Towards a World-Class Energy Sector

ENERGY MALAYSIA

Suruhanjaya Tenaga
Energy Commission

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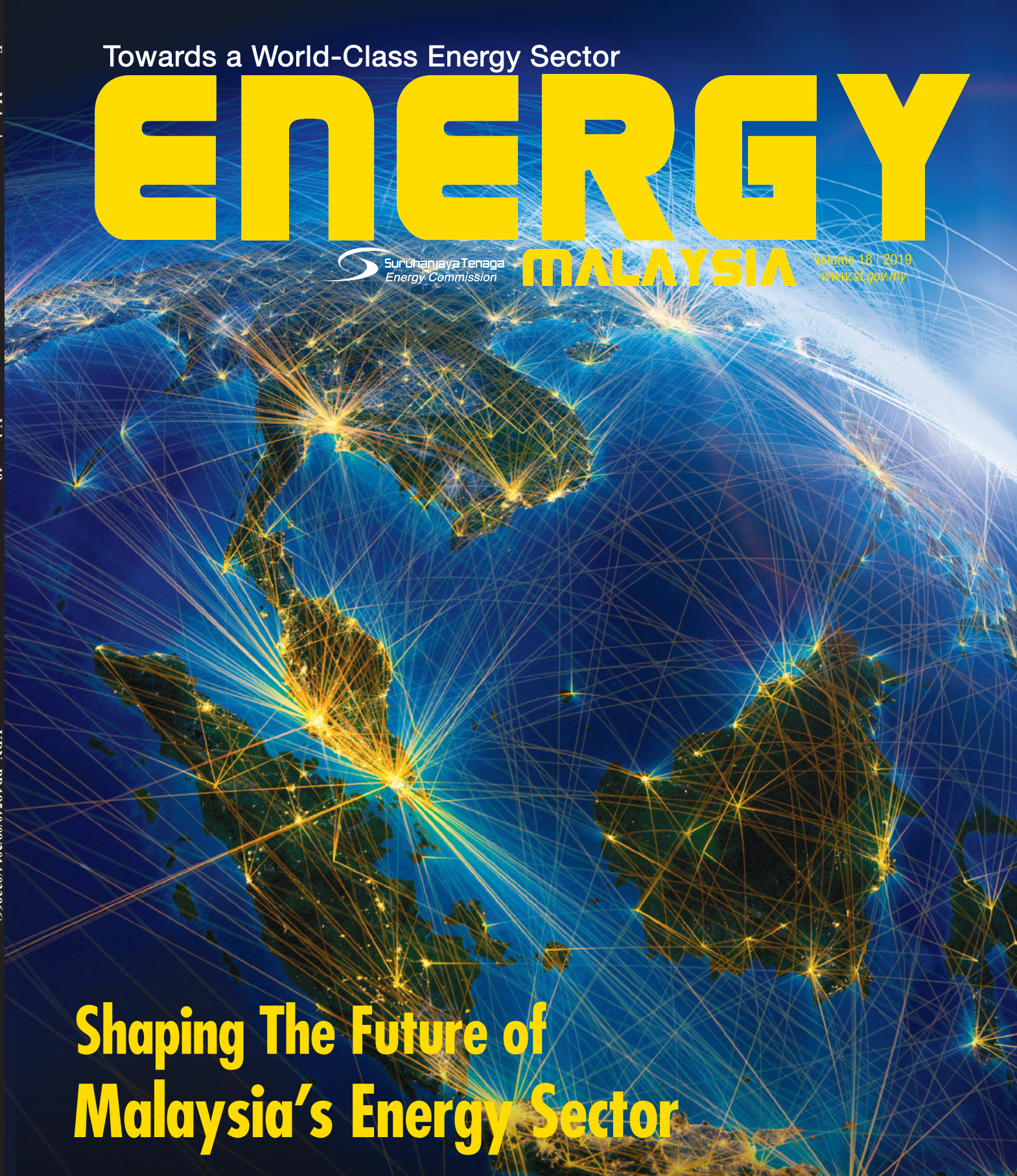

Shaping The Future of Malaysia's Energy Sector

DEFINING GOOD GOVERNANCE
An in-depth look at the governance of regulatory bodies and the standards they are held to.

A GREEN, SUSTAINABLE AND CARBON-FREE TOMORROW
Energy Malaysia explores the vision and plans for what the future holds for the energy sector in Malaysia.

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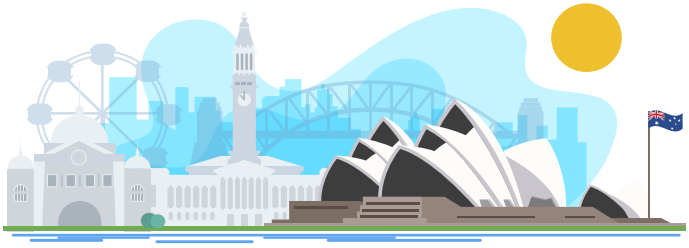

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Leading the Energy Sector

Datuk Ir. Ahmad Fauzi Hasan
Energy Commission, Malaysia

Globally, the energy landscape is undergoing a major transformation. It is becoming more complex with the rise of smart technologies, game-changing business models, consumer empowerment and shifting regulatory landscapes. The traditional utility business model is now increasingly challenged by market liberalisation, decarbonisation, decentralisation and digitalisation.

More and more consumers, especially in developed economies, are becoming prosumers where they are able to generate, store and have the choice to consume their own electricity when the utility tariff is high and sell the excess back to the grid or to their neighbours via peer-to-peer decentralised transactions.

With the help of smart meters and IoT technologies, demand response aggregators are now able to work with consumers to adjust electricity consumption and offer financial incentives in order to reduce peaks in demand. New energy solution providers are also now supplying services to energy, capacity, and ancillary services markets.

As we seize growth opportunities from these transformational changes and move towards increased electrification of the economy and a cleaner energy future, undoubtedly, we will face tough technical, economic, capacity and regulatory challenges. Workable performance-based regulatory policy frameworks that are based on lessons learnt from international good practices are needed to steer us through unchartered waters.

High performing regulators play a key role in achieving good and orderly outcomes for the industry and consumers. It is critical that regulatory policies are supported by a good governance framework. This requires well-designed rules and regulations, high-quality institutional capacity and resources as well as effective, consistent and fair operational processes and practices as recognised in the Organisation for Economic Co-operation and Development's (OECD's) recommendations on Best Practices for the Governance of Regulators.

However, even the best designed legal and regulatory framework will be ineffective if it is not credibly enforced. Hence, our vision to be a world-class energy regulator that is effective and authoritative to help shape the future of Malaysia's energy sector. Towards this end, we recently undertook a restructuring and strengthening of our organisation to make it more agile, strategically focussed, synergistic and job enriching.

We will continue to undertake regular and purposeful engagement with regulated entities and key stakeholders focused on improving outcomes. Regulatory decisions and functions will be carried out with the utmost integrity to ensure that there is confidence in the regulatory regime. We will also seek to continually improve our regulatory policies and practices to deliver win-win outcomes for all by assessing the impacts of existing and proposed regulatory frameworks.

Lastly, I wish to take this opportunity to express our utmost appreciation and thanks to our retiring CEO, Ir. Azhar Omar, for his exemplary dedication and contribution to the country's power sector all these years. He has certainly played a key role in raising the sector's performance to the next level. EM

A Tribute to Our Dedicated Chief Executive Officer,

Ir. Azhar Omar

Ir. Azhar Omar recently completed his tenure as Chief Executive Officer of the Energy Commission on 31 March 2019. He started his career in the Department of Electrical Inspectorate after graduating from University College Cardiff, Wales with a Bachelor of Science (Hons) in Electrical & Electronic Engineering in 1984, before joining the Department of Electricity and Gas Supply in 1990.

Ir. Azhar then joined the Energy Commission after its establishment in 2002 as Deputy Director of Electricity Supply Regulatory Department. He was promoted as Senior Director of the same department in 2011, before being appointed as the Acting Chief Executive Officer of the Energy Commission in July 2017 and as the Chief Executive Officer on 2 April 2018.

As a well-respected professional engineer, Ir. Azhar was a member of the international investigating team that studied the 1992 blackout incident in Peninsular Malaysia and developed the Peninsular Grid Code and Distribution Code. He was also instrumental in the development of the new Grid Code for Sabah, amendment of the Electricity Supply Act 1990, power quality baseline study and the establishment of competitive bidding mechanism for new generation capacity in the Peninsula and Sabah.

He has also played a leading role in transforming and strengthening the economic regulatory framework for the power sector through the introduction of incentive-based regulation mechanism, structured tariff setting and account unbundling frameworks for TNB and SESB, Single Buyer rules, metering accuracy regulatory framework as well as technical guidelines for the introduction of Large Scale Solar and Net Energy Metering into the power system. The Energy Commission's organisation too has undergone a positive transformation during his tenure as Chief Executive Officer. He is well-liked and respected by the staff as a firm, friendly and caring boss.

Indeed, Ir. Azhar's contributions and achievements for the Energy Commission and its stakeholders are well recognised and will always be remembered by us for many years to come. Through his continuous striving for excellence, the Energy Commission and the energy industry has progressed to a higher level of efficiency and effectiveness. All this was made possible with the dedication and leadership of Ir. Azhar Omar.

Our heartfelt thanks to you, Ir. Azhar. May Allah bless you and your family always. EM

Our Heartfelt Appreciation and Thanks To

Ir. Azhar Omar for his dedication and service as **Chief Executive Officer of the Energy Commission of Malaysia** *(Suruhanjaya Tenaga)* from April 2018 to March 2019. His guidance and mentorship were invaluable, and we at the Energy Commission thank him for his tenure.

The Dawn of Floating Solar Panels

Floating solar plants are on the rise around the world, with worldwide capacity having reached 1.1 GW as of 2018, with global potential capacity of 400 GW according to the World Bank. Asia, incidentally, is leading the way with a number of major projects announced during the end of 2017 throughout 2018.

Singapore, for instance, will soon be home to the first floating solar plant on seawater. Developed by Sunseap Group, the 5 MW project was announced in November 2018 and is expected to be operational in early 2019. While floating solar plants are usually built on fresh water sources, the island city-state's lack of such resources means having to go offshore into the Straits of Johor.

India is also banking on this technology, and in December 2017, the country's largest floating solar plant was opened in Kerala. While just having a capacity of 500 kW, this is a significant increase from the 10 kW plant inaugurated in 2016. Incidentally, the Indian Government is determined to increase solar power capacity from 5 GW in 2015 to 100 GW by 2022, and has carried out an auction for 150 MW of capacity, with three winning bidders responsible for setting up 50 MW plants each.

The undisputed leader in floating solar has to be China, where the use of renewables is pushed by the Government's drive to reduce carbon emission levels in the country, which has seen many cities choked in smog. Already, a 40 MW floating solar plant came online in the province of Anhui in mid-2017, while the end of that year saw the announcement of a massive 150 MW floating solar plant, also in Anhui.
– Voice of America and Climate Action

Renewables on the Rise

According to the International Energy Agency's (IEA) annual report on renewables, which was released in October 2018, the installed capacity of renewable energy could exceed more than one trillion watts over the next five years. One scenario forecasts a capacity of 1.3 TW by 2023, while the more conservative estimate predicts it will rise to 1 TW.

The IEA has identified several factors behind this rise. These include increased Government support for renewables worldwide, and a drop in the prices of solar, wind and hydro technologies. The report also stated that hydropower will grow by 12 percent over the next five years and wind power by 66 percent. The biggest winner however is solar power, which is expected to reach a capacity of 600 GW by 2023, accounting for 60 percent of the forecast total.

Driving this increase will be China, which has become the world's largest users of renewable energy over the past few years. It is forecast that installed renewable generation capacity in China will reach 430 GW or more than 40 percent of the world's total by 2023.
– International Energy Agency

Emissions from generating electricity

Numbers indicate tons per year per thousand households

	Wood	Waste	Coal	IGCC*	Natural Gas	Geothermal	Nuclear	Hydro	Solar	Wind
CO	51	9	5.8	1.2	1.5					
CO_2			9,362	8,377	3,558					
NOx	28	44	3.4	1.7	0.3					
PM	2.7	2.2	0.9	0.3						
VOC	5.6	0.9	0.2	0.1						
SO_2	2.8	18	5	0.9	0.2					
Mercury			0.0001	trace	trace					

Most — Middle — None

*Coal to natural gas

Source: Natural Gas Supply Association

Natural Gas
The Clean Choice

In this age of increased environmental awareness, fossil fuels in general have the stigma of contributing to greenhouse gas levels and carbon emissions. However, not all fossil fuels are created equal, and while not 100 percent clean, natural gas has the distinction of being the least polluting and most efficient fossil fuel out there.

For instance, while burning natural gas produces carbon dioxide (as does burning any other fossil fuel), the amount of CO_2 released is 50 to 60 percent less than when burning coal and 30 percent less than when burning oil. According to the American Gas Association, natural gas emits 90,000 fewer pounds of CO_2 per billion BTU than coal.

Furthermore, US energy company National Fuel has claimed that generating electricity from natural gas has a 92 percent efficiency rate, compared with those produced by coal.
– International Gas Union and IGS

Powering Up With Microgrids

Electricity is taken for granted in Malaysia, yet around the world, approximately 1.1 billion people or 14 percent of the population do not have access to electricity. Many of these people live in rural sub-Saharan Africa and Asia, and in order to extend power to these areas, the United Nations is banking on decentralisation through microgrids.

According to United States Department of Energy, a microgrid is a local energy grid that has the capacity to operate autonomously. This means that power can be generated (usually through small-scale power plants such as solar power and other renewables) and distributed locally. This eases dependence on the national grid and is very useful in places that are prone to natural disasters or have little to no infrastructure.

Global microgrid capacity is expected to increase by 6.2 Gigawatts from 2015 to 2024. One country leading the way in adopting this technology is India, which has a Government policy aiming to establish 10,000 renewable-based microgrid projects around the country.

Another nation that has been identified as being ripe for microgrids is Nepal, where electricity connectivity is near impossible to rural, hard-to-reach mountainous areas. An initiative by Nepalese solar company Gham Power is seeking to create several clusters of microgrids in the northeast of Kathmandu to help power 102 households and 87 businesses.
– Forbes and Raconteur

"Microgrids are misunderstood because there can be a focus on comparing cost on a kilowatt/hour basis and asking why the poorest are being supplied with expensive energy. But they are displacing dirty energy and increasing revenue for local people, and no one has yet quantified that."

– Anjal Niraula,
General Manager of Gham Power, Nepal

Malaysia Aims For EV

According to Deputy Minister of International Trade and Industry, Dr Ong Kian Ming, Malaysia's new National Automotive Policy (NAP) will be focused on electric vehicles (EV) and new technology. Speaking at the Kuala Lumpur International Automotive Conference 2018 in November, he noted that this was a shift from the previous NAP which concentrated on energy efficient vehicles (EEVs),

The Deputy Minister's announcement was another indication that the Government is seriously looking into the development of EVs in Malaysia. In July 2018, the Malaysian Green Technology Corporation (Greentech Malaysia) revealed that it was working on a proposal for the proposed new national car to be an EV.

Then Greentech Malaysia CEO, Dr Mohd Azman Zainul Abidin, said the proposal would be presented to the Ministry of Energy, Science, Technology, Environment and Climate Change (MESTECC) for approval, before being sent to the Prime Minister. Pointing to MESTECC Minister Puan Yeo Bee Yin's passion for the environment, Dr Mohd Azman stated that he was confident of a positive future for EVs in Malaysia.

Incidentally, even if Malaysia does not produce its own EV, the National Electric Mobility Blueprint aims for the country to be an EV marketing hub by 2030.
– *Retail News Asia and The Malaysian Reserve*

Jordan Looks to the Sun

Although located in the oil-rich Middle East, Jordan's own reserves of hydrocarbons has never been of great significance, leading to it to depend on imported energy. However, that could be set to change, as the country seeks to resolve the situation with solar power. This is expected to help produce 1,000 GWh of electricity per year.

Currently, however, Jordan is only utilising a small amount of that potential, with any current solar power plans only being used to generate energy for purposes such as social services and lighting for more rural areas and settlements.

One exciting development regarding Jordan's solar power implementation is the Ma'an Development zone which will feature over 250 MW of concentrated solar power through the coming together of various private sectors through a number of projects. These projects only emphasise the country's focus on increasing the use of reusable energy sources. With only less than 30 days' worth of sunless days, this area is a viable spot for the implementation of solar-powered electricity generation. – *Echoing Sustainability in MENA*

NATIONAL BUILDING ENERGY INTENSITY (BEI) LABELLING FOR GOVERNMENT BUILDINGS

BEI LABELLING

- The Commission as the implementing agency to verify building's data and to issue the BEI label
- The aim is to encourage Government buildings to improve the energy intensity performance
- It acts as a medium of communication for sharing information about the building's energy consumption to others

WHAT IS BEI?

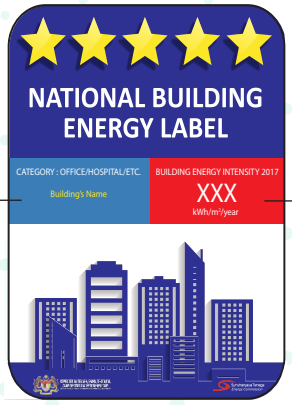
- Ratio between total annual energy consumption (kWh/year) and nett floor area of the building (NFA)
- BEI (kWh/m^2/year) $= \dfrac{\text{Annual Energy Consumption (kWh)}}{\text{NFA (m}^2\text{)}}$
- BEI : Indicate the intensity of energy used per meter square of a building
- BEI is a benchmarking tool in monitoring building energy performance

BEI LABELLING BENEFITS

- To ascertain energy performance of Government buildings
- To accelerate efforts in making Government buildings energy efficient through Government Lead By Example
- To provide and disseminate information to occupants on the building's energy consumption performance in comparison to energy efficient building
- To create healthy competition among building owners in improving energy-use
- To help Government achieve national commitment to reduce GHG emissions intensity of GDP by 45% by 2030

LABEL CONCEPT

Star range:
1 Star : Highly inefficient
5 Star : Most efficient



Building Category & Name:
Office/ Hospital / University / School

Unit for Building Energy Performance:
kWh/m^2/year

STAR	BEI RANGE
5-Star	BEI $<$ 100
4-Star	100 $<$ BEI $\leq$ 130
3-Star	130 $<$ BEI $\leq$ 160
2-Star	160 $<$ BEI $\leq$ 250
1-Star	BEI $>$ 250

**BEI range for Government office building*

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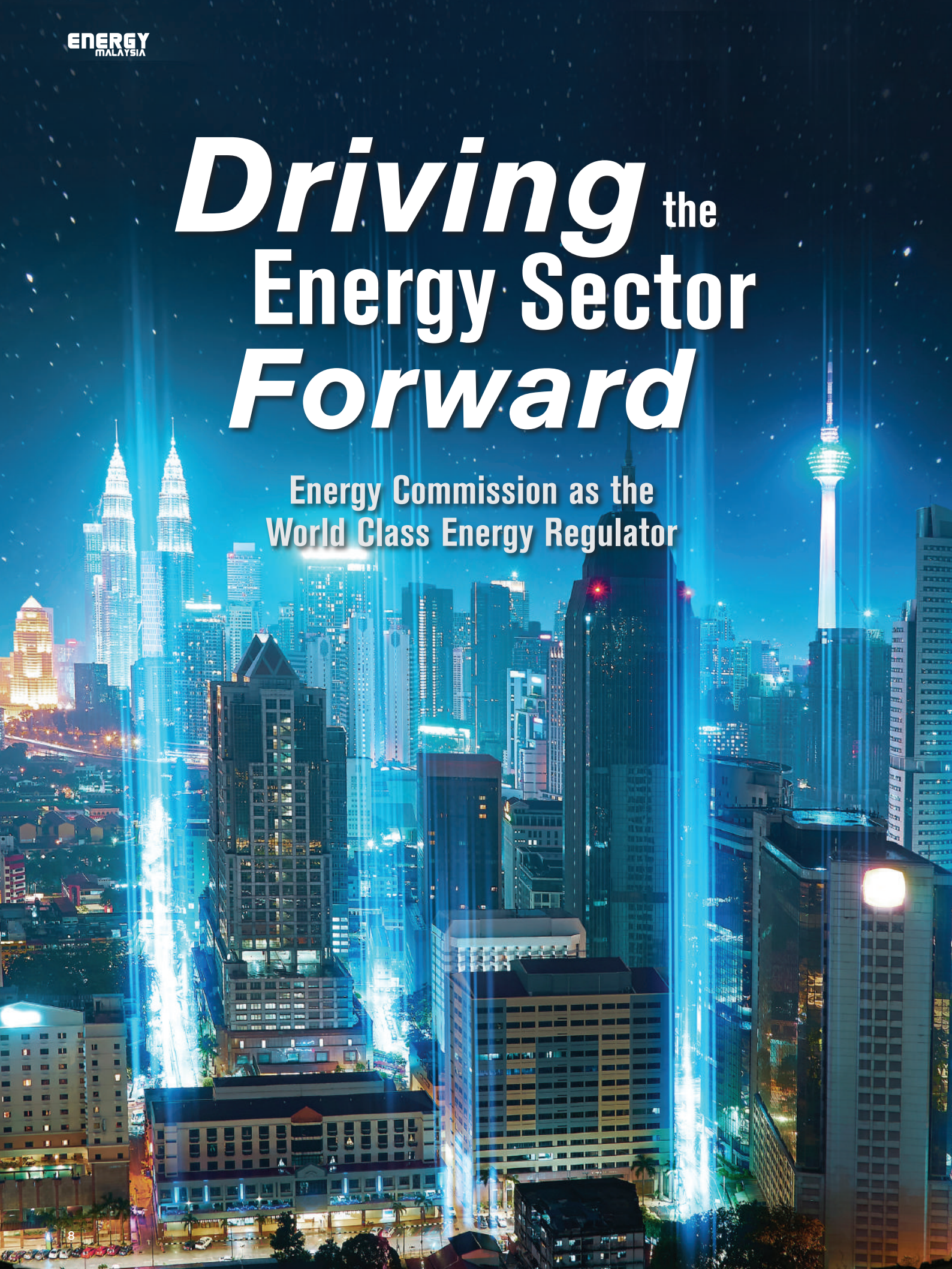
Driving the Energy Sector Forward

Energy Commission as the World Class Energy Regulator



In a global shift towards a competitive and sustainable energy market, Malaysia is on track to follow suit. To be on par with world-class regulators in the industry, the Energy Commission has aligned with the policies put forth by the Government to effectively perform its role as the key regulator for the nation's energy industry.

With the changing landscape of energy supply and demand, the Energy Commission's role as regulator becomes even more important to ensure that both the interests of the industry and consumers are met. To allow more efficiency, the Commission's organisational structure recently underwent a remodelling, from sector-based to functional-based. This essentially means both the electricity and gas sectors' regulation has been integrated under the Commission.

For a smooth transition, the Commission has been quick to respond with a task force equipped to not only weather the current changes, but to plan for future advancements in the industry. The integration of sectors for the purpose of regulation brings better functionality and cohesiveness. Under this new organisation structure, the Commission's key roles of economic, technical and safety regulation has been consolidated in the two sectors.

In terms of economic regulation, the Commission promotes economic growth in the generation, transmission, distribution, supply and use of electricity and in the reticulation and use of gas. This also covers the promotion of competition, and the regulation of fair use and efficient market conduct, whereby the Commission prevents the misuse of monopolised market power in both the electricity and piped gas sectors.

With technical regulation, the Commission ensures the security, reliability, efficiency and quality of supply and services in both electricity and piped gas supply. Finally, safety regulation involves the protection of the industry, consumers and public against any safety issues that may arise from the generation, transmission, distribution, supply and use of electricity and the distribution, supply and use of piped gas.

To perform these regulatory roles effectively, the Commission's strategic vision aims to strengthen its position as a highly effective energy regulator. To reiterate this stance, the Commission leverages on four key strategies: reliable and quality service of electricity and piped gas industry; safety in supply and utilisation of electricity and piped gas; energy security and sustainability; and finally, economic efficiency and affordability in electricity and piped gas industry.

These core strategic visions are essentially aligned with the macro and micro policies laid out by the Ministry of Energy, Science, Technology, Environment and Climate Change (MESTECC). In this regard, the Commission's role is to advise both the Ministry of Economic Affairs (MEA) and MESTECC on regulatory activities within the governmental framework.

Economic Regulation – Market Competitiveness & Fair Use

To introduce more competitiveness to the energy industry, both the gas and electricity sectors have actively explored ways to liberalise the market and introduce more players into the industry.

As the biggest gas off-takers are from the power sector, policymakers have broken up this monopoly by implementing Third Party Access (TPA).

The MEA's Director of Energy Dr. Mohd Shaharin Umar explained, "With the introduction of the Gas Supply Act Amendment 2016, TPA came into effect on 16 January 2017. The Act introduces competition among industry players, ultimately leading to efficient pricing for consumers as well."

With this comes a need to stipulate and regulate TPA's introduction into the market. The Energy Commission is has introduced a pilot regulatory period from early this year until the year-end to determine the tariff for the use of transmission and distribution lines.

Presently, 90 percent of the gas tariff is determined by gas price. However, this will change to Incentive-Based Regulation (IBR) upon the introduction ofthe tariff facility this year. Full implementation of IBR takes place in 2020.

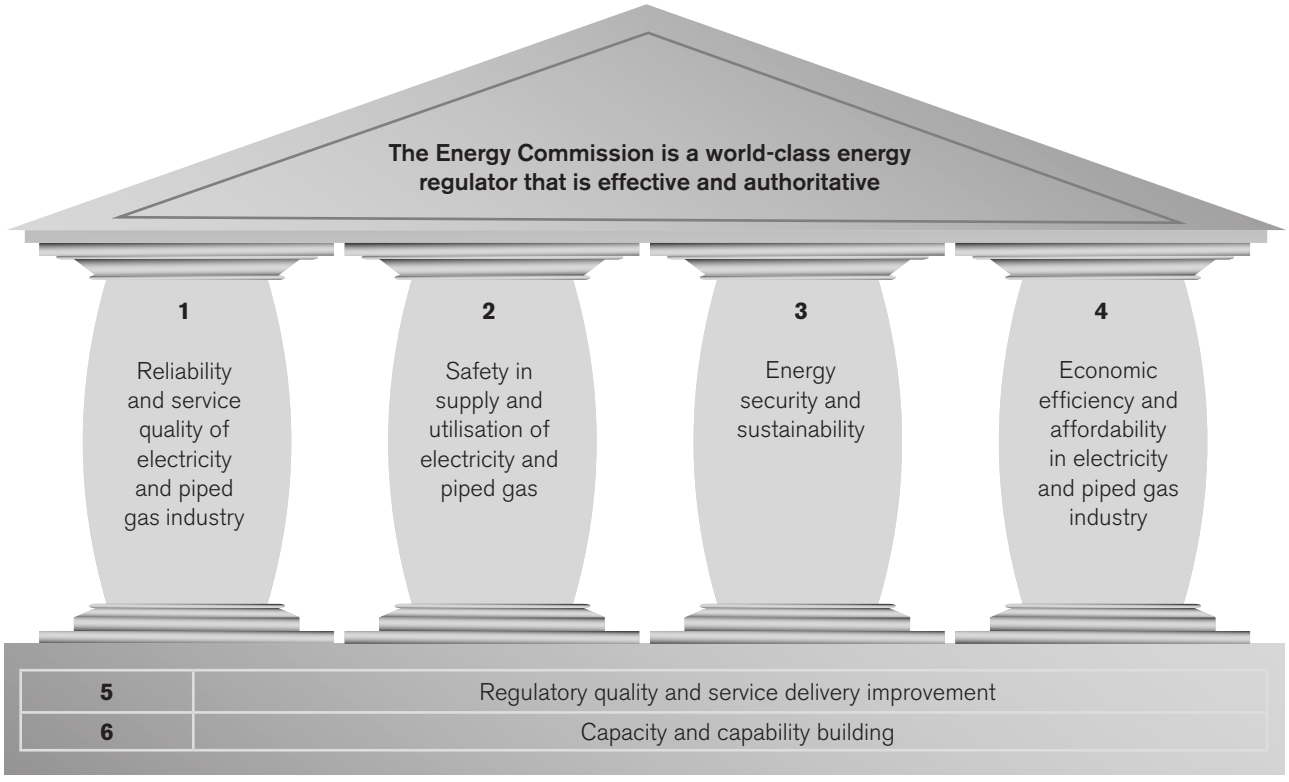
Although the TPA is already in effect, it will take some time to see the impact. "As seen in developed countries, they took 10 years or more to see the full impact of TPA. In line with this, currently there is no need to introduce new policies until we can fully determine its pros and cons," said Dr. Mohd. Shaharin.

Under the current Gas Cost Pass Through (GCPT) mechanism, the base tariff for the domestic sale of natural gas in Malaysia is to be gradually increased by RM1.50/mmBtu every six months, excluding surcharge — until end-2019, to match the market prices.

"Malaysia is still in negotiations with regards to Laos-Thailand-Malaysia-Singapore Power Integration Project (LTMS-PIP). Previously, Malaysia had settled on 100 megawatts of hydropower, but now the Energy Commission may look at increasing it further in the future phase."

– Ir. Azhar Omar,
CEO, Energy Commission

The Commission's Strategic Vision and Goals



The Government needs to ensure that vulnerable groups are protected and do not suffer any negative impact especially with regards to gas pricing. "When discussing subsidies and increasing gas prices, the Government will focus on the vulnerable groups especially the 'Bottom 40' group. The MEA will work with the Energy Commission to assist these groups," said Dr. Mohd Shaharin.

As for competitiveness in the electricity sector, the Energy Commission's CEO Ir. Azhar Omar explained, "Looking at how to manage and review Power Purchase Agreements (PPAs)

and Independent Power Producer (IPP) contracts will be a key factor in introducing competition into the sector."

This revisiting of current agreements will better ensure that future projects will be conducted through open tenders, and will do away with awarding projects through direct negotiations. By doing so, the energy supply will be stable while also ensuring that the government will not overspend beyond what is required.

Technical Regulation - Security, Reliability, Efficiency & Quality

"Our main concern is always to protect the best interests of the consumers in terms of availability and affordability of electricity and gas. Part of this is regulating market prices especially with the introduction of new policies," said Ir. Azhar with regards to the Commission's role.

With the TPA coming into play, the protocol in terms of governing factors has to be clearly defined. The Commission maintains the security of supply in the system, and ensures that all third parties introduced to the supply system are abiding by the rules for interconnection.

To protect and regulate the interests of both the industry and consumers, Dr. Mohd Shaharin said, "This liberalisation will ensure the sustainability of the industry, by welcoming more players who can offer better services, pricing and job opportunities."

In a bid to accelerate the Commission's vision to improve stability and reliability of electricity, MyPOWER works alongside the Commission by driving the Malaysia Energy Supply Industry (MESI)'s 2.0 initiatives.

MyPOWER is the Malaysia Programme for Power Electricity Reform, which is a special task force that aims to accomplish three agendas: customer empowerment, industry efficiency, and future-proofing the industry structure and regulations.

"MyPOWER assesses various options under each reform program and recommend the most probable or acceptable outcome for each initiative. The Energy Commission is continuously engaged on these action plans to ensure applicability in accordance with the regulatory framework.
The Energy Commission also assesses if amendments or enhancements are necessary to accommodate the new initiative, to facilitate ease of implementation as well as 'fair play' for the various stakeholders," said MyPOWER Corporation CEO Dato' Abdul Razak Majid.

In terms of efficiency, MyPOWER explores green initiatives such as solar photovoltaic, biomass, biofuel, coal generation, storage systems and smart meters. "The sector aims to empower the consumers with the way they use energy by exploring new and more efficient ways to use energy," said Dato' Abdul Razak.

Safety Regulation - Industry & Consumer Protection

With the merging of sectors under the organisational structure of the Commission, safety regulation becomes paramount. While regulations will be drawn out for each sector, this means regular compliance from industry players to ensure public safety.

"MyPOWER assesses various options under each reform program and recommend the most probable or acceptable outcome for each initiative. The Energy Commission is continuously engaged on these action plans to ensure applicability in accordance with the regulatory framework."

– Dato' Abdul Razak Majid,
CEO, MyPOWER Corporation

"With the introduction of the Gas Supply Act (Amendment) 2016, TPA came into effect on January 2017. It is new to the industry and will introduce more competition among industry players, ultimately leading to better pricing for consumers as well."

– Dr. Mohd Shaharin Umar,
Director of Energy, Ministry of Economic Affairs (MEA)

The Energy Commission has to look into the design, installation, inspection, testing, operation and maintenance of electrical energy, as well as gas certifications and codes of practice for the installation of gas-based systems and appliances. Moreover, with the introduction of more players in the market, revision of PPAs and IPPs, and the introduction of TPA, there needs to be regulation of compliance by owners, operators and all license holders to allow smooth sailing on a daily basis.

For a thorough regulatory process, the Commission develops codes of practice and guidelines to set safety standards for the evolving electricity and gas sector. It also liaises and collaborates with industry experts to implement newer and better practices to deter any electricity hazards through risk evaluation and control.

In terms of electrical safety, the Commission upholds regulation through non-domestic electrical installation safety codes and regulations, as well as the electrical safety management plan and programme. As for piped gas safety, there are established guidelines for gas certificate approvals, as well as the guide on piped gas safety management plan and programme.

Moulding the Future

In the journey towards sustainability, the energy sector needs to transform its approach to include and explore the potential of RE sources. Even though the Government has set 20 percent for RE in the energy mix, this is something that needs to be planned. As of right now, it is not viable for Malaysia to abandon conventional fuels in the near future as the nation is still relatively dependent on fuels such as coal and gas.

This presents a challenge to keep costs down as currently the energy needs are dominated by fossil fuels and the prices are increasing. The next challenge is how to provide affordable pricing to consumers, while also exploring RE sources.

Possible green energy sources on Malaysia's radar include solar and biomass, but this also means the need for an effective storage system. While cleaner energy supply is important in the long run, measures have also been taken from the demand side to cut down on usage and unnecessary waste. Where there is a willingness to be less dependent on these sources, the demand will also drop and shift towards clean energy.

In the realm of stabilising power supply, Ir. Azhar said, "Malaysia is still in negotiations with regards to Laos-Thailand-Malaysia-Singapore Power Integration Project (LTMS-PIP). Previously, Malaysia had settled on 100 megawatts of hydropower, but now the Energy Commission may look at increasing it further in the future phase."

Given the many wheels in motion already with regards to the local energy landscape, it is pivotal that Energy Commission work in unison with MESTECC, MEA, MyPOWER Corporation and other relevant authorities to shape its approach as a world-class regulator. This presents a unified front for the transformation of both the gas and electricity sectors, to steer the nation in the right direction. EM

A PROJECTION OF MALAYSIA'S ENERGY LANDSCAPE

The oil and gas industry is an important contributor to Malaysia's energy sector and the economy as a whole, as it contributed approximately 20 percent to the country's GDP in recent years. However, we also need to recognise the impact the industry has on the environment, such as marine pollution and gas emissions due to upstream and downstream activities. As a signatory to the 2015 Paris Agreement, Malaysia has committed to reducing its greenhouse gas (GHG) emissions intensity to Gross Domestic Product (GDP) by 45 percent by 2030 relative to GHG emissions intensity in 2005. In order to achieve the balance between our environmental, economic and energy needs, PETRONAS, the Oil, Gas, Energy & Environment (OGEE) sector, Economic Planning Unit (EPU) and several other ministries and Government agencies, industry players and academia, among others, published a White Paper – "Malaysia's Future Energy Landscape", while Sustainable Energy Development Authority (SEDA) is developing the Renewable Energy Transition Roadmap (RETR 2035). ***Energy Malaysia*** showcases some highlights from the initiatives.

Focus on Renewables

Fossil fuels are extracted daily to cater to Malaysia's growing energy requirements, and while they are economic necessities, they also no doubt contributes to an increase of GHG emissions. As such, the employment of sustainable strategies to encourage the generation of power through renewable sources is imperative. So too are energy storage solutions such as carbon capture, utilisation and storage (CCUS) and Carbon Capture and Storage. These are some of the proposed methods aimed at reducing GHG emissions in the environment.

Another important development is the advance of electric mobility. This will play an instrumental role in replacing oil as a fuel, while greater accountability in energy use in both power and non-power sectors will improve Malaysia's energy intensity from 0.24 tonnes to 0.009 tonnes per thousand dollars.

In addition, a more liberalised market has been suggested to increase competition in generation and retail, offering freedom of choice at the true cost of energy. Underpinned by modified decentralised power and smart grid technologies, this will lead to community generation and inspire consumers.

Curbing the Carbon Footprint

A carbon-savvy community that understands the effects of its footprint on the environment is one of the core visions under this objective.

It was suggested that educating citizens on the true cost of environmental degradation will propel Malaysia to its goal of ranking in the Top 20 of the Sustainable Development Goals index (SDG Goal 9 -industry innovation and infrastructure). Sustained at top quartile, this highlights a commitment to intensifying innovation and

While Malaysia aims for greater sustainability in the energy sector, oil and gas will still be a major contributor to its GDP.

Source: AFP

"It is paramount that we intensify collaboration between academia, research institutes and industry, to inspire and innovate the technologies and services that will reduce our carbon footprint and increase our carbon handprint."

– Dato' Nik Azman Nik Abdul Majid
Director, Economic Planning Unit

supporting infrastructure while collectively advancing its sustainability.

Oil and Gas Initiative

An 8 to10 percent contribution to the national GDP has been projected, targeting an increase in the downstream sector with a share amounting to around 70 percent and the upstream contributing to around 30 percent. This will simultaneously be supported by the active research and technology development in an effort to monetise challenging upstream chemical industry.

Lastly, the focus of this Oil and Gas initiative will be the plans for a world-class (energy) innovation system based on a culture of collaboration and research excellence.

This desired end-state will be driven by an influential global presence, innovative solutions for the industry, as well as sustainable production. This will require the support of a responsible society in conjunction with the existence of active policy and governance.

8 KEY INTERVENTIONS HAVE BEEN IDENTIFIED TO SUPPORT THIS 30-YEAR AMBITION

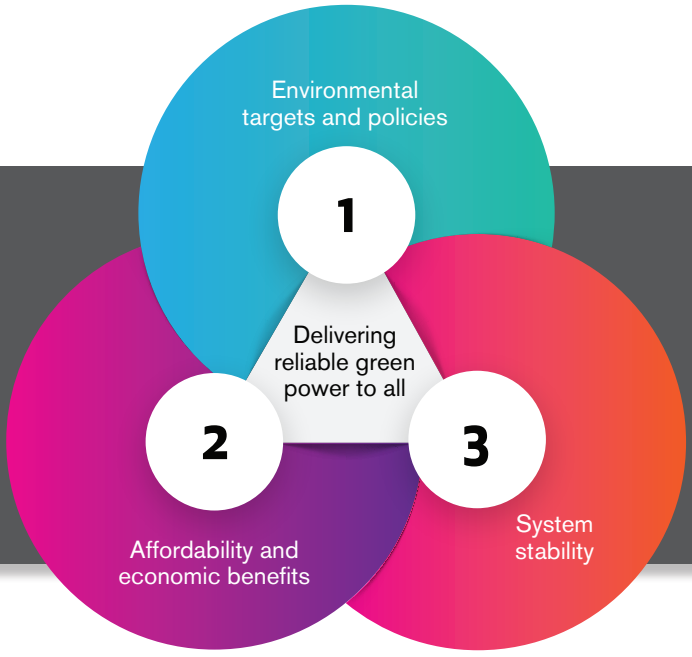
Source: Malaysia's Future Energy Landscape 2050 (White Paper)

In order to secure the future, we start with small steps, and as those steps turn into strides, it is not long before we can stand proud as an example to the world of the progress that Malaysia represents. EM

The Renewable Energy Transition Roadmap (RETR) 2035 will strike a balance between environmental targets, affordability/economic benefits and system stability

Development of renewables has been slow in Malaysia, and calls for the need of a roadmap of future electricity system to spur renewables penetration. RETR 2035, currently being developed by SEDA in collaboration with industry stakeholders, determines strategies, comprehensive action plans and resources required to transit to the future electricity system and achieve RE targets. The outcome of the roadmap is to be part of the 12th Malaysia Plan (2021-2025).

Key boundary conditions of the RETR 2035



1

Environmental targets and policies

Roadmap to be aligned to and support key policies and targets in Malaysia

- Reduction of greenhouse gases (GHG) and other pollutants emissions
- Increase of **RE** in the national power mix to **20% of installed capacity (excluding large hydro[1]) by 2025**

[1] ***Large hydro: Hydro capacity above 100MW***

2

Affordability and economic benefits

Roadmap to define the pathway to achieve RE transition while maintaining energy affordability for all in a sustainable manner

- **Definition of affordability** to be determined with inputs from key stakeholders and comparable benchmarks

Roadmap to define ways to maximise the positive impact of RE transition on the local economy

3

System stability

Roadmap to determine the best options to ensure overall stability and reliability of power supply to end users

- High-level **assessment of system stability** based on comparable benchmarks

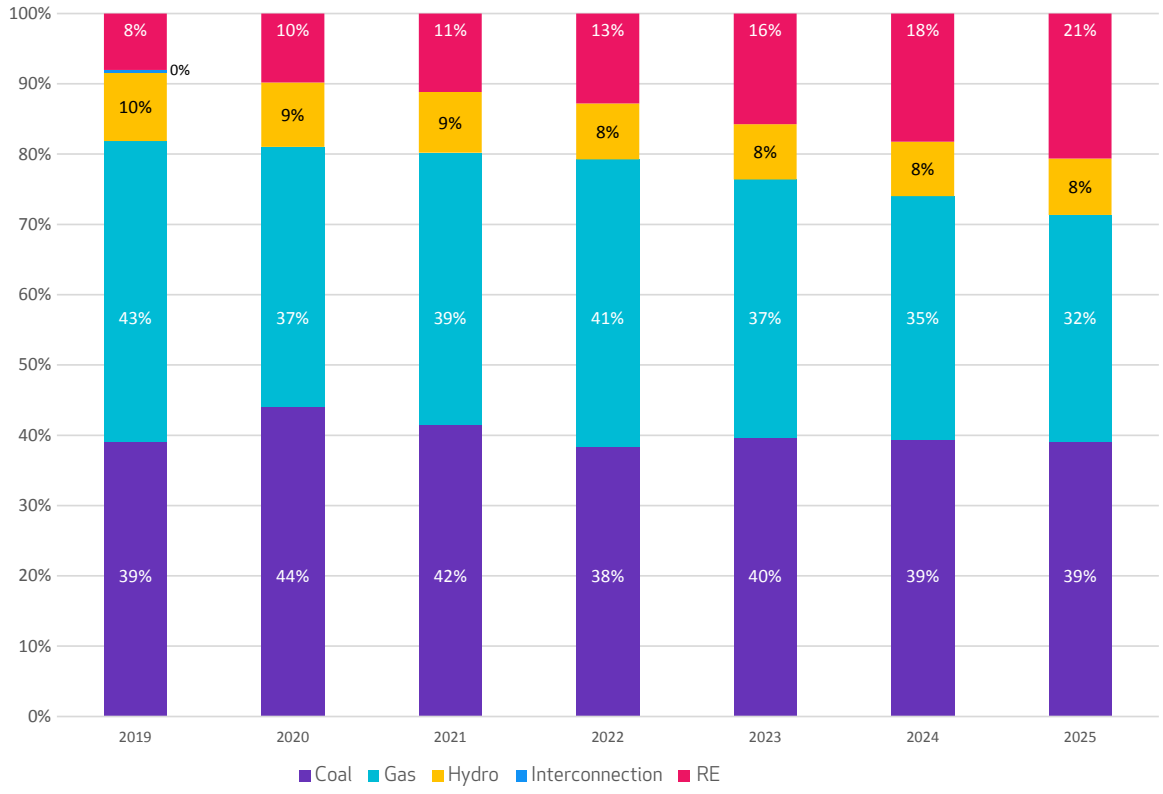
Source: SEDA

Sustainably Powering a Nation

Unearthing the Wealth of Renewable Energy

Malaysia harbours a wealth of resources capable of generating renewable energy (RE). Currently, the country taps into about 2 percent, which the Government targets to increase to 20 percent by the year 2025. The key objective is to transform our current energy mix into one that comprises more RE sources, not only for the continuity of supply but for the pressing environmental concerns that come with a dependency on fossil fuels.

Renewable Energy Projection in the Capacity Mix in 2025 (inclusive of Off-Grid RE)



Source: Energy Commission

The Energy Commission bases its regulation on Government policies, targets and initiatives. It aids and advises the Ministry of Energy, Science, Technology, Environment and Climate Change (MESTECC) to devise initiatives that cut down on reliance on conventional fuels and which increases the share of RE in the generation mix.

MESTECC Secretary-General Datuk Seri Dr. Mohd Azhar Yahaya said, "The Energy Commission has based its new initiatives for the coming years on MESTECC's key directives. MESTECC has intricately mapped out seven major initiatives targeted towards RE. To lead the way forward as an effort to use the energy efficiently, Energy Performance Contracting (EPC) will be adopted by 50 Government buildings, followed by the private sector."

Under the energy-focused initiatives, the Government buildings have also adopted a pilot project for rooftop solar panels. These solar panels have already been installed at the Prime Minister's Office (PMO) and Ministry of Energy, Green Technology and Water (KeTTHA).

Current and Proposed Energy Mix

To truly understand the need for Malaysia to explore RE more, the current standing of the energy mix needs to be evaluated. The nation is still relatively dependent on finite sources of energy such as fossil fuels. Currently, Malaysia's gas component makes up about 35 percent of the total energy mix in 2018 with coal holding steady at 57 percent in the coming years. The remaining percentage is currently contributed by a relatively smaller share of RE sources, which needs to be increased in the coming years.

While certain conventional fuels such as coal and gas will be retained in the future energy mix, the task at hand is to see a much larger contribution from RE sources. The main ones that show potential are solar, hydro, biomass, biogas, and geothermal.

Solar Power

Showing the greatest potential for Malaysia is solar power - with Large Scale Solar (LSS) programs and Net Energy Metering (NEM) furthering the reach of solar power generation.

LSS aims to expedite power generation from photovoltaic plants and solar farms, while NEM will allow consumers to generate and consume energy. Any excess energy generated from this can then be exported for distribution.

To increase electricity generation from RE, the Commission opened up the third cycle of the LSS scheme in February 2019. So far, the Government has implemented two LSS project cycles with an installed capacity of 958 megawatts. "To encourage more participation from the industry for LSS, incentives must be introduced," said Datuk Seri Mohd Azhar.

As solar power shows huge potential for Malaysia, "The NEM program is under regulation by the Energy Commission and focus primarily on solar photovoltaic and technology," said Energy Commission Chief Operating Officer Abdul Razib Dawood.

Since the start of the year, NEM has been improved through the adoption of the true NEM concept which allows excess solar PV generated energy to be exported back to the grid on a "one-on-one" offset basis.

The limitation with solar as of now is the intermittency drawback, and in planning for future targets, a study was commissioned to address supply security. To resolve this, an efficient storage system with storage batteries needs to be explored. However, for the time being, the commissioned RE penetration studies revealed that our current system can accept solar PV. In terms of the target percentage for 2025, the system is capable of delivering.

Although it is recognised that to move forward there is a need to explore storage capabilities, and the sooner it is explored – the better. When the solar energy quota is increased further in the future, effective storage systems will be necessary to have better penetration and mitigate intermittency issues.

In line with this, "The Government is conducting pilot projects with energy storage systems (ESS) to study how effective the storage is in mitigating the intermittency issue. And with the energy trend shifting towards decentralisation, these issues will need to be tackled at the earliest for a seamless transition. MyPOWER Corporation will take the initiative to draw up a plan of action for decentralisation upon further research. MESTECC will then implement it accordingly," said Datuk Seri Mohd Azhar.

Hydropower

As Malaysia is mainly looking at small hydro technology, it does come with its limitations. The drawback is that the hydro potential is located far off from where the demand is concentrated. To enhance the supply according to demand, funds need to be spent towards connecting the mini hydro to the grid system.

"The Energy Commission has based its new initiatives for the coming years on MESTECC's key directives. MESTECC has intricately mapped out 7 major initiatives targeted towards RE. To lead the way forward as an effort to use the energy efficiently, Energy Performance Contracting (EPC) will be adopted by 50 Government buildings, followed by the private sector."

– Datuk Seri Dr. Mohd Azhar Yahaya,
Secretary-General, MESTECC

"To realise 20 percent of RE by 2025 is a lofty task as currently, Malaysia stands at only 2 percent. This constitutes an 18 percent jump, which amounts to roughly 4000 megawatts. The Energy Commission will work with the Government to initiate projects specific to reaching this target."

– Abdul Razib Dawood,
Chief Operating Officer, Energy Commission

Biomass and Biogas

Similar to hydropower plant limitations, the potential of biomass and biogas is promising, but there will be costs incurred in its supply as the plantations are remotely located, away from most of the population.

With particular reference to biomass, Empty Fruit Bunches (EFB), which is essentially waste produced by oil palm plantations, offer increased supply and great value. Other countries mix EFB with fossil fuels in power plants, thus making conventional fuel plants greener.

Turning Waste into Energy

The saying 'One man's trash is another man's treasure' is perfectly manifested in the waste-to-energy (WTE) program. The initiative involves the concept of burning waste that is later converted into steam to power the turbines. This is a viable alternative to landfills, which can have negative implications on the environment.

"Currently, the public has to pay tipping fees for the council to collect the rubbish and it is still relatively affordable. With tipping fees, WTE costs can be subsidised and a portion of the fees can be used to build the plants," explained Abdul Razib.

Projected Targets

In line with the criteria set by the Planning and Implementation Committee for Electricity Supply and Tariff (JPPPET), anything more than 100 megawatts for hydro will not be counted towards RE. Hydropower plants have many sizes varying from 1 to 300 megawatts. The big hydro projects of 300 megawatts and above are not counted towards the RE share but for hydro specifically.

With this in mind, "To realise 20 percent of RE by 2025 is a lofty task as currently it stands at only 2 percent. This constitutes an 18 percent jump, which amounts to roughly 4,000 megawatts. The Energy Commission will be working with JPPPET to initiate projects specific to reaching this target," said Abdul Razib.

To commit to the adoption of RE on a global scale, Malaysia has aligned its targets with the United Nations Framework Convention on Climate Change (UNFCCC) 21st Conference of Parties (COP21). This aims at cutting down emission intensity by 35 percent to 45 percent based on 2005 GDP, by the year 2030.

Moving forward, it is pivotal that the Energy Commission in conjunction with MESTECC not only increases RE generation, but also delivers on the key national objectives - security of supply, affordability and sustainability. Collaboratively, Malaysia can accelerate its progress and reach its full potential as a sustainable economy. EM

GOVERNANCE AND STANDARDS

In the journey to becoming a world-class regulator, the road is paved with stepping stones towards delivering that harmonious balance between industry and public interests. The Energy Commission strikes that balance through the careful integration of best practices as a part of a broader initiative to improve on its performance as the energy regulator in Malaysia. With reference to the Organisation for Economic Co-operation and Development's 'Best Practices for Regulatory Policy: The Governance of Regulators', this is an insight on what happens behind the scenes.

A high-quality regulatory body is an integral part towards the growth of a nation's innovation and productivity. With recent advancements in industry and manufacturing, there is now a more careful examination of regulatory design options.

Most Governments improve their existing regulatory practices by assessing the effects of existing and proposed regulations. Good regulatory standards require more than well-established rules and regulations as recognised in the OECD's Recommendation of the council on regulatory policy and Governance (OECD,2012). This states that regulatory bodies should develop a consistent policy across all regulatory agencies in order to provide greater confidence that regulatory decisions are made on an objective, impartial and consistent basis, without conflict of interest, bias or improper influence.

The governance to which regulators are subject to is important to the effective execution of their roles. As such the powers they're given, their funding and how they're held accountable are all key issues to be scrutinised in order to maintain and reinforce the strict standards required.

Administrational Outlook

Regulatory governance falls under two broad components-external governance and internal governance. The two aspects meet to provide a more comprehensive blanket of operations effectively.

Internal governance delves into a regulator's organisational structure, roles and responsibilities, compliance and accountability measures, financial reporting and performance management. While external governance examines the decision making power between the Government, and the regulatory body.

Among the majority of regulatory agencies, supranational entities usually set a common regulatory framework for a number of countries within a region. This provides a platform onto which the governmental policy is set, with the power to appoint or advise on leadership dependent governance arrangements.

Other branches of the Government that work closely with the regulators include the legislature and the judiciary. The legislature's primary directive is to execute and modify the legislature to cater to performance improvements across regulatory systems in relation to national agencies or bodies, in addition to maintaining oversight over regulatory bodies.

OECD's Guide on Necessary Elements of Better Regulatory Outcomes

- Appropriate institutional frameworks and related governance arrangements
- Well-designed rules and regulations that are efficient and effective
- High-quality and empowered institutional capacity and resources, especially in leadership
- Effective, consistent and fair operational processes and practices

Best Practice Principles: the Governance of Regulators

The judiciary's role is equally vital to the process in maintaining accountability and trust in the regulator, with the power to sanction or dismiss the leadership of the regulator.

The regulator maintains standard practices by maintaining oversight over regulatory arrangements, identifying violations and providing advice on adherence to government policy. Productive governance structures encourages the regulator to streamline the process for communities honestly and fairly while appropriate governance maintains the integrity of the process.

This report also highlights the effects of good governance in regulatory bodies. Below are some of the qualities characterised by highly effective regulators.

Role and Functional Clarity

An effective regulator must have clear objectives, with definitive functions and mechanisms to coordinate with other relevant bodies so as to achieve the desired outcomes.

Accountability and Transparency

Businesses and citizens expect the delivery of regulatory outcomes from government and regulatory agencies and the proper use of public authority and resources to achieve them. In view of this, the expectations of each regulator should be clearly outlined, and should be published within the corporate plan.

Governments and/or the legislator should monitor and periodically review the effectiveness of the system.

Effective Decision Making

Regulators require governance that ensures their functioning preserves regulatory integrity and delivers the objectives of its mandate. The governing structure of a regulator should be determined by the nature of and reason for the regulated activities, including its level of risk, degree of discretion, level of strategic oversight required and the importance of consistency.

Purposeful Engagement

Regulators should undertake regular and purposeful engagement with regulated entities and stakeholders focused on improving operations and outcomes of regulatory frameworks or schemes. All procedures should be institutionalised as consistent, transparent practices and should protect against potential conflict of interest.

Performance Evaluation

It is important that regulators are aware of the impacts of their regulatory actions and decisions. This helps drive improvements and enhance systems and processes internally. It also demonstrates the effectiveness of the regulator to whom it is accountable and helps to build confidence in the regulatory system. Regulators themselves should determine which decisions, actions and interventions will be evaluated in the performance assessment. The main purpose of the performance evaluation should be to maintain and drive improvements in the performance of the regulator and its staff.

Impartial Funding

In order to cultivate a high degree of integrity, funding should not influence regulatory decisions and the regulator should be impartial and efficient to achieve its objectives. Allocation of funding should be adequate for regulators to operate efficiently and to effectively fulfil the objectives set by the Government and other relevant legislations.

Preventing Undue Influence

It is important that regulatory decisions and functions are conducted with the utmost integrity to ensure that there is confidence in the regulatory regime. This is even more pivotal to ensure the rule of law, encourage investment and create an enabling environment for growth that is built on trust.

By staying true to these core values, the Energy Commission maintains a high-quality regulatory environment that is essential to fostering long-term national productivity and growth. In due course, Malaysia's standing can be on par with its peers globally. EM

SEVEN QUALITIES OF HIGHLY EFFECTIVE REGULATORS

1

CLEAR

Clarity of vision helps the effective and swift achievement of objectives. Being focused and driven, the regulator is able to better balance industry and public interests.

AGILE

The economy is fast-paced, and good regulators need to evolve with the changing industrial landscape through improvisation and adaptability.

2

3

TRUSTWORTHY

Be a transparent, honest and reliable regulator, and the public will instil their faith in your capabilities to deliver on promises.

CURIOUS

Welcome the thirst for knowledge and insights. A regulator needs to be open to different avenues so as to know what solutions work best moving forward.

4

5

HUMBLE

Humility is an integral part of being a high-class regulator, as there is always room to grow when striving to be world class.

UNBIASED

To be truly just and effective, every good regulator needs to be neutral and make decisions for the greater good of the nation.

6

7

PROACTIVE

Foresight is part and parcel of effective regulating. It allows the key players and stakeholders to seamlessly adapt to the future of the industry.

Source: International Association of Medical Regulatory Authorities

THE 8TH NATIONAL ENERGY FORUM

Towards a Carbon-Neutral Malaysia

Held on 27 November, the 8th National Energy Forum (NEF), themed "Carbon Neutral Future – A Country in Transition", was jointly organised by the Energy Commission of Malaysia, the Malaysian Gas Association (MGA), and the Energy Council of Malaysia. The event paid particular focus to the challenge of balancing the need for a secure and reliable supply of energy to maintain economic growth while also taking into account the effects of climate change.

YB Yeo Bee Yin, the Minister of Energy, Science, Technology, Environment and Climate Change, during her keynote address.

In his welcoming address, the Chairman of the Energy Commission Datuk Ir. Ahmad Fauzi Hasan said that the energy sector has rarely faced such rapid changes, and urged attendees to take stock of the implications they will have on the country. Emphasising the importance of keeping climate change in mind, he also highlighted the nation's ambition to be carbon neutral by 2050.

Expressing optimism over this aim, Datuk Ir. Ahmad Fauzi pointed out that the years 2014 to 2016 showed a flat-lining of global carbon emissions, as a result of increased generation of renewable energy. With that being said, the Commission Chairman also pointed out that there was a 1.4 percent increase in carbon emissions in 2017; a trend that is set to continue throughout 2018.

Creating a Pathway

In line with the theme of the 8th NEF, the speakers and panellists at the event spoke on how to chart a pathway towards carbon neutrality.

Hazli Sham Kassim, President of the Malaysian Gas Association highlighted the steady increase in Malaysia's energy consumption in his presentation, "Pathway towards a Carbon-Neutral Future for Malaysia". For example, in 1996, the total energy used was around 20,000 ktoe. 20 years later, in 2016, the figure had risen to more than 57,000 ktoe.

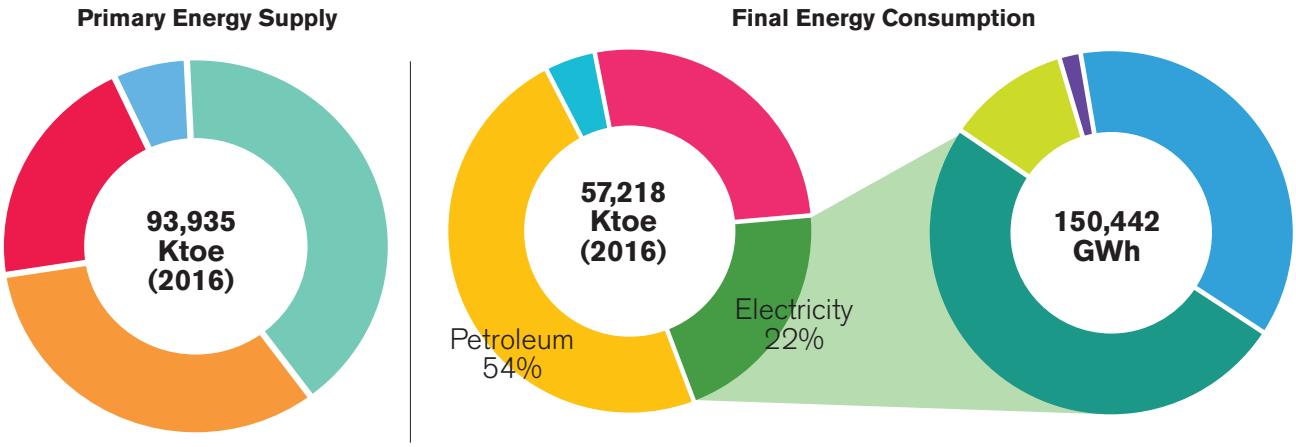
According to Hazli Sham, the ever increasing consumption of electricity by Malaysians reflects the growing affluence of the country. For example, as income levels have gone up, so too has the use of air conditioners. That, however, has led to the increase in carbon emissions as more gas and coal have to be burnt in order to meet electricity demand.

This is evidenced from the fact that carbon emissions have also gone up, from slightly over 3 tonnes per capita in 1990 to 8 tonnes per capita in 2014. As such, the MGA President believes that this will only help push the impetus for a swifter transition to using more carbon friendly solutions.

In order to achieve that, three challenges have to be addressed. The first is the "energy trilemma", which Hazli Sham identified as the need to find the right balance between energy security, environmental sustainability, and energy equity. The second is the need to address emerging megatrends such as rapid urbanisation, diminishing resources, new technologies and the rising need for energy. The third and final challenge is to smoothly manage the transition to carbon neutrality in a way that ensures continued economic growth.

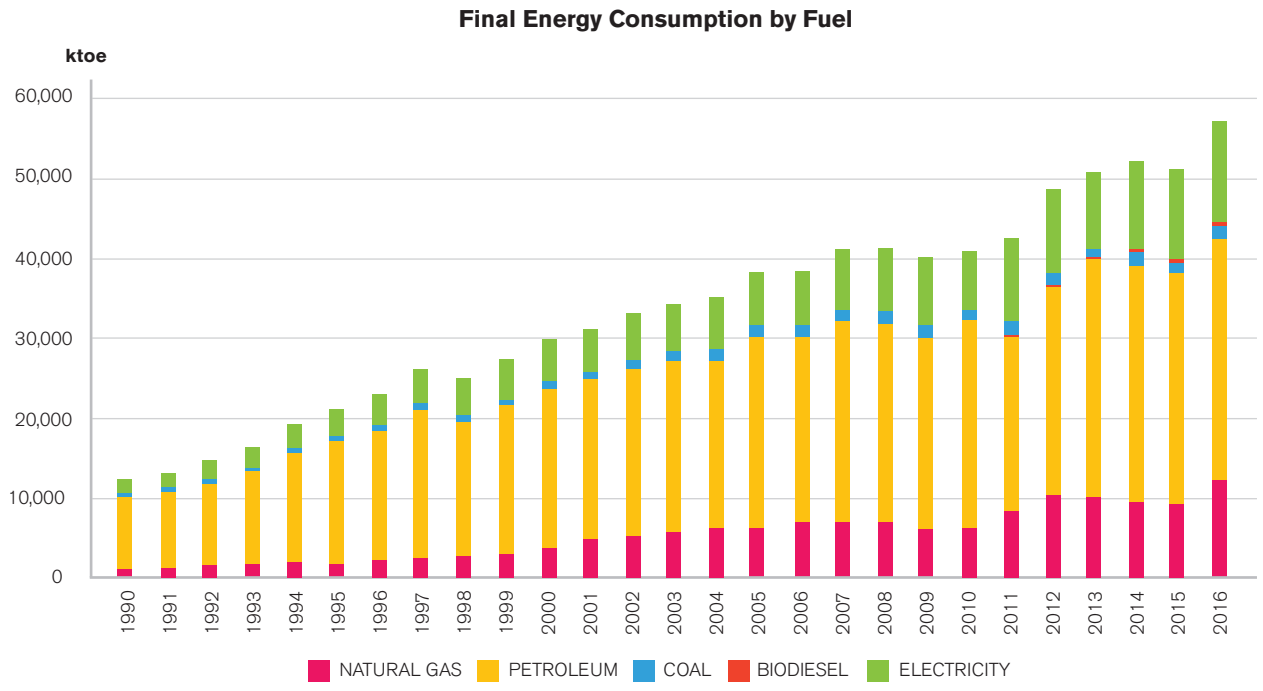
While addressing these challenges will not be a walk in the park, the MGA President stressed that it is possible for Malaysia to achieve carbon neutrality. He highlighted four steps that need to be taken to create a pathway towards this, namely increasing electrification, properly managing indigenous energy resources, encouraging demand for clean energy by industries, and finally creating and executing comprehensive, long-term energy policies.

By increasing electrification in industry and, particularly, in transport, the emission of pollutants can be reduced. One way to do this is to boost the availability of fast charging stations



In 2016, Malaysia produced 93,935 ktoe of energy and consumed 57,218 ktoe, or 60 percent of the supply.

Source: Energy Commission



Energy consumption in Malaysia has risen over the years, as higher standards of living have resulted in increased use of electricity.

Source: Malaysia Energy Statistics Handbook 2018

for electric vehicles. However, the generation of electricity using fossil fuels also adds to the carbon levels.

As such, Hazli Sham recommended that the generation mix be made greener by increasing the share of cleaner fuels such as renewables. Also, in order to address the intermittency problem faced by the generation of renewable energy, he encouraged the adoption of technologies such as flexible gas turbines and energy storage systems. The former can be used to generate electricity as and when needed, while the latter is used to store energy already produced for later use.

The next step to carbon neutrality is the sustainable and responsible management of indigenous resources. This can be achieved by increasing the use of renewable resources that are native to the country such as biomass and hydropower. At the same time, Hazli Sham stated that it is important to properly utilise our oil and gas resources, and maximise the value we receive from them by using them for higher value-added activity that will enhance the economy.

Hazli Sham also called for industries, especially energy intensive ones, to expand their use of clean energy, thereby driving the push towards a carbon-neutral Malaysia from the demand side. Examples of clean energy include solar, biomass and natural gas.

He also highlighted several long-term policies the government should adopt. These include creating a transparent, competitive and liberalised energy market, encouraging innovation in energy research and supporting collaborations between industry and academia, developing tax and financial incentives to encourage carbon-neutrality, raising SMEs' contribution to the GDP, and developing human capital to help realise the agenda.

Views from the Government

In her keynote address, YB Yeo Bee Yin, the Minister of Energy, Science, Technology, Environment and Climate Change, revealed that Malaysia needs to enact changes that will lead to a more immediate adoption of clean and efficient energy.

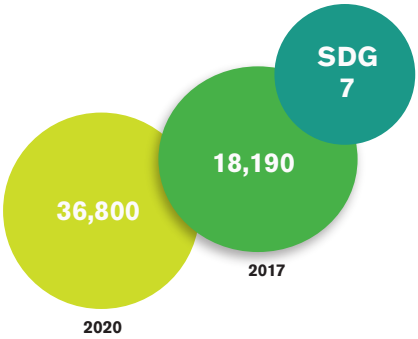
This, she noted, should not fall on the shoulders of the Government alone, and that a top-down approach will not work. Instead, she believes that investors in renewable energy will be more receptive to financial incentives. She expects this to attract much needed talents and more industry players to adopt renewable energy.

Dr Mohd Shaharin Umar, Director of Energy at the Ministry of Economic Affairs revealed, in his presentation, the three criteria taken into consideration for energy policy planning in Malaysia – namely, energy security, affordability and sustainability.

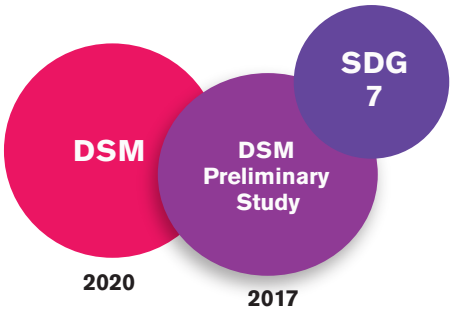
He highlighted the shift in energy policy, and how it has been trending towards becoming more environmentally friendly. This started in the year 2000, where there was a push for greater diversification in electricity sources. This has, he said, resulted in the country being better positioned to tackle issues relating to climate change and renewable energy.

Presently, the focus of energy policy, as set during the mid-term

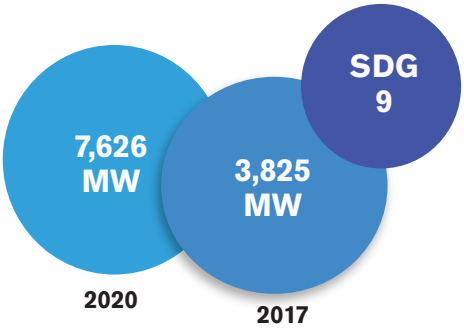
Achievements in Energy in the 11th Malaysia Plan



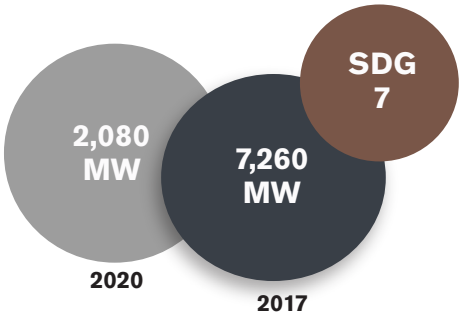
Additional Houses Supplied with Electricity



Completed Demand Side Management (DSM) Preliminary Study in 2017 as part of DSM Master Plan



New power generation installed capacity in Peninsular Malaysia



Renewable energy installed capacity as of 2017

Source: The World Bank

During the mid-term review of the 11th Malaysia Plan, it was revealed that a number of targets for the energy sector have made good progress. These targets have also been mapped in accordance with UNDP Sustainable Development Goals.

review of the 11th Malaysia Plan 2016 - 2020 (11MP) is to align its strategic thrusts with that of the UNDP's Sustainable Development Goals (SDGs). The SDGs identified as being most relevant to energy policy are SDG 7 – Affordable and Clean Energy, SDG 11 – Sustainable Cities and Communities, SDG 12 – Responsible Consumption and Production, and SDG 13 – Climate Action.

Dr Mohd Shaharin further expounded on the achievements reached at the halfway stage of the 11MP. For instance, 18,190 rural houses have been given access to electricity as of 2018 against a target of 36,800 by 2020. A preliminary study on demand side management (DSM) was also completed in 2017, with the final DSM Master Plan set to be finalised in 2020.

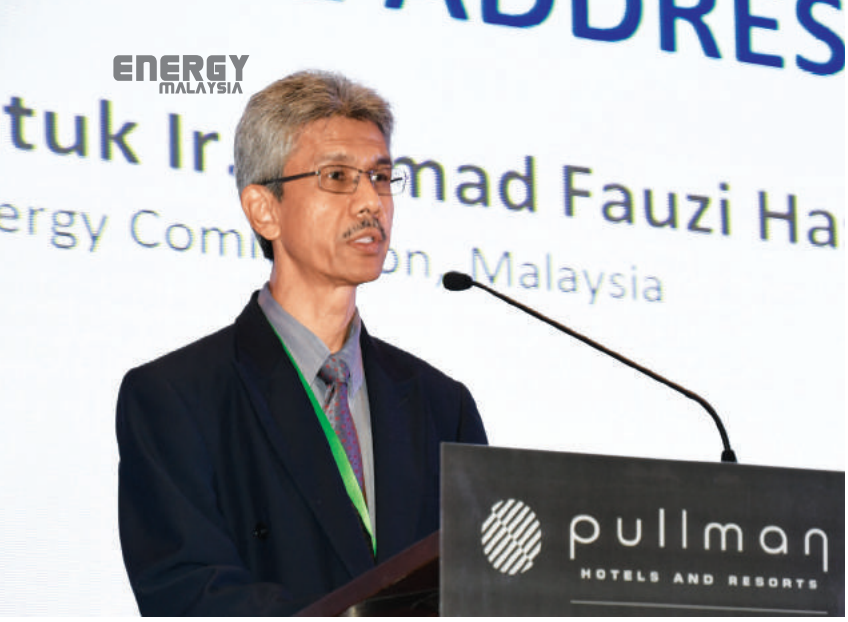
Also, there has been a 26.8 percent reduction in greenhouse gases emissions by 2018, against a final target of 40 percent by 2020. Most impressively, there was an additional 7,260 MW of renewable power installed capacity added by 2017, which far exceeds the 2,080 MW target under the 11MP.

Looking beyond 2020, Dr Mohd Shaharin expects a transition towards lower carbon energy sources and further reforms of the energy market. This includes further liberalisation of the generation and retail side in order to attract more efficient players.

Increasing Efficiency

In the discussion of ways to move Malaysia towards carbon neutrality, one of the topics touched was on energy efficiency, which has long been regarded as the sixth fuel – an addition to Malaysia's existing five fuels of coal, gas, oil, hydro and renewables.

For instance, by improving efficiency in generation, more energy can be derived from existing feedstock, thereby reducing the need to burn more fuel. To illustrate, when gas turbines were first introduced to the country, their efficiency rate was around 40 percent. Today, thanks to advances in technology, the efficiency rate of new gas turbines stand at over 60 percent.



Energy Commission Chairman Datuk Ir. Ahmad Fauzi Hasan giving his welcoming speech.

Hazli Sham Kassim, the President of the Malaysian Gas Association, giving his presentation on "Pathway towards a Carbon-Neutral Future for Malaysia".

Ali Salam, CEO of the Institute of Democracy and Economic Affairs (IDEAS), speaking during the plenary session on climate change. Looking on are – third from the left Andreas Pistauer – Executive VP and Country Division Lead, Power Generation Division of Siemens Malaysia, Yasmin Rasyid – President of EcoKnights, and Dr Helmy Haja Mydin - Co-Founder of Asthma Malaysia. The session was moderated by Tan Chung Han – Producer and Presenter at BFM Radio.

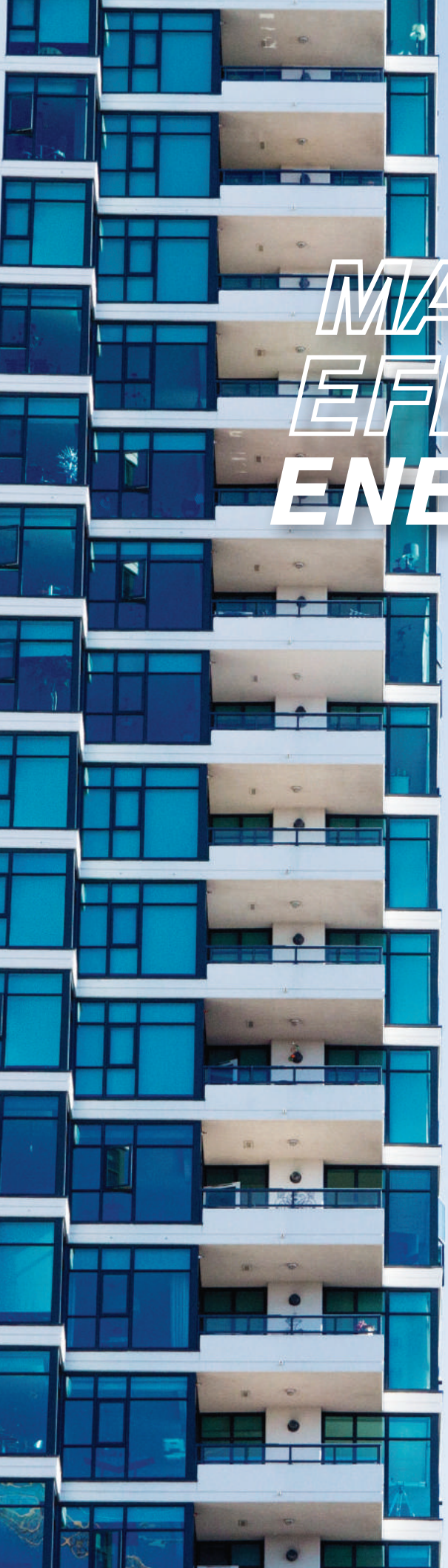
Panellists also discussed the importance of cogeneration policy, and pointed out that other countries such as Japan and the United States have had such policies since 2004 and 2014 respectively. Dr Lim Daw Yuen, the Leader of the Taskforce for Promoting Cogeneration at MGA, suggested that financing support in the form of a revolving fund should be made available.

Steven Aroki, Chairman of the Energy Management Committee of the Federation of Malaysian Manufacturers (FMM), recommended that cogeneration plants be allowed to sell excess energy to the grid. This, he said, should be priced the same as that of power produced by IPPs using the same fuel.

The event was closed by Dato' Abdul Razak Abdul Majid the President of the Energy Council of Malaysia, who reinforced the Minister's statement that a successful transition to a carbon-neutral future will not be possiblethrough a top-down initiative from the Government.

As such, he said that it is vital that the directions for the sector are clearly communicated across the wider economy, and that the stakeholders beyond those present at the 8th NEF are made to appreciate and recognise their role in achieving the vision. There must be an awareness that we stand to lose from not pursuing carbon-neutrality and on the flip side, we stand to gain a lot from it.

All in all, what made the 8th National Energy Forum such a significant event was the diversity of speakers, panellists and attendees. Ranging from representatives from oil & gas majors to government officials to renewable energy experts and more, they all contributed their thoughts and expertise in discussions on the future of Malaysia's energy sector. EM



MAXIMISING EFFICIENCY IN ENERGY USAGE

Electricity is, undoubtedly, the most important resource in modern society, as it – literally and figuratively – powers the engine of the economy. Malaysia is a good example of that, as advances in living standards and economic development are commensurate with a rise in electricity consumption. The challenge with this situation is that while demand will keep on rising as the economy grows, supply is finite. In order to address this, the Energy Commission is determined to enhance consumers' awareness on energy efficiency.

National Plan of Action

The drive towards greater efficiency in the use of electrical energy is outlined in the National Energy Efficiency Action Plan (NEEAP) 2016-2025. According to Zulkiflee Umar, the Deputy Director of Energy Efficiency and Conservation at the Energy Commission, NEEAP is based on similar plans by EU countries, and aims to reduce electricity consumption in Malaysia by 8 percent by 2025. It isparticularly focused on industrial and commercial consumers, as they are responsible for the lion's share of electrical energy demand in the country.

In order for the plan to be effective, the Commission aims to be more proactive in its campaigns to raise awareness of electrical energy consumption among consumers. This will lead to them adopting energy-saving measures such as implementing management practices and purchasing electrical equipment that meet the Minimum Energy Performance Standards (MEPS) requirements.

The Commission is continuously encourages consumers, particularly building owners, to implement energy audits. This will help them become better informed of their level of electricity usage and the ways to reduce it. Other methods include advocating and disseminating innovative no-cost and low-cost methods such as switch/ wiring adjustments.

National Building Energy Intensity (BEI) Labelling for Government Building

1- Star	2- Star	3- Star	4- Star	5- Star
BEI > 250	120 < BEI ≤ 250	130 < BEI ≤ 160	100< BEI ≤ 130	BEI ≤ 130
Highly Inefficient	Inefficient	Moderate Efficient	Efficient	Very Efficient

Source: Energy Commission

This is where a switch is adjusted to control only one light instead of five, making it easier to turn on just the light source needed and reducing electricity usage.

Under MEPS, domestic electrical appliances are given a star rating according to their energy efficiency category with five stars being the most efficient. This is especially useful for consumers as certain appliances, such as air-conditioners, have become must-haves in many middle-income homes. These, however, consume a lot of electricity which leads to higher bills. As such, using more energy efficient appliances will allow them to reduce the cost of energy consumed and their electricity bills.

Leading by Example

As the entity entrusted with championing energy efficiency, the Commission has been tasked with monitoring the performance of Government buildings in Malaysia. It does this by determining the Building Energy Index (BEI) of each building, which measures the use of electricity per square metre of space per year (kWh/sq.m/year). Like MEPS, BEI utilises a star rating system, where the higher number of stars indicate better energy efficiency.

Incidentally, the Commission also leads by example as its Diamond Building Headquarters is one of the most efficient in the country, with consumption of 65 kWh/sq.m/year. In comparison, a typical Malaysian office building averages around 200-220 kWh/sq.m/year.

It should be noted that the Diamond Building was purpose-designed and built to be energy efficient, using methods such as slab cooling and maximising daylight use. Incidentally, the Commission is also assisting companies to be energy efficient, with one way being the employment of Registered Electrical Energy Managers registered by the Energy Commission.

Managing Efficiency

The responsibility of a Registered Electrical Energy Manager (REEM) is to ensure that installations consuming a large amount of electricity (equal or more than 3 million kWh for a period of 6 consecutive months) implement energy-saving measures and submit a periodical report of their consumption and measures to the Energy Commission.

REEM functions on a consultancy basis, monitoring and advising companies on their energy management in order to reduce both cost and inefficiency. The above mentioned initiatives are part of the requirements under the Efficient Management of Electrical Energy Regulations (EMEER) 2008.

As of 2018, there are 1,079 REEMs managing 1,995 installations. These installations account for about 80 percent of the industry's total electricity consumption. That being said, Zulkiflee Umar revealed that the Commission is constantly working towards increasing the number of REEMs, due to the increase of awareness amongst consumers of the importance of energy efficiency and conservation.

As technological needs increase by the day, so too does the demand for electricity. Fortunately, there are enough opportunities at every corner to reduce the consumption of electricity without overly affecting the lives of consumers. The Energy Commission will make full use of all opportunities to further Malaysia's transformation to become an energy efficient nation. EM

RELIABLE, SUSTAINABLE & AFFORDABLE

Finding the Balance in Electricity Prices

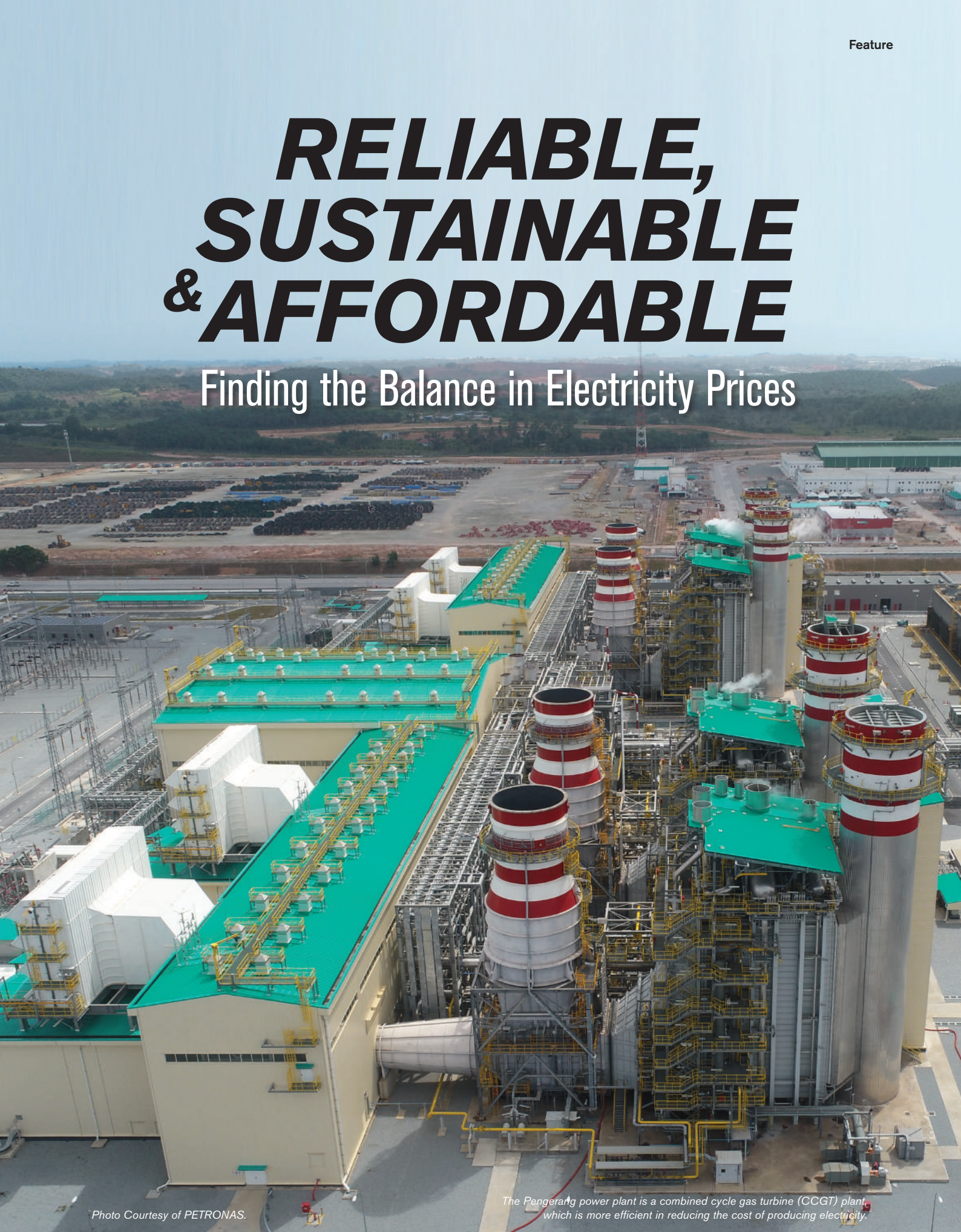


Photo Courtesy of PETRONAS.

The Pengerang power plant is a combined cycle gas turbine (CCGT) plant, which is more efficient in reducing the cost of producing electricity.

As the regulator of the energy sector in Malaysia, one of the Energy Commission's goals is to ensure the reliable and sustainable supply of affordable electricity in the country. At the same time, it also has to take into account the interests of its stakeholders, particularly the Government, consumers and power utilities. ***Energy Malaysia*** looks at how the Commission carries out this balancing act.

Improving Supply Efficiency

There are a number of internal and external factors that affect the price of electricity. These include the cost of fuel and the fuel mix used, as well as the efficiency of generation, transmission and distribution infrastructure. While some of these, such as the cost of fuel, are outside the purview of the Commission, it plays a very active role in managing the ones that it has influence over.

One of these is to enhance efficiency in supply. According to Marlinda Mohd Rosli, the Director of Economic Regulation at the Commission, this includes reducing the amount of electricity lost as it travels along the supply chain from generator to the end user. This loss is caused by a combination of technical and non-technical factors, and averages to around 10 percent per year.

It should be noted that this number has been drastically reduced over the years, from more than 13 percent to the present amount. This is reflective of the work the Commission has put in, and it is continuously looking for ways to improve the system in order to reduce wastage and loss.

For instance, under the incentive based regulations (IBR) system, the electricity utility has been given KPIs to improve efficiency and thereby reduce the impact of losses on consumers.

The importance of efficiency in supply cannot be underestimated. For instance, a 1 percent reduction in electricity loss will result in savings of RM300 million, which can be reflected in lower tariffs for consumers.

"It does not really work when you make the electricity tariff cost reflective. While you may benefit some, you are also actually causing a lot of difficulties to people at the bottom of the pyramid."

– YB Yeo Bee Yin,
Minister of Energy, Science, Technology, Environment and Climate Change

(quoted from The Star)

Banking on Renewables

Another way of reducing the cost of electricity is to look at the fuel mix used. Presently, the price of electricity in Malaysia is very much influenced by the price of coal and natural gas, as these are the two main fuels for power stations. The Government, however, has placed more impetus on renewables, and this is reflected in the plan to have renewable energy account for 20 percent of the fuel mix by 2025.

Solar power will be the main focus of this renewables drive. According to a recent dialogue session with solar photovoltaic industry players held by the Sustainable Energy Development Authority (SEDA) and the Energy Commission, there is extremely high potential for solar energy in Malaysia as compared to other renewable energy sources. Furthermore, in October 2018, the Minister of Energy, Science, Technology, Environment and Climate Change (MESTECC) YB Yeo Bee Yin stated that public support for solar energy is growing.

It should be noted that the cost of producing renewable energy is slightly higher than using fossil fuels. However, the Government has determined that the push towards going green should not

adversely impact consumers. This is reflected in a statement by YB Yeo Bee Yin during the Energy Efficiency Town Hall session in October 2018, where she said "We will not deprive the people just because we want to drive the green agenda."

To entice more consumers to use solar power, the Government also announced that there will be no price difference between the sales and purchase price of electricity produced under the Net Energy Metering (NEM) system. Under NEM, consumers install solar panels on their premises and produce electricity for their own consumption, and then sell any excess to the utility.

Prior to 1 January 2019, the selling price of electricity to the utility was at RM0.31/kWh, while the price of purchasing power from the utility was RM0.50/kWh. As of the start of the new year, the selling and purchase price has been equalised, thereby ensuring that people under the NEM programme enjoy better rebates.

Another programme which started on 1 January was the Supply Agreement for Renewable Energy (SARE) programme, where consumers can lease and install solar panels in their homes at no upfront costs. Previously, anyone who is interested in participating in the NEM programme had to purchase and install their own solar panels, which was cost prohibitive.

Maintaining Reasonable Pricing

Another way in which electricity prices can be brought down is through competition. Presently, this is only possible on the generation side, and the Commission encourages power producers to compete against one another. One such way is through the New Enhanced Dispatch Arrangement (NEDA) scheme, which seeks to increase efficiency and thereby push down the cost of production, with the aim of transferring those savings to the consumers.

The Energy Commission is also trying to manage fixed costs so that the national electricity utility's returns are consistent with reasonable wear and tear. As Marlinda noted, reasonable tariffs are very achievable with efficient cost systems using effective regulations. Strong regulations negate the negatives of potential energy monopolies.

Following the Leaders

To enhance the Commission's regulatory methods, it is looking at countries such as Australia, the United Kingdom and United States. Another country that is also being studied is Singapore, which only recently opened up its electricity retail market. Prices on the Singaporean electricity market are market driven, and there are no measures used to artificially affect the costs such as subsidies.

That being said, it should be noted that there are some fundamental differences between the Malaysian and Singaporean energy market, such as capacity costs, which means that a wholesale adoption of the Singaporean model may not be feasible.

In the Consumers' Hands

In the meantime, consumers can help push the cost of their electricity bills themselves by becoming more energy efficient. The Commission has advocated a number of ways to do so, such as using more energy efficient appliances and turning off the power when not in use. It has also spread awareness of these methods through campaigns such as the Energy Efficiency Run and the Energy Efficiency Challenge.

Other methods that consumers can take up is to produce electricity using solar panels for their own use. This is part and parcel of the NEM scheme, and is also integral to the national mission of raising renewable energy use in the country.

Ultimately, the quest for affordable electricity is one that involves all stakeholders, from the Government, to power utilities and even consumers. Each has to play their part to ensure a balance between supply and demand, and the Energy Commission performs the vital role of bringing them all together with the aim of achieving the best possible solution. EM

Surging Ahead

Enforcement Officers: The Force Behind An Evolving Energy Commission

The energy sector is extremely pertinent to the advancement of Malaysia's economy and its transition into a sustainable future. To ensure that the sector sees continual growth, the Energy Commission remains an integral cog in its day-to-day operations. A team of enforcement officers work at keeping the energy sector running like a well-oiled machine, by steering the Energy Commission down the right path. With the rate at which the electricity and gas sectors are transforming, there is a growing scope of responsibilities thrust upon enforcement officers to balance both the industry players' needs and consumer expectations.

Shift in Approach

As the landscape of the economy transforms, there comes a need to adapt strategies to move the energy sector forward. In light of this, a new organisation structure has been set forth for the Energy Commission to be in line with a shift in the industry's organisation structure from sectoral to functional.

With this, enforcement officers now have to assimilate the needs of both, instead of focusing on one or the other.

The Director of Enforcement and Regional Operations Ir. Md. Zakuan bin Ibrahim sees this shift in scope as a way to bring the sectors together and pool the resources to function in unison. "It makes the execution more seamless and has encouraged transfers between electricity and gas departments. It helps to widen and build on the skillsets available to further the reach of the industry," said Ir. Md. Zakuan.

With this integration of sectors, each enforcement officer would be well-rounded with a skillset that would expand to include electrical or mechanical engineering qualifications, a background in law, experience and knowledge in the supply of electricity and gas through pipelines, and a thorough understanding of the Acts and Regulations under the Energy Commission's jurisdiction (relevant to the supply of electricity and gas through pipelines).

To ensure a smooth transition and maintain the highest effectiveness, the enforcement officers must undergo regular training to stay informed about the latest developments in Acts and Regulations under the Energy Commission's jurisdiction. They also must have attended all the necessary training courses, covering meter tampering quality assurance and quality control for instance.

"The shift in organisational scope integrates the electricity and gas sectors and widens the skillsets to further the reach of the energy industry."

– Ir. Md. Zakuan Ibrahim
Director of Enforcement and Regional Operations,
Energy Commission

Range of Impact

Under the Director of Enforcement and Regional Operations, there are four key units that contribute to daily enforcement operations: enforcement planning and coordination, investigation, prosecution and consumer affairs. It becomes clear that enforcement is only the first step of many to ensure that regional operations are thorough and efficient and in compliance with the Electricity and Gas Supply Acts and Regulations.

As per the new organisation structure made effective since 1 August 2018 across the region, the Energy Commission has 9 offices throughout Malaysia, except for Sarawak. There are currently 82 enforcement officers throughout Peninsular Malaysia and Sabah.

For enforcement officers across the board, their role is challenging and requires using one's own judgement and discretion when on the job without neglecting safety procedures and while upholding the reputation of the Energy Commission. This is especially put to the test during inspections and raids, where there is often a lack of cooperation from those being prosecuted.

The Commission expressed the need for more discretion to compound offenders 'on the spot' as a more efficient alternative to paperwork. To further improve the enforcement process, the Energy Commission has called upon the Government bodies and other agencies to lend support, cooperation and provide enforcement officers with the capacity to be able to perform enforcement, investigation and prosecution activities smoothly. Having more efficient practices in place will do away with time-consuming protocols and work towards establishing the Commission as a world-class industry regulator.

Enforcement officers have a responsibility to both the energy industry and to its consumers. The industry needs to foster growth, drive profitability in business and build sustainability in the market. While the customer expectations gravitate towards the safe and affordable supply of electricity and gas through pipelines. In its transformative journey towards becoming a more effective regulator, the Energy Commission will set very strategic initiatives to ensure its enforcement officers are well equipped to deliver as laid out under the Acts and Regulations. EM

REGIONAL FOCUS: SABAH

While the Headquarters is the crux of regional enforcement, each Regional Office has its own scope of activities. The role of enforcement is usually vested on Regional Offices since the engagement is more direct to consumers and relevant to the particular region. Regional Offices would generally cover a wider scope based on the governing Acts and Regulations.

To shine a light on the intricacies of region-specific energy sector operations, the disparity in approach between Peninsular Malaysia and Sabah is a prime example. The Regional Director for the East Coast of Sabah (Sandakan) Ir. Amir Faisal bin Khamshah states, "In comparison to the Headquarters and Peninsular Regional Office, Sabah has lower compliance rate, slower growth in demand and supply, power interruption issues, and non-technical losses from theft by illegal squatters."

For the east region of Sabah, energy regulations are overseen and enforced by the Regional Office stationed in Sandakan. To measure electricity supply performance, System Interruption Duration Index (SAIDI) is usually used. Based on this, an analysis on the region by the Regional Office revealed that distribution installation contributed the most to its failure in achieving its SAIDI target for 2016 and 2017.

Furthermore, the supply index recorded from 2016 to 2017 shows a significant reduction of 20.2% from 365.38 to 291.44 minute per customer. Despite this, it is still not enough to bring Sabah's overall SAIDI to 100 minutes per customer by 2020, since Sandakan is the second largest region in Sabah. To achieve the target SAIDI by 2020, the Ministry of Energy, Science, Technology, Environment and Climate Change (MESTECC) through Special Project Planning Delivery Unit (SAPADU), and the Task Force 150 (TF150) by Tenaga Nasional Berhad (TNB) assisted Sabah Electricity Sdn. Bhd. (SESB) in improving their generation, transmission and distribution infrastructure.

The Energy Commission holds frequent dialogues with key stakeholders to raise safety awareness in the energy sector

Ir. Amir Faisal elaborated, "From an investigation into the root causes of distribution issues by the Energy Commission Regional Office, system tripping and outage due to vegetation and equipment failure were identified as the two major causes." By singling out these causes, the Regional Office unearthed three key contributors to address: obsolete, outdated installation and infrastructure, bad maintenance practices, and lack of coordination and escalation of issues to relevant authorities.

Transformative Measures

To ensure the electricity supply issues can be addressed, the Sandakan Regional Office initiated a Joint Committee comprising the Regional Office and SESB to monitor the distribution supply performance. To uphold supply performance, the Committee looked into issues that SESB faces such as TF150 projects progress, SESB region projects, schedule maintenance progress and illegal squatters. With this collaborative effort, problems under the jurisdiction of the regional office or SESB were resolved.

On the safety and distribution front, the committee implemented impromptu safety audits and regular inspections on scheduled maintenance of distribution installation and identified projects, especially TF150 projects. The objectives of these initiatives were to make sure the installations were constructed in a proper manner based on Acts, Regulations and standards within the timeline proposed. As a result, by November 2018 all 25 of TF150 projects for Sandakan and 34 out of 35 planned projects in the Tawau region were completed and expected to give a huge impact on supply performance in 2019.

With these transformative measures in place, it is necessary to disseminate public awareness in order to ensure compliance on all levels with regards to safety and supply. In keeping with this, awareness programmes, several seminars and dialogues were conducted to target the public, contractors and relevant institutions.

ENFORCERS OF ENERGY

KEEPING TABS ON INDUSTRY STANDARDS AND COMPLIANCE

While governing regulations keep energy industry standards in check, it is the Energy Commission that enforces, investigates and takes legal action to keep the electricity and gas sector in line. The Commission's key role is to regulate the energy industry based on binding safety and supply stipulations, while also balancing the needs of consumers and energy providers. It is through these actions that Malaysia is ensured a stable, reliable and secure supply of energy.

Scope of Enforcement

As regulators of the energy sector, the Energy Commission's scope of activities encompasses a wide range of responsibilities, from planning and coordination, to investigation and finally prosecution. To ensure that all energy suppliers are in compliance with the law, regular monitoring needs to be done not only for the electricity sector but also the gas sector.

If there are any red flags during these checks, the enforcement officers need to then carry out an investigation to see if there is any blatant violation such as meter tampering, electricity theft or questionable equipment. During raids, unsafe equipment can be confiscated if deemed not up to mark. Should any violation be found during site investigations, the case will be submitted to public prosecutors and tried in court.

Site inspections may be held due to complaints, or just to ensure a supplier is in compliance with licensing or safety standards. On any given day, random checks can be conducted on meters, installations and piped gas systems. While other days, it can also be in the form of scheduled visits such as audits.

Enforcement Activities

Beneath the surface, there are a lot of activities that go into daily enforcement such as inspections, audits, and singling out any fraudulent installations or possible electrical safety threats. On further analysis of the details of inspections, the number

of electrical accidents has reduced, but the number of fraudulent electricity operations has increased.

Development of Codes and Guidelines

One of the Energy Commission's key roles as an energy sector enforcer is to increase electrical and piped gas safety, under the codes and guidelines for each respective area. For electrical safety, there are the Non-Domestic Electrical Installation Safety Code and Guideline on Design, Installation, Inspection, Testing, Operation and Maintenance of Water Heater Systems. There is also the guideline on Electrical Safety Management Plan & Programme that covers seven (7) elements to allow the industry to implement self-auditing, and it requires these elements to be compiled by owners, operators, retail license holders or private license holders.

For piped gas safety, several guidelines and codes of practices had a direct impact in improving enforcement activities. These guidelines include the Application Guide for Gas Certificate Approvals, Guide on Conduct of Repair Work, and Testing, Commissioning, Decommissioning and Recommissioning of the Installation and the guide on Piped Gas Safety Management Plan and Programme. The Codes of Practice include the Installation of Fuel Gas Piping System and Application (MS 930:2017), which was revised in 2017, and the practice for Storage, Handling and Transportation of Liquefied Petroleum Gas (LPG) (M S830:2013).

Action Taken for Industry Safety

Following issues of safety involving instantaneous and storage water heater, the Commission has developed a Guideline for the Design, Installation, Inspection, Testing, Operation and Maintenance of Water Heater Systems to address the safety aspects of electrical wiring and accessories in the design, installation, inspection, testing, operation and maintenance.

As for piped gas safety, the Commission developed an Application Guide for Gas Certificate Approvals in 2017 to ensure that only approved gas appliances and equipment are marketed in Malaysia. It will essentially act as a guide to manufacturers and importers, in order to benchmark local safety standards.

Unified Front for Best Industry Standards

In unison with the vision and regulations mapped out by other regulatory authorities, the Energy Commission had also taken a proactive initiative to develop better safety standards in relation to the installation of piped gas systems.

In line with this, the Energy Commission worked closely with Government agencies such as the Department of Safety and Health, Fire Department (BOMBA) and Standard and Industrial Research Institute of Malaysia (SIRIM) in a bid to develop the Code of Practice for the Installation of Fuel Gas Piping System and Appliances (MS 930:2017).

To ensure continuity and consistency in quality service, the Energy Commission has established the Energy Commission Data Centre in support of the Support Data Centre. This particular data centre hosts systems like ECOS Online, SAGA, Portal ST, e-Kelengkapan and Complaints.

Non-Domestic Electrical Installation Safety Code

01 Promote suitable practices in the design, construction, inspection, testing, operations and maintenance of electrical installation, which are generally found to be appropriate in terms of safety.

02 Provide the safety in relation to the design, construction, operation, inspection, testing and maintenance of the relevant installations, in accordance with applicable technical standards and good practices.

03 Address the type of safety tools and equipment to be used in carrying out electrical works in the relevant installations.

04 Provide the framework for individual owners or operators of the relevant installations to produce their own safety management programme.

Source: Energy Commission

The collaborative efforts of the Energy Commission and related authorities in the energy sector have helped develop tools and frameworks that will play an integral role in how the Energy Commission oversees, regulates and accordingly takes the necessary action to cement the highest industry standards. EM

OUTSMARTING THE CULPRITS

CRACKING DOWN ON ELECTRICITY THEFT WITH SMART TECHNOLOGY

Where there is a will, there is a way. This is no different when it comes to electricity theft. With every anti-theft measure set in place, the culprits will find newer and smarter ways to bypass them. Attesting to this statement, the Northeast Group, LLC's *'Electricity Theft and Non-Technical Losses: Global Markets, Solutions and Vendors'* study revealed that electricity theft and other non-technical losses total a staggering $96 billion per year globally. This situation was echoed in Malaysia, in 2017, where Tenaga Nasional Berhad (TNB) recorded around RM102 million in losses while Sabah Electricity (SESB) calculated losses of around RM3 million. This spells the need to upgrade the current state of anti-theft technology in the electricity sector.

Generally speaking, electricity loss is either deliberate or accidental. The deliberate portion of the equation is what the sector needs to look at, as it is relatively more substantial in terms of losses. Deliberate stealing of electricity is commonly achieved through direct connection to overhead cables, bypassing the meter, or tampering with the meter. In some cases, power thieves can lose their lives or be injured, as a result of tampering activities. For example, a person making an illegal or hazardous connection may be electrocuted and get severe shocks and burns while touching a power line.

Unbilled revenue from electricity theft can be a major issue for utilities, and may force them to change their tariff rates in proportion to infrastructure costs caused by electricity theft. This will inevitably transfer an additional financial burden onto consumers. Over time, this negative figure on the balance sheet can become a recurring burden, unlike the positive impact investments can make, which in dire situations may bring utilities to the point of bankruptcy.

A case in point, according to a recent report, SESB may be on the verge of insolvency where losses from electricity theft amounting to around RM3 million may have acerbated SESB's current situation. The theft problem is crippling utilities around the world, driving up prices for paying customers and in

turn affecting electricity supply quality, utility service, industry revenue and ultimately, economic progress.

To counter such drawbacks in the electricity sector, the Government and utilities need to work together to actively seek out new and efficient ways to curb or rather monitor electricity theft. Giving weight to technological advancements such as smart grids, anti-tampering technology and theft detection and monitoring systems, will pave the way to smarter anti-theft measures.

Smart Grids with Smart Meters

Traditional grid models and anti-theft systems need to be adapted and upgraded, to stay afloat and keep up with the latest and more complex methods of electricity theft. Outdated electrical grids have become mostly inefficient particularly in handling the latest onset of electrical theft issues. This is why, the world over, the sector explores ways and looks to implement smart grid technology.

A smart grid is an electrical grid that intelligently controls various aspects of electricity delivery in an efficient manner, from source to end user. This is achieved via smart meters, sensors, and renewable sources of energy which help ensure proper electricity resource management.

The smart meter model uses data from the distribution transformer to detect electricity theft, with the aid of sensors as well for more accurate and immediate detections. With the use of the latest cloud computing technology, these smart meters can send back information to the cloud where detailed real-time data analysis can be done.

In view of this, Malaysian utility company Tenaga Nasional Behad (TNB) has begun work on a 'Grid of the Future'. This will use Advance Metering Infrastructure (AMI) as a value delivery method to the end user. TNB is the largest electricity provider in the country, and such upgrades would go a long way in attending to electricity demands. The 'Grid of the Future' introduces automation and smart solutions with lower grid costs and is set to cost the utility RM2.7 billion.

Anti-Tampering Technology

While smart meters have tamper detection features that notify providers if they have been removed or otherwise manipulated, there are other supplementary technologies designed to detect tampering attempts with energy meters. A multifunctional sensor capable of capturing tampering attempts made with an energy meter has been recently developed by Omron in collaboration with Tata Power Delhi.

In Malaysia, efforts to curb meter tampering have extended to re-centralising the Meter Installation Tampering Special Unit for better strategies, planning and coordination; investing in high technology meters with anti-theft features to deter fraud; using more refined scanning modules with advanced AI; and carrying out more joint inspections with the Energy Commission, the police and the Malaysian Anti-Corruption Commission

Theft Detection and Monitoring Systems

Another key facet of anti-theft strategies deals directly with theft detection and monitoring systems. Working as a cohesive system, monitoring helps access usage data and detection helps to identify whether the activities constitute theft.

On an international scale, new distribution system meters will measure electricity supplied to specific areas. Combined with software tools to enable electricity balancing analysis, distribution system meters will help the electricity suppliers identify electricity theft more accurately and address it more quickly.

Zeroing in on advanced meter models, remote metering also drives the access to more reliable real-time data. Especially with bigger facilities and operators, it becomes harder to track down electricity theft. What remote monitoring does is allow remote accessibility of the consumption data, which in turn also reduces manpower and operational cost.

Such systems have already been implemented in Malaysia. For example, Syarikat SESCO Berhad's meter inspection team using a remote monitoring device, with which they are able to monitor and download the meter's data remotely. The data is read on a daily basis, and allows for immediate detection of tampering attempts.

Taking a page from emerging markets abroad, Malaysia is continually looking at technological infrastructure it can adapt to combat locally prevalent theft issues. To become an increasingly sustainable energy sector, it becomes even more pressing to do away with any infiltrations that compromise the future of electricity supply and demand. EM

When one looks at the Australian electricity market, it is possible to spot certain historical similarities with Malaysia. For instance, prior to reforms in the 1990s, the generation, transmission, and distribution of electricity in individual Australian states were controlled by a monopoly. Since then, the Australian electricity market has been liberalised with generation and distribution/retail activities opened up to competition. As Malaysia seeks to open up its own electricity market, Energy Malaysia takes a look at the lessons that can be learned from the Land Down Under.

One of the substations in Queensland, Australia that's distributing electricity to over 2 million consumers

Powering the Land Down Under

Liberalising the Australian Electricity Market

Presently, Australia is divided into six states and three territories, with the states comprising New South Wales, Victoria, Western Australia, Queensland, South Australia and Tasmania, while the Australian Capital Territory, Northern Territory, and Jervis Bay Territory.

By and large, the generation, transmission and distribution of electricity in the country used to be divided into State/Territorial lines. For instance, electricity generated in New South Wales was transmitted, distributed and sold only within the state.

Initial steps to reforms were taken in the 1990s with the opening up of the generation and then the retail markets. In the former, the monopolies controlling the generation of electricity were done away with, and other parties were invited to produce electricity. This is a situation very similar to the independent power producers (IPPs) in Malaysia.

The latter was more unique, and saw the granting of licences to electricity retailers which enabled them to sell to end users. Each individual area within a state or territory will have a set distributor and the distributor has to supply electricity at a price to a retailer who will then sell it to the consumers.

It should be noted that distributors can also get a license to be retailers, but in situations where they are both distributor and retailer in the same area, strict measures are taken to ensure a clear demarcation between the two entities so as to prevent uncompetitive practices.

Introducing the National Electricity Market

In 1998, the sector was further reformed with the introduction of the National Electricity Market (NEM). This brought together four states in the east coast – Queensland, Victoria, South Australia, and New South Wales (inclusive of the Australian Capital Territory) – and enabled them to trade electricity with one another. A fifth member – Tasmania – joined in 2005.

Presently, the NEM is responsible for supplying 80 percent of Australia's electricity consumption, which is around 200 TWh per year. It also operates a 5,000 km interconnected power system, which is one of the longest in the world.

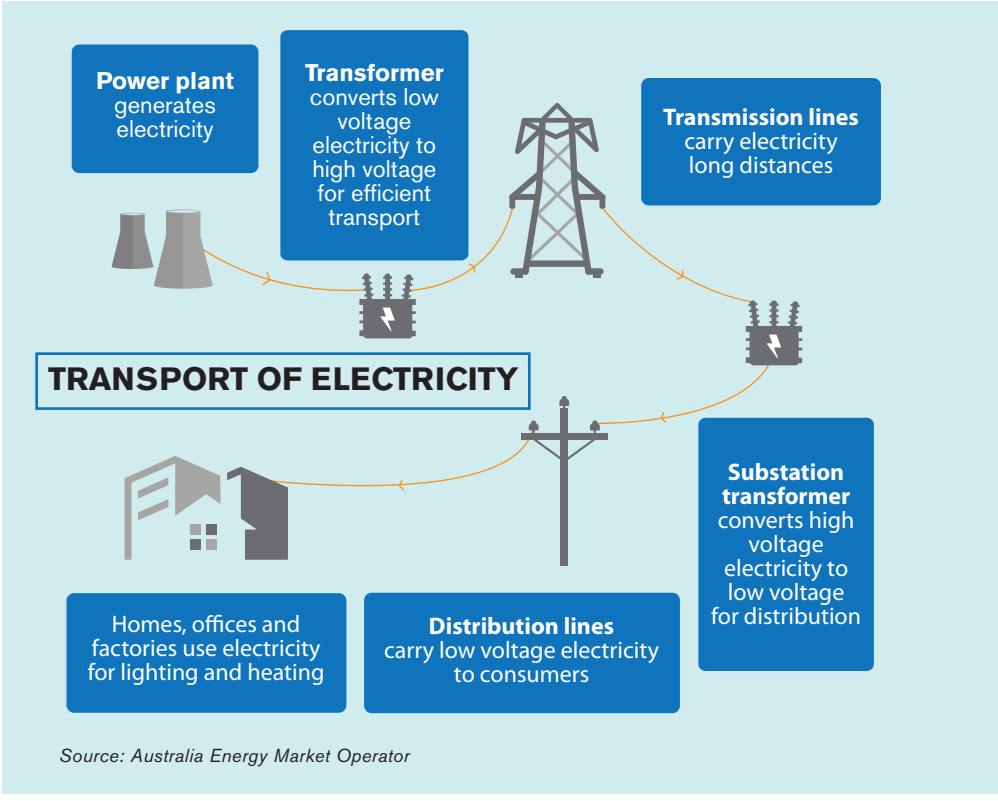
The NEM exchange works by pooling the electricity produced by all generators in member states and then transmitting it to meet demand. This pool is managed by the Australian Energy Market Operator (AEMO), which uses advanced ICT systems to determine demand, maintain reserve requirement, determine spot price, and ensure that supply is balanced with demand.

Reactions to Reforms

In 2006, the Australian Government conducted a review of the reforms, which stated that they have resulted in "significant levels of investment in energy supply" and also increased productivity, "particularly capital utilisation". However the report also stated that because of the low-cost nature of coal fuel, Australia has actually increased its greenhouse gas emission – making little progress for cleaner alternatives.

It was also noted that favouring of the former, older coal-fuelled power plant by market regulation and design has also played a part in pushing back any advances for alternative power plants. All in all though, the effects were mostly positive.

This was not the case in 2015, when reports revealed that the bubble had burst, causing price hikes as high as 130 percent for consumers over the previous average in 2007, even when adjusted to inflation. If that isn't worrying enough – a 2018 study by the Grattan Institute writes that this trend isn't going away, and that it should be treated instead as the "new normal".

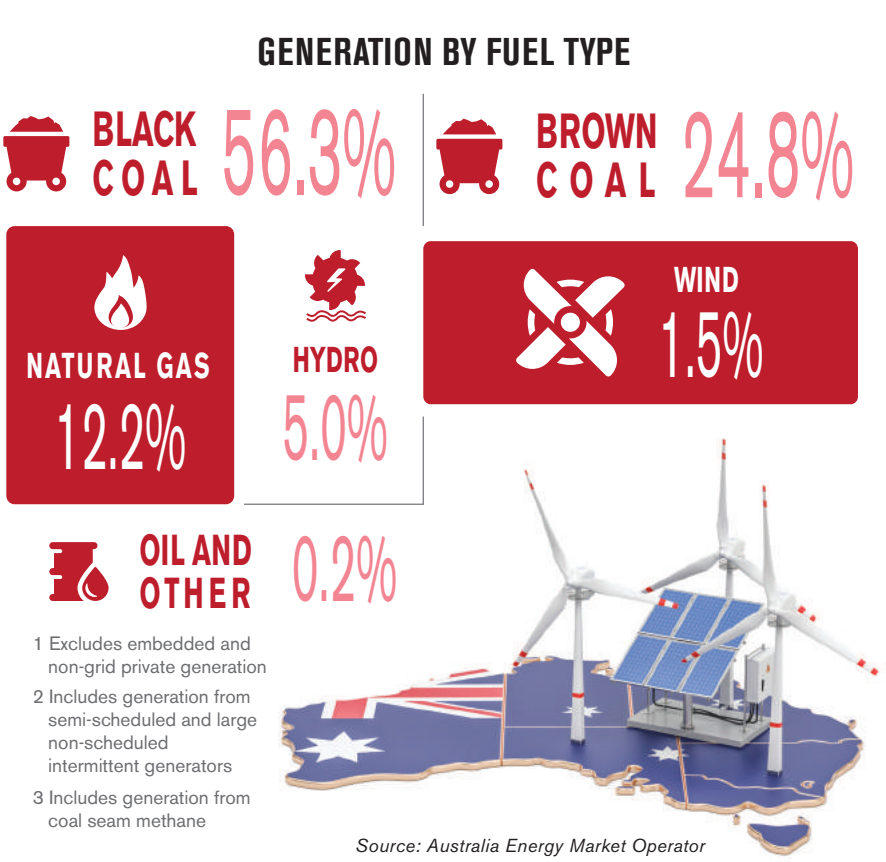


Source: Australia Energy Market Operator

Studies further revealed the cause for this price hike in recent years are due to the closing of two big, old low-cost coal-fired stations, reducing supply and pushing prices up. It has been estimated that the closing of the big coal stations was responsible for the 60 percent increase in electricity prices.

In effect, this later snowballed to push other key inputs, especially gas (but also black coal) to rise, at a time when plants they fuelled were needed with higher frequency, resulting in a 40 percent rise in price.

Lastly, the third cause for prices to skyrocket is that generators have "rigged the system", whereby the few big companies that dominate the market create an "artificial scarcity of supply", thus forcing prices up. A Grattan Institute report states that this pattern of "gaming" has shown up in markets like Queensland and South Australia. The study also anticipates the same would happen in the New South Wales, "as supply tightens with the scheduled closure of Liddell coal-fired power station in 2022."



Source: Australia Energy Market Operator

Addressing the Issues

Since these occurrences demonstrate that wholesale prices are not likely to go back to numbers equivalent to the early 2000's, a number of recommendations have been given on how to tackle the problem. The first step is for the Australian Energy Market Commission (AEMC) to change the market laws, and put a stop to the problem of "gaming". In fact, it is estimated that the value of electricity is due to increase up to A$800 million (RM2.37 billion) in trading in the NEM under the present market laws.

Secondly, the Australian Competition and Consumer Commission (ACCC) has also recommended the Australian Government to lift the present "moratoria on gas exploration", considering developments for that sector of energy instead based on individual cases presented. If successful, the utilisation of gas as fuel would help soften the 75 percent total market hold that coal currently has over Australia's electric generation.

Last but not least, the most important step the Australian Government can take is to use this pricing crisis as an opportunity to invest in and apply for climate change policies that encourage utilisation of cleaner energy alternatives, such as the newer wind power plant, or the older cost-efficient, hydropower plant.

On the bright side, studies revealed that there is an upward rise of 3 percent each year in the utilisation of hydropower plant worldwide – and is set to steadily increase in this percentile for the next 25 years, hopefully replacing the environmentally damaging fuels. This would prove to be both a crucial investment for the future of Australia, as it would not only provide better pricing for end-consumers, but it is also important because the fight against "climate change" needs to happen now before it's harmful effects become irreversible.

So, as Malaysia's own energy market inevitably moves towards liberalisation, it would be helpful to look into how it has impacted the Australian energy market, and consider regulations and policies that we could put in place to avoid some of the effects that have come upon Australian consumers. EM

INSTITUTE OF ENERGY POLICY AND RESEARCH

A Goldmine of Knowledge Opportunity

The Institute of Energy Policy and Research (IEPRe) at Universiti Tenaga Nasional has a goal to develop think-tank who will be well versed to spearhead research and consultancy activities in energy studies. The outcomes from research are expected to save millions of ringgit and put in sight probable long-term energy scenarios. To find out more about IEPRe's research activities, ***Energy Malaysia*** speaks to Professor Ir. Dr. Tuan Ab Rashid Tuan Abdullah, Director of IEPRe, for his valuable input.

According to Prof. Rashid, IEPRe was officially launched on 11 August 2009 to improve Malaysia's energy policy by studying and analysing energy policies and trends in major world economies such as the United States, Europe, Japan, Russia, China and ASEAN countries. The findings from these studies can be used to assist the Government agencies, corporations and other stakeholders to make informed decisions.

IEPRe is best known for its flagship program, "The International Forum on Global Energy Landscape (IFGE)". In 2016, the IFGE public talks carried the theme of "Geopolitics & Global Energy Landscape: Its implication to Asia". In 2018, the IFGE theme was "Electricity & Gas Market Liberalisation and Its Implication to Malaysian Economy".

IFGE has featured renowned experts from local and international institutions including Tenaga Nasional Berhad; Malaysia Gas Association; the Institute of Energy Economics, Japan; Oxford Institute for Energy Studies, UK; the Research & Advisory Practice at the Energy Intelligence Group, USA; Rapidan Group, USA; the National Bureau of Asian Research University of California, USA; Energy Research Institute, National Development and Reform Commission, China; Energy Research Institute of the Russian Academy of Sciences, Russia; Frontier Economics, Australia and a few others.

The knowledge and experience of these experts, which they showcased through talks and panel discussions about the changes to the world energy market, have contributed to enhancing the capabilities of Malaysian researchers and the industry.

The speakers, such as Prof. Ken Koyama, Prof. Jonathan Stern, Dr. Tatiana Mitrova, Charanjit Singh Gill and many others, have also opened an avenue of research network for IEPRe researchers and scholars, who are working on specific energy study projects.

Prof. Rashid also stated that IEPRe works closely with Government Ministries and agencies like the Ministry of Energy, Science, Technology,

"The Chair in Energy Economics program offers scholarships or salaries for selected candidates to do post-graduate program at Master or Doctor of Philosophy (PhD) levels or Post-Doctoral research fellowship. The Post-Doctoral program is for those who wish to continue their research after their PhD program."

– Professor Ir. Dr. Tuan Ab Rashid Tuan Abdullah,
Director, Institute of Energy Policy and Research (IEPRe)

Environment and Climate Change (MESTECC), Ministry of Land, Water and Natural Resources, Ministry of Economic Affairs (MEA), the Energy Commission, and the Sustainable Energy Development Authority (SEDA). These Ministries and agencies provide tremendous assistance to IEPRe researchers and scholars in carrying out their projects on energy studies.

Over the years of IEPRe being in operation, the research network between IEPRe researchers/ scholars and renowned experts from local and international institutions has resulted in many useful findings or outcomes benefitting academia, Government agencies, industries and the general public.

Another significant program carried out by IEPRe is national capacity building in energy studies, which is in-line with the establishment of the Chair in Energy Economics at IEPRe.

This program offers scholarships or salaries for selected candidates to do post-graduate program at Master or Doctor of Philosophy (PhD) levels or Post-Doctoral research fellowship. The Post-Doctoral program is for those who wish to continue their research after their PhD program.

IEPRe has also worked together with other research institutes locally and abroad to brainstorm on research directions and share research facilities and findings with other like-minded energy experts to increase the spread and improve the understanding of Malaysia's energy policy and its implication on social-economic sectors.

In line with the Government and UNITEN's direction to enrich researchers' exposure to the world economy, IEPRe also host mobility programs. This includes hosting visiting undergraduate students, research fellows and professors from both local and international research institutions.

With these courses, scholarships and research projects, IEPRe has proven to be a mainstay in the ever-changing environment of Malaysia's Energy Policy. ***Energy Malaysia*** is looking forward to IEPRe's next endeavour, with the results highly likely to push Malaysia's energy policy in the direction it needs to go. IEPRe's commitment towards increasing the number of knowledgeable energy researchers means that the country's energy policy will see even more improvements in the near future. EM

IGEM

A COMMITMENT TO GOING GREEN

Datuk Badriyah Ab Malek – then Deputy Secretary-General (Energy) of MESTECC, YB Yeo Bin Yin – MESTECC Minister, and Abdul Razib Dawood – COO of the Energy Commission during the Energy Efficiency Townhall session.

"Going Green" is not just a buzzword in Malaysia. It is a national aspiration, and this is best reflected in the country being the host of the International Greentech & Eco Products Exhibition and Conference Malaysia (IGEM). The largest green technology fair in Southeast Asia, IGEM 2018 comprised a number of talks and forums, and featured 250 exhibitors from 30 countries from around the world.

Commencing the three-day conference and exhibition, YB Yeo Bee Yin, Minister of Energy, Science, Technology, Environment and Climate Change addressed the gathering with her opening words on the potential of green businesses and its expected contribution of 1.5 percent or RM60 billion to the national economy this year.

The growing importance of green technology and energy in the country brought forth a National Policy Roundtable that assembled representatives from various stakeholders to discuss the matter of "Greening Malaysia's Energy". This event was part of the "Greening of Asia" project by the International Institute for Strategic Studies (IISS), and was co-convened by the Sustainable Energy Development Authority (SEDA) and the Energy Commission.

Declared open by Dr. Pierre Noel – Senior Fellow for Economic and Energy Security at IISS - the Roundtable witnessed three sessions with the underlying theme of green energy and the shift away from finite energy resources. The first session explored the topic of "Deploying Renewables", where the panel discussed the country's renewable energy policy for the future. Chaired by SEDA's acting CEO Dr. Wei Nee Chen, the session panellists deliberated on Malaysia's renewable energy targets and how solar energy would be the cornerstone of alternative energy.

The momentum carried through to the second session, where the theme was "Coal, Gas and Renewables: Towards a Cleaner Mix". Chaired by the Chief Operating Officer of the Energy Commission, Abdul Razib Dawood, the session emphasised the need to shift away from a conventional fuel mix to one with more renewable sources.

The President of Energy Council of Malaysia Datuk Abdul Razak Abdul Majid led the session followed by other key representatives from key financial institutions and businesses in the energy field. Each speaker took the floor to examine the power systems, as well as the benefits and barriers of implementing solar energy utilities. One stated challenge was the intermittency of solar power and the need to overcome this for better power generation.

Closing out the conversation, the final session looked into "Gas Prices, Gas Market Reform and the Greening of Industrial Energy", which saw The President of the Malaysian Gas Association, Hazli Sham Kassim take the stage to speak on price deregulation. He was followed by other key players in the gas industry who spoke of gas access, purer burning of fossil fuel and the greening of industrial energy.

Officially concluding the roundtable, Datuk Ir Ahmad Fauzi Hassan, the Chairman of the Energy Commission and Acting Chairman of SEDA delivered his keynote address on the major shift from non-renewable to renewable energy, from medium-high carbon emissions to low carbon emissions and also from less efficient to more efficient energy utilisation.

Rounding up the IGEM events, Malaysia saw its first ever Energy Efficiency Townhall session, where YB Yeo Bee Yin, Datuk Badriyah Ab. Malek and Abdul Razib Dawood fielded questions from members of the public. Among the issues addressed were concerns over electricity tariffs, while the Minister also spoke about the Building Energy Index and Energy Efficiency Conservation Bill, which is set to be tabled in 2019.

With over 30,000 visitors from around the world, IGEM 2018 was a resounding success and strengthened confidence that Malaysia's green agenda is on the right track. EM

LEADING THE ENERGY SECTOR THROUGH UNCERTAINTY

From left to right: Abdul Razib Dawood - COO of the Energy Commission, James Shannon - President of the International Electrotechnical Commission, Datuk Fadilah Baharin - Director-General of Standards Malaysia, Ir David Lai Kong Phooi - President of the Institution of Engineers Malaysia, Prof Emeritus Datuk Dr Marimuthu Nadason - Chairman of the Malaysian Standards and Accreditation Council, Datuk Ir Ahmad Fauzi Hasan - Chairman of the Energy Commission of Malaysia, and Shaharul Sadri Alwi - Director of Standardisation at Standards Malaysia, during the opening ceremony of the ASEAN Electrotechnical Symposium & Exhibition 2018.

The brightest minds in the engineering and energy sectors of Malaysia assembled under one roof on the 9th of December, to attend the ASEAN Electrotechnical Symposium. Held every two years, this year's symposium shed light on the current situation of Malaysia's engineering and energy sectors and the integrated role they play in setting standards that drive global value chains. The event welcomed key speakers from industry bodies such as Institution of Engineers (IEM), Standards Malaysia, and the Energy Commission.

Keynote speaker Abdul Razib Dawood, Chief Operating Officer of Malaysia's Energy Commission touched on Malaysia's current energy supply and the need to diversify the fuel mix for the future. Given that Malaysia is heavily reliant on coal to generate power, it results in more greenhouse gas emissions. "The Energy Commission's efforts are to diversify the energy sources to protect both Malaysia's environment and economic sustainability," said Abdul Razib.

To achieve this goal, Abdul Razib encourages the use of renewable energy sources such as photovoltaic panels. Technology transfers will help in the achievement of this goal, with the consumer able to buy their own photovoltaic panels. This together with Net Energy Metering will show a good degree of consumer empowerment.

Plenty of countries in the world are trying to minimise carbon emissions and this development suggests the same course of action through the incorporation of renewable energy. Malaysia joining these efforts signifies the nation's involvement in the global push for carbon reduction. The push for more renewable energy such as solar panels is mirrored by other countries' increased use of photovoltaic technology, as is seen in China.

Furthermore, this will also lead to Malaysian consumers having more freedom and control over their energy use, which is another step towards standardisation. These developments further point towards increased efforts on Malaysia's part to conform to global energy trends. Director General of Department of Standards Malaysia Datuk Fadilah Baharin also emphasised that standardisation is essential for the energy sector and engineering as a whole. She believes that international standardisation is inevitable as time goes by, implying possible collaborations between Malaysia and other countries.

The symposium acted as a bridge between key energy and engineering players, allowing an interactive conversation on standardising electrotechnical value chains – specifically pertaining to the ASEAN region. To effectively standardise energy supply across ASEAN countries, the event also introduced the launch of electrical installation standards and regulations in buildings amongst ASEAN countries. This is line with the initiatives of the ASEAN connectivity blueprint for 2025, and emphasises on generation, transmission, distribution to boost competitiveness. EM

The winners of the 2018 EE Challenge with the representatives from the Energy Commission and Ministry of Energy, Science, Technology, Environment and Climate Change.

ENERGY EFFICIENCY

Taking Up the Challenge

The Energy Efficiency Challenge (EE Challenge) organised by the Energy Commission was first introduced in 2014 as an annual event that aims to promote energy efficiency among the younger generations and drive the positive changes amongst the youths. Open to secondary schools in Malaysia, the challenge has managed to get schools to save a total of 428,311 kWh of electricity worth RM134,147 as of 2018.

In 2014, only 7 schools participated. In 2018, the event garnered participation from 112 schools from the Peninsular and Sabah, with 83 schools sending their completed reports. The evaluation period took into consideration the electricity bills and the comparison of energy usage specific index for the year 2017 and 2018 based on the number of teachers, students, support staff and total school days.

For The Most Creative Video Presentation, SMKA Kuala Abang from Terengganu won the first prize while SM Islam Hidayah from Johor came in first for The Most Viral Video category.

The winner for the 2018 EE Challenge is SMK Seksyen 7 from Shah Alam, Selangor, which recorded a decrease of 12 percent in their electricity usage. The school formed a squad, among various other initiatives, called E-Smart@7 that is responsible in making sure that the whole school are adhering to their energy efficiency initiatives. They also worked together with the Faculty of Electrical Engineering, UiTM, TNB, and UNISEL to audit and for professional advices, besides organising campaigns involving parents and the local community.

Meanwhile, the first runner up, SMK Taman Nusa Damai from Johor Bahru, Johor, also recorded a 12 percent decrease through efforts like cleaning the fans and air-conditioners, and changing fluorescent lamps to LED. They also put labels beside all the switch boxes that reads “Please turn off the switch when not in use”, and those who are wasting electricity will be fined.

SMK Air Putih from Kuantan, Pahang was the second runner up after recording a decrease of 18 percent in terms of electricity usage which was done through talks, monitoring and enforcement by fellow students, labels, posters and notice about energy efficiency and a Recycle Campaign.

The Prize Giving Ceremony was attended by students, teachers and staff representing the winning schools.

Since 2014, this programme has recorded total savings of 1,124,908 kWh. The Energy Commission aims to educate the young generation on the importance of conserving energy and how it can be achieved through simple measures and thus, will continue the challenge for next year. EM

Group briefing before starting the activity.

A staff member carrying the baby mangrove, taking care not to break it.

Revitalising Mother Nature

The Energy Commission Commits to a Greener Malaysia

As a leading regulatory agency, the Energy Commission is not only dedicated in its management of the nation's electricity and piped gas sectors, it has also gone above and beyond its mandate. One example was in November 2018 when the staff of the Energy Commission visited the Kuala Selangor Nature Park to plant mangrove trees, to symbolise their commitment to a greener Malaysia.

Measuring 800 acres, the Kuala Selangor Nature Park comprises secondary forests and wetlands, and is one of the more bio-diverse locations in the Klang Valley. According to the Malaysian Nature Society, the caretakers of the park, the health of Kuala Selangor's forest reserve can be measured by the diversity and amount of birds spotted seasonally as they go about their natural migration process. With over 90 species of birds, it is safe to say that things are well and healthy at the Kuala Selangor Nature Park.

Setting out in the afternoon, the team from the Energy Commission trekked through acres of swampland before reaching the planting site. The journey there was the first part of the challenge. The next part was to plant the delicate mangrove saplings without breaking them. The fact that the area was a swamp also raised the difficulty bar as any wrong move could lead to a very muddy situation.

Despite these potential pitfalls, all participants were extremely enthusiastic about playing their part for nature. The proof of the pudding was how the number of trees planted exceeded the number originally planned. Having set out to introduce 200 new mangrove saplings to the Kuala Selangor Nature Park, the Energy Commission team planted a total of 220 trees.

According to Kamarul Ariffin Ibrahim, the Director of Strategic Planning & Communication, the trees planted that day will contribute to the environment as every 2.5 acres of trees (numbering at approximately 3,000 trees) absorbs 1.5 tonnes of CO_2 per year. This helps reduce the size of the carbon footprint. Also, mangroves act as a natural buffer against tsunamis.

The mangrove planting is just the more recent of a string of other similarly successful corporate social responsibility initiatives undertaken by the Energy Commission – the Touch Points Programme, EE Challenge and EE Run – all of which aim to heighten awareness on energy efficiency. While the EE Run is a running event to advocate the importance of energy efficiency among the masses, the EE Challenge specifically targets schools where the students are challenged to reduce energy consumption. In addition to driving energy efficiency, the Touch Points Programme also educates consumers on electrical safety.

Moving forward, Kamarul Ariffin revealed, "We are thinking of doing something to simultaneously help the community and the environment." Beyond that, activities such as these reinforce the Energy Commission's drive to be a socially responsible organisation. EM

Suruhanjaya Tenaga
Energy Commission

ORDERLY SUPPLY and USE OF ENERGY

Suruhanjaya Tenaga (ST), 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.

The Energy Commission...

Advises
Ministers on all matters concerning the national policy objectives for energy supply activities, the supply and use of electricity, the supply of gas through pipelines and the use of gas.

Regulates
electricity and piped gas tariffs and the quality of supply services, as well as promote competition and prevent misuse of monopoly power.

Promotes
good practices, as well as research, development and innovation in the electricity and piped gas industries.

Plans and develops
laws, regulations, rules, codes, guidelines, programmes for the orderly development and functioning of the electricity and piped gas industries.

Licenses and certifies
electricity and piped gas suppliers, competent electricity and gas personnel, training providers, contractors, equipment and installations, energy service companies and energy managers.

Monitors and audits
performance and compliance of licensed and certified suppliers, service providers, installations, equipment importers, manufacturers and retailers.

Investigates
complaints, accidents, offences and industry issues; and enforces compliance.

Suruhanjaya Tenaga (Energy Commission of Malaysia) | st_malaysia | ST_Malaysia | Portal ST

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