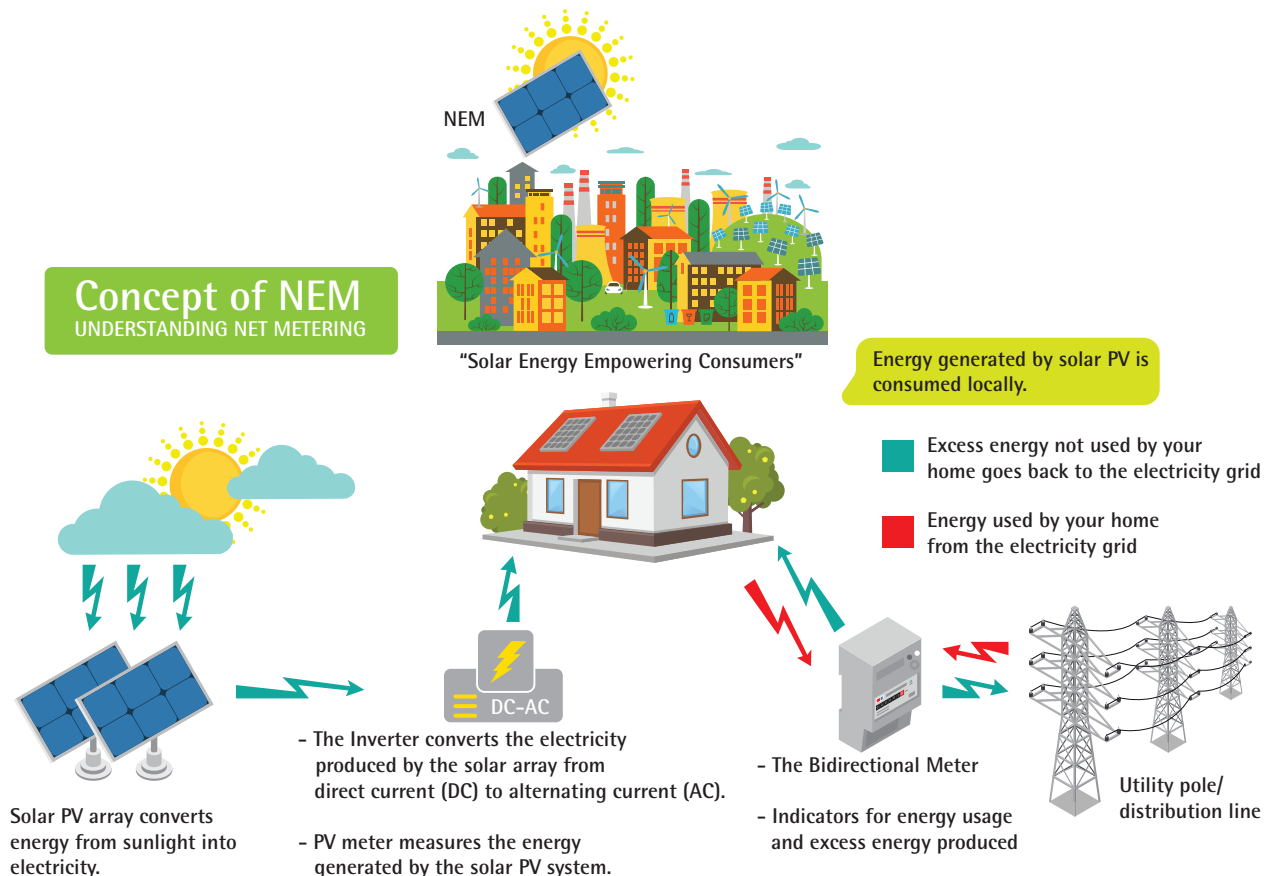
## HOME DEVELOPERS

The NEM Scheme, which replaced the solar FiT scheme in 2016, allows households to become solar energy producers by installing solar PV systems on rooftops for their own consumption, with the option to sell excess capacity to the grid. Under this scheme, consumers can offset their electricity bills against the sale of power produced by their solar PV system. The NEM scheme has a RE quota of 500MW, with 100MW/year to be distributed over a five year period (2016-2020).

As at 2018, only 17MW was taken up. This is attributed to the disparity in tariff rates between the sale of excess solar capacity and purchase of electricity from TNB. Solar power producers are selling excess power at 31 sen/kWh compared to purchasing electricity from TNB for a higher block domestic tariff of around 50 sen/kWh. To make the NEM programme more attractive, the Government announced two measures in October 2018.

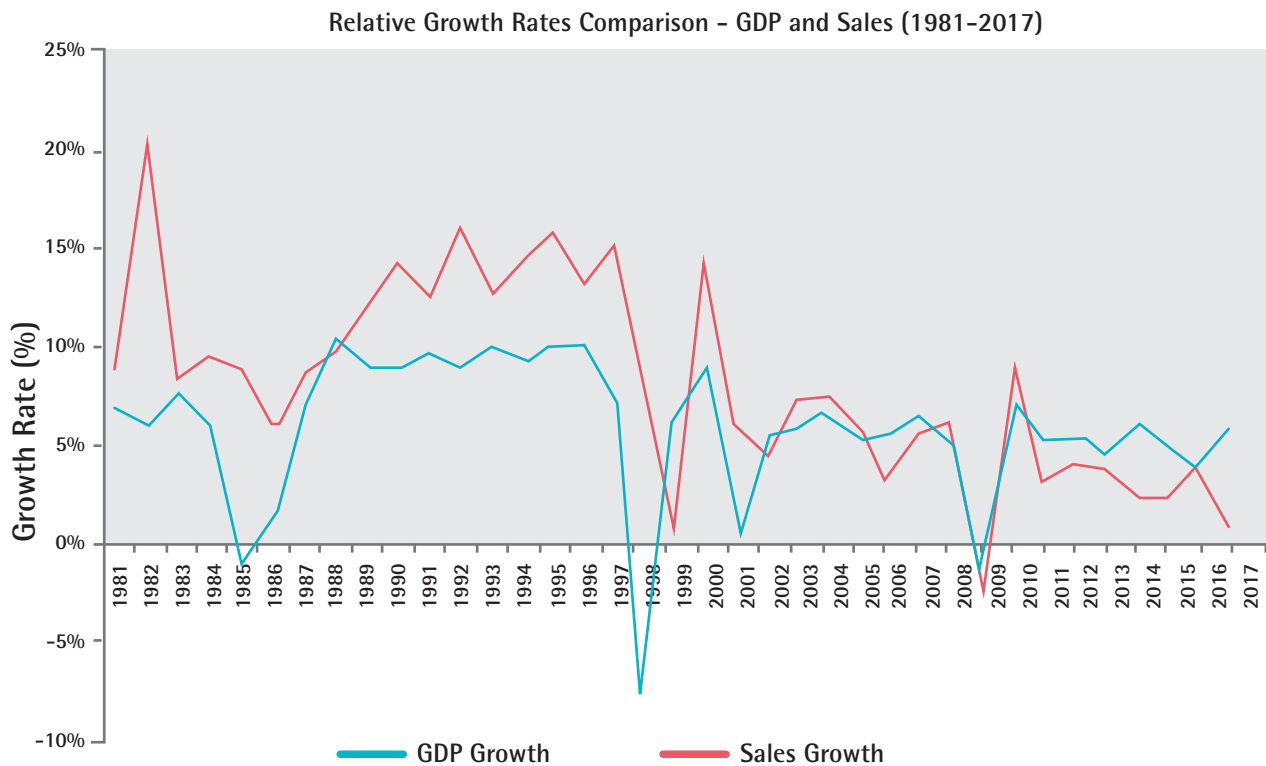
With effect from 1 January 2019, there will be no difference between the sale and purchase price of electricity from the grid. The other measure is the solar leasing concept, an enhanced version of the Supply Agreement for Renewable Energy (SARE). Under the leasing concept, there is zero entry cost for consumers wishing to install solar panels to generate electricity for their homes or commercial premises. In addition, monthly repayments to solar panel suppliers can be settled via their TNB bills.

SARE offers cheaper electricity for domestic and commercial producers as well as the business opportunity to make profits from selling solar power to the grid. The ultimate goal is to make RE the mainstay of the national grid.



## DRIVING DOWN EMISSION INTENSITY – 45% REDUCTION BY 2030

Malaysia has been a net carbon producer since 2004. GHG emissions have increased in tandem with the GDP, although there are signs of decoupling since 2011 with the implementation of wide ranging EE initiatives as indicated in the diagram below:



According to the Ministry of National Resources and Environment, 76% of emissions are linked to the energy sector, with power generation being a primary contributor because of heavy reliance on fossil fuels. The consequential impacts of carbon emissions and global warming are already observed in Malaysia, and the Ministry warned of more adverse impacts should the nation continue with a "business as usual" route.

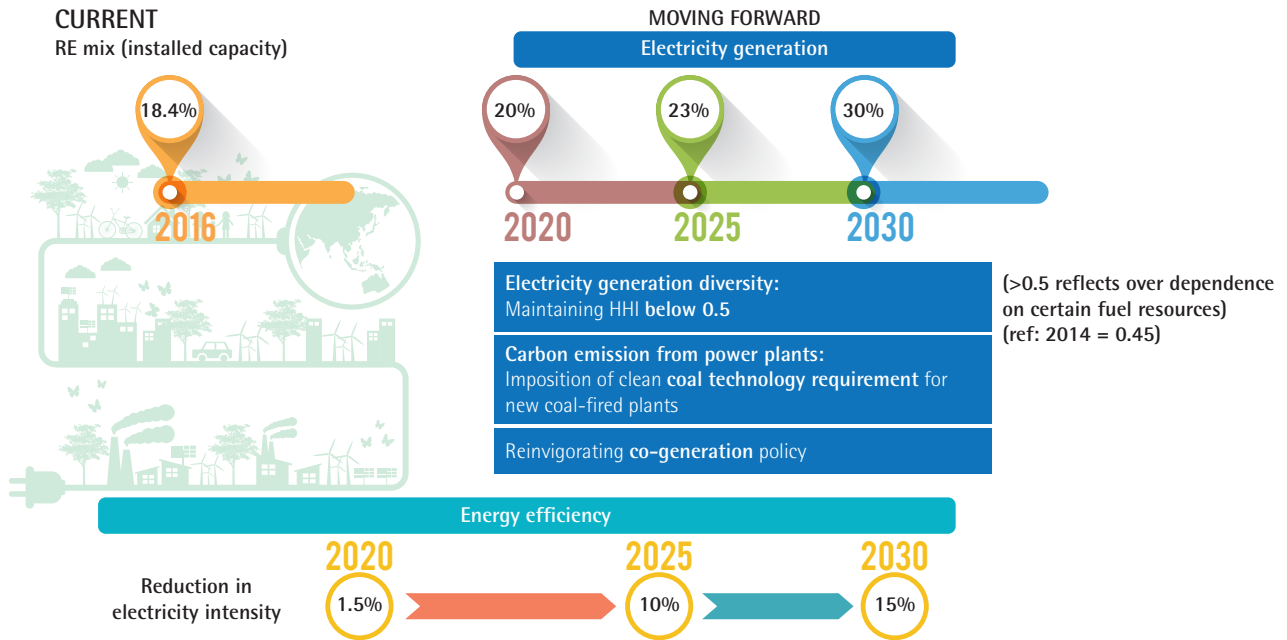
As at 2011, Malaysia's GHG emission intensity stood at 102 tonnes CO<sub>2</sub> equivalent per USD100,000, comparable to Thailand and Indonesia. However, it lags behind Singapore and the Philippines.

Since then, Malaysia has undertaken a number of carbon mitigation (emission reduction) and adaptation (to reduce the impacts and risks or exploit beneficial opportunities) strategies to tackle climate change. As per the 2015 Biennial Update Report to the United Nations Framework Convention on Climate Change (UNFCCC), Malaysia had achieved about 33% reduction of carbon emission intensity per unit of GDP.

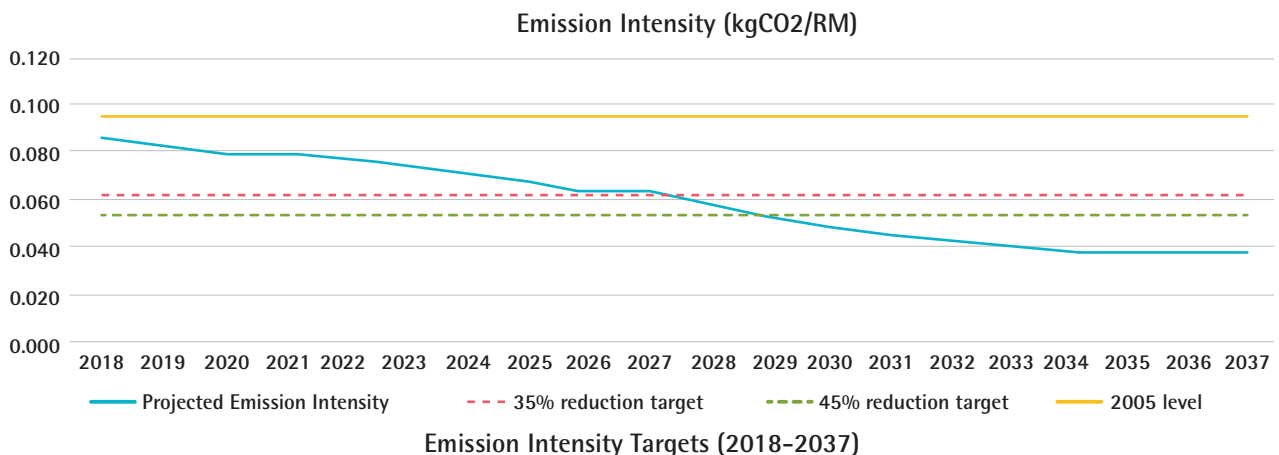




In 2017, the GTMP unveiled its decarbonisation plan for the energy sector as indicated in the diagram below:



On its part, the Ministry of Energy, Science, Technology, Environment and Climate Change (MESTECC) released its own energy intensity targets for the next 20 years (2018–2037) – a reduction of 45% by 2037. Strong Government support and ongoing green initiatives such as LSS and NEM are expected to play a big part in delivering the targets below.



Source: Energy Commission

As at 2018, emission intensity (emission per RM of GDP) had declined below the 2005 level and stood at 0.086 kgCO<sub>2</sub>/RM compared to the 2005 status of 0.096 kgCO<sub>2</sub>/RM. As decarbonisation efforts intensify, it is projected to decline by 35% in 2027, and by 45% in 2029. Malaysia's COP21 commitment is a 35% reduction of emission intensity by 2030 and 45%, with technical and financial assistance from advanced nations and multilateral agencies.



## REDUCING CONSUMPTION - BY 8% BY 2025

Consumers too have to play their part in reducing the carbon footprint. In 2016, the NEEAP set out to reduce electricity consumption by 8% by 2025. The Commission has various EE initiatives aimed at different market segments to achieve this target. Among them are:

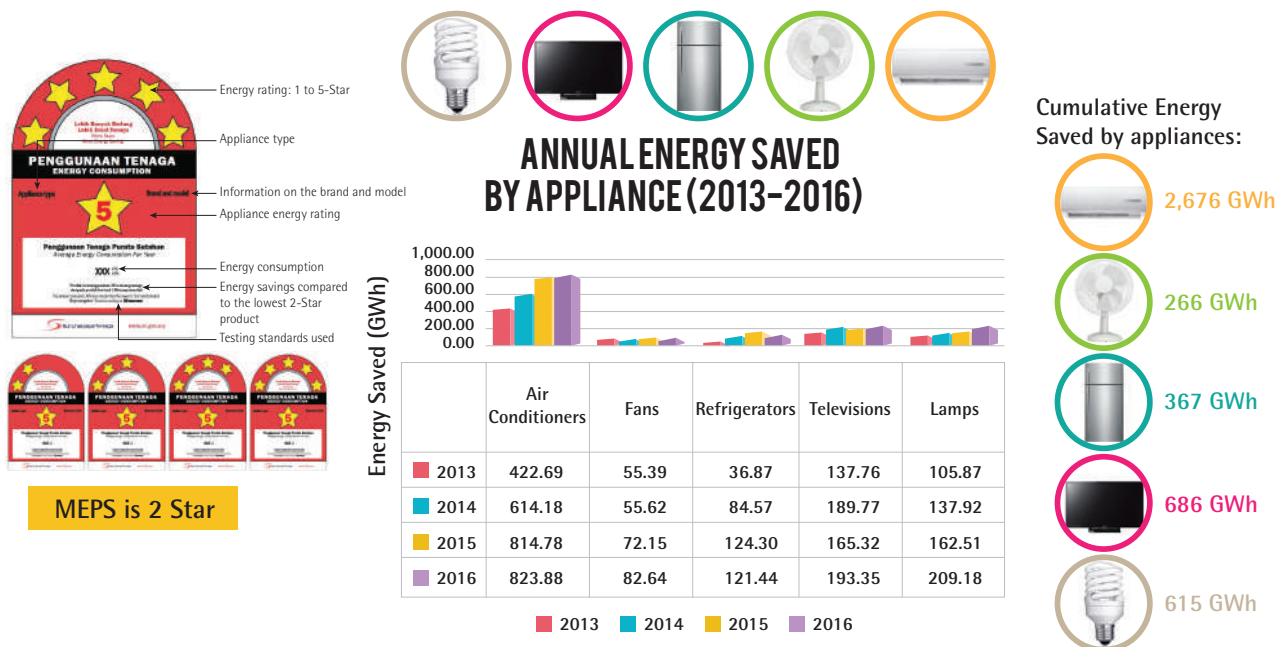
### ENERGY EFFICIENCY INITIATIVES STAR-RATED EQUIPMENT AND APPLIANCES

The Commission has made direct overtures to consumers on the merits of buying STAR-rated electrical appliances and equipment based on the Minimum Energy Performance Standards (MEPS) regulation enacted in 2013. MEPS assigns stars to electrical appliances and equipment according to their energy consumption patterns – the higher the star, the lower the consumption.

Industrial and commercial consumers, who account for the lion's share of energy consumption, are encouraged to make

it a management practice to buy STAR-rated equipment. The rationale is that initial investments will be recovered from lower electricity bills. The Commission also recommends building owners to implement energy audits to reduce their electricity consumption.

Between 2013 and 2016, MEPS delivered the following: cumulative energy saved at 4,610GWh, the equivalent of RM1.5 billion in savings and 3,512 ktCO<sub>2</sub> emissions.



**4,610GWh** Cumulative Energy Saved since 2013, which is equivalent to RM1.5 billion & 3,512 ktCO<sub>2</sub> emissions



## BEI-LABELLED GOVERNMENT BUILDINGS

In 2018, MESTECC launched the National Building Energy Intensity (BEI) programme for Government buildings and the Commission has been appointed as the implementing agency for this programme. Government buildings cover office buildings, hospitals, institutions of higher learning and schools.

The objective of BEI Labelling is to encourage building owners to optimise energy use in their buildings. It is a benchmarking tool that monitors a building's energy performance based on energy used per square metre per year. It is calculated by taking the ratio between annual energy consumption of a building (kWh/year) and net floor area of the building. Like, MEPS, BEI uses a star rating system, where the higher the star, the better the energy performance of the building.

Since its launch, 54 ministries and Prime Minister's Department buildings were BEI-labelled.

In 2019, the focus on creating awareness of the programme continued, and 52 Government buildings were BEI-labelled, a shortfall of the 100 target for that year. Between 2019 and 2022, another 1,900 buildings are set to be BEI-labelled. Beyond that, the target is for another 3,000 BEI-labelled Government buildings. BEI-labelled buildings are subject to audits every three years. In the long term, BEI is to be extended to the private sector.

The BEI label indicator and cumulative impact of BEI-labelled Government buildings is far reaching as indicated in the diagram below:

### What BEI Stars Mean



#### BEI LABEL

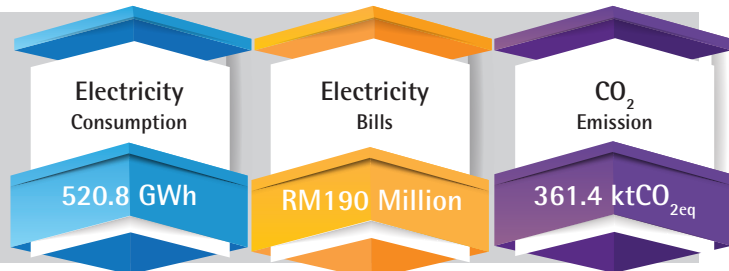


### Outcomes of BEI-Labeling of Government Buildings



**MAJOR IMPACTS**  
Each building is expected to move up from its existing star rating, by at least one star within three to five years

#### ESTIMATED SAVINGS





## CHALLENGING SCHOOL CHILDREN

Every year, the Commission organises the EE Challenge programme for secondary schools in Peninsular Malaysia and Sabah. In 2018, EE Challenge attracted 112 schools who submitted reports on their energy savings initiatives over a 6-month period.

The winner of the 2018 EE Challenge was SMK Seksyen 7, Shah Alam that recorded a 11.67% decrease in electricity usage during the challenge period. Cumulatively, 112 schools joined the programme which in total avoided using 428,311kWh of electricity, saving RM134,147 in electricity bills.

Since its introduction in 2014, the EE Challenge has recorded a total energy savings of 1,124,908kWh. The EE Challenge is a fixture in the Commission's annual calendar.

## REGISTERED ELECTRICAL ENERGY MANAGERS (REEM)

Large energy consumers, typically installations using three (3) million kWh of energy or more over the period of six (6) months, must seek out the services of Registered Electrical Energy Managers to identify inefficiencies and to advise on the implementation of energy saving methods. This is part of the Commission's Efficient Management of Electrical Energy Regulations (EMEER) launched in 2008.

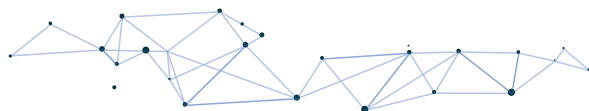
As of 2018, there were 1,311 REEM managing 1,995 installations. The Commission will continue increasing the number of energy managers to reduce further energy consumption in the country.



## TRENDING: ULTRA-SUPERCritical TECHNOLOGY

To make coal generation more efficient, ultra-supercritical technology is trending. It is capable of generating steam at very high temperatures and pressure compared to the supercritical technologies used now. Such power stations are 40% more energy efficient compared to 36% by supercritical stations.

In 2018, there were three ultra-supercritical power plants in Peninsular Malaysia, namely TNB Janamanjung (Unit 4), Tanjung Bin Energy Sdn. Bhd. and TNB Manjung Five Sdn. Bhd. For future coal plants, the Commission encourages tenderers to adopt ultra-supercritical technology as they burn less fossil fuel to deliver more energy.



## CHALLENGES

Business profitability and consumer behaviour are among the obstacles to the establishment of an environmentally sustainable energy system in Malaysia.

The usage of energy efficient equipment and appliances across all market segments is still not encouraging. This is because they are more expensive than conventional ones, and the higher the star rating, the higher the cost. Returns from such investments can only be realised over time, with lower electricity bills. However, consumers are more concerned with the upfront costs.

Meanwhile, RE implementation lags behind that in advanced economies. It is constrained by costs: the cost of technologies involved in RE generation and consumer's willingness to pay corresponding hikes in electricity tariffs in a middle income country such as Malaysia.

The power industry is the most crucial and strategic sector for any country to achieve its vision. In Malaysia, electricity consumption is set to increase sharply as the country moves forward with green growth and decarbonisation initiatives anchored on the establishment of smart cities, smart transportation systems and the like. As always, energy security is a non-negotiable agenda.

Resource diversification remains the hallmark of Malaysia's energy security efforts. The GTMP sets generation diversity at below 0.5 in the HHI; it stood at 0.45 in 2014. Meanwhile, the Commission's target is to achieve 0.4 HHI by 2025, and to decline further to 0.38 in 20 years with increasing diversification of fuel in the generation system.

HHI measures the market concentration of a certain industry, from monopolistic situations (high concentration) to free market scenarios, with many firms of more or less equal size that share the market. Anything more than 0.5 reflects overdependence on a certain source or supplier, and this can be a threat to energy security.

Malaysia's Fifth Fuel Policy and a liberalised marketplace are measures to avoid such a situation. The former promotes a generation mix consisting of three fossil fuels (coal, oil and gas), hydro-electricity and RE. As at 2018, fossil fuels accounted for 96% of total generation. The 20-year target is coal (46%), gas (40%), renewables (8%), hydro (3%) and interconnections (3%) in 20 years.

In 2018, the Government revised the RE target to 20% by 2025. The time has arrived for the next wave of power plants consisting of RE systems to meet this immediate target. In tropical Malaysia, the focus is on solar energy, an infinite energy source, unlike finite fossil fuels.

Power generation is currently in the hands of national utility company TNB and Independent Power Producers (IPP). Steps have already been taken to further democratise the power generation marketplace, especially with solar energy generation that lends itself well to this intent. The goal is to have capital intensive RE investments as well as involve households in solar energy production for personal consumption, and sell the excess to the grid.

While a world-class sustainable energy system is a priority, the Government remains steadfast on energy security. The goal is to achieve diversity in the generation mix and marketplace, without compromising on reliable, accessible and reasonably priced electricity supply.

Under the Electricity Supply Act 1990, the Commission is entrusted to ensure that electricity demand is met at all times. For this purpose, the Commission set up the Demand Forecasting Committee (DFC) that advises the JPPPET. Representing both public and private organisations involved in national economic development planning, energy sector planning and forecasting, DFC uses independent and objective inputs to arrive at Malaysia's short term and long term economic and electricity demand situation with a degree of precision.

The outcome is an integrated 20-year forecasting model to determine future electricity needs.





## ENERGY SECURITY – 20-YEAR FORECASTING MODEL

### HERE AND NOW

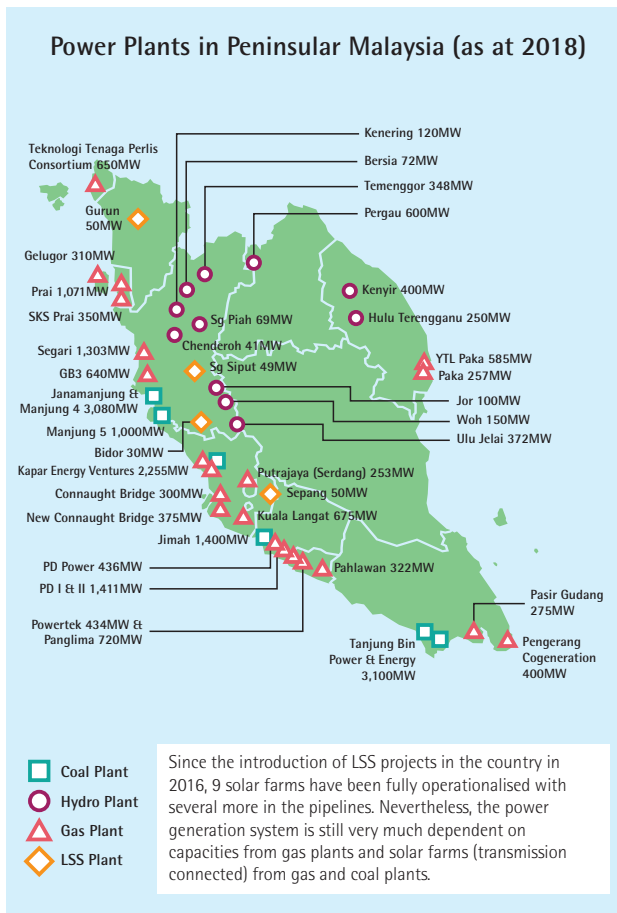
Up to 99.6% of Peninsular Malaysia is electrified. Located at the tip of the Asian landmass, it covers 132,265 square kilometres, and has a population of 26 million that is forecast to grow at 1% over the next 20 years.

There are 44 power plants in the country – gas (22), coal (7), hydroelectricity (11) and LSS Transmission Connected (4). LSS farms were operationalised for the first time in 2018, with several more to come on stream in the next few years.

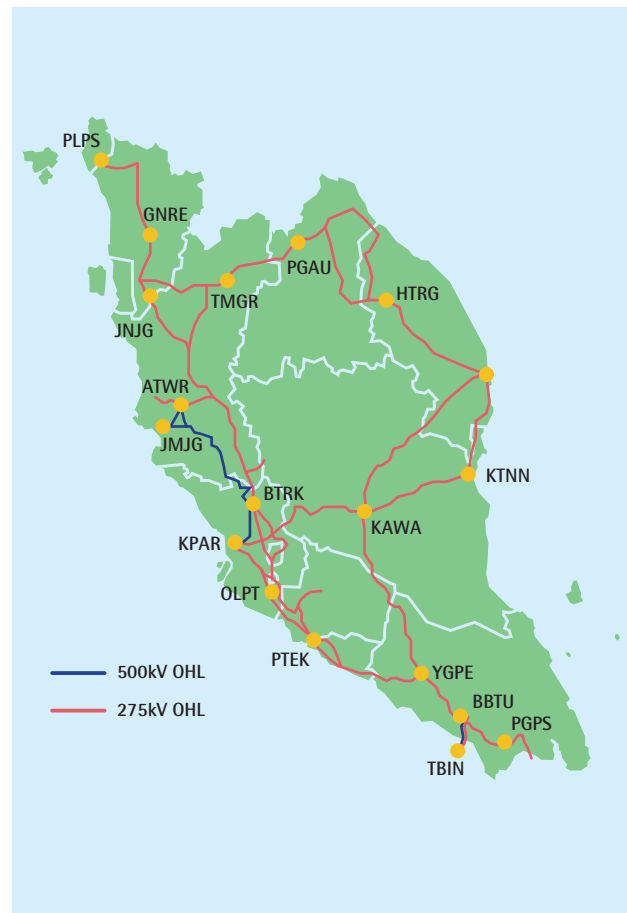
Power generation continues to be heavily reliant on fossil fuels – gas (40%) and coal (56%) because of its availability and propensity to produce a firm base load at a reasonable price. Since the Fifth Fuel Policy was introduced in 2001, the Government has implemented several programmes to promote RE.

### Electricity Supply in Peninsular Malaysia

#### Generation



#### Transmission



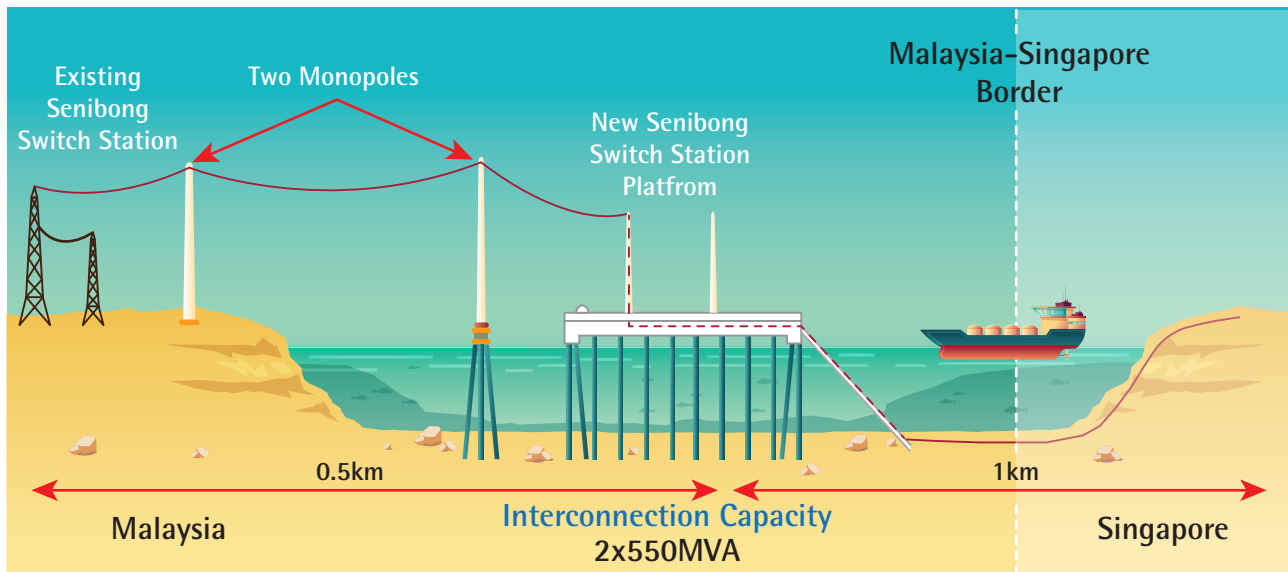
Peninsular Malaysia's 44 power plants have generated a total energy of 126,790GWh and maximum demand stood at 18,338MW in 2018. There were new power plants but their capacity was offset by the retirement of ageing facilities during the year. As such, installed capacity remained unchanged at 24,139MW. The 2,900MW minimum Operating Reserve is available to the system operator within a short interval of time to meet demand, in case a generator goes into forced outage or there is a disruption in supply. In terms of system reliability, it met the Loss of Load Expectation (LOLE) criteria of not more than one day a year. Reserve margin was reduced from 36% in 2017 to 32% in 2018, which is still higher than the global average. The target is for the reserve margin to decline to 20% by 2035 when interconnections become more established.

In 2001, the National Grid was equipped with its first 500kV lines from Manjung and Air Tawar in Perak connecting the large generating capacity in Lumut to the central region via the Bukit Tarek 500kV substation and Kapar. Currently, the 500kV grid spans from Gurun in the north to Pasir Gudang in the south, but the lines are energised at 275kV. Based on the Transmission Development Plan, another 500kV backbone, which spans from Ayer Tawar - Bentong South - Lenggeng - Yong Peng East, is scheduled in 2020 to maintain the integrity of the grid system.

The National Grid, which is the backbone of the integrated transmission network, is interconnected with Thailand's transmission system operated by Electricity Generating Authority of Thailand (EGAT) in the North via a High Voltage Direct Current (HVDC) interconnection. In the South, the National Grid is connected to Singapore's transmission system at Senoko via two 230 kV submarine cables.

Besides these interconnections, Malaysia also supports ASEAN Power Grid initiatives. The success story of the LTM interconnection proves that multilateral power trading under the ASEAN Power Grid study can turn into real implementation. As per 2018's record, Malaysia received around 16GWh of power from Lao PDR via Thailand under a non-firm arrangement. The arrangement translated into the Energy Purchase and Wheeling Agreement that was signed on 27 September 2017 during the 35th ASEAN Ministerial of Energy Meeting (AMEM) in Manila. The agreement between public utility companies of Malaysia, Lao PDR and Thailand addressed technical operating procedures and the commercial terms of power transfer.

## SINGAPORE HVAC





## 20-YEAR HYBRID LOAD FORECASTING MODEL

Electricity demand is driven by correlated drivers such as GDP, population size, weather, size of household, electricity price and commercial or industrial floor space.

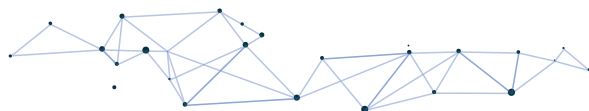
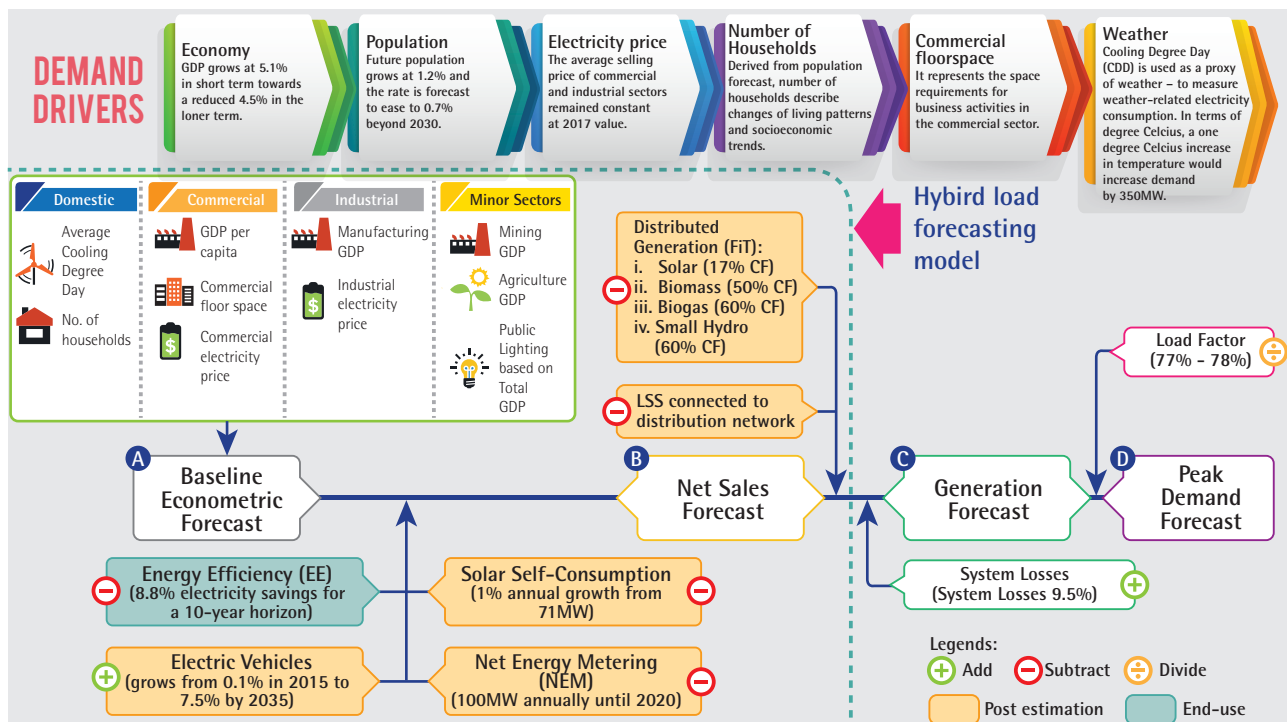
Since forecasting is an annual practice, the methodologies and model are subject to review every year by the DFC chaired by the Chairman of the Commission. Prior to the DFC approval, the model's assumptions and findings are presented to the Load Forecast Working Group, which includes representatives from the Commission.

In 2018, the Commission enhanced its annual 20-Year Electricity Demand Forecast to provide more accurate and precise information for planning and implementing future capacity for generation and transmission.

Based on the Hybrid Load Forecasting Model, the new forecast uses a combination of the following three methods:

1. *The Econometric Method* of capturing historical trends that does not take into account current and emerging trends such as RE and EE. Econometrics is strictly a study of the relationship between electricity drivers and prevailing or historical external drivers.
1. The *End-use Method* based on emerging and future trends, customer behaviour and technology evolution. It builds forecasts from bottom-up for each customer segment, end-use and technology. It also captures the impact of new technologies, customer trends and Government policies such as EE. Its salient feature is modelling the impact of EE.
2. The *Post-estimation Adjustment Method* for additional elements not covered by the econometric and end-use methods. This method identifies key trends that are becoming important and likely to influence future demand. It includes RE and electric vehicles, and each component is modelled independently as a post-estimation adjustment.

### How the Hybrid Load Forecasting Model Works



The Hybrid Load Forecasting Model predicts that the industry sector will continue to be the major energy consumer (40%) followed by the commercial (35%) and domestic (22%) sectors. It also forecasts that the electrification of the automotive industry will cause a spike in electricity consumption. According to a 2016 McKinsey study, the electric vehicle penetration rate is expected to grow from 0.1% in 2015 to 7.5% in 2035.

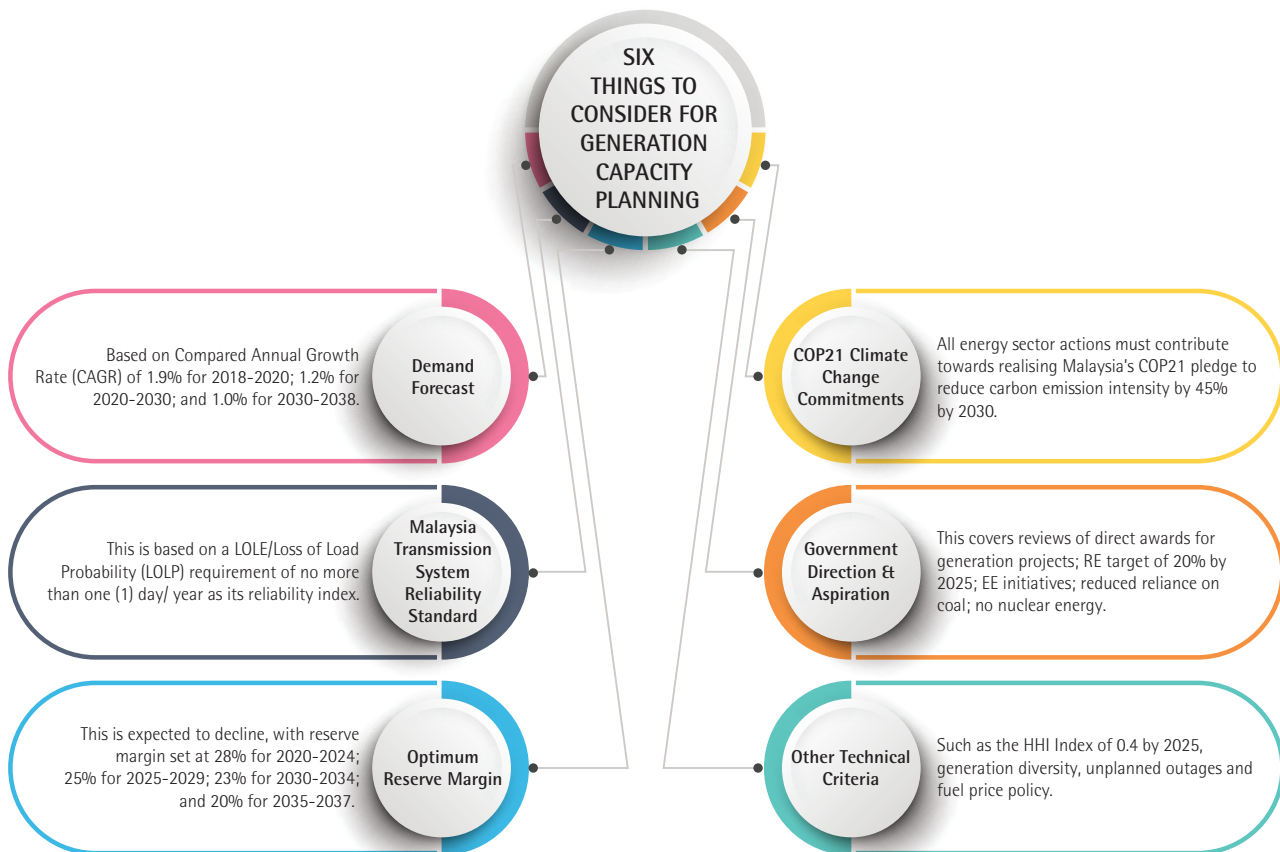
In the commercial and domestic sector, most of the energy is consumed by air conditioning systems. With various EE

initiatives across all consumer segments, it is assumed that there will be an overall 8.8% savings over 10 years time.

In addition, the model takes into account of Government policies and market trends. It has integrated the Government's 20% by 2025 RE target into the capacity mix, and estimates an LSS capacity of 200MW between 2021 and 2026. Meanwhile, NEM capacity is set to grow 100MW annually until 2020; with a 1% annual growth in solar self-generation and consumption that will address gaps in RE capacity.

## SIX THINGS TO CONSIDER FOR GENERATION CAPACITY PLANNING

There are six key planning criteria to consider for generation capacity expansion, before the plan is presented to JPPET for approval. The endgame is to provide acceptable levels of service reliability to consumers at a minimal cost, while realising Government aspirations and commitments.



## FIVE THINGS TO CONSIDER FOR GRID REINFORCEMENT PLANNING

Grid development comes under the jurisdiction of TNB's Grid Division, which is entrusted with:

- Ensuring that enough capacity and capability is available to enable the system to return to normal operation under normal and secured contingency
- Planning, designing and developing the transmission system in accordance with the Malaysian Grid Code and Transmission System Reliability Standard

The Commission reviews the Annual Transmission Development Plan prepared by the Grid Division to identify issues and risks associated with the growth in load/demand levels and new generation plant up in the grid system over a rolling 10-year period. It evaluates the adequacy and security of the transmission network using the following five (5) criteria:

1. *Thermal loading limits* - The loading limit for a transmission line must be safeguarded against excessive overloading that can cause conductors to melt.
2. *Voltage limits* - Voltage limits are key to ensure secure power transfer over the transmission network. Excessive overvoltage could cause equipment to explode. Voltage that is too low leads to load tripping.
3. *Stability limits* - Stability is the ability of the system to bring back its operation to a steady state within a minimum possible time after having undergone any transience or disturbance. Stability limit is crucial to ensure that the equilibrium of supply/demand is always intact. Cascade tripping of generating units due to an unstable system would lead to widespread blackouts.
4. *Short-circuit limits* - A short circuit is an unwanted or unintentional path that a current can take when it bypasses the original route. An abnormally high current will flow through the circuit and if this fault current exceeds the circuit breaker rating, equipment may explode and cause supply interruption.
5. *Voltage Performance Margin* - Voltage performance margin is required to ensure that adequate reactive power (MVAR) is in the system. Lack of MVAR reserves would risk voltage collapse.

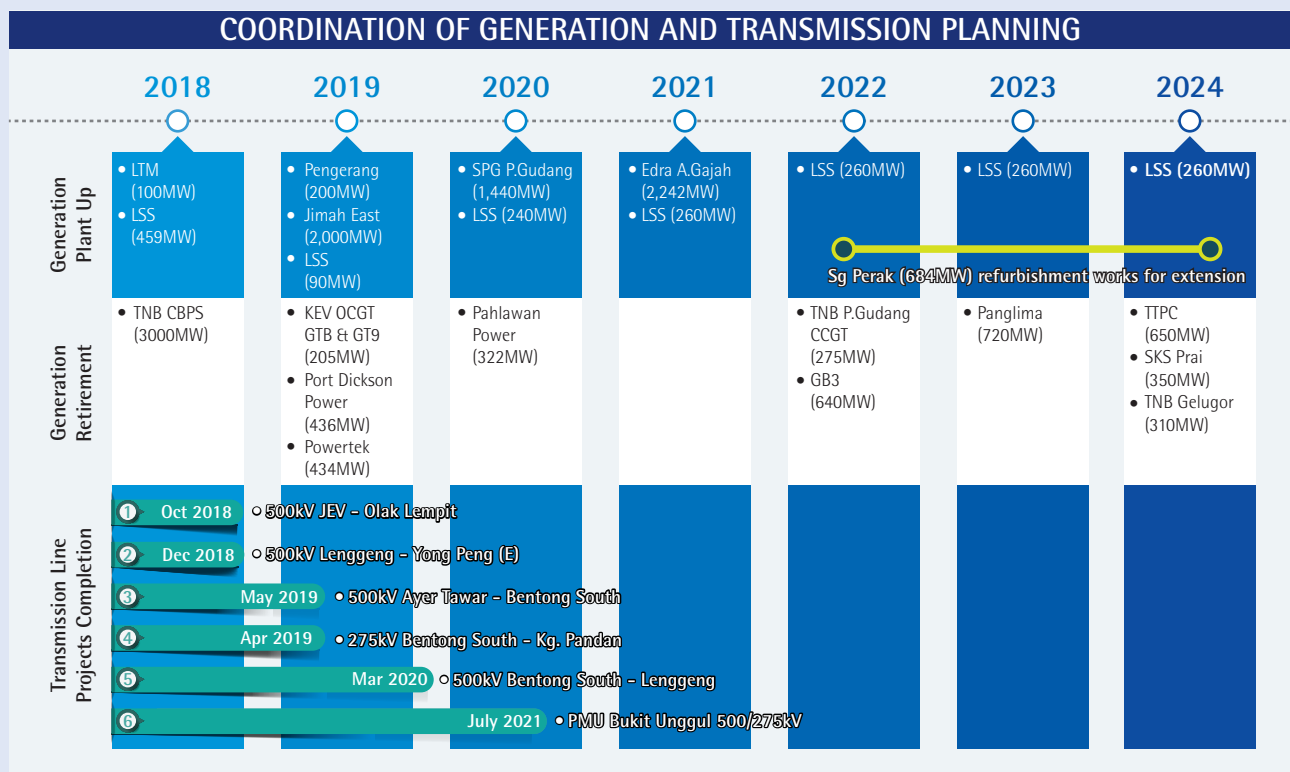




## SEAMLESS GENERATION-TRANSMISSION PLANNING

The Commission closely monitors generation and transmission projects to ensure continuity of supply and seamless delivery to end users. It is crucial for transmission projects to support future plant up and retirement schedules to optimise system costs, reduce constraints and ensure demand is fully supported.

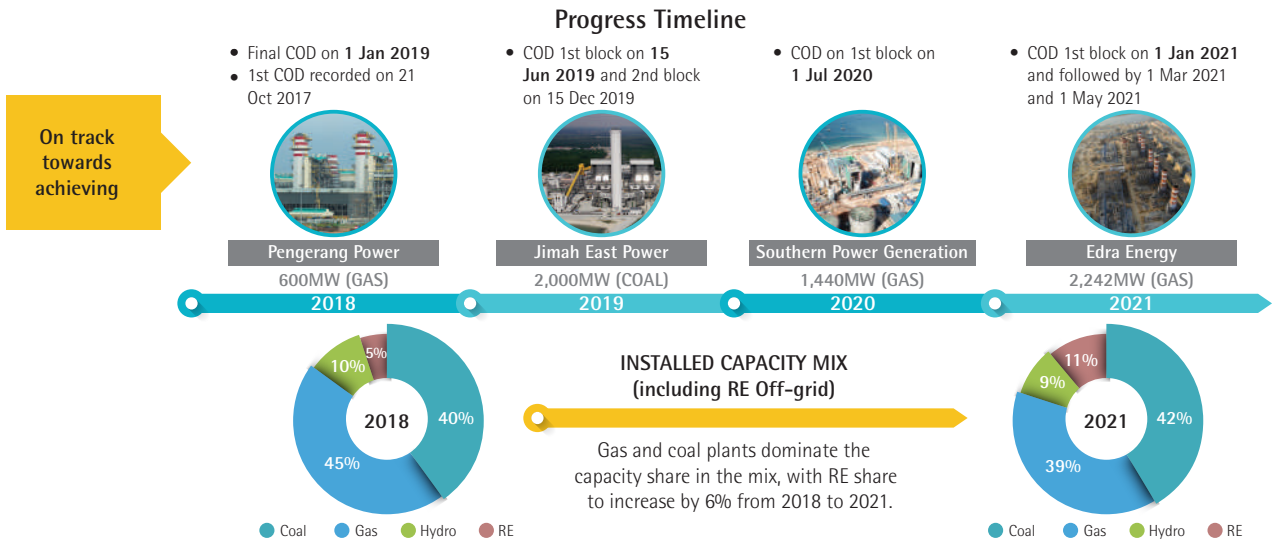
Between 2018 and 2024, there are four major generation projects. They are Pengerang Power (200MW, gas) Jimah East Power (2,000MW, coal), Southern Power Generation (1,440MW, gas) and Edra Energy (2,242MW, gas) scheduled for completion by 2021. In addition, 11 plants are earmarked for retirement and six major transmission projects are to be completed during this period – the diagram below refers.



Note: This plan is reviewed periodically, subject to changes in demand forecast, generation requirement, completion of committed projects and government policies.



## PROJECTS ON TRACK



Gas and coal plants will continue to dominate the generation mix, although the share of RE increases from 5% in 2018 to 11% in 2021. This is due to an increase in LSS projects after the third LSS bidding cycle in 2019.

## FUTURE PLANT UP

With the Government's 20% RE by 2025 target, several awarded projects and large hydro projects are being reviewed as to whether or not they represent an optimal generation solution given the Government's green agenda. Instead, there is the accelerated implementation of RE projects to deliver 6,371MW by 2025.

Meanwhile, a study by the SB highlighted that coal power will be affected when solar penetration reaches 27% of peak demand. For large hydro plants, the Commission recommends retaining existing plants because besides power generation, they mitigate floods and aid in irrigation. As such, the Sungai Perak and Kenyir Hydro Stations will be ramped up for energy security.

Year	FUTURE GENERATION DEVELOPMENT PLANT
2019	Pengerang (200MW), Jimah East (2x1000MW), RE (790MW)
2020	SPG (2 x 720MW) RE (621MW)
2021	Edra Energy (2,242MW) RE (560MW)
2022	RE (782MW)
2023	RE (782MW)
2024	RE (782MW)
2025	RE (782MW)

SEDA is currently studying the RE potential in Peninsular Malaysia to develop a transition roadmap for implementation. As such, some of the targets and strategies may be revised.

### RE Capacity Factor

Solar: 17%	Biomass: 50%
Mini Hydro: 60%	Solid Waste: 50%
Biogas: 60%	

Note: This plan is reviewed periodically, subject to changes in demand forecast, generation requirement, completion of committed projects and government policies.



## INTERSTATE POWER TRANSFER

The populous and industrialised Central Region (Greater KL) accounts for 43% of total electricity demand in Peninsular Malaysia. Due to supply deficit, the region relies heavily on power transfers from the Northern Region (40%) and Southern Region (35%). The balance comes from generation plants in the Central Region (16%).

To facilitate power transfer, a 500kV network is being constructed from Gurun in the north to Pasir Gudang in the south. To facilitate this, there are six major projects on the ground, scheduled for completion in 2021.

The 522km 500kV network will serve as an inter-area bulk power transfer facility as well as ensure full power evacuation to the Central Region from the least cost generation sources located in the Northern and Southern Regions.

Without this backbone, power transfers to the Central Region will have difficulty complying with the Transmission System Reliability Standard's performance criteria and limits.

## STAKEHOLDER ENGAGEMENT

The Commission monitors the implementation and delivery of major transmission projects to ensure their timely delivery. For this, it engages with relevant stakeholders, project developers and the grid owner to resolve issues that may delay project delivery.

Among the common issues affecting transmission projects are community concerns over transmission projects affecting their homes, health and their livelihood. Land acquisition and environmental concerns are also key issues.





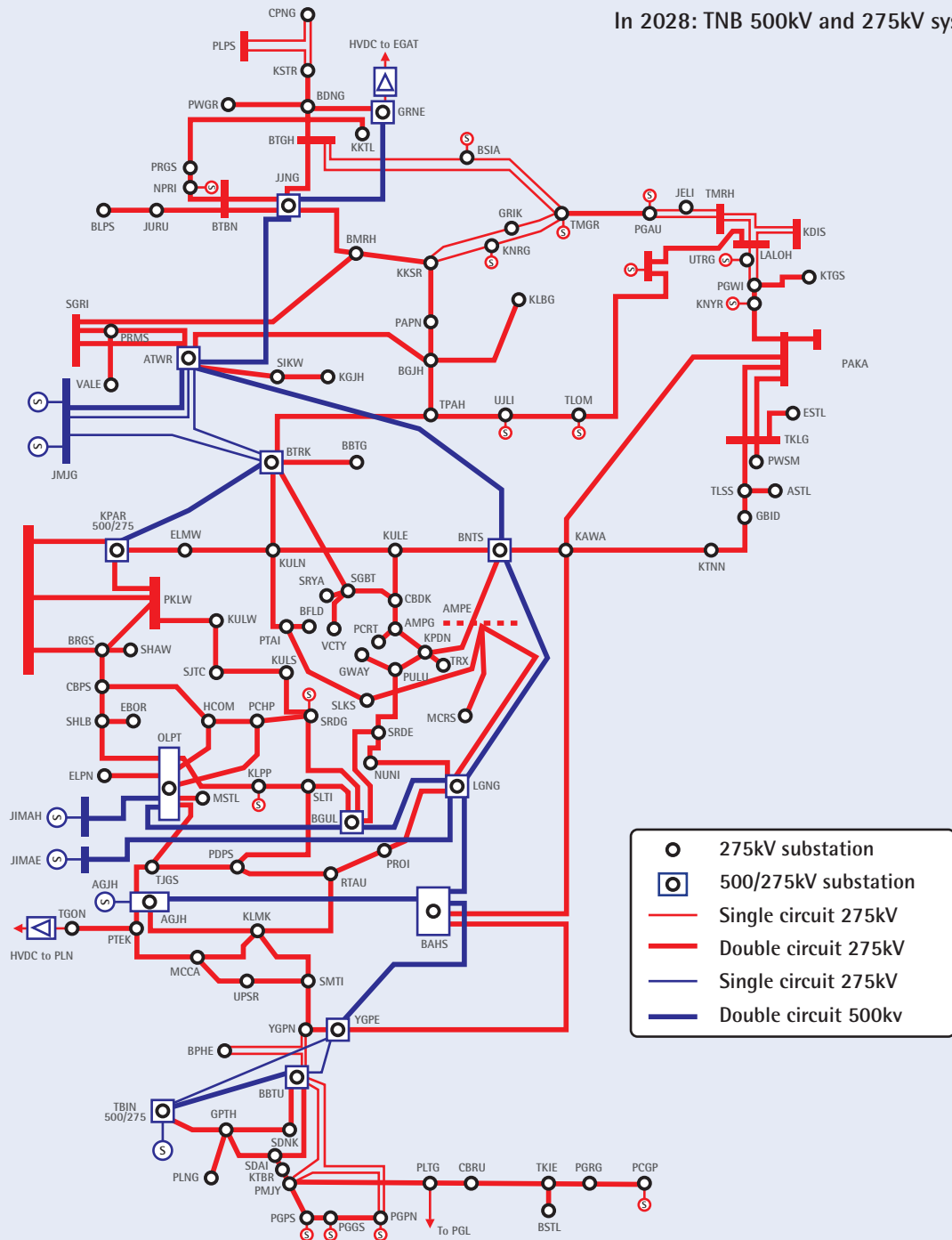
## DELIVERABLES

IN 5 YEARS: A ROBUST 500KV GRID



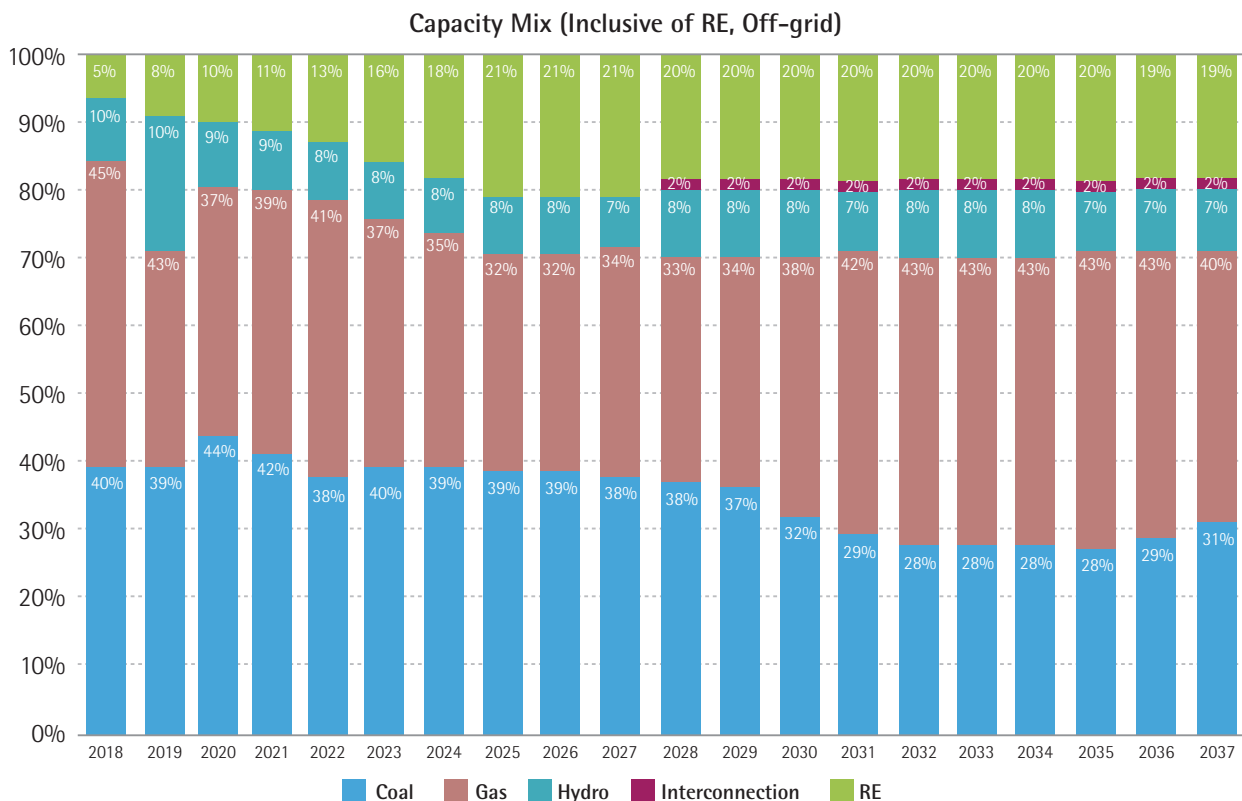
**IN 10 YEARS: A WELL-INTEGRATED 500KV-275KV NETWORK**

In 2028: TNB 500kV and 275kV system



## IN 20 YEARS: LESS COAL, MORE RENEWABLES

RE will have increased its share in the generation mix and as a result, there will be a reduction in the dependency on fossil fuels. This will, in turn, contribute towards reducing emission intensity, bringing Malaysia closer to realising its COP21 decarbonisation target. RE also opens up the power producer market further because it can be generated by big businesses as well as SMEs, communities and households.



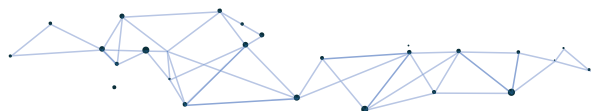
- There is an acute difference between achieving a 20% RE target with respect to capacity mix as opposed to energy mix. In all cases the quantum of RE does not include large hydro.
- 20% RE target by 2025 for an installed capacity of 25,484MW would entail about 6,371MW of RE.

Note: This plan is reviewed periodically, subject to changes in demand forecast, generation requirement, completion of committed projects and government policies.

## INTERCONNECTIONS: ANOTHER WAY FORWARD

Power trading arrangements among ASEAN member states began on cross-border bilateral terms, then expanded to a sub-regional basis, and are now an integrated regional system. The ASEAN Power Grid is expected to enhance electricity trade across borders to meet rising electricity demand and improve access to energy services among member states.

Heads of ASEAN Power Utilities and Authorities are members of the Specialised Energy Body tasked to ensure regional energy security by promoting the efficient utilisation and sharing of resources through the ASEAN Power Grid.





## CHALLENGES

For energy security, the question always is: Do we have sufficient fuel for the future?

The Commission relies on both conventional means and topical issues to forecast electricity supply for the future. It chairs the Coal and Gas Committee twice yearly to gather inputs from representatives of MESTECC, utility provider TNB, IPP and other stakeholders to determine fuel prices, plant performance, mitigation initiatives and the way forward.

As at 2018, Peninsular Malaysia imported coal from Indonesia, Australia, Russia, South Africa and made small purchases from Colombia. Gas, hydro-electricity while renewable fuels are domestic resources.

Fuel shortages, price fluctuations and currency variations are longstanding issues facing the energy industry. In recent years, geopolitical instability and US-China trade tensions have emerged as imminent threats.

Besides imports, interconnections are emerging as another power source. The ASEAN Power Grid aims to improve access and supply among ASEAN member states. In 2018, Malaysia received its first supply from Lao PDR via the ASEAN Power Grid. This is a bilateral arrangement between the Governments of Malaysia, Lao PDR and Thailand (with the intermediate grid) in an Energy Purchase and Wheeling Agreement signed in 2017. Phase 2 is scheduled to commence post-2020.

Typically, power trading involves Government-to-Government arrangements, and can be subject to protracted negotiations and affected by geopolitical instability.



## ENERGY EQUITY – MARKET LIBERALISATION FOR REASONABLE TARIFFS AND ENERGY SECURITY

Malaysia's electricity tariff is among the most cost reflective in the region, and it is the Government's aspiration to maintain this competitive advantage to boost the economy and the people's welfare. In 2018, the Government announced that there will be no increase in electricity tariffs over the next three years (2018-2020).

For the Commission, the challenge is in maintaining the fine balance between reasonably priced electricity and managing rising supply chain costs and consumer demand for green energy, improved reliability and energy security. This is the quintessential trilemma anywhere in the world.

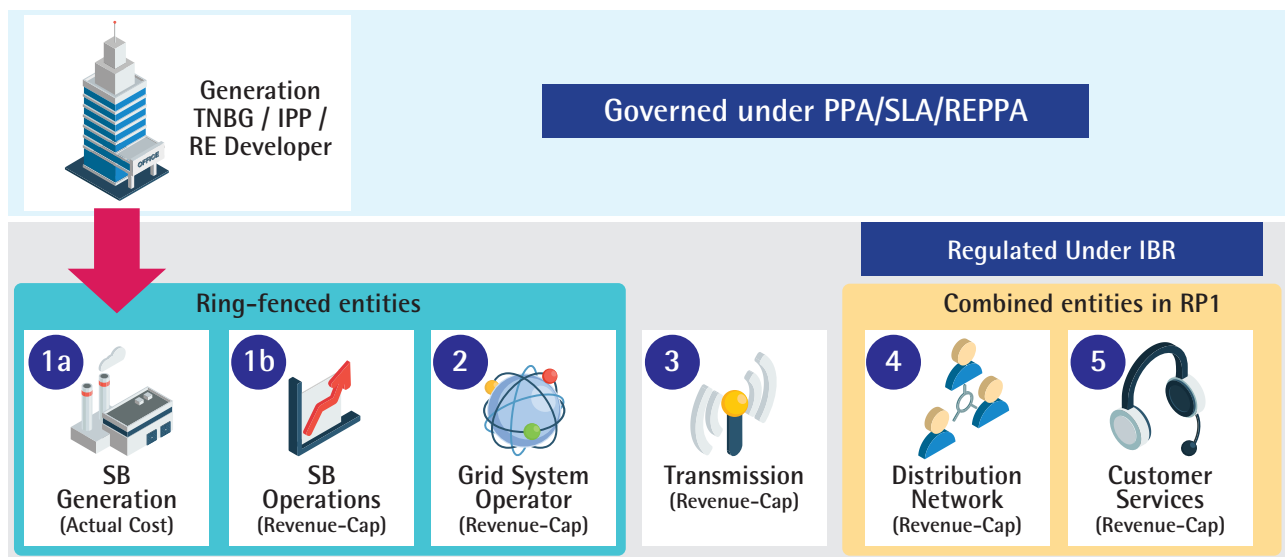
As a solution, the Commission embarked on the liberalisation of the power generation market in 2015, followed by the liberalisation of the gas supply market in 2017. Currently, the emphasis is on the liberalisation of the power generation market, with special emphasis given to RE generation. This strategy envisages players ranging from big solar farms to community and self-generation of solar power, with excess sold to the grid.

In the longer term, the Commission plans to open the grid and retailing of electricity to other players as well. Currently, the grid is owned by TNB and managed by the ring-fenced Grid System Operator (GSO) within the public utility.

Power generation was first deregulated in the mid-1990s in the interest of energy security in a rapidly industrialising Malaysia. This led to the birth of IPPs who invested heavily in large power plants and sold energy to TNB according to the commercial terms specified in their respective Power Purchase Agreements (PPA), which typically run over a period of 21 to 25 years. The initial PPAs guaranteed that IPPs would be able to sell electricity to TNB at attractive margins while enjoying subsidised fuel prices (gas).

In 2012, the Commission introduced the concept of the SB to manage the impending renegotiation of expired PPAs. SB is a ring-fenced entity within TNB that is the sole off-taker of electricity and related services from the power producers.

### SB-Power Generator Arrangement



Source: Energy Commission



New PPAs were subsequently renegotiated under more competitive terms, resulting in substantial savings for the SB. The savings were, as required by the Commission, used to fund the cost of rebates to consumers. This strategy is said to have contributed towards keeping Malaysian electricity tariffs stable as well as among the most cost reflective in ASEAN.

As at 2018, power generation continues to remain largely in the hands of TNB and IPPs, with some strides being made with the entry of RE generators. Unlike fossil fuel-based power plants, RE generation lends itself well to the participation of big and small businesses and households. This is especially so with solar power generation that can be undertaken as capital-intensive LSS farms as well as low cost investments by small businesses, or even households. All power producers must be licensed by the Commission, which awards contracts to them on the basis of competitive bidding.

To attract more players in power generation and ensure that electricity tariffs are fair to both consumers and producers, the Commission introduced the hallmark IBR in 2015. IBR was approved by the Government and implemented by the Commission as part of a wider regulatory reform of the power marketplace.

## HOW IBR WORKS

The IBR is a transparent electricity tariff setting mechanism, which takes account of controllable costs (capital and operational expenditure, return on investment, performance and cost of service) and uncontrollable costs (volatile fuel prices and currency fluctuations) to set electricity tariffs that benefit both consumers and producers. While power producers manage controllable costs, they do not take any risk as far as uncontrollable costs are concerned. This is borne by the SB.

Under IBR, tariffs have two components – one, a base tariff that is reviewed at the end of a 3-year regulatory period; and two, Imbalance Cost Pass-Through (ICPT) that is reviewed every six months. The latter takes into account the SB's projected procurement costs based on external market conditions. When there is an imbalance between projected and actual costs, ICPT comes into effect. When actual costs exceed projected costs, the difference is passed on to consumers as a surcharge. When actual costs are below projections, rebates are passed on to consumers. Surcharges or rebates occur in 6-month cycles.

During IBR's First Regulatory Period (RP1) that ended in 2017, the SB had forecast procurement cost at RM129 billion. But the actual cost incurred was RM88.9 billion, at a base tariff set at 38.53 sen/kWh. As a result, RM6.3 billion of rebates were given to consumers. The lower costs were due to cheaper coal, reduction in gas volume and greater cost-efficiency.

To cushion the impact of rising generation costs and protect consumers from tariff spikes, the Government established the Electricity Industry Fund (KWIE). The Commission oversees KWIE that became operational in 2016. The fund consists of payments made by power producers; it also receives allocations from the Government. The money is to be used to make up for cost overruns.





## HIGHLIGHTS OF THE SECOND REGULATORY PERIOD (RP2) [2018-2020]

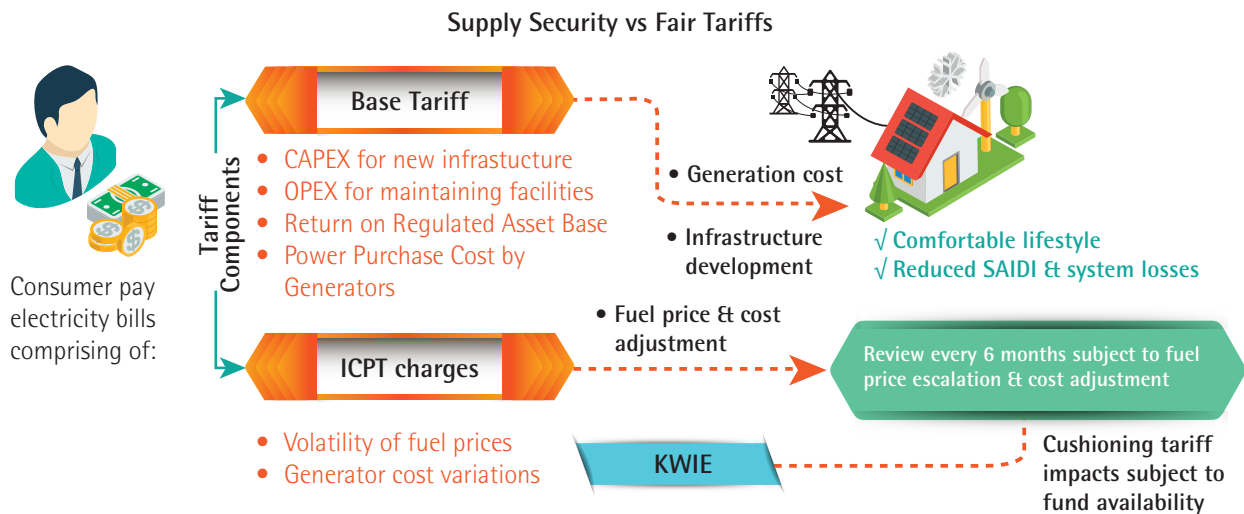
Under RP2 (2018-2020), tariffs will remain unchanged. Although the forecast for the base tariff was set at 39.45 sen/kWh, a 2.4% increase, the Government decided to maintain it at 38.53 sen/kWh as per RP1.

In 2018, TNB as the SB utilised the ICPT mechanism to cover rising generation costs. In December, it announced (NST Business, December 14, 2018) an electricity surcharge for

business consumers. The surcharge was 2.55 sen/kWh for six months, from March 1 until June 30, 2019. Earlier in June, there was a 1.33 sen surcharge, also for businesses.

In both instances, the surcharge did not apply to households.

The reason given was higher fuel and generation cost in the second half of the year that cost an additional RM1.82 billion. In its media statement on 14 December 2018, TNB said, "To ease the RM1.82 billion cost to be passed through to customers via the ICPT mechanism, the Government had approved that the surcharge for residential customers, amounting to RM308 million would be funded by KWIE.



Note:

1. Generation cost based on forecast fuel price, actual price will be transpired during the ICPT process.
2. Investment required for transmission and distribution network development to deliver electricity to cater to new demand.

- KWIE or Electricity Industry Fund was established and enforced on 1 January 2016.
- The KWIE fund comprises payment from any sum of money allocated and paid by licensees in accordance to Section 448 of the Electricity Supply Act 1990.
- The Commission regulates and oversees the payment into the KWIE account.
- KWIE will help to reduce electricity tariff impacts on consumers, but subject to the fund availability and Government decision.

One of the salient features of RP2 is the AMI to monitor energy consumption and the separation of the distribution function from customer service to enhance the customer experience.

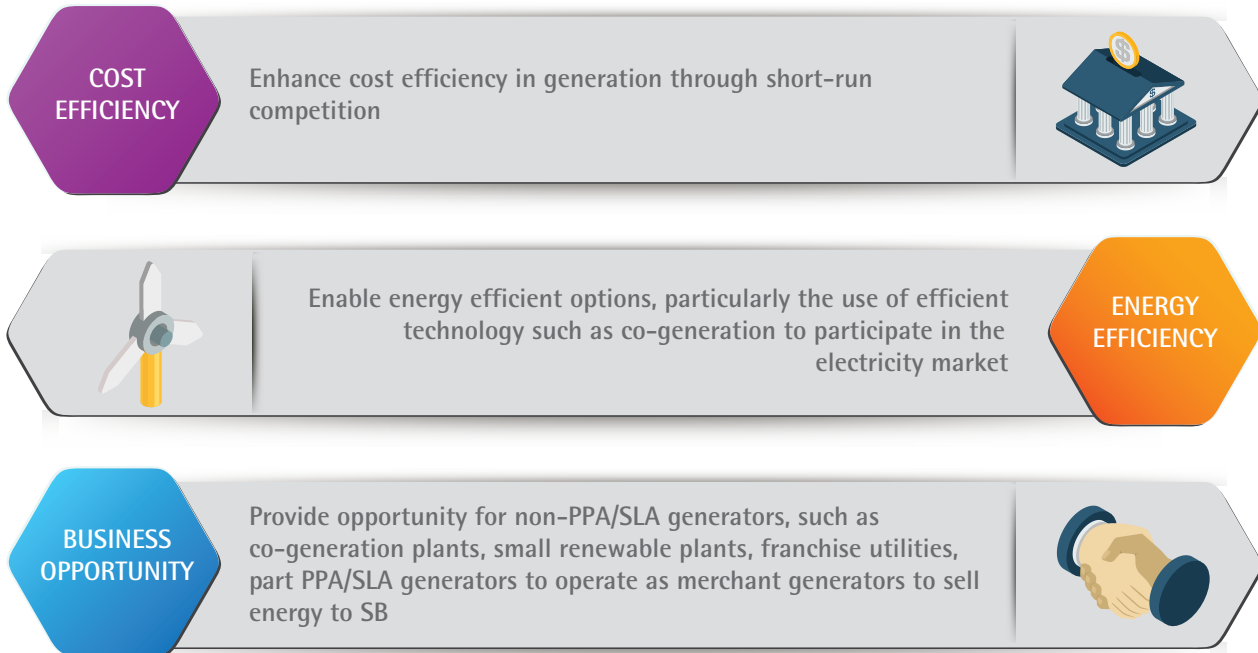
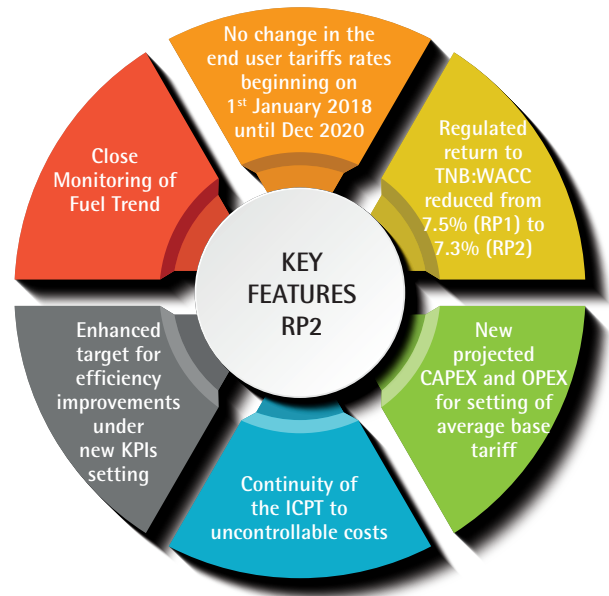
The Commission will also continue improving the transparency of the price setting mechanism while pushing for greater generation efficiency to control costs. There is also increased focus on green initiatives such as RE penetration and EE lifestyle. Ultimately, IBR is about ensuring reliable, safe and fair priced electricity in the country.



## NEW BUSINESS OPPORTUNITIES

The New Enhanced Dispatch Agreement (NEDA) was implemented in October 2015 to foster competition among power producers. The NEDA trial run ended on 1 April 2017 and it showed that increased competition has the potential to generate as much as RM14 million in savings in power generation.

NEDA represents business opportunities for co-generation plants, small renewable plants, franchise utilities, part PPA/Service Level Agreement (SLA) generators and expired PPA/SLA generators to operate as merchant generators selling energy to the SB. NEDA aims for improvements in cost efficiencies and usage of EE technologies by players to thrive in the competitive power generation market.



## SELF GENERATION FOR DOMESTIC USE AND PROFIT

The NEM programme encourages households and commercial premises to install solar PV systems for their own use and sell excess energy to the grid. The NEM framework was enhanced in 2019 to increase participation.

This involved two policy changes. One, was the introduction of the solar leasing arrangement under the SARE. Two, was the removal of electricity pricing disparities between solar suppliers and Single Buyer TNB. This will reduce the electricity bills of solar power users who are NEM licencees.

## A MAJOR MILESTONE UNDER THE THIRD PARTY ACCESS (TPA) ARRANGEMENT

The liberalisation of the gas market provides a new opportunity for the electricity supply industry in options to source for gas through the TPA arrangement, which allows Third Party gas suppliers to use Malaysia's gas facilities, namely, re-gasification terminals, transmission pipelines and distribution pipelines in a fair, equitable and non-discriminatory manner. The objective is to create a level playing field where players can compete in a fair and healthy manner. Under this arrangement, licensed shippers will have access to gas infrastructure owned and operated by Petronas Gas (re-gasification terminals and transmission network) and Gas Malaysia (distribution network), which would allow them to sell gas into the Malaysian market.

On 7 October 2019, the Regasification Terminal Sungai Udang (RGTSU) in Melaka took delivery of the first Third Party Liquefied Natural Gas (LNG) cargo that arrived in Malaysia under the TPA arrangement. The approximately 3.5 TBTU LNG import was the result of an agreement between utility company, TNB and Shell Trading Sdn Bhd, a subsidiary of the oil major, Shell. The cargo was unloaded and regasified at RGTSU, and subsequently transported via the Peninsular Gas Utilisation (PGU) pipeline network to TNB's power stations in Port Dickson, Negeri Sembilan and Klang, Selangor.



Source: The Star, 22 October 2018



The first Third Party shipment of LNG arrived at the Regasification Terminal Sungai Udang in October 2019, to mark the operationalisation of the TPA arrangement for gas market liberalisation.





## CHALLENGES

Electricity tariffs have a direct impact on the cost of living, which affects the socio-economic fabric of the nation. As such, the Commission works hard at keeping tariffs cost reflective and affordable to the broad spectrum of users. The trend now is market segmentation of tariffs, for example, passing ICPT-based surcharges to businesses instead of carte blanche for all consumers. Still, it is critical for Malaysia to have a competitive electricity tariff structure to lower the cost of doing business in the country, and attract foreign and domestic investments to grow the economy.

As a regulator, the Commission pushes for a cost-efficient electricity and gas supply chain while pulling back on tariff hikes to control the cost of living. New technologies can improve power production, distribution and retail efficiencies, but they come at a cost – often too high and evolving too soon.





## CONCLUSION

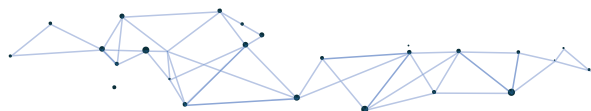
The Energy Trilemma has been an ongoing challenge for the electricity supply industry, which is continuously evolving, and requires judicious decision making and trade-offs to balance environmental sustainability, energy security and energy equity. These three core dimensions entail complex interwoven links between the public and private sectors, Governments, regulators, economic and social factors, natural resources, environmental concerns and individual behaviours. Thus, the ongoing question remains, how do we ensure continued energy security, affordability while supporting a more sustainable world?

Global concern over climate change has motivated Malaysia to adopted several approaches to promote RE. The likes of which include the Government's COP21 pledge to reduce 45% GHG emissions intensity per GDP by 2030 compared to the 2005 levels, the development of the GTMP and the target for 20% RE capacity by 2025. These are key drivers accelerating public-private collaboration to realise Malaysia's decarbonisation agenda. Moreover, Strategic Thrust 4 of the 11th Malaysia Plan (2016-2020) emphasises a better quality of life and overall wellbeing at low environmental risk.

Apart from the climate change agenda, MESTECC is looking at diversification of energy resources at an optimal price. The Commission plays a pivotal role in this regard, by proffering advice to the Minister on energy matters, especially on long term integrated planning, programmes, and strategies to promote RE on a larger scale through regulatory instruments while keeping prices reasonable for consumers.

Meanwhile, the Ministry has embarked on the second phase of its industry reforms under MESI 2.0, which will run from 2019-2025. MESI 2.0 follows the success of MESI 1.0 (2010-2014) that saw a definitive restructuring of the industry, making it more relevant, progressive and aligned to global trends. The fact is the energy industry continues to be in a state of flux. To better manage the fluidity of the global energy industry and challenges arising from the Energy Trilemma, MESI 2.0 will see Malaysia implementing several strategic measures such as:

- Opening up of the fuel supply market to encourage efficient risk allocation and price discovery, and establishing transparent price-setting mechanisms that are more economically efficient;
- Establishing a hybrid generation market that facilitates new entry, creates a capacity market and enhances NEDA as an energy market;
- Enabling TPA to promote third party participation in the generation and retail segment of the MESI value chain;
- Facilitating choice in retail through the opening up of the MESI retail market in the interest of empowering consumers to make their own choices on energy supply packages; and
- Increasing transparency and reducing conflicts of interest by transitioning the SB and GSO to independent entities to ensure a level playing field in the Malaysian Energy Supply Industry.



## NOTES





## NOTES





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