

Towards a World-Class Energy Sector

ENERGY



Suruhanjaya Tenaga
Energy Commission

MALAYSIA

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SMARTER CONSUMERS

**Energy Efficiency and Conservation
By the People, For the People**



POWERING PROSPERITY

The energy sector strives to meet increase in electricity demand while keeping true to efficiency targets.

MINISTRY INITIATIVES

KeTTHA's Secretary General shares the ministry's role towards achieving energy efficiency as a national goal.

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Energy Malaysia thanks the following personnel from the Energy Commission for their input in this issue:

Zulkiflee Umar, Head of Demand Side Management Unit for *Energy Smart*, *Energy Efficient*; *The Price of Progress* and *Setting the Standards*.

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10-3A, Jalan PJU8/3,
Damansara Perdana,
47820 Petaling Jaya,
Selangor Darul Ehsan, Malaysia.
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Fax: +603-7729 4887
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By the People, For the People



The energy industry has always been propagating safety, reliability and efficiency in the supply of power to our offices and homes. The Energy Commission strives to achieve success through its principles of safety and rigorous competency imperatives that industry professionals must strictly adhere to. Yet the field's strength lies not only in the competent decision-makers, professionals and operators in the power industry but also in consumers who must appreciate and consciously choose the maintenance of energy efficiency from their households and business spaces.

As all of us are energy consumers, it is vital that the desire for energy efficiency begins with ourselves. And while consumers band together to work on ensuring their supply of power is ecologically-friendly and efficiently served, the regulatory agencies for the sector must ensure that professionals are constantly working on enhancing the performance of the industry, backed by tested principles of reliability.

To improve upon ourselves, we as policy-makers must look into how people on the ground adapt to new policies and energy efficiency initiatives. By learning more about how small business owners, corporations and homeowners innovate upon brand-new efficiency measures, we learn what the people require and how we can best cater to their needs.

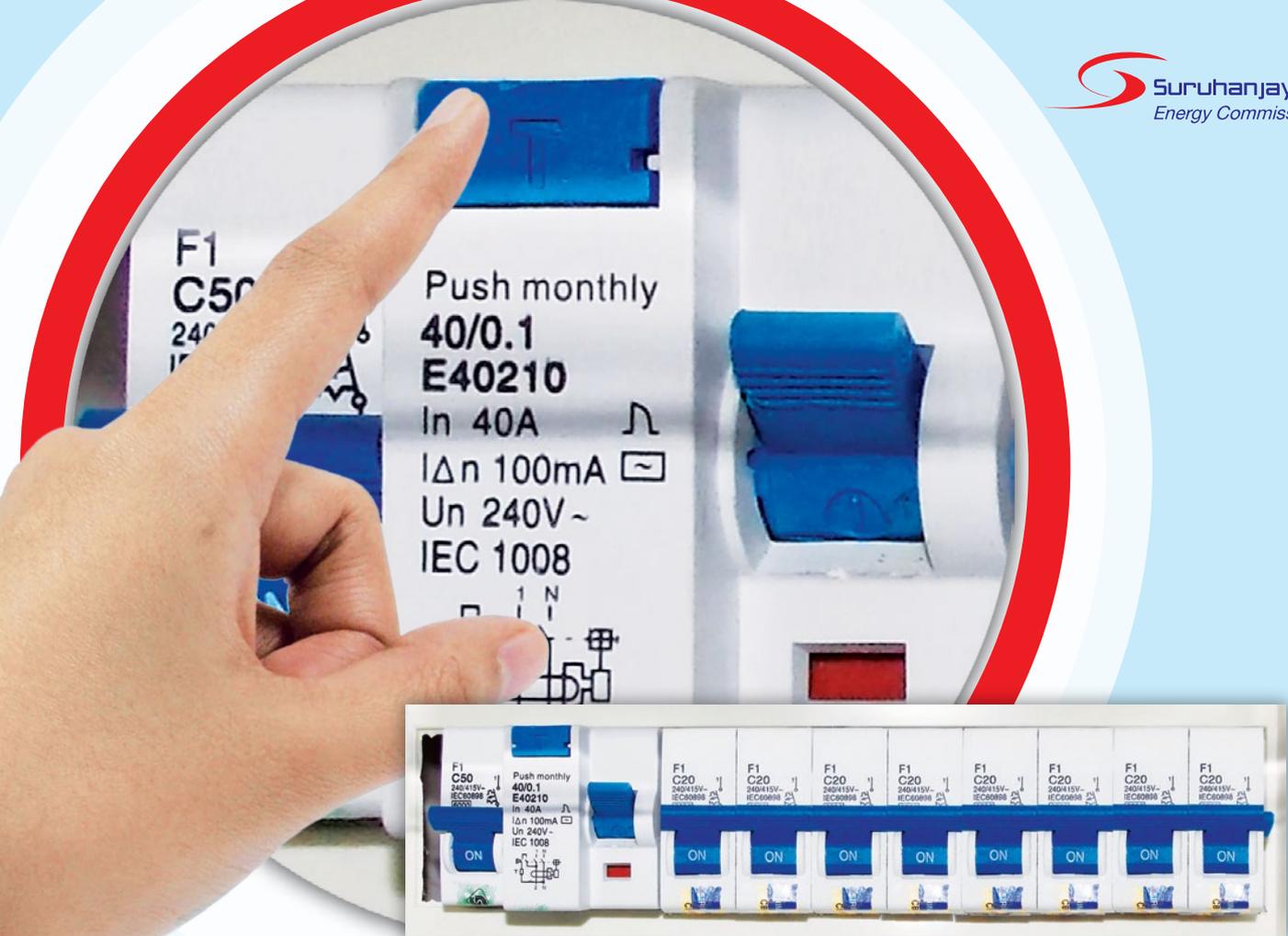
Another aspect of good customer engagement is how utility companies and power suppliers empower consumers to take charge of their consumption. New and innovative efficiency initiatives are constantly being churned out of the energy industry, some of which involve utility companies proactively meeting regulatory requirements, thus decreasing the cost to serve –

which would have otherwise been the burden of the consumers. Users are now being continually offered the opportunities to better manage their energy usage in order to save on monthly electricity bills.

Looking in from another angle into the crucial issue of energy efficiency within the power sector, the recent National Green Council Meeting discussed the inclusion of the Green Technology Masterplan as a measure to drive energy-smart behaviour in government buildings. This will smoothen policy coordination and integration across all organizational bodies while reducing carbon emissions in five key sectors – Energy, Transport, Building, Water and Waste. Working towards these objectives, the government is driving the growth in renewable technology to potentially attract RM26 billion in green investments while creating around 150,000 more jobs in a newer and more environmentally-friendly power industry by 2020.

As seen in all energy efficiency optimisation efforts globally especially in developed countries, the complete success rides very much on the back of responsible consumers. The Energy Commission actively encourages efficient behaviour through innovative and dynamic initiatives that adapt to the shifting energy demands of the people, while maintaining strict regulations on safety standards alongside general avoidance of energy wastage. The citizens of Malaysia are the ones who will make all the difference in achieving our targets, when they enthusiastically cooperate with the power industry's policy makers to ensure the continued sustainability of efficient power in our nation. **EM**

Dato' Abdul Razak Abdul Majid
Energy Commission, Malaysia



Safe And Efficient Usage Of Electricity

Test the automatic circuit breaker switch in your home today!

Automatic circuit breaker switches found in the electrical distribution board in your home are to protect you and your family from the dangers of electric shock.

Ensure that the automatic circuit breaker sensitivity does not exceed **100 mA or 0.1 A** and is tested at least once a month to ensure that it always functions satisfactorily.

A simple way to test the automatic circuit breaker is to press the test button (marked 'T'). An automatic circuit breaker switch that works well will trip when the test

button is pressed and you can restore the switch to its original position.

If the automatic circuit breaker switch does not trip after the test button is pressed, you should immediately consult a Registered Electrical Contractor for inspection and replacement of the automatic circuit breaker switch.

If you are using an **electric water heater** in the bathroom, make sure that the automatic circuit breaker switch with a sensitivity of not exceeding **10 mA or 0.01 A** is installed in the water heater circuit.

VALUE OUR LIVES. AVOID ACCIDENTS AND WASTAGE!

PRACTISE EFFICIENT WAYS OF USING ELECTRICITY

Switch off electricity when not in use. The more you waste, the more you pay.

Use energy-efficient electrical appliances such as refrigerators, fans, TV, lights and air-conditioners with energy efficiency labels.

Use electrical appliances at moderate speed, temperature and load.

Use natural lighting and ventilation to reduce the use of electrical appliances.

Monitor the electricity consumption level at your premises.

Ocean Wave Energy

Universiti Malaysia Terengganu (UMT) is in the process of developing innovations in energy production, using ocean waves as a new source of electrical power. According to Berita Harian, the project, known as 'Hydraulic Wave Energy Converter System,' aims to reduce dependence on fuel to generate electricity at a fishing village in Kuala Terengganu.

The project is the idea of three UMT students together with their lecturer, Prof Dr Mohd Zamri Ibrahim. One of the group members, Khairul Anwar Mohamad, a Physics (Renewable Energy) major, said, "When the system is receiving waves as high as three meters consistently within an hour, it could generate up to 40 Kilowatts (kW), or equivalent to generating for four houses for a month. Our goal is to fully utilise the system by 2019."

At an early stage, the energy generated will be supplied free of charge to the public at the fishing village. Khairul noted that the project received a grant of RM1.4 million from the Ministry of Energy, Green Technology and Water (KeTTHA). **EM**



Prof Dr Mohd Zamri Ibrahim, Research Officer and Lecturer at Universiti Malaysia Terengganu (UMT) showing a model of the wave power generator.

TNB Signs Power Purchase Agreements

Tenaga Nasional Berhad (TNB) has signed power purchase agreements (PPAs) with UITM Solar Power and TNB Sepang Solar. Under the PPA, UITM Solar Power and TNB Sepang Solar will design, construct,

own, operate and maintain a solar photovoltaic energy generating facility.

TNB Sepang Solar will build its 50 watt-peak (Mwac) plant in Sepang, while UITM Solar Power will build its 50 Mwac

facility in Gambang, Pahang. Both facilities are scheduled to start commercial operations on 1 November 2018.

TNB also stated that the PPAs govern the obligations of the parties

to sell and purchase the energy generated for 21 years from the commercial operation date. It added that the signing of the PPAs will have a neutral impact on TNB's earnings during the course of the agreements. **EM**

Mutually Beneficial Partnership for RAPID

Petroleum Nasional (Petronas), Malaysia's national petroleum company, and Saudi Aramco, Saudi Arabia's national oil company, signed an agreement yesterday to collaborate on Malaysia's Refinery and Petrochemical Integrated Development (RAPID) project. Saudi Aramco will invest US\$7 billion (RM31 billion) in the US\$27 billion RAPID project.

RAPID is a project to develop an oil refinery on a 2,000 hectares (ha) site in Pengerang, on the south of the Johor coast. It will mean employment for 70,000 people during the development phase, and will generate as many as 4,000 new jobs once completed, which is expected to happen in early 2019. The agreement was signed on 28 February 2017, in conjunction with Saudi ruler King

Salman Abdulaziz Al-Saud's four-day state visit to Malaysia. The partnership marks the start of a strategic and mutually beneficial relationship between Saudi Aramco and Petronas.

With the signing of the agreement, both parties will hold equal ownership in selected ventures and assets of the RAPID project. Saudi Aramco will be supplying the facility with 70% of the crude feedstock required by the refinery, while Petronas will provide a constant source of natural gas, power and other utilities. **EM**



Top: (From left) Amin H. Nasser, President and CEO of Saudi Aramco and Khalid Al-Falih, Saudi Arabia's Minister of Energy, Industry and Mineral Resources and Aramco chairman of the board of directors, shook hands on their partnership with Petronas, represented by Datuk Seri Abdul Rahman Dahlan and Wan Zulkiflee, Ministers in the Prime Minister's Department.

Left: Overall view of construction of the jetty structure at the Pengerang Deepwater Petroleum Terminal.





SMART ENERGY METERING

Smart energy meters are rapidly being adopted around the globe as part of a larger smart grid initiative. They are the next generation of gas and electricity meters, offering consumers a range of intelligent functions. These include showcasing the amount of energy used through a display panel in the user's home and directly communicating electricity consumption reading with the utility thus eliminating the need for physical reading.

Another benefit of smart meters includes real-

time information on the consumer's energy use which allows them to better manage their energy consumption. It also provides them with more accurate electricity bills.

Great Britain is vigorously venturing into the usage of smart meters as a crucial step towards digitising its nation's energy system. Transitioning to the new system will take some time, requiring careful management and arrangement. Its target is to have a smart meter installed in most of the nation's

Oil Investment Revival

After a two-year rout as the Organization of Petroleum Exporting Countries (OPEC) cut its output to boost oil prices, oil companies are reviving. In a report, the International Energy Agency (IEA), an agency that advises most of the world's biggest economies on energy policy, said there are "signs

of a modest recovery" in spending in 2017.

According to IEA, investment will increase this year after back-to-back declines of about 25% cut of the global investment to US\$433 billion in 2016. IEA forecasted that investment could drop again this year.

Non-OPEC supply as a whole will expand by 3.3 million barrels a day in the period from 2016 to 2022, compared with last year's prediction of 2 million a day through 2021. "Global oil supply could struggle to keep pace with demand after 2020, risking a sharp increase in prices, unless new projects are approved soon," said the report. **EM**



households by the year 2020. The UK's Department of Energy and Climate Change (DECC) has also been appointed to manage the implementation of the smart metering programme.

Globally, the smart meters market is also expected to grow to reach more than US\$20 million by 2020. Countries in the Asia-Pacific, especially China, are expected to increase their use of smart meters which is mostly driven by supportive government policies towards their implementation. **EM**

ENERGY SMART, ENERGY EFFICIENT

Meeting National Goals through Empowering Energy Consumers



24 degrees Celsius is the recommended temperature for air-conditioners in Malaysia in order to save energy and reduce bills. This ensures optimum comfort levels.



Homes and office work stations can conserve electricity by using natural lighting, thus reducing the need to turn on the lights.

On 19 April 2016, the daily demand for electricity in Peninsular Malaysia reached its highest ever level, when it peaked at 17,788 MW. What made this more remarkable is that it was the second time in just over a month that the daily demand record was breached, having reached 17,175 MW on 9 March the same year. The increased usage was attributed to a higher utilisation of air-conditioners as an El Niño weather phenomenon caused a heatwave and a spike in temperatures. With climate change resulting in warmer temperatures, causing electricity usage meant for cooling to increase, it is important for consumers to adopt ways of better managing their consumption.

The Price of Keeping Cool

For some, the air-conditioner is considered to be also among the most important inventions of all time, and in fact Singapore's founding



Prime Minister Lee Kuan Yew once credited the appliance for the island city-state's development as it allowed people to work in tolerable conditions. However, while the steady stream of cooled air lowering the temperature around us may be bliss (especially in the Malaysian heat and humidity), comfort comes at a price.

And it could be quite a hefty one, as several homeowners discovered in the aftermath of the 2016 heatwave. As reported in a local newspaper, a number of consumers found that their electricity bills had gone up dramatically.

For instance, one resident saw his monthly electricity tariff rise from an average of RM80 to at least RM580, after he had left air-conditioners in his house running throughout the day (at least eight hours) for a month. Similarly, another consumer experienced a jump in his monthly bill from RM125 to RM231, after leaving his air-conditioning on for 8 hours a day instead of the usual 5 hours, as his consumption went up from 428kWh to 598kWh.

Commercial and industrial building owners and managers experienced a more pronounced effect on their overheads as such premises tend to use more energy. Businesses saw their power costs soar during that period.

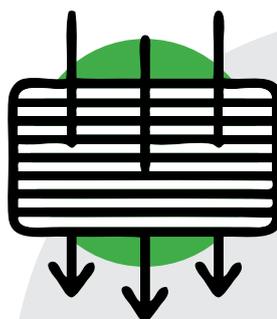
While we may be focusing on one particular period, the fact of the matter is that energy demand and consumption have been rising over the past 10 years. While the authorities, the energy sector regulator and the utility have all introduced measures to increase efficiency from the supply side, consumers also need to play their part by becoming energy smart.

Controlling Temperature, Controlling Costs

Being energy smart is a way in which consumers can empower themselves by taking greater control of their energy usage, which will result in lower electricity bills. Aside from reaping personal benefits, energy smart consumers also play an important part in helping the nation achieve its goal of a 45% cut in carbon intensity by 2030.

When it comes to power consumption, the air-conditioner is the biggest culprit, as it uses the most electricity of all common household and office appliances, over the longest period of time. For instance, a 750 Watt air-conditioning unit in a house costs around RM0.21 per hour to operate. This works out to around RM52.94 over 31 days, if the air-conditioner is running for 8 hours a day.

That calculation is only valid if the air-conditioner is being run at a temperature of 24 to 25 degrees Celsius. However, for every one degree the temperature is lowered, power usage goes up around 4% to 7%. Therefore, the lower the air-conditioner is set, the heftier the electricity bill.



Regular (once every 3 to 4 weeks) cleaning of air-conditioner filters ensures that more cool air will be allowed to flow out thus reducing the need to reduce the temperature and/or increase the fan speed.



Motion sensors in offices can help reduce bills by automatically turning off lights and air-conditioning when the office is empty.

This is why the Malaysian government imposed a rule in 2011 where all government offices had to limit their air-conditioners to a minimum of 24 degrees Celsius. This initiative, along with a goal set in 2013 to achieve 5% in energy savings in all government buildings, are indicative of the government seeking to set the standards when it comes to prudent consumption of electricity.

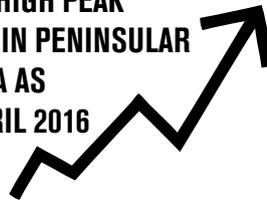
Also, according to Minister of Energy, Green Technology and Water, Datuk Seri Panglima Maximus Johnity Ongkili, there is an initiative to "Promote the retrofitting of government buildings through Energy Performance Contracting (EPC) to reduce energy consumption and thus reducing carbon emissions."

Incidentally, the Energy Commission has been entrusted with monitoring the performance of the various ministries, agencies and statutory bodies in this regard, and its efforts and achievements can be seen in *Leading by Example* in Volume 10 of *Energy Malaysia*.



17,788
MW

RECORD HIGH PEAK DEMAND IN PENINSULAR MALAYSIA AS AT 19 APRIL 2016



16,901
MW

PREVIOUS RECORD HIGH PEAK DEMAND ON 6 JUNE 2014



-18°C

IDEAL TEMPERATURE FOR A FREEZER

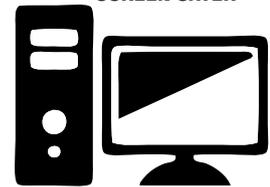


115w

AVERAGE COMPUTER LOAD DURING OPERATION

105w

AVERAGE COMPUTER LOAD WHEN USING A SCREEN SAVER



20w

AVERAGE COMPUTER LOAD DURING SLEEP MODE

6w

AVERAGE COMPUTER LOAD WHEN TURNED OFF BUT WHILE STILL PLUGGED INTO A LIVE SOCKET



Through smart meters, home and office owners can keep better track of their electricity usage, even from their mobile devices, thereby enabling them to make more informed decisions regarding their use of appliances.

By using energy efficient electrical equipment, homeowners and companies can cut their electricity usage between 30% and 50%. For an SME, with monthly electricity bills of around RM3,000, this move can result in annual savings of RM18,000 – a sizeable amount that can be reinvested in other areas.

As can be seen, MEPS applies mostly to appliances that are mainly used in a domestic environment, although lights, fans and air-conditioners are also employed in commercial and industrial settings. Also, plans are now underway to add industrial chillers and cooling towers to the list of electrical equipment that require adherence to MEPS.

There are other ways in which industrial and commercial consumers can reduce their electricity consumption. These range from simple solutions such as turning off the lights and air-conditioners when not in use, to more complex actions such as investing in thermal storage that can store water and chill them at night (during off-peak tariff hours), in order to use it for the air-conditioner the next day.

Incidentally, all commercial and industrial consumers that use up to or more than 3 million kWh of electricity for six months need to hire a registered electrical energy manager who will give recommendations on how to reduce energy use (more on this in *The Price of Progress* in this issue of *Energy Malaysia*).

Cost-Savings Investment

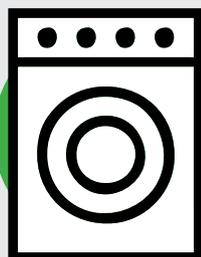
It is important to note that the various actions taken by the government departments to reduce their electricity consumption are all achievable by ordinary home and office owners at no huge cost. As stated, one such move is to set the air-conditioner at 24 degrees Celsius and above, in order to reduce power usage.

In order to complement this, home and office owners are encouraged to invest in electrical appliances that have been rated 5-stars, indicating that they are the most energy efficient according to the Star Rating set by the Energy Commission.

To further boost the production, sales and usage of such equipment, the *Electricity (Amendment) Regulations 2013* stipulates that five types of domestic appliances – refrigerators, air-conditioners, televisions, domestic fans, and lighting – sold in Malaysia need to have a 2-star rating at least. More on the Minimum Energy Performance Standards (MEPS), as this initiative is known, can be found in *Setting the Standards* in this issue of *Energy Malaysia*.



Invest in air-conditioners with inverters, as they can help cut monthly operational costs from RM80 to RM40.



Top loading washing machines are more energy and water efficient than front loading ones.



The Net Energy Metering scheme introduced by the Malaysian government enables home and office building owners to install and generate solar power for their own use, thus reducing the strain on the grid.

One other initiative that industrial and commercial electricity users, particularly building owners and/or operators, can adopt is that of energy performance contracting (EPC). Under the EPC scheme, building owners can commission an energy service company (ESCO) to implement energy efficiency in their premises, and the savings resulting from these will be used to pay the ESCO.

Monitoring Usage

There is a saying, "The price of freedom is eternal vigilance." In a way, that too is the price of cheaper electricity, as building owners and managers should constantly monitor electricity usage. Without a doubt, the best way to do so is by installing a smart meter, which will enable access to more detailed, real time information about the rate of power consumption.



Already 1,000 smart meters were rolled out in 2016, with 800 of them being installed in various premises in Melaka and the remaining 200 in Putrajaya. Given that faulty, older meters are among the most frequent causes of disputes regarding electricity bills between consumers and the utility, smart meters can also help reduce costs by ensuring accuracy in reading.

One other advantage of smart meters is that they help consumers to plan their electricity usage. Although domestic or residential tariffs in Malaysia are not separated into peak and off-peak times, industries are eligible for Time of Use (ToU) and Enhanced Time of Use (EToU) tariff schemes.

These schemes divide the price for electricity into peak and off-peak hours (for ToU), as well as into peak, mid-peak, and off-peak hours (for EToU). Qualified companies can therefore make use of the lower tariffs during mid-peak and off-peak times to run power-intensive tasks, while limiting electricity use as much as possible during peak hours.

Producing Own Power

Perhaps the most unique way in which consumers can reduce their electricity costs is to produce it themselves. While this may sound like a radical solution, it is something that has been afforded to Malaysians thanks to the Net Energy Metering (NEM) scheme which was introduced in November 2016.

Under NEM, consumers – domestic, commercial and industrial – are allowed to generate electricity for their own consumption using solar photovoltaic (PV) cells installed on their rooftops or on structures such as carparks and garages. The annual capacity for NEM has been set to 90MW for Peninsular Malaysia and to 10MW for



To help reduce strain on the power supply, schedule tasks such as clothes washing and boiling water during non-peak hours (from 6 pm to 7 am).



Notebook and laptop computers use 30% less power than desktop computers. Also, turning the computer off and pulling the plug from the socket will eliminate energy consumption. If powering off is not viable, then sending the computer to sleep mode is the next best option.

Sabah and Labuan, and domestic users can generate up to 12kWp for a single installation, while commercial and industrial users are limited to 1MWp or 75% of maximum demand (whichever is lower).

Not only does NEM help offset the electricity bill, excess energy can be sold to the grid. This creates a win-win situation as consumers can enjoy savings on energy costs, while the strain on power generation, transmission and distribution is lessened particularly during peak demand hours. Last but definitely not least, it goes some way into helping the country achieve its renewable energy and carbon reduction targets.

There are many ways in which consumers can become smarter with their energy usage. These range from simple acts such as turning off appliances and lights when not in use, to more complex ones like using tinting on windows to reduce heat during daytime or using natural sunlight for lighting. Consumers, especially commercial and industrial ones, are also encouraged to perform energy audits to identify the main areas of their premises where energy wastage occurs. Then there is the *Guidelines on No-Cost and Low-Cost Measures for Efficient Use of Electricity in Buildings*, a very useful guide on being energy smart, which is published by the Energy Commission. Ultimately, the power is in your hands. **EM**

THE OF PRICE PROGRESS

Managing Rising Energy Demand in the Wake of Increased Economic Activity

The cityscape of Kuala Lumpur has long been a testament to the rapid progress Malaysia has undergone since it gained independence 60 years ago in 1957. Tall office blocks stretching up into the sky; shopping malls full of retail outlets and people; restaurants and bars open until the wee hours of the morning; street lights, traffic lights and neon billboards that can be found throughout the city. Today, more and more towns and cities in the country are showing similar signs of progress. This however comes with a price in the form of higher energy demand and costs. The challenge is to balance the development needs of the country with the prudent management of energy supply and demand.

In *Energy Smart*, the main feature of this issue, we detail how an El Niño-caused heatwave in March and April 2016 resulted in daily electricity demand in Peninsular Malaysia hitting a record high of 17,788MW on 19 April. This means that its peak demand was at 80% of the total installed capacity in the Peninsula, which is 22,220MW.

According to the Energy Commission, electricity demand in Malaysia is expected to grow at a rate of 2% to 3% per annum over the next few years. As

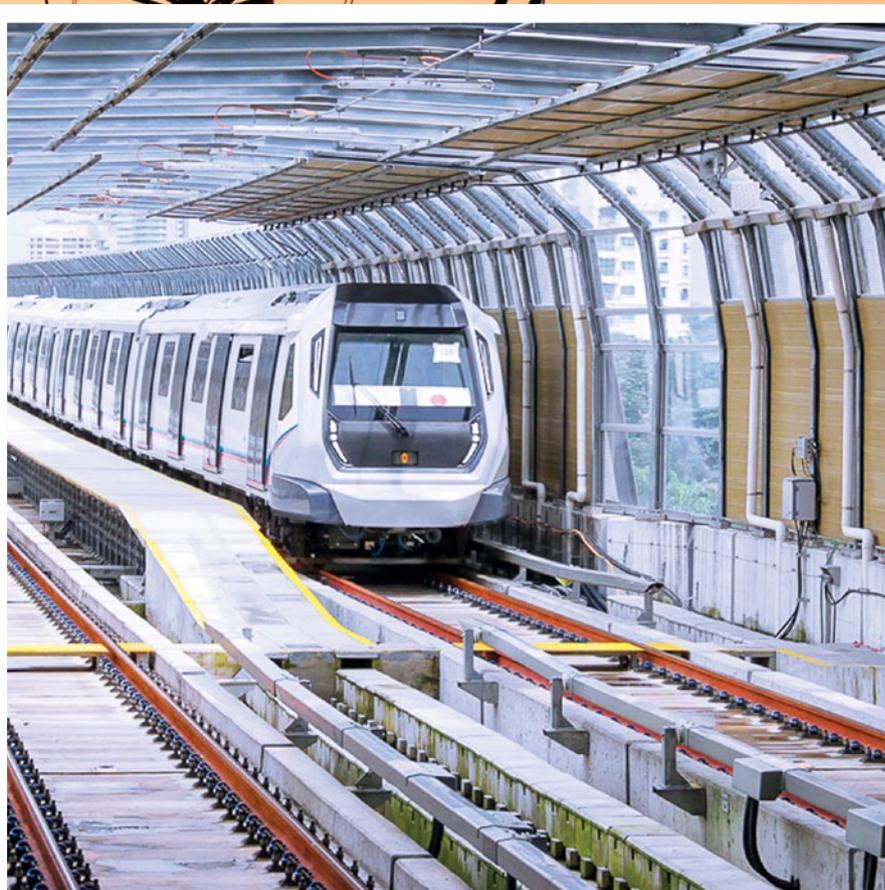
the deadline to become a high-income, fully-industrialised nation by the year 2020 draws closer, as per the Vision 2020 Master Plan, the intensity and pace of efforts have increased in order to spur growth.

Powering Prosperity

For instance, the transport sector is expected to account for a significant spike in energy demand, as the Klang Valley Mass Rapid Transit (KV MRT) becomes operational. To illustrate, in the 2012 agreement between MRT

Corp – which manages and operates the MRT – and utility Tenaga Nasional Berhad (TNB), the latter agreed to supply the Sungai Buloh-Kajang Line with electricity up to a maximum demand level of 116.5MW.

Another transport project that will likely add to electricity demand and consumption is the Kuala Lumpur – Singapore high speed rail (HSR). While there has yet to be any exact calculations about its expected electricity demand, a rough estimate may be derived by benchmarking the



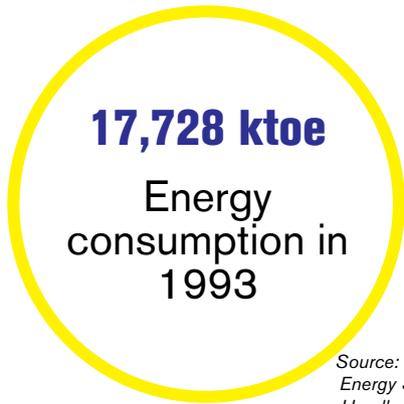
HSR against the German Inter-City Expressway (ICE) high speed train.

According to data from the European MEET (Methodologies for Estimating Air Pollutant Emissions) project, the energy consumption of ICE ranges from between 22.2 kWh to 38.5 kWh (depending on the variables such as distance travelled).

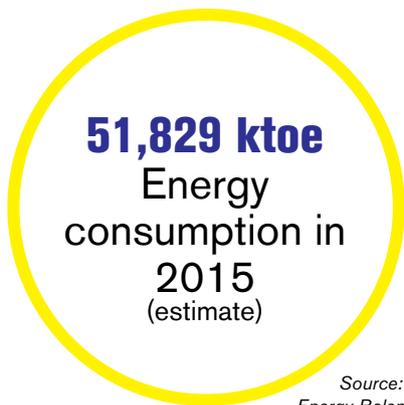
Both the MRT and HSR are integral projects under the ETP, which seek to boost revenue growth in Malaysia, and increase gross national income (GNI) per capita to US\$15,000 by the year 2020. Other initiatives include constructing new hypermarkets and superstores, developing more integrated resorts, boosting the manufacture of electronics, and establishing Malaysia as a data storage hub.

These, as well as other projects under the ETP, will help create 3.3 million new jobs. In order to make the ETP targets a reality, an estimated US\$444

The construction of electric railway lines such as the Mass Rapid Transit (MRT) (pictured) and the High-Speed Rail (HSR) is part of Malaysia's national development plan, thus leading to greater demand for energy.



Source: Malaysia Energy Statistics Handbook 2015



Source: National Energy Balance 2015

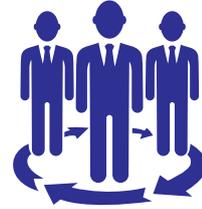
Number of Domestic Electricity Consumers in Peninsular Malaysia

6.7 million



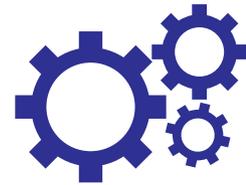
Number of Commercial Electricity Consumers in Peninsular Malaysia

1.4 million



Number of Industrial Consumers in Peninsular Malaysia

27,000



billion worth of investments are needed, mostly from external sources. This leads to greater responsibility being placed on the energy sector as Malaysia needs to demonstrate that it has the capacity to meet the expected increase in demand so as to attract foreign investors.

Balancing the Mix

Another factor that is adding to the rise in electricity demand is the increase in the number of homes, particularly in the rural areas, that receive electricity from the grid. Under the 10th Malaysia Plan (2011 – 2015), rural electrification in the country rose from 93% as of 2010 to 98% by 2015. The 11th Malaysia Plan (2016 – 2020) aims to bring this to at least 99%.

Again we can see the potential dilemma because, while wider access to electricity supply helps to enhance socio-economic development, it adds to the strain on the supply side. At present, Malaysia is still a net exporter of oil and

gas, and the latter accounts for around 34% of the country's generation mix, with coal making up 58%, hydro 5%, and renewables 3%.

As recently as 2013, natural gas accounted for 58% of electricity generated in Malaysia. However, concerns about over-dependency on one source resulted in a move to create a more balanced generation mix. Thus coal has increased in prominence.

It should also be noted that the price of gas per mmBtu is higher than the price of coal. In the past, producing power using gas was more cost-effective to generators because of the high gas subsidies given by the government. However, with the rationalisation of gas subsidies, coal has turned out to be a less-costly option.

Another factor is that the continued use of subsidised natural gas for domestic consumption means potential loss of revenue for

development. With an estimated 33 years of natural gas reserves remaining in Malaysia, the most strategic move would be to fully exploit its revenue generating capability for national development.

On the other hand, Malaysia has to import coal, and therefore the cost is subject to the international coal price and exchange rate fluctuations. With consumption and demand going up, power generators are expected to produce more electricity, which means more fuel being used, which means higher expenses for the nation.

The Responsibility of All

A number of initiatives have been introduced on the supply side to address this issue. These range from adopting more efficient generation technologies to minimising transmission and distribution losses, so that more power can be supplied from the same amount of (if not less) fuel.

Other measures include boosting generation from renewables and hydropower dams. Nuclear power has also been considered, and while it remains a potential project under the ETP, public concerns about its safety and viability, particularly after the 2011 Fukushima disaster in Japan, has led to it being put on hold.

Presently, Peninsular Malaysia's and Sabah's energy production capacity is around 24,464MW, of which 12,449MW is from gas, 9,066MW from coal, 2,615MW from hydro, 283MW from diesel and the rest from renewables. Owing to their age, which has resulted in reduced efficiency, a number of gas-fired power plants, with a total capacity of more than 1,782MW, are slated to be retired.

In order to replace them, new coal and gas-fired power stations are being developed, with a total capacity of 1,400MW (1,000MW from coal and the rest from gas), expected to be operational within 2017. Also being built are large scale solar (LSS) plants that will be able to generate a total of 300MW, while small-scale solar and biomass generators contribute around

400MW as part of the Feed-in Tariff (FiT) scheme. Last but not least, by January 2018, the Laos-Thailand-Malaysia (LTM) interconnection will be established, thus enabling the country to purchase electricity from hydropower plants in Laos, where low demand means that they have a lot of excess supply.

Therefore, when it comes to capacity, Malaysia has a healthy reserve margin to meet anticipated demand for at least the next five years. Even so, initiatives have also been introduced to ensure maximum efficiency in the supply side, such as ensuring that optimum heat rates are maintained, thus ensuring lower generation costs.

Managing Demand

As the old saying goes, "It takes two hands to clap," and efforts to strengthen the energy sector from the supply side also needs to be met with equal, if not greater, effort from the demand side. The Economic Planning Unit (EPU) of the Prime Minister's Department has been working with the UN Development Programme (UNDP) to carry out a study on demand side management

(DSM) in order to formulate strategies and a master plan.

Presently, a number of initiatives have been introduced to encourage the better management of energy usage by consumers. More details of these can be found in Energy Smart, Energy Efficient, the cover story for this issue.

Also under the Efficient Management of Electrical Energy Regulations 2008 (EMEER 2008), all installations on commercial and industrial premises that consume not less than 3 million kWh for a period of up to six months, need to appoint an electrical energy manager (EEM) registered with the Energy Commission.

The EEM will then carry out an energy audit, and make recommendations on how the installation can be more energy efficient. The installation has to submit a report to the Energy Commission, which includes details on the amount of energy consumed over the past six months, the measures suggested by the EEM that are being implemented and how much savings they will bring about, as well as those recommendations that are not being implemented and why.

The EEM is also required to confirm that they have been granted full access to the relevant records of the installation, and that the information contained in the installation's report is correct.

It should be noted that EMEER 2008 does not stipulate that the installation needs to produce savings. However, the understanding is that by appointing an EEM, the organisation in question will work towards implementing actions that will reduce energy consumption

The main objective is to create awareness among industrial and commercial consumers about the importance of efficiency, and how they need to take on the responsibility of managing their electricity usage.



Structures such as skyscrapers lit up at night or water fountains that constantly spray water into the air (such as the one pictured here in KLCC Park) are among the symbols of Malaysia's progress, but are also huge consumers of electricity.

Placing focus on both the supply and demand side of the energy sector enables a more holistic view of the challenges the sector faces, and ensures that a more comprehensive plan of action can be created. Just as important, it also serves as a reminder that when it comes to energy security and efficiency, everyone – both consumers and producers – need to play their part. **EM**

Nurturing an Energy Efficient Society

It's easy to take energy usage for granted, without realising the cost to both the environment and to your bank account. However, people are becoming more aware of the importance of energy saving. In support of the aspiration to move towards a world-class energy sector, Tenaga Nasional Berhad (TNB) in tandem with the Energy Commission of Malaysia and the Ministry of Energy, Green Technology and Water (KeTTHA), aim to educate Malaysians through its latest customer engagement programme, the Home Energy Reports (HER). Ir. Kamaliah Abd Kadir, Senior General Manager (Customer Service) of the Distribution Department in TNB shares with **Energy Malaysia** the resulting benefits and impacts of this programme.

WORLDWIDE IMPACT OF HER

SAVINGS OF:

11 billion kWh
13 billion lbs of CO₂
US\$ 1.5 billion in electricity bills

Source: Opower

Get In With the Programme

The Home Energy Report (HER) programme combined world-class user experience and was designed with behavioural science to provide its domestic customers with more information on their energy usage. TNB is the first utility company to run such a programme in Southeast Asia and third in Asia after Hong Kong and Japan.

The programme is designed to provide new information on energy savings to help its customers understand their home's energy usage and find smart ways to make their home more efficient. The programme tracks its customers' home electricity consumption and then provides them with a monthly comparison and tips on energy saving.

Developed and designed by Oracle America Inc., the holding company of Opower Inc., HER has been implemented in 10 countries worldwide, including US, Canada, UK, New Zealand, and India. To date, the programme has helped utility clients save their customers over 11 billion Kilowatt-hour (kWh), 13 billion pounds (lbs) of carbon dioxide (CO₂), and US\$1.5 billion on energy bills.

The cost of electricity is actually very low in Malaysia, especially for domestic and residential consumers, compared to the rest of the world. So there's a tendency for people to not value resources when they're cheap. Once you're not efficient in your energy, you're not only wasting your money and your own resources, you're wasting the resources of the country."

– Ir Kamaliah Abd Kadir,
Senior General Manager (Customer Service) of the Distribution Department in Tenaga Nasional Berhad

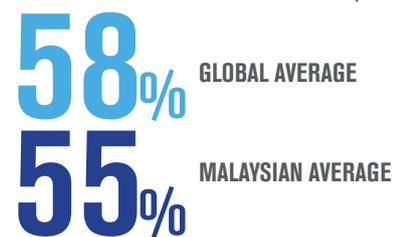


The programme is coherent with the government's vision of energy efficiency and is in full support of the Eleventh Malaysia Plan's (11MP) sustainability initiatives. It is also proof of the continuous and serious effort by the government to ensure the success of energy efficiency programmes in further reducing carbon emissions.

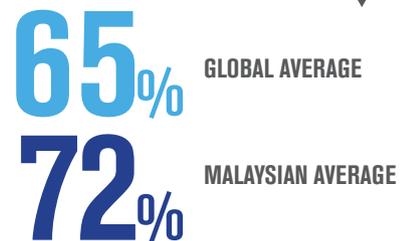
HOME ENERGY REPORTING HAS BEEN IMPLEMENTED IN

- ▶ NEW ZEALAND ▶ CANADA
- ▶ JAPAN ▶ THE UK ▶ INDIA
- ▶ THE UNITED STATES
- ▶ MALAYSIA ▶ HONG KONG

Satisfaction Rates: ▼



HER Read Rates: ▼



Source: Opower

As Malaysia's first time to conduct such a programme, the first phase started out with a relatively small group. Ir Kamaliah noted that, "The first phase was done in 2015 where they selected 250,000 participants in the Klang Valley, Negeri Sembilan, and Melaka. The participants are chosen based on their average electricity consumption, which is more than 200 kilowatt-hour (kWh) or equivalent to more than RM45 per month.

Over the course of the first phase, out of the 250,000 customers, 50,000 are part of a random control group for survey purposes. The survey showed that the group saved over 13,979 megawatt hours. The participants that were involved in the survey made significant changes on their electricity consumption with the help of the programme.

Home Energy Report (HER) Features



Information on customer's home energy use

Customers can see their home's energy usage in comparison to the energy usage of homes that are nearby and similar in size.



Ideas on Energy Efficiency

On each report, customers are provided with energy-saving tips so they can make informed choices.



Randomised Control Trial (RCT)

An approved and relied upon by regulators in over 40 jurisdictions worldwide to measure the recipient groups' change in behaviour in correlation to HER programme.



Progress Tracking

To enable customers to compare differences in energy usage during a certain period of time.



Home electricity bills can be reduced by practising simple efficiency habits such as ensuring that fridge doors are closed properly when not in use.

TNB, as a national utility company, is an industry leader and vocal advocate of energy efficiency initiatives. As such, through the HER programme, TNB aims to create a positive sentiment and elevate customer satisfaction by giving an alternative and environmentally friendly approach to electricity usage.

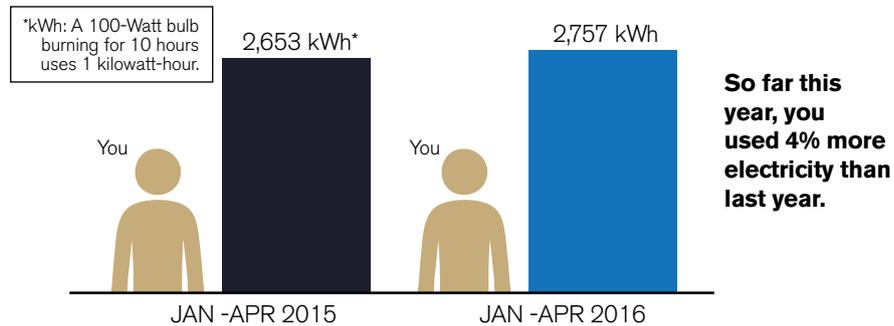
Cultivating Good Customer Experience TNB

Based on the customers' satisfaction survey, the programme was proven to be very effective. The survey indicated that 66% of customers that took part in the HER programme were satisfied with TNB, compared to 57% of customers that were not.

Even more so, the overall customer satisfaction was 9% higher and 5% lower for overall customer dissatisfaction compared to customers who were not a part of the programme. Ir. Kamaliah noted, "This is TNB's largest customer satisfaction increase ever recorded over a period of 7 years and 100 programmes."

HER Personal Comparison

How you're doing compared to last year:



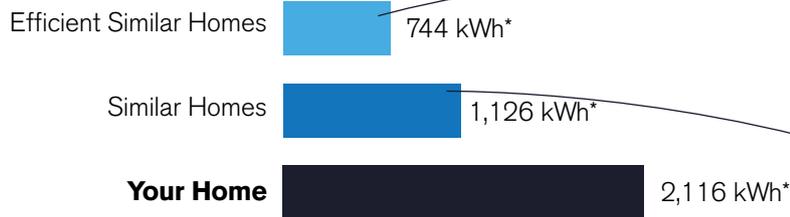
Source: TNB

Through the Home Energy Report (HER) programme, TNB tracks its customers' progress and then provides them with a report, showing a personal comparison of energy usage during a certain period of time.

HER Household Comparison

Last 3 Months Household Comparison

You used 88% more electricity than similar homes.



Which Homes are Compared?

Efficient Similar Homes:

The most efficient 20 percent of similar homes.

Similar Homes:

Approximately 100 occupied, nearby homes.

Source: TNB

Home Energy Report (HER) programme will show how much electricity its customers consume and make a monthly comparison with similar nearby homes.

The good reception of HER programme brought positive mass-media stories and TNB was even awarded Innovation & Leadership award for it, by the EU-Malaysia Chamber of Commerce on 15th December 2015.

The programme was proven so successful, that phase 2 is currently in the works and is expected to launch in August 2017. Phase 2 will run for 1 year on a larger scale. "Together with the government, we're looking at 450,000 customers this time around," said Ir. Kamaliah.

The Home Energy Report (HER) programme is one of many efforts by the government with the Energy Commission and TNB to strengthen the government-public positive relationship in light of energy efficiency, empower its customers to take action and responsibility of their energy consumption and reduce the carbon footprint. **EM**

CERTIFYING ENERGY EFFICIENT APPLIANCES

Energy security is the concern of everyone, and one of the key ways in which consumers can contribute is by using energy efficient appliances, which not only helps lower electricity bills but also reduces overall energy consumption and demand. To encourage this, all refrigerators, air-conditioners (ACs), televisions (TVs), domestic fans and lamps sold in Malaysia need to adhere to Minimum Energy Performance Standards (MEPS).

The Standards

MEPS is an evolution of a process which started with the introduction of the Energy Efficiency Label (EEL), which rated appliances from 1-star (for the least energy efficient) to 5-star (for the most energy efficient). This was complemented by the Voluntary Energy Efficient Appliances and Equipment standards and labelling programme, which ran from 2009 to 2012. This scheme encompassed ACs, refrigerators, domestic fans, TVs, insulators, ballasts, high-efficiency

motors (HEM), and fluorescent and LED lighting. In essence, MEPS specifies the minimum level of energy performance that appliances and lighting must meet or exceed before they can be offered for sale or used for commercial purposes.

“Previously, all these appliances were regulated on their safety aspect, not on their energy efficiency aspect. Come 2013, due to the country’s initiative to save energy, the Energy Commission of Malaysia started to regulate products to



be tested and to comply with Malaysian energy efficiency standards,” said Nur Fadhilah Muhammad, Senior General Manager for the Testing Services Department of SIRIM QAS International.

Symbiotic Relationship

SIRIM QAS International is the designated and recognised body in testing and verifying electrical appliances’ energy performance. It has also been recognised by the Energy Commission as the testing house

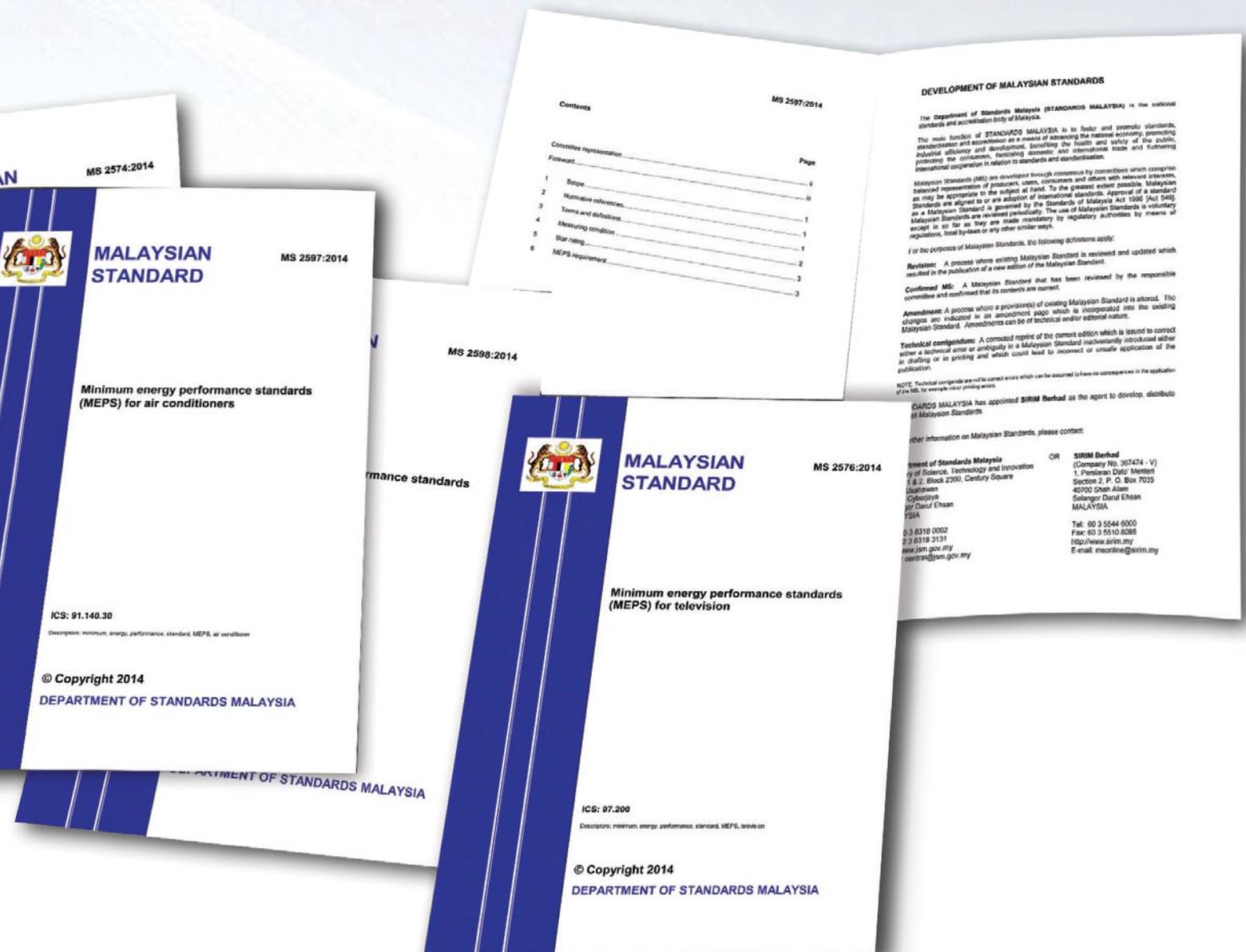
that can provide testing services for appliances identified under the EEL.

“We have a very close working relationship with the Energy Commission; as their designated testing and certification body, we have close collaboration with ST on technical matters, not just for MEPS but also on safety requirements.

As MEPS is a living document, its criteria are up for review by the Energy Commission every five years

or so. Regulatory measures have also been put in place to encourage manufacturers to improve the efficiency of the products that they send into the market, thus helping consumers make the best choice to meet their needs.

Therefore, for an appliance to reach the highest MEPS rating, Nur Fadhilah noted that the onus is on the manufacturers to start playing their part in producing more energy efficient products. “For example, a new innovation towards this energy efficient



effort is the inverter technology for ACs, which is used to control the speed of the compressor motor to continuously regulate the temperature. For lamps, the LED technology is a better energy efficient light compared to the normal fluorescent lights. This means that if you take a normal 40 watt (W) tube, its brightness may be the same as a 20 watt (W) LED light. So, it is the innovation in technology that would determine whether an appliance is energy efficient or not."

Thus, the Energy Commission, as the regulatory body of MEPS, needs to ensure that the industry is ready to provide energy efficient technologies before reviewing and raising the bar of the MEPS.

Apart from that, SIRIM QAS International is also very much involved with technical committees that develop the standards and criteria for MEPS, in which they play the role of technical advisors for the testing process.

It is also in a two-way relationship with manufacturers in terms of



For lamps to meet the requirements set under MEPS, it is gauged according to its lumen maintenance level, which is how long the light can maintain its maximum luminosity. The results are then printed onto the lamp packages to allow buyers to make the best choice.

product development, dissemination of information and in conducting awareness seminars for manufacturers on the new regulations and standards within the industry. Nur Fadhilah added, "We work closely with manufacturing associations like the Federation of Malaysian Manufacturers (FMM), Malaysian Air-Conditioning & Refrigeration Association (MACRA)

and The Electrical and Electronics Association of Malaysia (TEEAM)."

Meeting Minimum Expectations

The success of the Voluntary Energy Efficient Appliances and Equipment standards and labelling programme, which saw 5,016 appliances registered, enabled the authorities to make



"We always measure the output of the product. For air conditioners, the output is the coolness of the room. For fans, it's the air and for lights it's the brightness. For televisions, it's video (picture) and audio (sound) that we should get. Manufacturers need to start designing appliances to be efficient in that they consume the least amount of energy to produce the output that is required."

– **Nur Fadhilah Muhammad,**
Senior General Manager for the
Testing Services Department of SIRIM QAS International

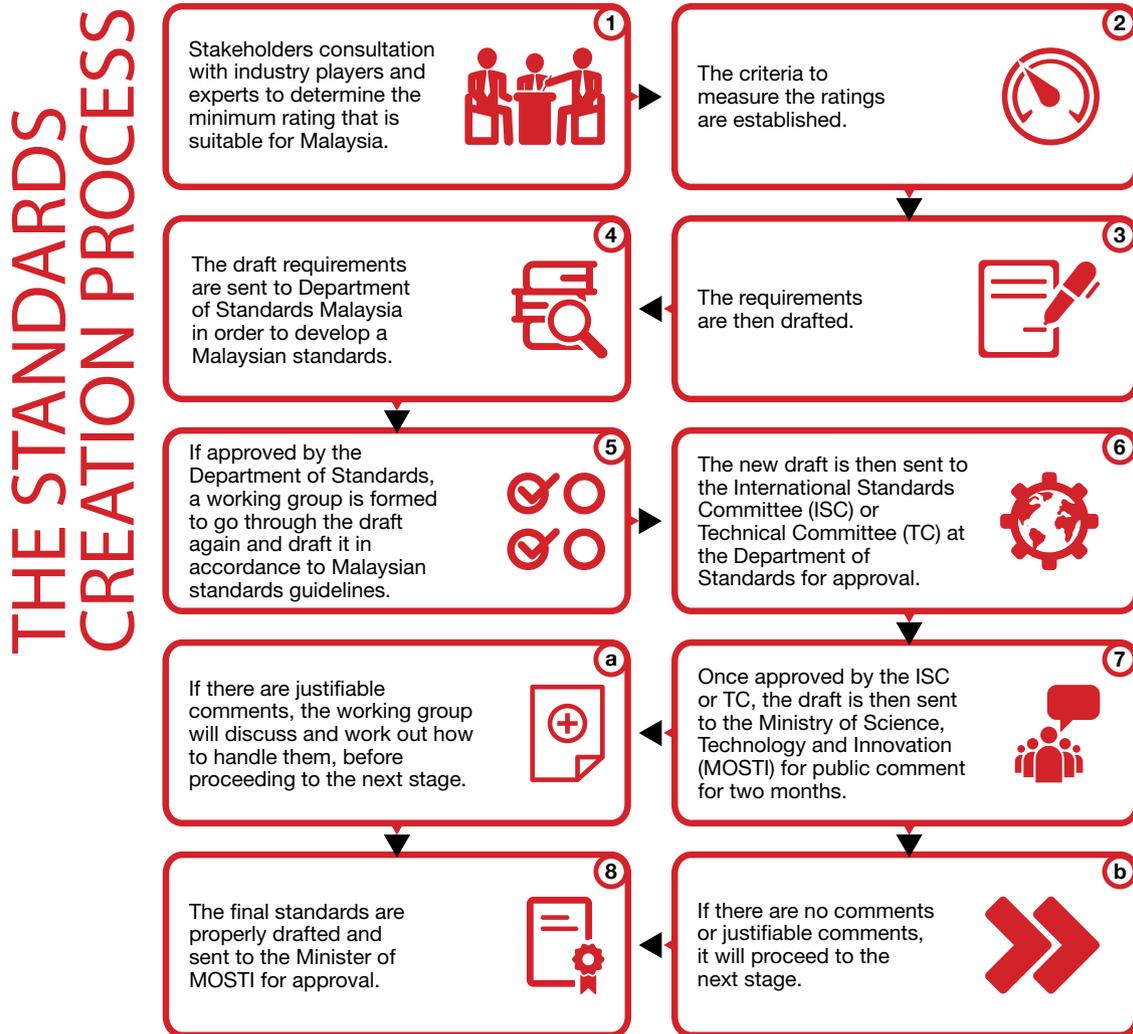


Diagram 1

Source: Energy Commission

energy efficiency mandatory for the aforementioned appliances.

This ruling came into force on 3 May 2013 and is part of the *Electricity (Amendment) Regulations 2013*. Thus, such appliances need to receive a Certificate of Approval (CoA) from the Energy Commission after undergoing testing by SIRIM QAS International for performance and safety, without which they cannot be imported into, manufactured or sold in the country.

For regulated equipment manufactured overseas, foreign test reports can also be used to qualify for a CoA if the test laboratory is one that is recognised by the Energy Commission. The process for creating the standards for each appliance is a long one that involves the input and participation of various stakeholders from

both the public and private sectors, particularly the industry and experts. This is important because it ensures that the standards set are the ones best equipped to enhance energy efficiency and security, while also taking into consideration the country's developmental needs and status.

In order to meet the requirements for MEPS, appliances are benchmarked against a 2-star rating on the Energy Efficiency Label. A 2-star rating means that it produces energy savings of less than 5% compared to the average. As a comparison, a 5-star rated appliance has savings of at least 25% compared to the average.

Explaining the 5-star rating system, Nur Fadhilah elaborated, "ACs, for example,

usually consume a lot of electricity to cool the room. If it is a 5-star rated appliance, it would consume less energy to cool a room versus a 2-star appliance which would use more energy to cool that same room. There are methods for testing this and a formula used to calculate the ratings."

Lamps, however, are gauged according to their Lamp Efficacy (Lumen/Watt). It is based on measurement of lamp output or also known as Luminous flux (Lumen) and power consumption (Watt) under standard condition. A lamp with higher value of Lamp Efficacy is more energy efficient compared to the one with lower Lamp Efficacy.

In addition to the Lamp Efficacy, Lumen Maintenance level, which is how much

light output is maintained after certain period of time, is also measured. LED lamps need to have minimum lumen value of 80% (of initial lumen value) after 1,000 hours of operation and 70% after 6,000 hours operation, while fluorescent lamps need to comply with minimum lumen value of 80% after 2000 hours of operation.

Future of Efficiency

Since MEPS was imposed, the number of electrical equipment that has successfully met expectations and received a CoA has increased from year to year. For instance, in 2015, a total of 1,215 appliances were certified, whereas in 2016, this went up to 2,083.

It should be noted though that the five appliances are only the start, and the aim is to add at least five more appliances to the list. These are rice cooker, washing machine, water heater, electric oven, and vacuum cleaner. Just like the original five appliances, these were chosen as they are the most commonly found electrical items in an average Malaysian household, and also ones that are used the most often and for the longest period of time.

More than that, as further appliances are added to MEPS, it will help spark the manufacture of more energy efficient electrical appliances and technology innovations in Malaysia, thus enhancing that particular segment of the manufacturing sector. In addition, the creation of more Malaysian standards for MEPS strengthens the country's position as a hub for energy efficiency, making it a choice destination for the testing and accreditation of such equipment as well as an example that other developing nations seeking to introduce MEPS to their own systems can emulate. **EM**

Behind the Scenes of SIRIM

To shine the light on the testing process by SIRIM, the **Energy Malaysia** team went to the SIRIM QAS International laboratory in Shah Alam to have a first-hand look at how the testing process is done, as well as the testing facilities that are available at the SIRIM QAS International labs.



A lab technician at the photometry test facility placing a bulb into the integrating sphere which measures the light characteristics of lamps.

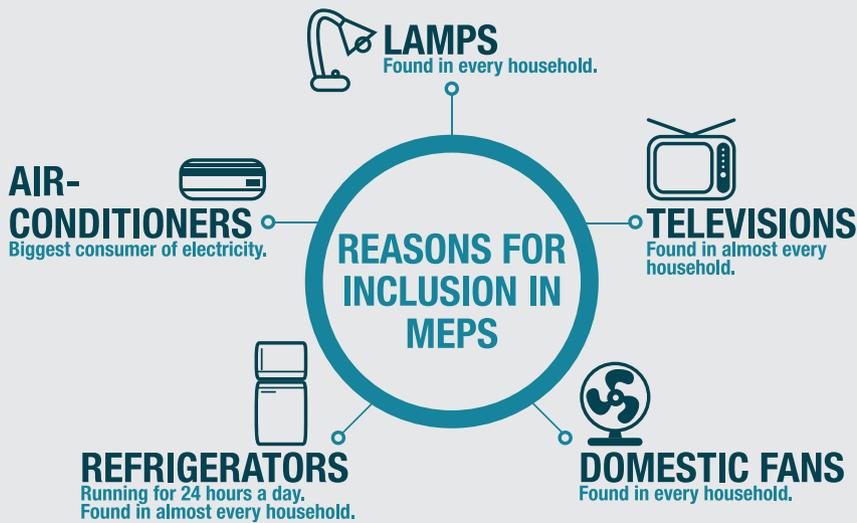


Diagram 2

Air Conditioners (ACs)

The performance indicator for ACs is the Energy Efficiency Ratio (EER) that is attained based on tests done in accordance to MEPS. The tested capacity value must reach at least 90% of that declared by the manufacturer for it to pass the testing stage. An AC unit must go through two testing methods as specified under C1.6 of MS ISO 5151 Standard, which consists of the Calorimeter Cooling capacity test and the Indoor Air-Enthalpy capacity test.

There are two chambers available at SIRIM QAS International labs that are specifically used for testing the energy efficiency of ACs, which are the psychrometric chamber and the balanced ambient room type calorimeter. The psychrometric chamber measures the air enthalpy (the amount of heat in the air) at the inlet and outlet section of an AC, as well as the mass air flow through the indoor section. To measure the total cooling capacity of an AC unit, the air flow amount is multiplied by the enthalpy variation.

The balanced ambient room type calorimeter consists of chambers akin to floating units, with two separate rooms to simulate the internal section of a room for the indoor unit and the external section of a room for the outdoor unit of the AC. The AC is

installed and wired as it would be in a real room. The size of the chamber is important to simulate normal use conditions. The air between the two rooms is maintained at the same dry bulb temperature as inside the room. Testing done in these balanced ambient type chambers are much more accurate since it ensures zero heat loss through the walls, ensuring the most accurate EER reading.

Refrigerators

For refrigerators, the Star Index is based on the daily energy consumption obtained from the tests in conformity with the requirements laid out under MEPS.

Testing is conducted in a walk-in environmental test chamber with normal room temperature and humidity level. An environmental chamber is able to test up to six refrigerator units at any given time. Presently, SIRIM QAS International has more than one unit of the environmental test chamber to cope with the current demand.

Fans

For ceiling and stand fans, the Coefficient of Performance (COP) is based on the air delivery measurement done in accordance with the

requirement of MEPS. The COP is also calculated whereby the measured air delivery is divided by the input power.

The fan is wired to the ceiling in real life simulation of the appliance in operation. It is then switched on and the air is measured by a meter. The meter captures the air that the fan generates with the four sensors that are placed at each of the unit's propellers. To calculate the most accurate total air delivery measurement of a fan unit, the test-run must be conducted at least two times.

Televisions (TVs)

For TVs, there is a standard signal that needs to be complied with to ensure that it consists of every colour throughout the signal of a picture. The world standard signal is from a standardised dynamic signal from the International Electrotechnical Commission (IEC). The testing method is according to MEPS standard (MS2576), in compliance with the standard condition for TV units under IEC 62607.

To test the video, the IEC dynamic broadcast content video signal is generated from an IEC Standards disk. The standard also specifies the required audio signal. SIRIM QAS International's technician uses a 1 Kilo Hertz signal from the audio generator to represent the audio standard signal.

The test for each TV unit usually takes around 10 minutes to capture the average power used to generate the standard signal, which determines the star rating that the TV qualifies for. Before the test is conducted, the appliance is set on factory default mode, as how the user receives the sample at the initial stage.

Lamps

There are two types of photometry test facilities available at the SIRIM QAS International lab. Lamps are generally tested in the integrating sphere where the light characteristics are measured

Right: An efficiency test for a television unit is underway which ensures that the appliance complies with a standardised signal as set by the International Electrotechnical Commission (IEC)

Bottom: Lamps go through life/ endurance test to ensure that it can maintain its lumen level for up to 6,000 hours as required under the MEPS. The large lamp testing facility at SIRIM QAS International can test various types of lamps with various mounting orientation at one time.



according to MEPS standard (MS2598) which cross refers to relevant MSIEC Standard for test methods, such as MSIEC 62612 for LED Lamps and MSIEC 60969 for florescent lamp bulb and MSIEC 60081 for florescent tube. The integrating sphere is a hollow globe shaped with its interior covered with a diffuse white reflective coating equipment, whereby the light source is placed at the centre of the sphere for light measurement. The sphere is connected to a photometer that measures the brightness of the lamp. Characteristics of light to be measured includes the Luminous flux (Lumen), Colour rendering index (CRI), Colour correlative temperature (CCT), Colour

XY coordinates, Standard Deviation Colour Measurement (SDCM) and the Spectral power distribution for the lamp.

The Goniophotometer is used to test the light fixtures such as street light and flood light. The system is connected with Spectroradiometer

and uses a mirror to reflect the light onto a detector. The rotating mirror will capture the brightness reading of the light emitted from the lamp source at different angles. The system is placed in a dark room to ensure that only light from tested light source is measured. There will be a control room outside of the facility.



The results from this testing is used by light designers, architects and OEM companies that need to visualize the intensity, light distribution and to map out light into designs. For example, street lights for Malaysian Public Works Department (JKR) require the photometric data, where the reading from the Goniophotometer system is attained to determine the correct position and distance between each lamp pole by the road designer for most optimum and efficient installation.

Dato' Seri Ir Dr Zaini Ujang



Secretary-General of KeTTHA on Achieving the Nation's Energy Goals

One of the functions of the Ministry of Energy, Green Technology and Water (KeTTHA) is the planning and formulation of policies and green technology programmes, in line with the Malaysian government's commitment to spearhead initiatives on the energy, green technology and water industries. Dato' Seri Ir Dr Zaini Ujang, the Ministry's Secretary-General, talks to Energy Malaysia about how the energy industry's stakeholders are working together to implement these programmes, the challenges of achieving the country's energy goals, and how these issues can be overcome.

Q: You were the Secretary-General of the Ministry of Higher Education, you served as the Vice Chancellor of Universiti Teknologi Malaysia, and you are also a qualified environmental engineer. How do these past experiences help you carry out your duties in KeTTHA?

A: While the job description of each of my past jobs are different from each other, they have some common denominators – skills that are necessary in each, such as dealing with people, empowering them, implementing policies, and working with whatever resources are available to us. These are the skills and experience that I bring here to KeTTHA as well.

Q: How is the Ministry working with other public sector bodies as well as the private sector to realise national energy efficiency goals? What do you see to be the biggest challenges and what is being done to overcome them?

A: The Ministry is very unique and ideal in terms of function – we focus mainly on managing the overall portfolio of the energy, green technology and water industries, and the sectors' roles are very well-defined. We also focus on policy-making while the other agencies such as the Sustainable Energy Development Authority (SEDA) Malaysia and the Energy Commission take care of delivery.

The challenge here is in implementation – how best to deal with the people and organisations involved so they can implement the policies. For instance, when it comes to renewable energy (RE), the challenge lies in how to inject it more into the system, especially as our energy portfolio is less than 30% RE. Energy efficiency (EE) is also quite low in the country.

To overcome these, we start by leading by example. Those who understand the policies, the ones promoting them, must practice them. For instance, here at our office, we use electricity very minimally – the lights are off in this room as we speak. Lifestyle is also very important – changes in the way we live and work will contribute a lot to achieving EE. We all must learn to be smart with our consumption, to not be wasteful or too reliant on high usage of electricity.

We also encourage having a good system in place, starting from building design, for instance – if the windows in a room are large, they allow in lots of light, thus encouraging less use of electricity. On a bigger scale, we promote green buildings, those that are built with energy efficiency in mind, and the KeTTHA building is a great example of this – we are the first LEO (Low Energy Office) Building in Malaysia.

Other initiatives we have worked on are the Net Energy Metering (NEM), a special billing system that provides credit to customers who generate some or all of their electricity, and the rating system for appliances in Malaysia, which encourages customers to purchase and use energy efficient equipment.*

Q: With energy efficiency a national goal, how are we working to ensure that we all reach this goal?

A: Our goal is 15% reduction in energy intensity and 25% increase in the use of renewables by 2030. The future of RE in Malaysia lies in solar, biomass, biogas and small hydro. As we migrate to cleaner energy, we need to review our tariffs. Ours is much lower compared to our neighbouring countries, but we still need to stop relying on coal as a base load and start looking into cleaner alternatives instead. The question is, which one is cleaner?

We are working closely with the stakeholders of the energy industry to get a definitive answer to this question. In the meantime, all of us – the public sector, the private sector and individuals – can do our part. Every small step counts.

More information on the rating systems can be found in our feature **Certifying Energy Efficient Appliances on page 22.*



The Ministry of Energy, Green Technology and Water (KeTTHA) is the first LEO (Low Energy Office) Building in Malaysia and one of the most energy efficient.



Solar Installers:

Devoted to the Green Cause

Malaysia is historically known for its abundance of natural resources that consist of oil, gas, hydropower and coal. However, the government's green initiatives in recent years have reinforced a new desire to secure renewable energy sources. Currently, solar energy has proven to be the chief among the renewables, with a market share of up to 43%, swiftly followed by small hydropower, biomass, and biogas. With the country's geographical location near the equator allowing us to receive between 4,000 to 5,000 watt-hour per square meter per day, solar energy proves to be the renewable energy resource to tap into. **Energy Malaysia** delves into the day to day life of a solar system installer as they fight for a greener nation, one installation at a time.

Industry Heats Up

Lionel Yap, the General Manager of Solamas Sdn Bhd, a boutique solar system installer, believes that the Malaysian solar industry has reached levels way beyond its own realisation. "Regionally, Malaysia has the most number of nationally accepted standards for solar installations, testing, and commissioning. We are probably the most well-rounded at the moment of any ASEAN country, including Singapore," he stated.

According to Lionel, Malaysia has also become the preferred destination for solar players around the globe to come and learn from. One of the many attractions is the space to run pilot projects, exempling the many rooftops of buildings all around the Klang Valley and Shah Alam. Apart from that, the country also ranked 16th in the world for ease of doing business according to reports by the Malaysian Investment Development Authority (MIDA). He added that "Malaysia is there in the solar industry, we just

Solar panel installation in progress by capable installers.



need to realise we are there and take the next bold step forward.”

An Insider’s Perspective

As the industry blossoms, it becomes the onus of industry professionals like solar system installers to keep up the momentum. Complicated regulations and application procedures that used to hamper the installation process is now made smoother as associations bout for better regulatory procedures.

Through new programmes such as Net Energy Metering (NEM) and Solar for Own Consumption, advocated by the Malaysian Photovoltaic Industry Association (MPIA), Malaysians are given the opportunity to install systems in their own homes and businesses based on good economic sense. Lionel explained that with the introduction of these programmes, “The application process is harder when you are dealing with public money. With NEM, you only sell what is in excess.”

With this, comes the opportunity for solar installers to fully utilise the new “broader” market. As Lionel aptly



“Most people in solar tend to be very optimistic. They also tend to have a certain passion and drive because the bigger picture of what this industry can do includes granting the country energy security, which then falls into every other aspect of business in this country. If the industry does well, it can provide up to 10,000 new job opportunities.”

– Lionel Yap
General Manager of Solamas Sdn Bhd

puts it, “We want the average person down the road to actually pick up on solar panels. We would be very happy, the more the merrier. Because, in the end, everyone then contributes towards the overall stability and energy security of the country.”

Solar System Installer

Lionel describes the job as a simple one, yet far from being easy. The installation works are generally straightforward in that there are solar panels, cables, connectors, DC safety, inverters and AC safety connected to either the house or to the meter. Solar panels are, after all, the most basic form of electronics. “It just happens that when sunlight hits the cells, the photon excites, the electron starts to move and electricity starts to flow,” Lionel explained.

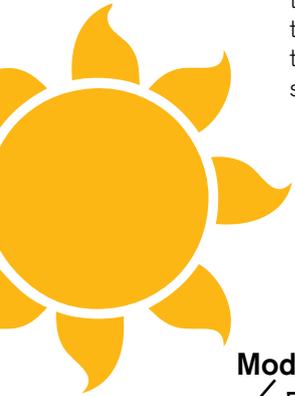
The challenge, however, is the different conditions that installers have to deal with on site, such as the type of roof and surfaces they need to install the solar system on. Thus, to become a good solar system installer, one would need vast experience

and a specialised skill set. He says it is akin to “using the same toolbox but getting stuck with a myriad of different configurations for different houses.” A typical timeline for a solar system installation with a reasonable roof, as well as workable weather conditions, can take up to two full days..”

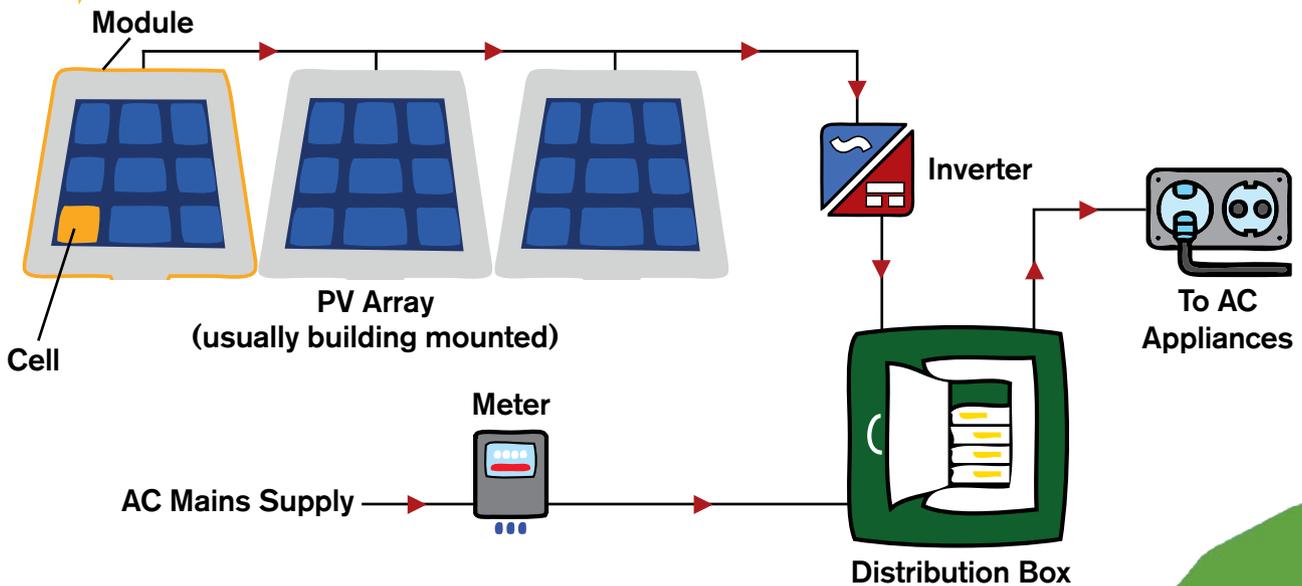
What it takes

Skills that are required of a solar installer are the basics in engineering and an understanding of electricity, such as the difference between alternating current (AC) and direct current (DC), the nature of the two types of electricity and the way they work. One would also have to have some knowledge of the safety standards. In terms of qualifications, it is encouraged to have a technical background. Some measure of engineering would also make the learning process quicker.

As for the industry itself, it must grow to streamline and incorporate elegance into its solar system design while still complying with the Malaysian standards. Lionel looked to Germany where they have modernised their solar system wiring using less cable for a similar-sized system here in Malaysia.



Grid-connected Solar System



Net Energy Metering Configuration

A pictorial explanation of the workings of a grid-connected solar system in a home installation. Mains electricity in the form of an alternating-current (AC) is delivered to homes and businesses. The solar output generated by the Photovoltaic (PV) in the form of a direct-current (DC) is then inverted to the AC by an inverter, where it is synchronised with the local utility.

Source: fannysoh.blogspot.my



He said, "This is the level that Malaysia has to go to now. We have to bring elegance and a bit more art to the design of our solar systems. A lot of it comes from experience in the field."

Apart from that, the solar installation industry would flourish with skilled labor men installing the connections. With over 500 GW worth of power, there really is an insufficient amount of skilled labor entering the profession. "MPIA is now working with Universiti Teknologi Malaya (UiTM) and the Sustainable Energy Development Authority Malaysia (SEDA) in trying to get as many people qualified on the ground, in the last mile implementation. It is not that we don't want foreign labour to get the job done, it's about retaining competency. We are trying to pass those skills back to Malaysians," Lionel states.

In trying to grow the market, the nation must put as much skill into as many people's hands as possible. According to the Energy Commission, there are about 69,000 AC certified wiremen certified under them. However, there are still very few certified high-voltage DC wiremen, a specialised skill set for solar system installations. "If you enable these people and give them the qualifications and ability to be certified high-voltage DC wiremen, they become very employable around the region. By putting skills into the hands of Malaysians, we can earn foreign exchange," added Lionel.

For the Future

In combating the challenge of unpredictable on-site conditions in the profession, Lionel believes that there is a need to make solar system installations part of housing developments from the initial stages. "When we retrofit the systems later, the costs increase. If we build solar systems in the whole development as an overall theme or idea that you want to achieve something, then that's much better."

Thus, to raise the awareness for the use of solar energy, Lionel is keen on nurturing collaborations between the government and associations like MPIA. He believes that it is important to leverage off partnerships between government agencies, the Energy Commission, MIDA, the Ministry of Energy, Green Technology and Water (KeTTHA), Tenaga Nasional Berhad (TNB) as well as other relevant government bodies.

The Solar Sector

"Most people in the solar industry tend to be very optimistic. They also tend to have a certain passion and drive because the bigger picture of what this industry can do includes granting the country energy security, which then falls into every other aspect of businesses in this country. If the industry does well, it can provide up to 10,000 new job opportunities," said Lionel.

Being in the solar installation industry, one will discover that there is a fine line from it being a career to becoming a cause. "What we believe at MPIA is that solar is the future of going green. It's really about the country having enough energy to run business overall, from the small shops all the way to the big banks," Lionel said. He believes that although selling the idea of solar system is challenging, when one looks at how it can ensure energy security, in the long run, it becomes a price worth paying.

"Solar is the everyman's renewable energy." It is for everyone, from the smallest installation for one's own consumption to larger scale solar projects. It is important that the community realises that solar power is indeed attainable, for our nation to grow towards a greener, brighter and more economical future. **EM**





Training Experts

Enhancing Excellence in Engineering

TNB Integrated Learning Solution (ILSAS) provides training and services for all levels of the industry, from the ground technicians to the senior management running power plants. Its Managing Director, Dato' Ir Abdul Aziz Bin Jaafar, shares his insight on what the organisation has to offer to the energy industry.

Located in Bandar Baru Bangi, Selangor, the main campus is equipped with various workshops and simulators to train and refresh TNB's engineers in the field of power utility engineering, such as electrical motor workshops, transmission live lines, welding bays, metering workshops, protection simulators, solar PV laboratories, and much more. More than 40,000 participants attend ILSAS every year, with more than 800 different courses being taught. It has around 130 trainers who are professional engineers with technical certifications and experience in the subject matter. "We've been growing about 5% to 10% every year, for the last five years," said Dato' Ir Abdul Aziz.

The quality of training delivery and administration at ILSAS is accredited with United Kingdom Accreditation Service (UKAS) by the Standard and Industrial Research Institute of Malaysia (SIRIM). Its trainers have also attained recognition as Certified Training Professionals by the Institute of Training & Development (ITD). In addition, ILSAS has a dedicated Training Research & Development Unit (TRD) to ensure quality and maintain the

“We are adapting to the change by focusing more on the staff’s attitudinal and behavioural change. We ensure that TNB staff are competent and qualified in both leadership and technical aspects. As such, we aim to transform TNB into a global leader in the energy sector.”

– Dato’ Ir Abdul Aziz bin Jaafar
Managing Director of ILSAS



high standards of the training modules and trainers’ skills.

The Energy Commission recognises ILSAS’s expertise in electric utility skills, and has appointed it as an Industry Lead Body (ILB). This means that it is tasked with the development of the National Occupational Skills Standard (NOSS) to certify the competency of Chargeman, also known as Technical Apparatus

Through its many courses and expert trainers, ILSAS provides training for both local and foreign electrical engineers, making it a crucial component towards strengthening electrical engineering competency in the country. **EM**



ILSAS trainer, Zamzary Zainal Abidin, giving a hands-on display on how to wrap live line cables.

Operator, who is responsible for creating and maintaining the live line cables, underground cables, 11Kv Switching operation and many more.

As most technical training programmes are conducted through 70% hands-on simulators or workshops, with another 30% on theory in a classroom or lab, ILSAS does things differently by focusing more on staff’s attitudinal and behavioural change to adapt. The technical training, too, is reduced to around 600 courses from the initial 800, prioritising the most urgent courses, which are power plant maintenance, live line training, installation and testing of OPC (Operators Proficiency Check) and LPC (Line Proficiency Check) meters. ILSAS also provides training for other disciplines such as accounting, legal and information technology (IT).

ILSAS has been in the forefront of conducting programmes for international customers that include personnel from utility and non-utility organisations of countries like Thailand, Vietnam, Indonesia, Cambodia, Laos, Nepal, Mongolia, Egypt, Pakistan, Yemen, Oman, Afghanistan and more.

Live Line Training Course

In electrical engineering, live-line working is the maintenance of electrical equipment, and often operates at high voltage, while the equipment is energised. At ILSAS, line mechanics attended live line workshops to train and refresh their expertise and knowledge on live line working in relative safety.



THE RAPID TRANSFORMATION OF GLOBAL RENEWABLE ENERGY

Renewable energy has become a compelling investment proposition as its costs have declined in years, making it increasingly competitive with fossil fuel technologies. Despite global investment in renewable power remaining below its potential, it has grown rapidly over the past decade reaching US\$348 billion (RM1.5 trillion). **Energy Malaysia** analyses the facts and figures from RETHinking Energy 2017: Accelerating the Global Energy Transformation report by the International Renewable Energy Agency (IRENA) to shed some light on the rapid growth of renewable energy in the near future, and also Malaysia's role in it.

A New Paradigm

Governments around the world have already started to adopt national targets, formulate policies, and devise innovative investment and technology strategies to show their commitment to using renewable energy. Governments and the private sector have been playing a major role in scaling up deployment, signalling that technology centered on renewable energy will be the engines of sustained economic growth and development.

The expanding global economy, rapid industrialisation, high population growth, urbanisation and improved energy access led to a global demand for energy. With the negative economic and environmental impacts that resulted from heavy reliance on fossil fuels, governments have been forced to seek more sustainable options.

In every region of the world, new markets and centres of manufacturing are emerging. As such, more job opportunities are to be found in the renewable energy sector, and their numbers are rising.

Renewable Energy Now

The *REthinking Energy 2017: Accelerating the Global Energy Transformation* report stated that in 2015, the contribution of all renewable energy sources to the global energy mix has grown by the largest increment yet, particularly in the electricity sector. Renewable power generation capacity increased by 154 GW, an increase of 9.3% in 2014. Most additions were in wind, solar photovoltaic (PV) and hydropower. In 2015, additions of both wind power (66 GW) and solar PV (47 GW) exceeded those of hydropower for the first time, which also increased by 33 GW.

By the end of 2015, renewable power generating capacity exceeded 1,811 GW and accounted for more than 28% of global capacity. The bulk of that capacity is harnessed from hydropower at 58%, followed by wind power at 23% and solar power at 12%.

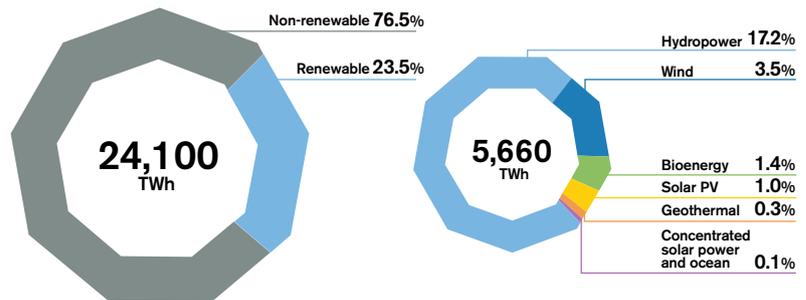
Renewables provided an estimated 23.5% of all electricity generated in 2015, which comes to 5,660 TWh. Hydropower accounted for the

largest share of renewable generation, followed by wind power, bioenergy and solar PV.

When it comes to upgrading and modernising electricity infrastructure, green technology is often the first choice. Since 2012, renewable power capacity installations have exceeded non-renewables by a rising margin.

In a growing number of countries, renewables have emerged as a mainstream solution to meet energy demand in a cost-effective, secure and environmentally

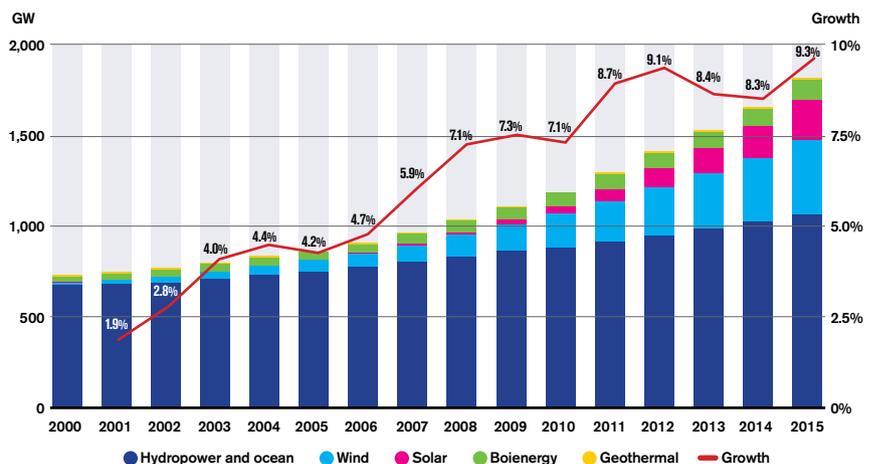
Global Electricity Generation by source, 2015



Source: IRENA

Renewable Energy has become a significant source of new employment in many markets around the world. The number of jobs in renewable energy rose by 5% in 2015 to an estimated 8.1 million, plus an additional 1.3 million in large-scale hydropower.

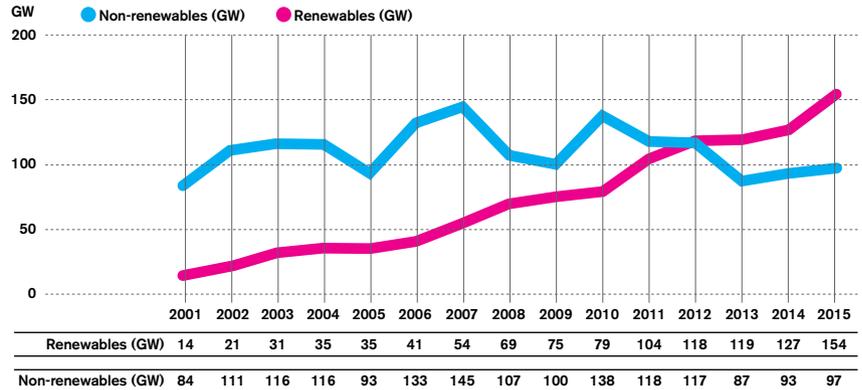
Renewable Power Capacity and Annual Growth Rate, 2000-2015



Source: IRENA

Renewables provided an estimated 23.5 of all electricity generated in 2015 – 5,660 terawatt-hours (TWh).

Renewable and Non-Renewable Power Capacity Additions, 2001-2015



Source: IRENA

In a span of 15 years from 2001 to 2015, renewable power capacity installations have exceeded non-renewables by a rising margin.

sustainable manner. Global renewable energy deployment has increased rapidly in recent years and continues to grow at an unprecedented pace.

Revealing Opportunities

According to IRENA, developing countries for the first time attracted the majority of renewable energy investments, continuing a progressive five-year shift from 30% to 51% of total investments, while developed markets witnessed a drop from 70% to 49%. This trend is the result of weaker markets in Europe and declining activity in Japan and Canada due to weak energy laws, repeated tariff cuts, and difficulty securing land and grid connections. Meanwhile, this allows markets of developing countries such as Malaysia to flourish.

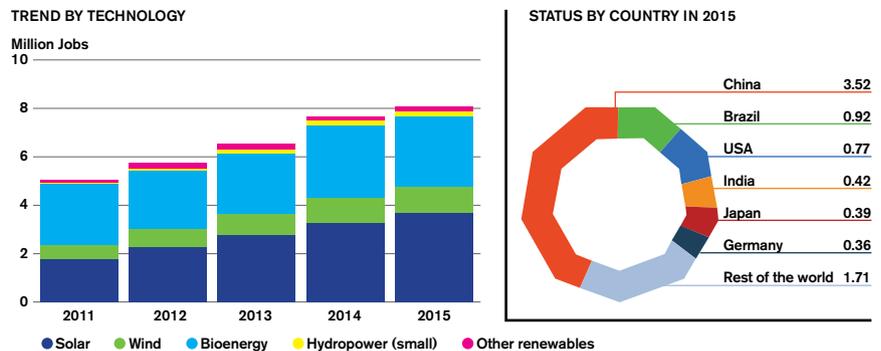
Malaysia's Green Tech Financing Scheme (GTFS) under the country's Ministry of Energy, Green Technology and Water (KeTTHA) provides partial guarantees for loans and rebates on the interest rate charged by financial institutions to support various green projects, enabling the public sector to invest in renewable energy. The fund scheme aims to reduce financing costs through loan guarantees, low-interest loans funded by revenue bonds, or currency risk guarantee funds targeted at hedging high costs.

Datuk Seri Panglima Dr. Maximus Johnity Ongkili, Minister of KeTTHA, stated that the original scheme has provided RM2.96 billion in funding to 272 local green technology entrepreneurs. The scheme will continue until 2022 with a USD\$ 1.12 billion (RM5 billion) allocation, already approved by the Malaysian government.

"The implementation of GTFS is important to ensure that projects that are green technology-based continue to receive funding and support, which will contribute to the growth of the development of the country's green technology industry," Datuk Seri Maximus told The Star.

Innovative business models can help to accelerate the growth of investment in a rapidly changing energy sector. Government-driven financial mechanisms can support early-stage project development and provide loan guarantees to help lower the cost of capital.

Global Employment in Renewable Energy, 2011-2015



Source: IRENA

The graph shows an exponential global growth of the use of renewable energies in a span of 15 years.

To scale up renewable energy investment, it will require active participation from the public and private sectors, including development finance institutions, private equity funds, institutional investors, export credit agencies, green banks as well as commercial banks.

Renewable energy is well positioned to play a central role in the implementation of international agreements on climate change mitigation. By the end of 2015, 173 countries had established renewable energy targets at the national, state and provincial level, with most countries also adopting related policies. And thanks to steep cost reductions in recent years, renewable energies have now become the most economical option for countries around the world. **EM**

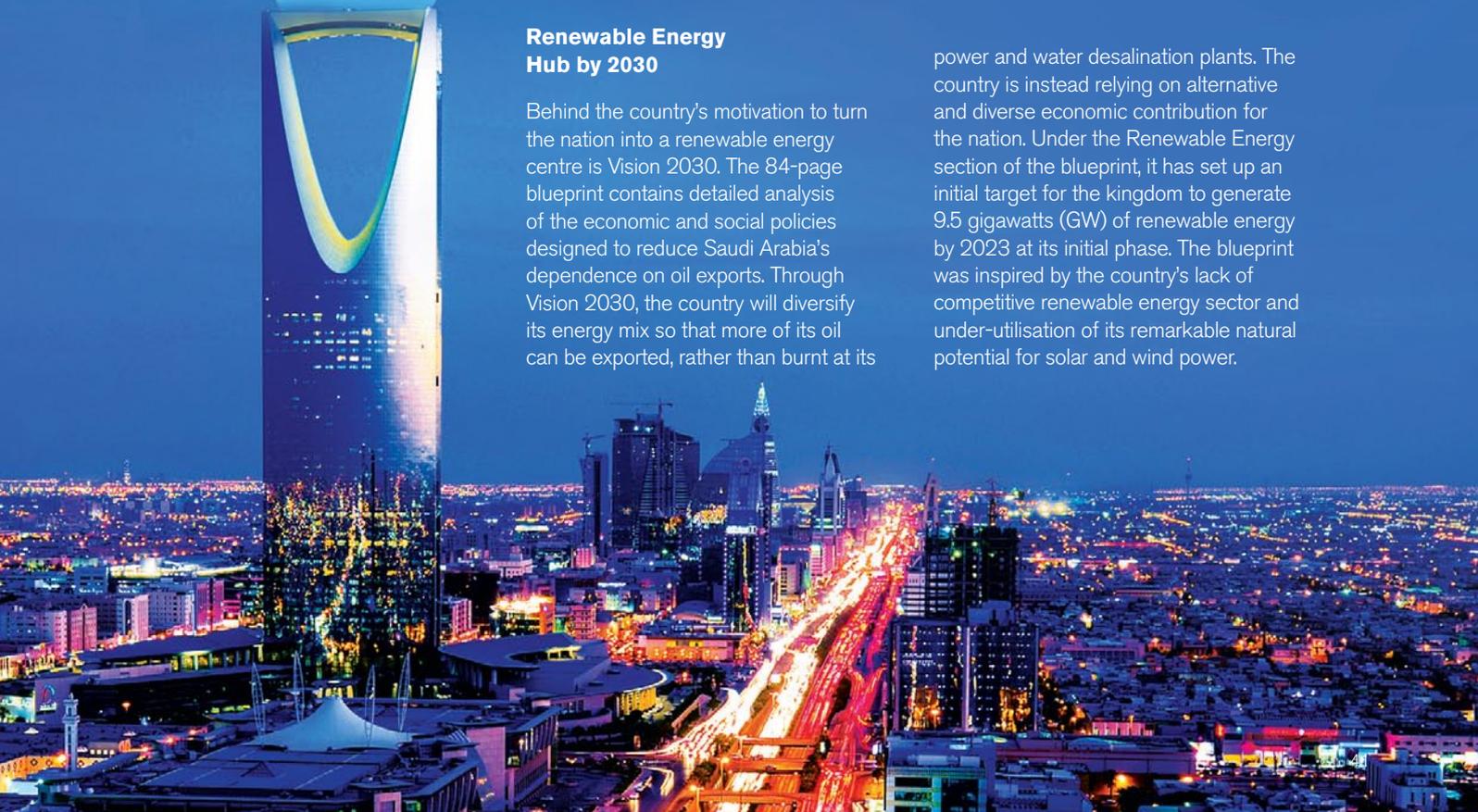
Saudi Arabia's BRIGHT VISION

Saudi Arabia, a country with ample sunlight all-year round, is setting its sights on developing the kingdom into a renewable energy capital. With the power demand in the nation rising by 8% annually and set to increase three times as much by 2030, the time has come for renewed action. According to a report by *The Financial Times*, Khalid Al-Falih, the country's Energy, Industry and Mineral Resources Minister has issued a statement declaring the country's ambitions to turn the petrochemical state into a "solar powerhouse" while also revealing their plans to issue tenders for major renewable projects worth up to US\$50 billion. **Energy Malaysia** looks into the reason behind Saudi Arabia's move towards green energy, and the impact it will have on the future of this sunny nation.

Renewable Energy Hub by 2030

Behind the country's motivation to turn the nation into a renewable energy centre is Vision 2030. The 84-page blueprint contains detailed analysis of the economic and social policies designed to reduce Saudi Arabia's dependence on oil exports. Through Vision 2030, the country will diversify its energy mix so that more of its oil can be exported, rather than burnt at its

power and water desalination plants. The country is instead relying on alternative and diverse economic contribution for the nation. Under the Renewable Energy section of the blueprint, it has set up an initial target for the kingdom to generate 9.5 gigawatts (GW) of renewable energy by 2023 at its initial phase. The blueprint was inspired by the country's lack of competitive renewable energy sector and under-utilisation of its remarkable natural potential for solar and wind power.



At a glance, the initial target may seem over-ambitious for a country generating a meagre 25 megawatts (MW) of renewable energy capacity by the end of 2015. However, with the steady growth of the country's electricity consumption, the target translates to a renewable energy share of an estimated 5% of the country's total electricity consumption. Germany, a country with less than half the solar irradiation of Saudi Arabia, was able to produce up to 32.6% renewable energy shares by the end of 2015, with 6.4% generated by solar photovoltaics (PV) alone. Thus, comparing that track record to Saudi Arabia, a kingdom with an abundance of solar resource and high wind speeds, the country should, in principle, be able to reach if not exceed the target set out in Vision 2030. This, however, depends on the country's political drive as well as a rigorous execution of the renewable energy plan.

Transforming into a Solar Powerhouse

Set for a brighter future, Saudi Arabia is laying down the groundwork for solar and wind power, to stimulate economic development in clean energy. With its ample sunlight and desert climate coming into play, reaching as high as 129 Fahrenheit during the summertime, this should present a massive solar opportunity for the country. The kingdom is working to capitalise on its national energy programme by harnessing the vast amounts of solar power for domestic use.

Off-grid solar PV applications are the most suitable for Saudi Arabia. However, to ensure the success of the solar PV installation, the solar equipment would need to be able to withstand the country's rough climate conditions and temperature fluctuations. For solar plants placed near the country's coastlines, the equipment has to be able to endure corrosive and salty moisture in the atmosphere.

From Wind to Power

The wind is a pure, free and readily obtainable renewable energy source. In line with Vision 2030, Saudi's General Electric Company (GE) has joined forces

“We are committed to expanding renewables; we are committed to turning Saudi Arabia into a solar powerhouse.”

– Khalid Al-Falih,
Saudi Arabia's Energy, Industry
and Mineral Resources Minister
as reported by *The Financial Times*



with Saudi Aramco to install Saudi Arabia's first wind turbine at the Turaif Bulk Plant, located in the northwest of the Kingdom. The project is the first regional installation of GE's revolutionary model named the 2.75-120 Wind Turbine, which has been custom-made to suit the country's climatic environment. GE's wind turbine is a digital industrial solution that analyses data points by the second to achieve higher levels of energy output and better operational efficiency.

According to several studies by the nation, there is abundant potential for wind energy generation in the kingdom, especially in its northern region. The Renewable Energy Atlas also states that "Higher wind speeds near 8.0 m/s and above (well above a standard economic viability speed of approximately 6 m/s) occurs in the northeast and central regions of Saudi Arabia, as well as near mountains in the western region." Thus, the installation of the wind turbines at Turaif Bulk Plant will allow the discontinuation of diesel usage for power generation in the plant, which is part of the nationwide plan to diversify energy supplies and to meet the increase in demand.

According to a measurement programme by Aramco, the new turbine is set to generate up to 2.75 MW of power at its peak which is enough to power approximately 250 Saudi households. This will aid in reducing the burning of diesel for

power generation by 18,600 barrels of oil equivalent per year.

The 2.75 MW to 120 MW turbine structure consists of a 129-meter propeller which is innovatively combined with a single-blade pitch control. The wind turbine also offers the latest enhancements in load management control, low acoustic emissions, efficient electrical power conversion and robust performance. GE and Saudi Aramco are enthusiastic in working together to enhance wind power generation in Saudi Arabia towards achieving the renewable energy target set out under Vision 2030.

The Kingdom's Initiatives

Saudi Arabia's energy ministry has created a new unit to spearhead the kingdom's renewable energy plan named the Renewable Energy Project Develop Office (Repdo). The division will be led by a committee that includes the major energy players in the country from Saudi Aramco, GE and Electricity and Cogeneration Regulatory Authority. Khalid Al-Falih said, "This dedicated team will assume overall responsibility for the execution and delivery of the programme, starting with the launch of the request for qualifications process on February 20."

With ample support from the government, the renewable energy plans under Vision 2030 is attainable. Much emphasis is put on renewables

by seeking the localisation of a significant portion of the renewable energy value chain from all stages including manufacturing as well as research and development (R&D). The country is confident that they have all the raw materials and inputs available locally for success, such as silica and petrochemicals as well as leading Saudi companies with extensive expertise in the production of different forms of energy.

The programme will be implemented under the umbrella of a new "King Salman Renewable Energy Initiative." Legal and regulatory frameworks for the deployment of renewable energy and the involvement of the private sector to buy and invest in the renewables division are also to be put in place. In their efforts to localise the industry and produce the necessary skill-sets, the

government is encouraging public-private partnerships.

The policy paper also encourages distributed renewable energy deployment through the "gradual liberalisation of the fuels market." When subsidised fuel and electricity is reduced, there will be a strong motivation for the distribution of solar energy in Saudi Arabia. A step in this direction has already been taken with the country's move in increasing the electricity tariffs at the beginning of 2016.

Malaysia's Soaring Solar Sector

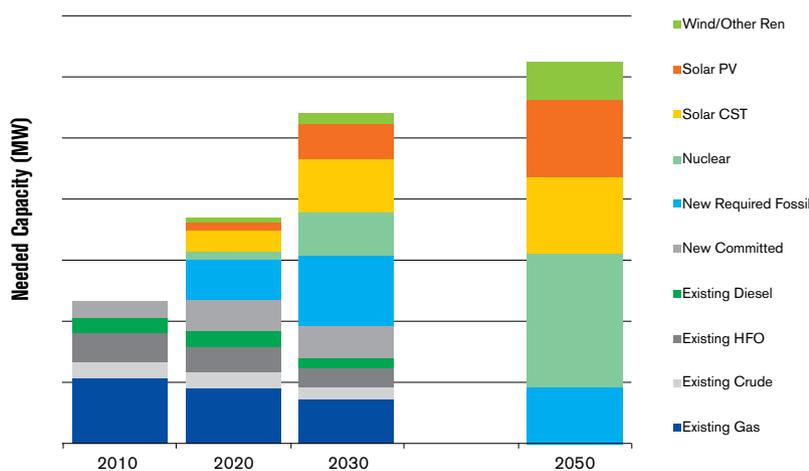
As Saudi Arabia is well on their way towards realising their own visions, Malaysia is also paving their way into the renewables sector. In line with the government's ambitions towards

becoming a major player in solar manufacturing by 2030, the Malaysian Industry-Government Group for High Technology (MIGHT) is working on improving supply chains and the integration of local PV systems. Mahalil Amin Abdul Malek, the programme director of MIGHT's Strategic Intelligence and Foresight unit, told online news site cleanmalaysia.com that in order to cultivate production and innovation within the sector, MIGHT will also be lending its support to local manufacturers of PV technologies.

Malaysia has all the workings of developing into a world-leader in solar technology as we presently have enough talent with several manufacturers already operational in the country. In line with the government's efforts in reducing Malaysia's carbon footprint and our reliance on fossil fuels, the government has given ample support with the aim of cultivating alternative energy sources within the nation. According to Mahalil Amin, with the availability of efficient workforce who are highly competent in the technical field, Malaysia could well become the world's second-largest producers of PV technologies behind China.

While Malaysia may have an edge over Saudi Arabia in terms of workforce and skills, Malaysia could stand to study Saudi Arabia's move in taking full advantage of its own renewable energy output. Under Vision 2030, Saudi Arabia plans to fully utilise the energy generated from the renewables for the future of the kingdom. Presently, Malaysia has set solar installations with only about 220MW, a mere 10% of the locally produced volume while the rest is for export.

Sustainable Energy Outlook for Saudi Arabia



Sustainable energy outlook for Saudi Arabia in line with Vision 2030 that plans to increase renewable energy generation in the kingdom.

Source: slideshare.net

Saudi Arabia is a kingdom that boasts a population of nearly 30 million people with domestic energy consumption growing rapidly annually. Facing an imminent energy challenge, the kingdom is on a mission to start meeting its domestic energy needs. The nation has come to a realisation that diversifying the kingdom's economy through Vision 2030 is the key to its sustainability. By venturing into renewables, the nation could potentially become a big player in the energy industry due to the ample solar and wind resources at their disposal. Powerful backing also comes from the Saudi royal family where Prince Turki Al Faisal Al Saud indicated his hopes into powering the kingdom entirely by low-carbon energy. With all these factors coming into play, Saudi Arabia's future is looking bright and very green. **EM**

The Electr Market

Dr Youngho Chang's Insights on its Deregulation

An Assistant Professor of Economics at Nanyang Technological University in Singapore, Dr Youngho Chang is indeed a respected name in his field. He specialises in energy security, oil, and macroeconomics as well as both the economics of climate change and electricity market deregulations. His vast collections of work on these specialised topics prove to be both insightful and thought-provoking. Being an expert on the topic at hand, he was invited to one of the Energy Commission's series of talks, where he gave a compelling talk on Electricity Market Deregulation and Energy Security and presented a case study of Malaysia, the UK, Singapore, ASEAN, and China.



The Economist

Dr Chang started his educational journey studying agricultural science at Seoul National University in South Korea. He then earned a Masters of Economics with honours at Yonsei University, South Korea, and a Ph.D. in Economics from the University of Hawaii, United States. Before his tenure as Assistant Professor in one of Singapore's most prestigious universities, Dr Chang started his professional career as a landscape architect at Han Yang Corporations in Korea and subsequently in Saudi Arabia. He then served as a financial analyst for four years in Korea. Dr Chang's impressive list of published work has indeed made him reputable in the energy economics industry.

A Liberalised Market

He started his talk on the different structures of the electricity market, differentiating between one that is under regulation and one that is under deregulation. "A market that is under regulation is a vertically integrated one, mostly government-owned, with an element of natural monopoly. The instruments used in this market are the prices and quantity of electricity," he said. He differentiated this with an electricity market that is under deregulation which separates the industry by ownership. "A deregulated market is horizontally unbundled where there is full competition in generation, wholesale and in retail, while still retaining a monopoly in transmission and distribution."

The advantage of a deregulated electricity market is that the market becomes more competitive, and abuse of market power will be reduced. It also allows easy entry and exit of players and higher efficiency of allocation, as well as lower and more stable electricity prices. The market prices would also be closer to the marginal cost in a market that functions properly. If all these criteria are met, Dr Chang is of the opinion that a good and stable electricity market can be achieved.

He then touched on four different regulatory models that are available for the electricity sector. Out of the four he discussed, he opted for a model which combines all the models into

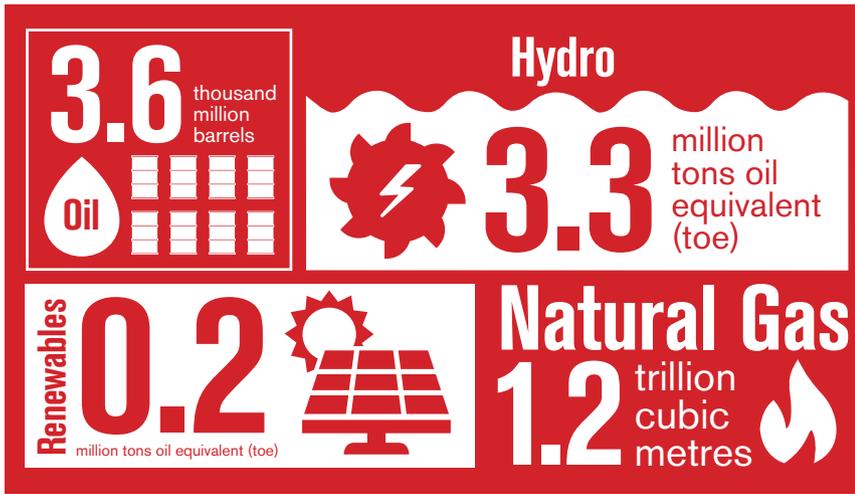
icity



Dato' Prof. Ir. Dr. Kamal Nasharuddin bin Mustapha, the Vice President of Universiti Tenaga Nasional (UNITEN) (second from right) is among the dignitaries present at the talk.



Malaysia's Electricity Endowment



Source: BP Statistical Review of World Energy (2016)

Currently, Malaysia is highly dependent on oil and hydro reserves for energy generation. Along with the government's green initiative, they have set a target for higher renewable energy contribution to the country's overall generation mix.

one comprehensive regulatory model. It is one where there is competition in the generation of electricity as a distribution company buys from a number of different producers. Apart from that, contract carriage of high voltage transmission lines is offered to all wholesale sellers and buyers. Another distinct feature of this preferred model is that it allows retail customers to choose their suppliers in full retail competition. He established this model to be the most economically efficient model.

Through his case studies of the UK and Singapore, the deregulation of the market proves to be beneficial for these countries where an adequate and reliable supply of energy resources can be achieved at a stable and sensible price. It has also aided both countries in attaining energy security.

Energy Security

Dr Chang continued his talk on energy security which he defined as "the

availability of energy resources that each country has in terms of proven reserves and the reserve-production ratio (R/P), for energy consumption." He went on to introduce the 4-A Framework which is used to indicate the energy security level of a country. Those possible indicators include the availability of energy through proven reserves, applicability through technologies, the acceptability of a society, and affordability.

In determining Malaysia's energy security level, the 4-A Framework was applied in a thorough case study. He came to the overall conclusion that the energy security of the Malaysian electricity sector exhibits an increasing trend over the years. Dr Chang noted that there has been a drop in installed capacity in the years 2000 and 2005 which indicates a lack of availability in our proven reserves. Therefore he opined that there is a need to increase installed capacity, by fully utilizing the country's ample renewable energy resources.

After examining Malaysia's energy applicability, Malaysia showed a general increase in the efficiency of electricity generation. However, Dr. Chang stressed that there is a need to develop the country's renewable energy technologies.

In terms of the society's acceptability, results showed an improvement as proven through the decreased CO₂ emissions in 2005 and 2010. Nevertheless, he advised some development for no or little carbon emitting generation technologies.

In attaining a strong level of energy security, the country would also need to focus on affordability. Currently, the electricity consumption per capita is showing a declining trend. The primary mission now is to create an affordable market while decreasing the number of people without access to electricity. There is also a need to decrease the amount of electricity wastage during the transmission and distribution (T&D) stages. It is also essential to introduce real-time pricing and time of use (ToU) charging.

Apart from that, Dr Chang also came to an overall positive evaluation when measuring the diversity of Malaysia's energy sector. He concluded that the country's energy resource options are quite diversified, with a good variety of energy assets - natural gas, oil, hydropower and renewable energy. The only possible policy suggestions would be to reduce the dominance of a single fuel and to develop renewable energy resources as well as expand their usage.

Having vast insight and knowledge into energy economics, Dr Chang is indeed an esteemed person in the industry. Energy security is the association between national security through the availability of natural resources for energy consumption. Without sufficient energy that is managed properly, a nation would be vulnerable. Thus it becomes important to regulate the electricity market well in ensuring continuous energy security for the nation. **EM**

The Ultimate



Power Trading Hub

From the 15 to 17 March 2017, the *12th Electric, Power and Renewable Energy (EPRE) Malaysia 2017* opened its doors at the Kuala Lumpur Convention Centre (KLCC). EPRE is the region's flagship biennial event showcasing the latest technology, equipment and machinery in the fields of sustainable power generation, energy efficiency, transmission and renewable technologies. This time around, EPRE welcomed some 200 companies from approximately 20 countries to exhibit their best products from their respective fields.

Themed *Essence of Energy*, EPRE 2017 was officiated by the presiding Deputy Minister of the Ministry of Energy, Green Technology and Water (KeTTHA), Senator Dato' Sri SK Devamany S. Krishnasamy, at its opening ceremony on 16 March 2017. Other dignitaries that were present that day were Datuk Abdul Razak Abdul Majid, Chairman of the Energy Commission, Datuk Ir. Mohd Aminuddin Mohd Amin from Tenaga Nasional Berhad (TNB), Tan Sri Asmat Kamaludin, Chairman of Malaysian

Exhibition Services (MES), and Ir. Chew Shee Fuee, the President of the Electrical and Electronics Association of Malaysia (TEEAM).

The ceremony started on a positive note with a speech by Tan Sri Asmat Kamaludin welcoming the participating companies that represent the many different sub-sectors and specialisations within the electricity and power generation industry. He also extended his appreciation to KeTTHA, the Energy Commission, TNB and various other

parties for their gracious support for EPRE 2017.

Senator Dato' Sri SK Devamany S. Krishnasamy then took the stage to give an energetic speech, recalling the Prime Minister's commitment in ensuring the reduction of carbon intensity or CO₂ emissions by 2030, at the 21st session of the Conference of Parties to the UN Framework Convention on Climate Change (COP 21) in Paris back in 2015. He asserted, "I think that we are moving in the right direction, although

The Deputy Minister of the Ministry of Energy, Green Technology and Water (KeTTHA), Senator Dato' Sri SK Devamany S. Krishnasamy (center) officiating the 12th Electric, Power and Renewable Energy (EPRE) Malaysia 2017 alongside (from left) Datuk Ir. Mohd Aminuddin Mohd Amin from Tenaga Nasional Berhad (TNB), Datuk Abdul Razak Abdul Majid, Chairman of the Energy Commission, Tan Sri Asmat Kamaludin, Chairman of Malaysian Exhibition Services (MES) and Ir Chew Shee Fuee, the President of the Electrical and Electronics Association of Malaysia (TEEAM).

it is going to be very challenging as we are still very much dependent on fossil fuel. This is due to the fact that 90% of our energy generation is from gas, petrol and oil." He referred to China and India as examples of nations moving forward aggressively in renewable energy (RE).

He reiterated the Prime Minister's interest in the RE sector which was mirrored in the 11th Malaysia Plan (11MP). Under 11MP, the country is targeting to achieve 53% coal, 29% gas, 15% large hydro and 3% RE in our energy mix and a RE capacity of 2,080 MW Feed-in-Tariff (FIT) by 2020.

He stated, "Moving forward, our next national agenda is to address the need to strongly decarbonise our country's economy through the Energy Efficiency and Conservation (EE&C) initiatives."

He also touched on two flagship RE programmes, which are Net Energy Metering (NEM) and Large Scale Solar (LSS) which continues to stimulate the RE growth via solar photovoltaic (PV) in Malaysia. NEM is a scheme that enables electricity consumers to install solar PV for self-consumption. The LSS on the other hand is a competitive bidding programme for the solar farm with the



EPRE 2017 welcomed some 200 companies from around the world, which includes our very own Sarawak Energy and China's Andeli Group Co. Ltd., encouraging competitiveness within the industry. The event presents the perfect platform for local and international industry players to network and study from each other.

size of 1 to 30 megawatt, estimated to contribute a total of 1000MW by 2020. Senator Dato' Sri SK Devamany S. Krishnasamy is optimistic, stating that, "With all these measures in place, Malaysia will continue to lead the way as a major player in the RE and green technology industry."

The event continued with the soft launch of the 8th International Greentech and Eco Products Exhibition and Conference Malaysia 2017 (IGEM). Organised by KeTTHA with Malaysian Green Technology Corporation (Greentech Malaysia) and Malaysian Exhibition Services (MES), IGEM is the region's largest platform for main industry players to showcase the newest breakthroughs in the green technology sector.



"Malaysia is often regarded as a success story depicting rapid development while ensuring a relatively manageable ecological footprint."

- Senator Dato' Sri SK Devamany S. Krishnasamy,
Deputy Minister of the Ministry of Energy, Green Technology and Water (KeTTHA)

With over 3,000 trade visitors from 35 countries worldwide estimated to visit the exhibitions throughout the three-day event, EPRE is indeed the premium power trading hub and will give the necessary push forward needed in achieving the national green agenda. **EM**

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Energy Malaysia welcomes your questions, comments and suggestions to help the Energy Commission of Malaysia work better at safeguarding your interest.

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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; arbitrates and enforces compliance.

