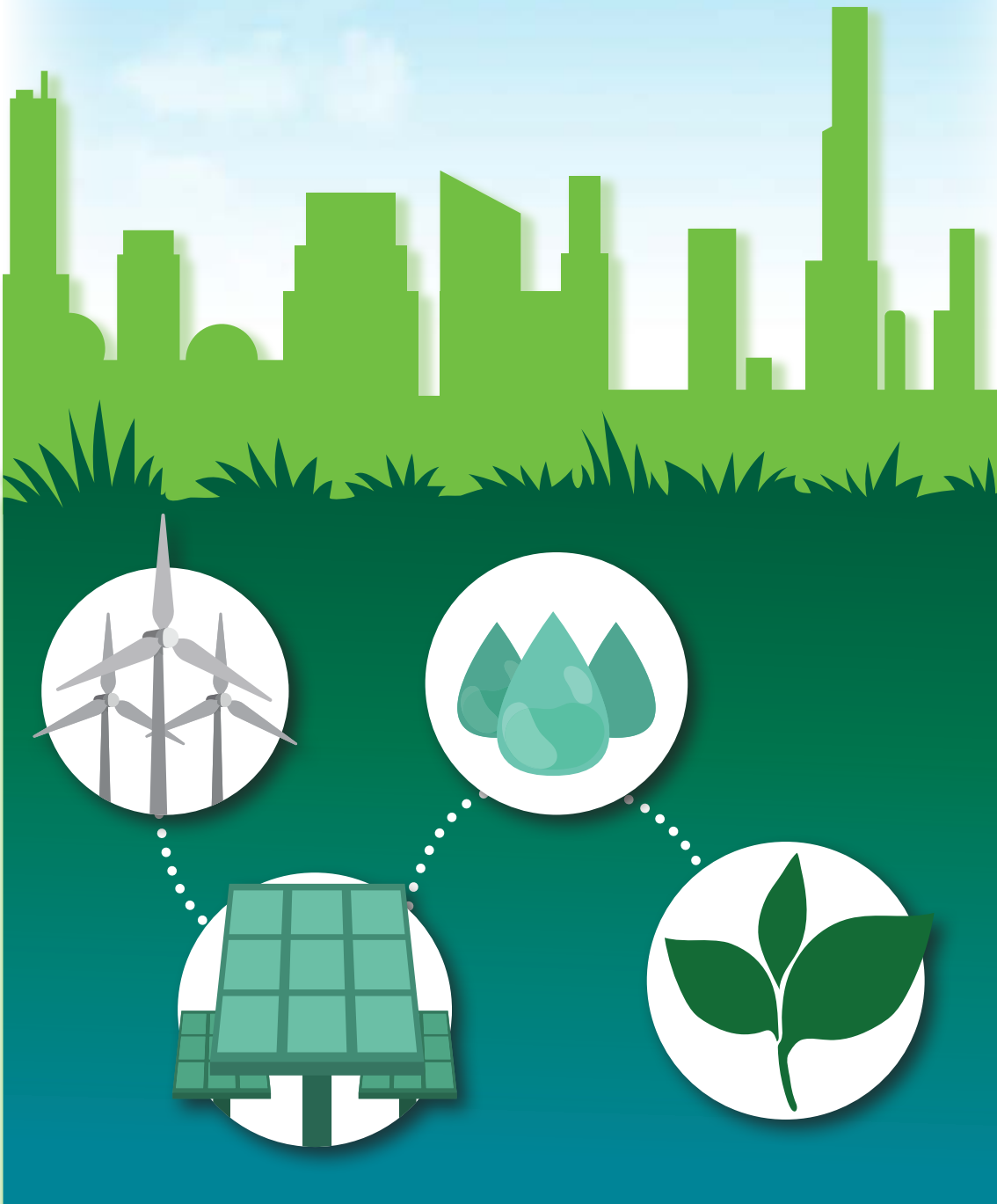
SEPTEMBER 2018

IEM
The Institution of Engineers, Malaysia

JURUTERA

The Monthly Bulletin of The Institution of Engineers, Malaysia
KDN PP 1050/12/2012 (030192)
ISSN 0126-9909

SE=RE+EE



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Number 09, SEPTEMBER 2018 IEM Registered on 1 May 1959

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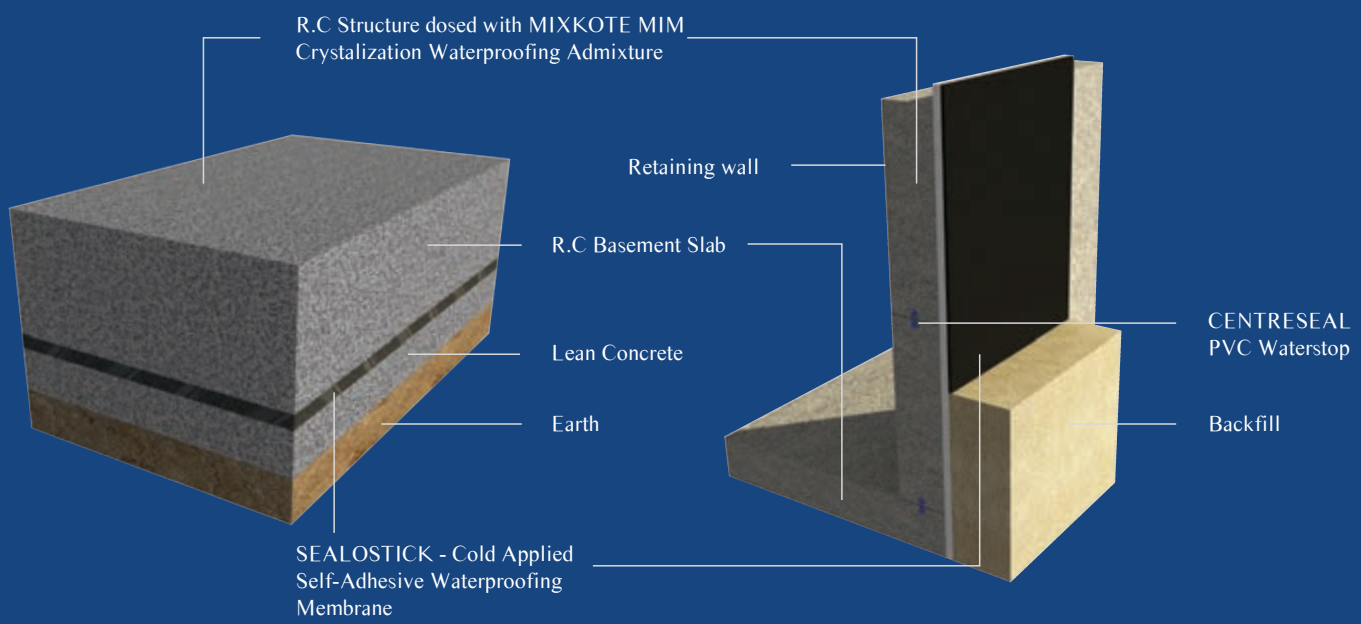

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Tel: +(603) 7493 1049 Fax: +(603) 7493 1047
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Subscription Department
E-mail: info@dimensionpublishing.com

Printed by

PERCETAKAN SKYLINE SDN BHD (135134-V)
No 35 - 37 Jalan 12/32B, TSI Business Industrial Park,
Off Jalan Kepong, 52100 Kuala Lumpur.

Mailer

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cover note

Towards SE=RE+EE

by Ir. Chong Chew Fan
Chairman,
Electrical Engineering Technical Division

The need for energy continues to grow. However, this shouldn't be achieved at the expense of our environment. In the past decade, the renewable energy industry has been booming as we strive to reduce carbon footprint while satisfying our hunger for energy at the same time.

Yet, only very few of us know that tapping from renewable energy resources is only half the equation. Thus, the IEM Electrical Engineering Technical Division (EETD) will dedicate this month's issue of *JURUTERA* to instilling an awareness that the complete equation for sustainability is SE=RE+EE. (SE, RE and EE stands for Sustainable Energy, Renewable Energy and Energy Efficiency respectively). A complete ecosystem should be in place, from energy providers all the way to energy consumers. Electrical engineers have a pivotal role to play in the energy chain as Malaysia continues to develop sustainably.

EETD has been actively creating awareness on sustainable energy among IEM members, through technical visits, seminars, workshops and talks. At the EETD AGM in May, 2018, the Sustainable Energy Development Authority (SEDA) presented a pre-AGM talk on sustainable energy. We expect to have more such activities and would like to invite all IEM members to assist us in our goal. ■

editor's note

by Ir. Razak Yakob
Bulletin Editor

Salam & Hello All IEMers,

I'm glad our theme this month zooms in on sustainability. I strongly support Ir. Chong and the EETD's efforts to promote sustainable energy for our future. When I deliver talks at universities, many people, regardless of their engineering disciplines, are interested to know about and be involved with renewable energy. This is really encouraging. At the same time, there are also concerns from the fossil fuels related disciplines. The rise of renewable energy signals the sunset for fossil fuels as energy resources. Is this true?

Sneak preview of the November 2018 *JURUTERA* issue: The theme to be featured is "Oil & Gas Asset Decommissioning". It means what we do at the end of production from an oil field. Renewable energy vs. fossil fuels has been a topic for debate for many years and will continue to be. Based on an article in World Economic Forum (October, 2017), the use of renewables is expected to grow faster than fossil fuels. However, according to the US Energy Information Administration, coal, oil and natural gas will still account for 77% of our energy in 2040.

No one has a definite answer but many have strong opinions. However, one thing I always believe in is, to not be afraid of change. Change is inevitable and we must keep ourselves updated on current trends. Perhaps we should explore further the topic of renewable energy vs. fossil fuels.

Let's continue to engineer our country to greater heights! ■

SUSTAINABLE ENERGY

- THE COMPLETE EQUATION

Datuk Badriyah binti Hj. Abdul Malek *is the Deputy Secretary General (Energy & Green Technology) at the Ministry of Energy, Science Technology, Environment and Climate Change (MESTECC). She has a Bachelor of Science (Hons) from Universiti Kebangsaan Malaysia, a Diploma in Public Administration from the National Institute of Public Administration (INTAN), and a Masters of Science (Environmental Management) from the University of Stirling, Scotland.*

This month's theme for *JURUTERA* is Sustainable Energy = Renewable Energy + Energy Efficiency. Before we can begin to understand sustainable energy, we need to first understand its two components.

Renewable energy is produced as a result of natural processes that are continuously being renewed. Renewable energy technologies reduce dependency on fossil fuel resources and provide opportunities for mitigating greenhouse gases. Solar, biomass, biogas, geothermal and wind energy are a few examples of renewable energy resources. In short, the first half of the "sustainable energy equation" deals with the supply side of the energy chain.

Energy efficiency is often used as a shortcut term to describe any form of energy-saving measure, though it should be distinguished from energy conservation — a broader term which can also include foregoing a service rather than changing the efficiency with which it is provided. It is a measure of how much useful energy can be derived from the input energy. This second half of the "sustainable energy equation" covers the demand side of the energy chain.

Sustainable energy primarily constitutes renewable energy and energy efficiency. It is an energy system that serves the needs of the present market without adversely affecting the ability of future generations to meet energy needs. To ensure sustainability, the complete energy chain comprising of both RE and EE has to be well-managed.

MANAGING ENERGY

Malaysia has not really been aggressive to be on the forefront of sustainable energy, but that may change very soon. Datuk Badriyah binti Hj. Abdul Malek, Deputy Secretary General (Energy & Green Technology) at the Ministry of Energy, Science Technology, Environment and Climate Change (MESTECC), says: "Sustainable Energy (SE) is integral to good economic growth. At MESTECC, we define sustainable energy as the combination of both Renewable Energy (RE) and Energy Efficiency (EE). On the supply side we have RE and other sustainable sources while on the demand side we are working on demand response, which involves managing the supply chain, whereby excess energy could be sold to others who may want it on the market."

She warms to our theme very quickly. "The Government has been extremely efficient when it comes to managing supply but has not put serious effort into managing demand; we need to have a good balance between these two aspects of energy management. Peninsular Malaysia has only a few rivers, so hydro energy isn't really an option," she says.

"To achieve low prices of RE, there needs to be an equally volumetric market for RE, and this can only be achieved by scaling up RE capacity instead of thermal plants. We have good renewable resources potential such as hydro, solar and biomass/biogas. Sarawak has huge hydro technical potential of an estimated 20,000 megawatts, yet only a little more than 3,000

Datuk Badriyah having a discussion with the EETD committee members

megawatts hydro power plants have been constructed.

"Solar energy, with a technical potential that is virtually unlimited, is one of the most viable options available. There's also biomass and biogas and, in the long run, ocean technology can be explored. Understandably, at a certain point, there will be a need to upgrade the grid to accommodate more REs with a larger volume of renewable energy such as solar. The good news is that grid upgrade can be delayed by migrating from an electricity system dependent upon base load to the creation of a flexibility market."

Flexibility marketing is a strategy that allows businesses to put something into action quickly with minimal disruption. Businesses that are speedy to implement will gain a competitive edge.

Datuk Badriyah says that the components of flexibility marketing include energy storage solutions such as:

- Storage on wheels such as EVs (electronic vehicles) or V2Gs (vehicle-to-grid). An electric vehicle, called an EV, uses one or more electric motors or traction motors for propulsion.
- Demand-side management via time of use (energy demand management, also known as demand-side management (DSM) or demand-side response (DSR), is the modification of consumer demand for energy through various methods such as financial incentives and behavioral change through education or managing the usage time).
- Greater cross border energy trading and enhanced ancillary services.

"The government is initiating the Renewable Energy Transition Roadmap 2050. This new policy study will look into, among other things, the introduction of voluntary renewable energy certificate (REC) market and a pilot run of energy trading using block chain technology. This energy trading platform will resolve the long term take up of NEM (National Electricity Market) in the country.

"We are also looking at ASEAN member states which have excess hydro energy and are keen to trade with neighbouring countries. Early this year, Malaysia spearheaded the successful multi-lateral power transfer of 100MW from Laos via Thailand. This milestone is a major breakthrough as a flagship of multilateral power transfer in ASEAN and we are expecting bigger capacity to be traded in the future," she says.

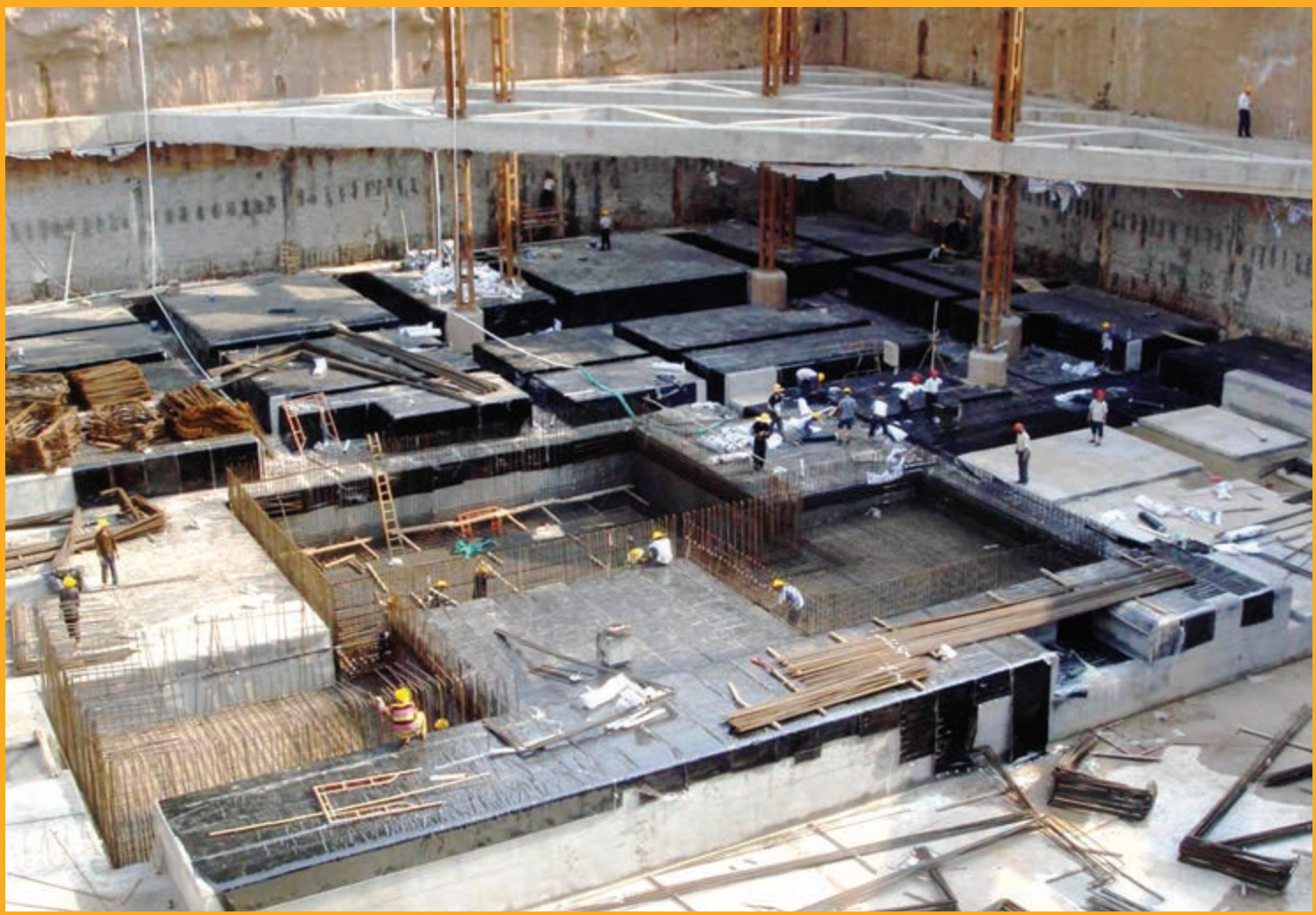
But Datuk Badriyah is pleased when it comes to power planning. She said that Malaysia's power development plan is for a long period, until 2036.

"This is a regimented 18-year plan. It's very good but sadly, it is only for power. We have been very diligent when it comes to supply and in the power sector, it's all about terawatts and megawatts. When we talk about the real spectrum of energy, we do not know how much energy we have in the basket. There is no national energy planning to ascertain what goes where," she says.

"If we have a comprehensive energy plan, we can control the capacity needed by the different sectors. The transport sector alone takes up a huge 42%, which is almost half the total supply. And of course another chunk is taken by power. So it all comes down to having a single entity and that is the only way we will be able to manage energy in Malaysia holistically."

Datuk Badriyah welcomes the new government and the new Minister of Energy Yeo Bee Yin with optimism. "There is a lot to be done and it needs to be done fast. My fervent hope with this new government is for change. When you talk about energy in MESTECC, it's only related to power," she says.

"Since GE14, I have been fighting very hard for MESTECC to become a single entity for all energy. This is urgently needed. Malaysia is one of the few countries in ASEAN (Association of South-East Asian Nations), without a single entity to manage the whole spectrum of energy. Our energy sector is multi-sectoral, cutting across many ministries and agencies. With so many government bodies to report to and so many in charge, it is difficult without a national focal point to manage the energy sector in a wholesome perspective. There is a huge gap, particularly in thermal and transport energy, which is currently not being addressed as there is no agency responsible for managing the energy part of these two sectors."



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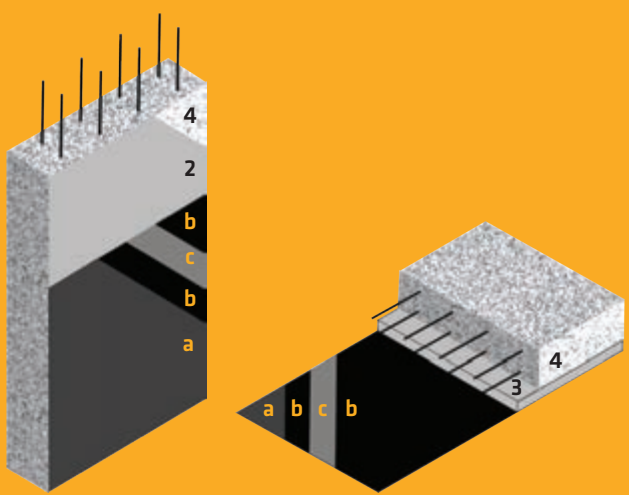

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ENERGY EFFICIENCY & CONSERVATION ACT

Since February 2018, MESTECC (formely Kementerian Tenaga Teknologi Hijau Dan Air (KeTTHA)) has undertaken the important task of drafting the Energy Efficiency and Conservation Act (EECA) which is at the top of Datuk Badriyah's priority list for now. EECA is a legal instrument that is urgently required to ensure our energy usage is efficiently managed.

Currently, there are only two legal instruments – Minimum Energy Performance Standards Regulations 1994 and Efficient Management of Electrical Energy 2008 – for energy efficiency and conservation. MESTECC is very serious about ensuring that the drafting process will meet the timelines anticipated as the EECA is expected to be enforced in 2021 (Q2/Q3). The two instruments mentioned earlier are insufficient to regulate the electrical and thermal energy usage.

MESTECC has set up the EECA Drafting Committee which comprises stakeholders such as ministries, government departments and agencies including industry representatives and NGOs.

The Ministry has appointed a consultant to assist in the drafting of the EECA which is expected to include both matters related to electrical and thermal energy. The Ministry has appointed a consultant team to conduct an in-depth study on thermal energy which will be included in the EECA.

"I have given the consultant three months to complete the study and to obtain the necessary data required as currently we have limited data on thermal energy usage. This is why the law is so important. Malaysia needs a law that will compel relevant parties to submit data on a regular basis; that law is long overdue," she says.

TRANSITIONAL CHALLENGES

2019 is set to be a busy year for the Energy Sector in MESTECC. "We are making up for lost time. We hope to complete the EECA draft by the end of 2018. Next year will be taken up for consultation and stakeholder engagements of the draft act and we will seek Cabinet approval probably in May 2019. The EECA is expected to be tabled in the Parliament in 2019 (Q4), probably during their last sitting of that year."

Datuk Badriyah expects a year of transition, with the EECA coming into effect in Q2/Q3 2021.

She says the power sector must be prepared for changes that will result in major shifts in the electricity industry. One of them is the duck curve phenomenon, a graph of power production over 24 hours to demonstrate the time imbalance between peak demand and renewable energy production.

She says the government is committed to ensure that electricity tariff is affordable, with minimum impact on cost of living, especially for lifeline consumers. A lower cost fuel option will be one of the main criteria in determining the type of fuel selected in generating electricity in the country.

Malaysia's most urgent priority is to ensure reliable and secure supply of electricity at affordable prices. "In the long term, sustainability issues need to be addressed to mitigate the high carbon emission from the power sector as our current energy mix is mainly fossil fuel (mainly gas and coal) which constitutes more than 75% of our generation capacity mix. So we have started efforts to increase the share of renewable energy to diversify the capacity mix. Higher renewables in the generation mix contributes positively to the government's pledge to reduce carbon intensity in Malaysia by 45% by the year 2030," she says.

ENERGY MANAGEMENT & MEDICAL SECTOR

When it comes to healthcare, Datuk Badriyah's team is, again, one step ahead. "Regimented Energy Management is crucial for healthcare facilities as the Ministry of Health (MOH) spends almost RM600 million annually on electricity bills," she says.

"Many hospitals have old, low-efficiency equipment which results in the inefficient use of electricity and contributes significantly to high electricity bills. Adopting energy efficiency programmes will help reduce operational cost while helping to meet the government's aspiration in carbon reduction. The money saved can be used to replace ageing assets which are critical in delivering services to patients."

To support the pledge to reduce carbon emissions by 2020, the MOH has implemented a new policy of Green Healthcare Facilities. A new concession agreement signed in April 2015 required all concession companies that assisted hospitals, to implement sustainability programmes including Energy Management (EM), Indoor Air Quality (IAQ), and 3Rs (Reduce, Reuse and Recycle).

Through its agencies such as Energy Commission and Sustainable Energy Development Authority (SEDA), MESTECC has taken the proactive step to assist MOH provide Development Budgets in the 11th Malaysia Plan to retrofit old chillers and to revamp selected hospitals. Part of the new Concession Agreement requires all hospitals to achieve a three-star rating according to the Energy Management Gold Standard (EMGS) by ASEAN Energy Management Scheme (AEMAS) within the first five years of the concession period. MOH resident engineers in each hospital will ensure that the implementation of the Energy Management programme is done according to the requirements.

Some high impact projects implemented by MOH are:

- Pilot project on Green Building certification via LEED Certification (Leadership in Energy and Environmental Design) under USGBC (United States Green Building Council) in Hospital Langkawi
- Pilot Project on Energy Saving by using Energy Performance Contracting (EPC) in Hospital Putrajaya, Hospital Raja Permaisuri Bainun Ipoh and Hospital Teluk Intan
- Solar Photovoltaic (PV) Project in Hospital Langkawi
- Solar Photovoltaic (PV) for a pedestrian walk that connects Hospital Putrajaya and National Cancer Institute in collaboration with SEDA

- Chiller retrofit project for energy savings in Hospital Sungai Siput, Hospital Duchess of Kent Sandakan, Hospital Segamat and Hospital Kulai in collaboration with KeTTHA and
- LED Lighting retrofit project for energy savings in Hospital Melaka, Hospital Raja Permaisuri Bainun Ipoh, Hospital Temerloh, Hospital Kota Baru and Hospital Queen Elizabeth I Kota Kinabalu in collaboration with KeTTHA.

ARCHITECTURE & CONSTRUCTION

Datuk Badriyah believes energy efficiency is very important. She strongly advocates the need to construct energy efficient buildings and eventually, the construction of new buildings which comply with green building standards.

"Green building comes at a premium. You have to pay more than that for a conventional building of the same size. It's not difficult to achieve green building when you already have a MS1525 compliant building. It just need a little tweaking here and there to make it a green building. Malaysia Standard MS 1525:2014 monitors energy efficiency and the use of renewable energy for non-residential buildings," she says.

Smart designs are integral to having an energy-efficient building.

"Ideally, a passive building will be incorporated into the design process. When you build a passive or energy efficient building, you only need to spend a small percentage more on the cost compared to that for a standard building," she says.

However, these additional construction costs are compensated for through savings obtained in the operational costs.

Passive building design is a rigorous, voluntary standard for energy efficiency in a building that reduces the building's ecological footprint. It results in extremely low energy buildings which require little energy for heating or cooling.

MOVING FORWARD

Recently, Datuk Badriyah met with the Prime Minister on matters relating to the electricity sector. During the discussions, Tun Dr Mahathir Mohamad asked MESTECC to conduct a study on managing municipal solid waste in a sustainable manner using modern technology, such as the "waste to energy" concept.

"Rather than just dumping in a landfill, we have to manage waste disposal in an environment-friendly manner. Among the issues we face are environment and health. A third, and probably the biggest challenge, is the social issue. We cannot divorce these factors from waste management. We need to work on incorporating the best economic technologies into our system," she says.

Datuk Badriyah intends to invite IEM to help with the study. "We will need all the input we can get, especially from the professionals," she says.

"In Malaysia, we still need fossil fuel power stations for our base load demand. The challenge is to bridge these supply limitations throughout a 24-hour demand. We need to find solutions to make electricity grids more efficient and streamlined while developing better storage system to allow renewable energy to be saved for needy times. Meeting future energy needs will require not just one but various alternatives in addition to fossil fuels. Apart from the adoption of higher efficient combined-cycle gas turbine (CCGT), all new coal power plants will use clean coal technology such as Ultra-Super Critical (USC)."

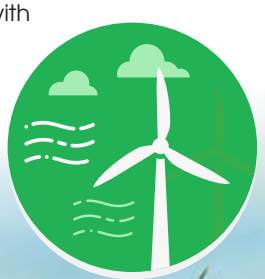
She is also keen to mention the influence of disruptive technologies. "It requires industry players, particularly those in the energy sector to prepare for dynamic renewal and disruptive technologies, as there are many things that are constantly changing and these may require new ways of thinking. As the way forward, the Green Technology Master Plan (GTMP) highlights the need to strive for innovation via imagination as new ways can be in the shape of circular economy and minimal change to ecosystems. The action plan being developed for GTMP will refurbish the requirements for new innovation in addition to existing initiatives. There will be no more cross subsidisation of energy as well," she says.

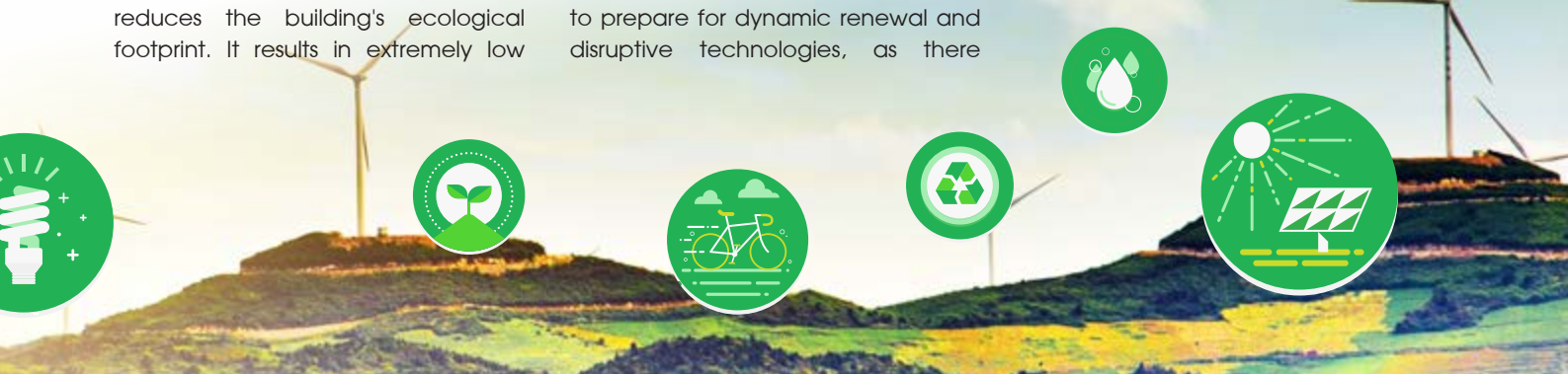
GTMP is an outcome of the 11th Malaysia Plan (2016-2020) which earmarks green growth as one of six game changers altering the trajectory of the nation's growth.

CREATING SUSTAINABLE ENERGY MOVEMENT

In the end, it comes down to awareness. "We need to reach the grassroots and educate them. We are hopeful that IEM can help us get to the masses; we can conduct workshops on energy efficiency and demand and IEM can be our partner in these efforts. IEM should be able to help policy makers in the ministry to propose new and resilient policies in the energy sector to future-proof the industry from new disruptive technologies looming on the horizon. We need each other and to work well together."

IEM, through the efforts of EETD, has been actively creating awareness of sustainable energy with activities organised to achieve the goal. This is a continuous effort to ensure that future generations can appreciate life without compromising the environment. ■





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Sustainable Energy for Malaysia: An Exciting Journey Awaits

Ir. Akmal Rahimi Abu Samah

Sustainable energy has taken centre stage in recent years, especially with the urgency of the climate change agenda and energy security issues. At the 21st Conference of Parties (COP21) in November 2016, Malaysia ratified the Paris Climate Agreement along with the deposition of instrument with the UN Headquarters.

The following year, during the 22nd Conference of the Parties (COP22) to the UN Framework Convention on Climate Change (UNFCCC), 47 developing countries pledged to transit to 100% renewable energy (RE). Even private companies have pledged for 100% RE (RE100.org) by a certain period.

Our Nationally Determined Contribution (NDC) is to reduce our Greenhouse Gas (GHG) emissions intensity of GDP by 45% by 2030, relative to the emissions intensity of GDP in 2005. This consists of 35% on an unconditional basis and a further 10% on condition upon receipt of support from developed countries.

ENERGY TRANSITION MEGATREND

Globally, we have acknowledged a new megatrend on the energy horizon. Pioneered originally by the Germans, many countries are now in the process of undergoing energy transition, i.e. transitioning from fossil-based energy to cleaner and more sustainable RE.

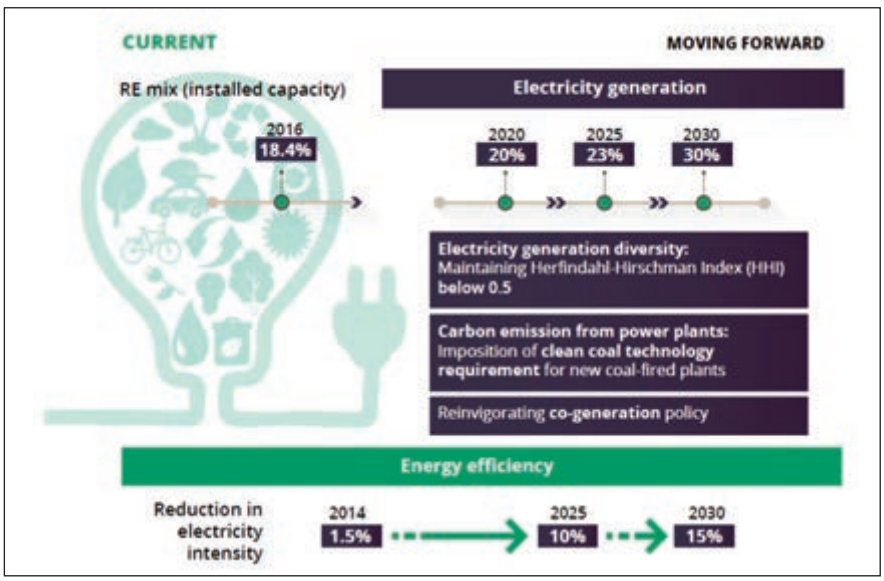
The growth for RE in 2017 has been impressive. According to the Renewables 2018 Global Status Report by REN21, global RE generation capacity increased by 178 GW in 2017, making it the strongest year ever for new capacity additions and bringing the global total capacity to 2,195 GW. Asia is the fastest growing region in RE and this is mooted by the steep learning curve of variable RE technologies such as solar PhotoVoltaic (PV) and wind.

While hydropower remains a significant portion of global RE, other new RE sources with zero marginal cost, such as solar and wind, have gained significant traction in the last decade. In 2017, for a record 2-year in a row, solar PV overtook wind in new installed capacity. Solar PV saw a record of 98 GW whereas wind was at 52 GW. 2016 saw a new record low of solar PV tariff offered at US$0.0242 per kWh in Abu Dhabi, and the record was broken again later in Mexico, Chile and Saudi Arabia where the tariff went below US$0.02 per kWh. In this respect, in some countries RE has reach grid, or at least, socket parity with conventional thermal energy.

RENEWABLE ENERGY TARGETS

Under the ASEAN Plan of Action for Energy Cooperation (APAEC), the target for RE is 23% of the total primary energy supply by 2025. For the power sector in Malaysia, it does follow the ASEAN definition of RE which includes electricity generated from large hydroelectric power. At present, RE constitutes approximately 22.5% of the country's total electricity generating capacity.

Other than the above, the nation's Green Technology Master Plan (GTMP) has also set a target of achieving 30% RE capacity mix by 2030. The manifesto of the newly-elected Malaysian government is even bolder and has stated a goal of achieving 20% RE mix (excluding large hydropower capacity) by 2025.



Targets for energy sector under Green Technology Master Plan (GTMP)

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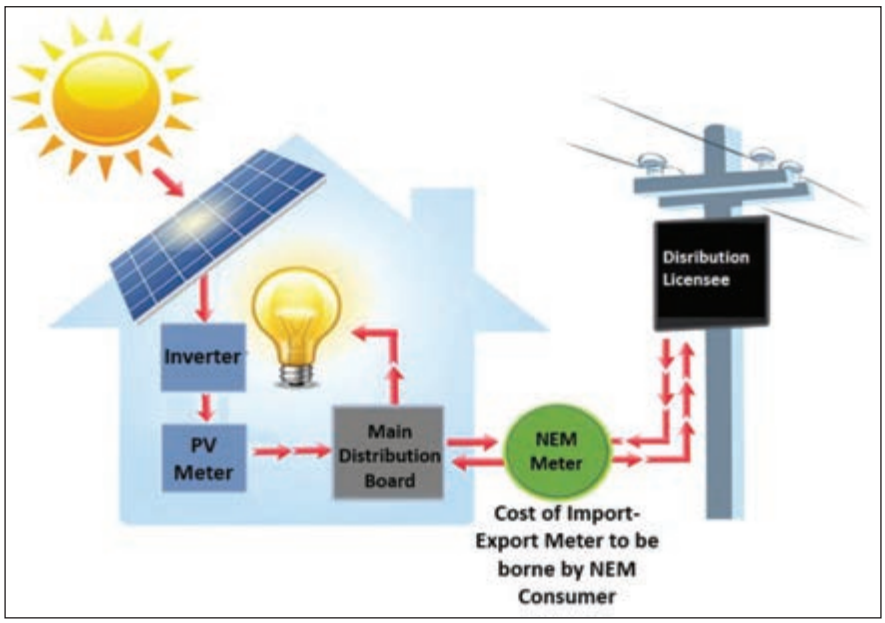
RENEWABLE RESOURCE	PROJECTS APPROVED			PROJECTS ACHIEVING COMMERCIAL OPERATION		
	No. of Applications	Capacity (MW)	% of total	No. of Installations	Capacity (MW)	% of total
Biogas	129	225.12	13.6%	33	63.03	11.4%
Biomass	44	396.44	23.9%	8	87.90	15.8%
Geothermal	1	37.00	2.2%	-	-	-
Small Hydro	63	555.48	33.5%	6	30.30	5.5%
Solar PV	12,282	442.42	26.7%	9,746	373.66	67.3%
TOTAL	**12,519**	**1,656.45**	**100.0%**	**9,793**	**554.89**	**100%**

Status of FiT programme (May 2018)



Concept of the Net Energy Metering (NEM) scheme

FEED-IN TARIFF (FIT) MECHANISM

Our country is well-endowed with renewable resources such as hydro, solar and bioenergy. In order to catalyse the growth of the RE sector, Malaysia introduced the RE Act in 011 to enforce the Feed-in Tariff (FiT) mechanism and established the Sustainable Energy Development Authority (SEDA) Malaysia the same year to ensure its successful application.

As of May 2018, SEDA has approved a total 12,519 FiT applications, with a cumulative RE capacity of 1,656.45 MW. In the same period, a total of 9,793 installations with a cumulative installed RE capacity of 554.89 MW has achieved commercial operation.

One of the key outcomes of the FiT scheme is that we have observed solar PV to have the highest take-up rate compared to other RE sources. Currently, solar PV represents 67% of the total capacity commissioned under FiT, that is 373 MW out of the 555 MW commissioned under the FiT scheme, way beyond the initial 9% target of solar PV from the total installed capacity of RE.

On the other hand, total capacity for bioenergy (which includes biomass and biogas) represents 27% of total capacity commissioned. The issues with bioenergy are not unique to Malaysia; many countries are also facing the same challenges of ability to secure long-term feedstock at reasonable price and grid access.

NET ENERGY METERING (NEM) AND LARGE SCALE SOLAR (LSS) PROGRAMMES

The FiT mechanism has successfully spawned RE market and created an equally strong RE industry. In Malaysia, an exit strategy has begun for solar PV under FiT. Post 2017, solar PV was no longer available under FiT. In 2016, the government initiated the net energy metering (NEM) and large scale solar (LSS) programmes, administered by SEDA and the Energy Commission (ST) respectively.

Under NEM, the total solar PV quota allocated is 500 MW and for LSS, it is 1,000 MW. The difference between the NEM and FiT is that NEM is only applicable (so far) to solar PV, where it is based on the concept of self-consumption. Any excess solar PV electricity generated is sold to the grid at prevailing displaced cost, using the net billing calculation method.

The credits earned under net billing shall be allowed to roll over for a maximum of 24 months. Any unused credit beyond this period will be forfeited. Compare that to the FiT, where 100% of electricity generated is sold at some predefined premium tariff for a fixed tenure. Therefore, from the financial standpoint, the yield from FiT investment would be more attractive than NEM. NEM thrives in an environment where electricity tariff is unsubsidised and at market rate, hence there is considerable savings from self-consumption. NEM is largely viewed as 'cost saving' measures; at macro level, the widespread applications of NEM will reduce demand on grid electricity.

Until end of 2017, 958 MW of solar PV capacity had been awarded through two rounds of tender/ auction under the LSS programme. The government received a lot of applications from RE developers to participate in the programme. The condition set by the Energy Commission which required all bidders to provide Performance Bond to undertake the project, guaranteed a more serious commitment from the private sector.

IMPACTS OF SOLAR PV TO ELECTRICITY NETWORK

Solar PV has the capability to do peak shaving as the electricity generation from solar PV coincides nicely with peak demand. The reduction in peak demand reduced the need to invest in more peaking plants which are not cost efficient to run as they generate electricity for only a few hours daily to meet the extra peak-hour demand.

Within any electricity grid system, there is a limit to the amount of intermittent or variable RE (i.e. solar PV in our case) that the grid can accommodate. For the time being, the amount of variable RE injection to the grid in Malaysia is still modest, and RE projects above a certain threshold capacity are already required by distribution licensees to conduct a power systems study.

Globally there is a move towards greater decentralised RE generation or distributed energy generation. Initiatives such as FiT, NEM and LSS are exemplary of a gradual shift towards adoption of decentralised clean power generation. Such adoptions lead to greater growth of electricity consumers concurrently becoming producers of electricity, a concept known as 'prosumerism'.

HYDROPOWER AS BALANCING SYSTEM

Hydropower plants play a key role in providing a balance to the electricity market as more variable RE is injected into the grid. Cheap electricity like hydropower has zero marginal cost and, in Sarawak, there is an abundance of HEP resources with the technical potential of around 20,000 MW. Sarawak has huge hydro potential which can help in providing flexibility to resources that are more intermittent in nature.

The issues with drawing Sarawak's hydro power are no longer technical in nature, but rather in terms of commercial viability, with regards to the investment cost of the submarine cable and the associated converters stations. As the cable will run through Indonesian waters, there is also a need to address the international and legal ramifications, as well as the geopolitical consensus. Nevertheless, Sarawak's hydro power is important for the future of the energy system in the country. Any country that has large hydro potential, serves as a natural energy storage provider for itself as well as its neighbouring countries.

FUTURE OF RE

In Malaysia, we have sufficient RE technical potential to meet our electricity needs. On a macro level, there is a need to change the electricity system market from baseload to a combined energy and balancing markets. A whole new paradigm of the electricity system is required. For this reason, the energy transition is so-named

Small hydro-electric is a very matured technology that has great potential to be further developed in Malaysia

because such a transformation cannot happen overnight, but through years of planning and commitment.

In future, many countries will go for 100% renewables. Globally, we have exceeded 60% of our carbon budget. How much more should we continue to inject carbon into the atmosphere before tipping the 2 degrees Celsius? At current NDC pledges, the collective country pledges can only reduce the global average temperature by 2.7 degrees Celsius.

Hence, the big question is always when will countries finally decarbonise? Some countries have pledged to adopt 100% RE, while others have reached the mark. A mega trend on the horizon has been created by leading corporations (such as Google, Apple, IKEA, BMW, Philips, Citibank, Nestle) as they pledged 100% RE by a certain year. They have made the initiative rather than wait for the Government to trump the renewable energy drive. The expectation from the market is more environmental responsibility, as demonstrated by these corporations.

Rooftop solar PV is one of the most promising RE sectors that we need to focus on

ENERGY EFFICIENCY (EE) – THE OTHER COMPONENT OF SUSTAINABLE ENERGY

As the sustainable energy equation comprises both RE and EE, the country is also actively promoting decarbonisation through energy demand management. Energy demand management includes energy conservation, energy efficiency and renewable energy. As energy efficiency and conservation are an important element of demand side management and must be rigorously pursued, the government has approved the introduction of the National Energy Efficiency Action Plan in 2015 to manage energy demand effectively.

The Action Plan aims to reduce energy consumption by 52,233 GWh over the plan period of 10 years by strengthening institutional frameworks, developing skilled capacity, establishing sustainable funding mechanism, promoting investment and integrating energy efficient initiatives.

Over the years, many initiatives have been introduced to promote EE in the country. We have also received a lot of support from international bodies such as United Nations Development Programme (UNDP), Japan External Trade Organisation (JETRO), Energy Conservation Centre Japan (EECJ) and the Danish International Development Agency (DANIDA). Some of the key projects and initiatives undertaken in the past were:

a) Malaysian Industrial Energy Efficiency Improvement Project (MIEEIP)
b) Sustainability Achieved via Energy Efficiency (SAVE) programme
c) Building Sector Energy Efficiency Project (BSEEP)
d) Industrial Energy Efficiency for the Malaysian Manufacturing Sector (IEEMMS)
e) Energy Performance Contracting (EPC)
f) Green Technology Financing Scheme (GTFS)

These initiatives have led to capacity building in various aspects of EE and increased awareness of EE among stakeholders, the private sector and energy user at large. The initiatives also paved the way for the formulation of regulatory instruments for selected segments of the EE sector.

Currently, the government has also started drafting the all-important Energy Efficiency & Conservation Act which will provide a holistic regulatory framework for the development and promotion of EE for Malaysia.

ENERGY AUDIT CONDITIONAL GRANT (EACG)

Under the 11th Malaysia Plan, the government has also initiated the Energy Audit Conditional Grant (EACG) with an allocation of RM54.4 million for a period of three years. This grant is applicable to the commercial and industrial sectors, for them to conduct energy audit for their buildings/facilities. Buildings with electricity usage of more than

Conducting an energy audit is an important first step towards implementing energy efficiency initiatives

100,000 kWh per month are qualified for the grant. After the energy audit, building owners are required to implement energy saving measures identified from the audit analysis where the investment amount must at least match the amount of the audit grant.

The programme is meant to encourage commercial and industrial building owners to adopt the use of efficient technologies and effectively cutting down on carbon emissions while saving operational costs. One of the major efforts of EACG is retrofitting government buildings, especially hospitals, to make them energy-efficient and able to save on utility bills.

As part of the initiative, a capacity building training course is also provided in order to create awareness and build up technical competency of the among the building owners personnel.

CONCLUSION

Malaysia needs to move forward in its sustainable energy agenda and to establish itself as ASEAN's green technology hub, with collaboration from all parties, as well as among ministries, agencies, private corporations, NGOs and concerted willpower from its citizens.

A mindset change is what's needed for us to forge ahead in the green sphere. Will Malaysia be able to move towards a change in mindset in order to embrace the new

energy paradigm, and additionally discard the present baseload electricity market and move to one that is made up of liberalised energy and balancing markets? Will Malaysia also be able to show its commitment to pursue the EE agenda with full conviction? Only time will tell but we must remain optimistic and have faith in our country. ■

Author's Biodata

Ir. Akmal Rahimi Abu Samah *is Chief Operating Officer (COO) of Sustainable Energy Development Authority (SEDA) Malaysia.*

The Editorial Board and the Standing Committee on Information and Publications for session 2018/2019

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Energy Use and Its Effects on the Environment

Francis Xavier Jacob

Energy is an essential commodity for human existence and way of life. It plays a central role in society's economic growth and development. Population growth, increasing urbanisation and the upgrading of the standard of living of the general population will result in an ever-increasing scale of energy consumption. On the international scene, in the *New Policies Scenario*, global energy needs rise more slowly than in the past. However, it will still increase by 30% between today and 2040[1].

In Malaysia, the energy consumption growth is even higher than this global figure. Under the Business As Usual (BAU) scenario, by 2040 Malaysia's final energy demand is expected to rise by 63% (34 Mtoe) compared with the 2013 level, reaching just below 88 Mtoe. This reflects an average annual growth rate (AAGR) of 1.8%. This is almost double the Asia Pacific Economic Cooperation (APEC) countries average of 1%[2].

ENVIRONMENTAL EFFECTS

This paper does not deal with the environmental effects of nuclear fuel, as it is not used as such in this country.

Like all human activities, energy activities will have effects on the environment. Each stage of fuel extraction and consumption will have such effects. These various stages are:

1. Extraction
2. Refinement/processing
3. Transport/storage
4. Consumption/combustion
5. Disposal of waste products

Fuel Extraction: Coal mining is in the form of deep mining, open cast mining or, in the case of lignite, peat and even some coal extraction from relatively shallow deposits by strip mining or other open cast techniques. The main environmental issues at this stage are:

- Risks due to underground accidents including cave-ins, gas explosions and health hazards associated with dust and the release of radioactive gases such as radon.
- The surface effects caused by the large scale dumping of mine spoil or open cast activities. These include effects of land settlement, safety hazards, visual intrusion and the occupation of land and the local effects of smell, noise, vibration and dust.
- The acidification and pollution of local water.
- Disruption of aquifers, threatening nearby water wells.
- Water pollution, particularly siltation and acid drainage.
- Noise and road damage due to the transport of large quantities of spoil.
- Losses in land productivity from soil alteration (especially in prime agricultural areas).
- Loss of wildlife habitat.

Oil and natural gas are extracted mainly by offshore deep drilling and transported to the mainland refineries by undersea pipelines or bulk carriers. Leakage from pipelines and accidental spillage that cannot be localised are the main causes of environmental impacts.

Fuel Refining/Processing: After coal is removed from the ground, it is usually sent to a preparation plant near the mining site for cleaning and processing to remove rock, dirt, ash, sulphur and other unwanted materials.

Based on the technologies employed, the following environmental concerns will have to be addressed:

- Potential surface and groundwater pollution.
- Wastewater discharge.
- Emission of NO_x, SO_x, particulates, etc. leading to air pollution. This will be subsequently lead to greenhouse effects, acid rain and damage to plants.
- Occupational safety and health risks from accidents and toxic chemicals.
- Carcinogens in direct process, intermediates and fuel products.
- Possible localised odour problems.

Similarly, oil refining will involve the reduction of sulphur, benzene and lead content in the refined oil as compared with that in the crude oil. This will lead to air pollution, water pollution, deforestation and disruption in the eco system.

Fuel Transport/Storage: Fuel has to be transported from mines and processing plants to consumers and the environmental concerns from the transport and storage of fuels include:

- Risks of accidents and spillage with subsequent problems from air/water pollution.
- Noise and road damage from the transport of large quantities of fuel.
- Land use and disruption to the eco system.

Energy Use in Fuel Extraction, Processing, Transport and Storage: Apart from the earlier stated environmental concerns in the extraction, processing, transport and storage of fuels, it has to be accepted that energy is also needed for this, resulting in further environmental impacts. Figures for such energy consumption are difficult to obtain, due to the variations involved and the lack of studies on this.

For coal obtained from surface mining (often used when coal is less than 60m underground), the overall energy consumption per ton of material moved is estimated to be about 20,000 Btu/t. Even this figure, when compared with the USA Department of Environment (DOE) figures, reveals that it is about 3.85 times less than what the DOE had indicated[3].

For oil production in the 1920s, it took 1 barrel of oil to extract, process, refine, ship and deliver 100 barrels of oil. Now, conventional oil production worldwide pays off at about a 20-to-1 ratio. In Canada, where the oil comes from tar sands, it's closer to 5-to-1[4].

Fuel Combustion/Consumption: Table 2 shows the final end use by energy type in Malaysia. It can be seen that about 22% of this is in the form of electricity.

Table 2: Final Energy Use by Energy Type in Malaysia (2015)[5]

ENERGY TYPE	AMOUNT OF ENERGY (THOUSAND TONNES OIL EQUIVALENT)
Natural Gas	9,566
Petroleum	29,087
Coal and Coke	1,778
Electricity	11,375
TOTAL	**51,806**

Table 3 shows that about 89% of the energy used for electricity generation is from thermal power stations. It is thus pertinent to look into the environmental effects of fuel combustion/consumption in power plants.

POWER GENERATION

Emissions from coal fired, oil fired and gas fired power stations depend on the composition of the fuels, particularly the sulphur content and also the combustion technology used. The emissions include carbon dioxide (CO_2), carbon monoxide (CO), sulphur oxides (SO_x) and oxides of nitrogen (NO_x). Apart from these, there may be small amounts of unburnt hydrocarbons and traces of heavy metals including mercury, arsenic and radioactive elements and isotopes such as uranium and thorium. Large quantities of warm water are also produced.

Table 3: Energy Used for Electricity Generation in Malaysia (2015)[5]

ENERGY SOURCE	PERCENTAGE
Hydro Stations	10.8
Thermal Stations	
Natural Gas	40.4
Petroleum	1.1
Coal and Coke	47.2
Renewables	0.5
TOTAL: 33,134 KTOE	

Figures exclude sources for self-generation

In Malaysia, the major fuel used for electricity generation is natural gas. It accounts for about 40% of the electricity generated in 2015[5]. Natural gas is a relatively clean fuel as for the same amount of energy produced, it emits about 40% less carbon dioxide than coal. In addition it emits almost no sulphur dioxide and little nitrogen oxide.

The environmental effects of emission from fossil fuelled power stations are complex. The main effects are increase in acid rain and global warming due to the greenhouse effect. They do not, however, contribute in a significant manner to the depletion of the ozone layer.

Hydro power generation also has environmental effects. This includes:

1. Fragmentation of river ecosystems – the dam acts as a barrier between upstream and downstream movement of river animals.
2. Reservoir sedimentation – resulting in diminished storage capacity.
3. Riverline and coastal erosion.
4. Greenhouse gas emissions – due to submerged biomass.
5. Effects on humans – diseases, resettlement.

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Transport: From Table 4, it can be seen that the bulk (about 45%) of energy used is in the transport sector. Motor vehicle greenhouse gas emissions is the major environmental impact concern here and this is projected to grow as the result of vehicle miles travelled (VMT). With population growth and the growing ownership of vehicles, VMT is projected to rise sharply. Motor vehicle emissions include carbon dioxide, water vapour, methane, nitrogen oxides (NO_x), carbon monoxide and non-methane hydrocarbons (C_nH_m).

GREENHOUSE EFFECT

The burning of fossil fuels worldwide produces about 5,000 million tonnes of carbon, or about 18,000 million tonnes of carbon dioxide every year[6]. The atmospheric increase in carbon dioxide and the consequent climate changes are attributed to the burning of fossil fuels.

Table 4: Final Energy Use by Sectors in Malaysia (2015)[5]

SECTOR	AMOUNT OF ENERGY (THOUSAND TONNES OIL EQUIVALENT)
Industrial	13,989
Transport	23,435
Residential and Commercial	7,560
Non-Energy Use	5,928
Agricultural	895
TOTAL	**51,807**

The term "Greenhouse Effect" commonly refers to global warming due to man's activities such as by the burning of fossil fuels or the destruction of the rain forests.

Disposal of Waste Products: The disposal of solid wastes has long-term land use effects and in the possibility of toxic materials being leached from disposal sites. They are basically of two types:

- Ash wastes from coal plants.
- Elements removed from ash and coal, wastewater treatment sludges, other materials such as catalysts and partially combusted products.

The magnitude of the waste in terms of the land required for it is huge. Also some of these wastes can be hazardous.

Environmental Externalities: Electricity generation projects have external impacts on the community where they are situated. The emissions from the generation installations, for example, have an impact on the health and social life of the inhabitants in the immediate surroundings and in society as a whole.

Such external impacts include benefits or costs as a by-product of the generation activity that is borne by someone other than the parties involved in the generation activity. As such, the costs of external impacts do not enter in the market pricing calculations of the parties involved in the activity. However they have to be considered by public policy makers when considering different options for generation.

If such costs are considered, the least cost option may result in different projects being more favourable than what they would have been otherwise. For example, projects using renewable sources of energy may become more favourable than those using fossil fuels.

MITIGATION OF ENVIRONMENTAL EFFECTS OF ENERGY

Energy Efficiency Policies and Programmes in Malaysia

One of the ways to reduce the effects of energy use is to use it more efficiently. Various strategies developed to promote energy efficiency in the country include:

- Focusing on the major energy use sectors, i.e. the industrial and commercial sectors.
- Enforcement of Energy Efficiency Regulations.
- Encouraging local financial institutions to finance energy efficiency and renewable energy projects.
- Implementation of fiscal incentives.
- Implementation of demonstration projects.
- Establishment of integrated complexes and townships with the aim of them being energy efficient and having economies of scale.
- Implementation of demand side management.
- Development of related industries and services to encourage greater uptake of energy efficiency projects/equipment.
- Research and Development in the promotion of energy efficiency.
- Implementation of energy use benchmarking.
- Implementation of energy rating and labelling. At present there are requirements for energy efficiency rating and labelling for the following:
  - Refrigerators
  - Air Conditioners
  - Fans
  - Televisions
  - Motors
  - Lamps
  - Fluorescent Lamp Ballasts
  - Insulation Material
- Project on Capacity Building in the Energy Commission and Related Key Institutions on Energy Efficiency and Demand Side Management.
- Formulation of National Energy Efficiency Plans.
- The Malaysian Industrial Energy Efficiency Improvement Project (MIEEIP). Its programmes include:
  - Energy use benchmarking
  - Energy audits
  - Energy service companies (ESCOs) support
  - Energy rating
  - Energy efficiency promotion
  - Energy technology demonstration
  - Local manufacturing support
- High Efficiency Motor Promotion Programme.
- Efficient Refrigerators Promotion Programme.
- Efficient Lighting Promotion Programme.
- Newspaper/Other Mass Media Energy Efficiency Awareness Campaign.
- Energy Service Companies (ESCOs) Support Programme.
- Clean Development Mechanism.
- In terms of legislation, the Efficient Management of Electrical Energy Regulations 2008 was introduced and the Uniform Building By-

laws (UBBL) amended to require compliance with certain provisions of energy efficiency standards. More recently, the Electricity Regulations 2004 was amended to include provisions for Minimum Energy Performance Standards (MEPS).

- The introduction of suitable courses in institutions of higher learning on the use of renewable energy and the practice of energy efficiency will be continued.
- In terms of energy efficiency in buildings, the government has stated that it will lead by example by implementing energy efficiency measures in its buildings, with special emphasis being given to optimal lighting and air conditioning and the undertaking of energy audits to identify additional measures that can be implemented to improve efficiency of energy use.
- The government has stated its intention for the energy pricing structure to be reviewed to reflect market prices. In this respect, a review will be undertaken to gradually reduce subsidies on energy prices.
- At regional level, there are plans for an ASEAN Plan of Action for Energy Cooperation (APAEC) in Energy Efficiency and Conservation Programmes. This is important as the global and regional economies become more interconnected. It will include having common labelling, standards and testing facilities in order to achieve greater economies of scale. It will also assist in preventing cheaper and more energy inefficient products from being dumped into the country.
- Malaysia has also developed its own green building rating system known as the Green Building Index or GBI.
- To enable the country to develop energy efficiency strategies and programmes in a more coordinated and effective manner, the National Energy Efficiency Action Plan is being developed and is expected to be revealed soon.

CONCLUSION

In its World Energy Outlook, The International Energy Agency reports that the world is not on track to meet the target agreed by governments to limit the long-term rise in the average global temperature to 2 degrees Celsius (°C). Global greenhouse-gas emissions are increasing rapidly and, in May 2013, carbon-dioxide (CO_2) levels in the atmosphere exceeded 400 parts per million for the first time in several hundred millennia.

Malaysia is committed to reducing GHG emissions as part of its commitments towards the global climate change initiative. Ahead of the 21st Conference of Parties (COP) of the United Nations Framework Convention on Climate Change (UNFCCC) in Paris, Malaysia submitted its Intended Nationally Determined Contribution (INDC). According to this, the country intends to reduce GHG emissions intensity (per unit of GDP) by 45% by 2030, relative to the emissions intensity in 2005[7]. This reduction consists of 35% on an unconditional basis and a further 10% conditional upon receipt of climate finance, technology transfer and capacity building from developed countries.

Engineers have a great role to play in realising this commitment by the country. ■

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IEM DIARY OF EVENTS

Title: Technical Visit to Proton Tanjung Malim

13 September 2018

Organised by: Mechanical Engineering Technical Division
Time : 9.00 a.m. - 1.00 p.m.
CPD/PDP : 3

Title: Talk on Stakeholder Management

13 September 2018

Organised by: Project Management Technical Division
Time : 5.30 p.m. - 7.30 p.m.
CPD/PDP : Applying

Title: Technical Visit to EWT Transformer Sdn. Bhd.

19 September 2018

Organised by: Mechanical Engineering Technical Division
Time : 9.00 a.m. - 1.00 p.m.
CPD/PDP : Applying

Title: Talk on Corrosion

22 September 2018

Organised by: Oil, Gas & Mining Engineering Technical Division
Time : 11.00 a.m. - 1.00 p.m.
CPD/PDP : Applying

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Elephants, Roads and Drivers: Case Study of Gerik-Jeli Highway


Dr Wong Ee Phin


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Jamie Wadey


Alicia Solana-Mena


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Dr Pazil bin Abdul Patah


Nasharuddin Othman


Salman Saaban


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At the start of 2018, the United Nations estimated that world population had reached 7.6 billion. Today, there are few untouched natural habitats left, where wildlife can live without crossing paths with humans and our activities. Linear infrastructures, such as roads, are rapidly proliferating all over the world.

Southeast Asia, in particular, is undergoing rapid economic growth and experiencing a massive, unprecedented expansion of road coverage. This is also the region with a large number of threatened megafauna, such as elephants, tigers, and tapirs. The largest terrestrial animal in Asia, the Asian Elephant (Elephas maximus), is already endangered due to the rapid decline in its population, due mostly to habitat loss and the resulting human-elephant conflict in the form of crop raiding (Fernando & Pastorini, 2011). The expected infrastructure development over the coming decades will most likely further threaten elephants and other megafauna in the region.

Roads affect animal behaviour, movement and distribution. Roads also affect wild habitat by modifying the environmental conditions in their vicinity, for example, by allowing more sunlight to penetrate to the ground and altering humidity and temperature. This is known as the "edge effect" and the result is changes to plant and wildlife populations as well as community structures in areas bordering roads and in other habitat fragments.

Roads impede wildlife movement and ability to use resources in the habitat. On a larger scale, roads can reduce landscape permeability and connectivity by acting as barriers that cause fragmentation and isolation of wildlife populations. Small populations are usually more vulnerable to local extinction due to inbreeding and stochastic events.

Elephants are particularly susceptible to landscape changes and the effect of roads as barriers. They are intelligent and sentient beings with a high attachment to traditional and very large home ranges. Adult females, especially the matriarchs, store in their memory intricate details of the landscapes, including movement routes that have paid rich dividends in the past (e.g. they remember where to find resources such as salt-licks, fruiting trees, grasslands and water). This perhaps explains why general patterns of elephant movements and habitat use have remained relatively unchanged for more than a century when one compares Sanderson's (1878) description of elephant movements with a study conducted by Sukumar (1989) in the same region of southern India.

Peninsular Malaysia is an important stronghold for wildlife, including Asian Elephants (*Salman et al., 2011*). Development has led to many land use changes in the country. The peninsula has lost its forest cover from nearly 80% in the 1940s to less than 37% in 2010 (Miettinen, Shi, & Liew 2011).

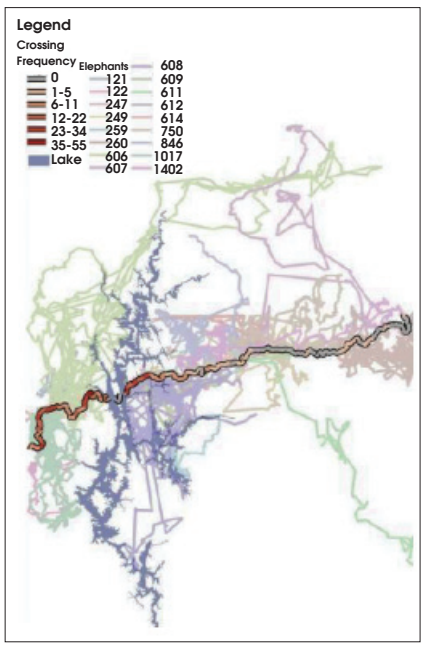

Figure 1: Map showing the frequency of road crossings by GPS collared elephants along the Gerik-Jeli Highway

Recognising the importance of the country's biodiversity and the dangers of a "business as usual" approach, the Malaysian Government has developed legislation and policies to protect its wildlife. The Central Forest Spine (CFS) is a very important national land-use master plan to maintain habitat connectivity for wildlife across major habitat patches in Peninsular Malaysia (DTCP, 2009).

The implementation of the CFS plan involved the construction of several viaducts under existing highways to facilitate wildlife crossing. The conservation of Asian Elephants in the peninsula is guided by the National Elephant Conservation Action Plan (DWNP, 2013). Scientific evidence from research will greatly help the implementation of these national plans. Here we present some of our on-going work on understanding how a major road affects the movements of elephants in Belum-Temengor, a priority landscape for elephant and tiger conservation.

COMPLEX EFFECT OF ROADS ON ELEPHANTS

Our study (*Wadey et al., 2018*) used GPS telemetry data and a mechanistic movement modelling framework to understand when and where wild elephants crossed the Gerik-Jeli Highway, a 120km long road that bisected the Belum-Temengor Landscape (BTL, Fig. 1).

The highway is fully asphalted, with a width of 2-3 lanes (~25 m), and often has additional structures such as steel and concrete barriers as well as concrete drains along its sides. Between 1970 and 1995, the forest reserves that run parallel to the road were heavily logged.

Wadey et al., (2018) monitored 17 wild elephants (10 local and 7 translocated from conflict areas) and found that local elephants crossed the road 14 times more frequently than translocated ones, indicating that familiarity with the landscape was important for elephants (Fig. 1). Elephants also crossed the road predominantly at night (81% of crossings were between 7.00 p.m. and 7.00 a.m.), when traffic density was lower. A study done in India found that Asian Elephants crossed roads in a wildlife sanctuary in order to get to a water source during the dry season, but they also showed higher levels of agitation in response to disturbance from vehicles (*Vidya & Thuppil, 2010*).

The Malaysian study also found that the Gerik-Jeli Highway acted as a strong barrier to elephant movements, with an 80% reduction in permeability.

However, the relationship between elephants and the road is very nuanced and although the road seriously disrupts elephants' availability to move from one side to the other, it also acts as an attractor as elephants spend a lot of time feeding on the abundant fodder on the roadside.

In another study in the same landscape, we found that elephants staying near the Gerik-Jeli Highway were able to consume more of their preferred food, such as grass and other early succession plants, while elephants far (> 5km) away from the road had to consume more woody plants (*Yamamoto-Ebina et al., 2016*).

Asian Elephants are known to be edge specialists (Campos-Arceiz, 2013) and so they are attracted to the roadsides. They are often labelled as mega-gardeners of the forest due to their important ecological role as agents of seed dispersal (i.e. they consume large-seeded fruits like mango and durian and disperse the seeds in new places for the next generation of trees to grow; Campos-Arceiz & Blake, 2011). Given that the road affects their diet and movements, elephants that stay near the road end up consuming a much simpler diet, with less wild fruit and they disperse seeds over shorter distances than elephants living in the primary rainforest.

The steady increase in traffic volume (~4% annually between 2005 and 2014; MoWM, 2014) along the Gerik-Jeli Highway can eventually deter elephants from crossing the road altogether, majorly impacting habitat connectivity between Belum and Temengor. In 2017, two elephants, a juvenile and a sub-adult, were killed in a collision with a vehicle on this highway (Fig. 2).

Figure 2: Juvenile elephant killed in a car accident on 16 June, 2017, along the Gerik-Jeli Highway

Figure 3: A translocated elephant killed by poachers for the tusks

In addition, two of the nine (22%) males we tracked in the Belum-Temengor landscape were poached for their ivory (Fig. 3) within 3 km from the road. The BTL is considered one of the hotspots for poachers. According to WWF-Malaysia (2011), there are at least 80 access points which facilitate poaching along the 120km highway in BTL. The road has become what is called an ecological sink (or ecological trap) because elephants are attracted by the abundant food but also suffer negative effects on their movements and safety due to collisions and poaching.

VIADUCTS, DRIVER BEHAVIOUR AND MITIGATING THE IMPACT OF ROADS

Towards the end of our study, the Malaysian Government had constructed a wildlife viaduct along the Gerik-Jeli Highway. Our elephant movement data was collected prior to the establishment of the viaduct and we cannot, therefore, judge its effectiveness, although before the viaduct construction we detected

only one road-crossing event in that area.

Follow-up studies are now necessary to monitor the movement of elephants near the viaduct to assess its effectiveness in facilitating landscape connectivity for elephants and other wildlife. In any case, a single viaduct across such a long stretch of road is not sufficient to provide landscape connectivity for elephants. The viaduct should therefore, be considered as part of a suite of mitigation tools, rather than as a silver bullet to maintain permeability in the BTL.

Although much has been discussed about green infrastructure (e.g. viaducts), the role of infrastructure user behaviour has been largely neglected so far, in spite of its high potential to mitigate the impact of roads on wildlife.

The predominant determinant of the risk of motorist-wildlife collision is vehicular speed. Reducing speed, either through speed limits or physical barriers such as speed bumps, will go a long way towards reducing collisions. The enforcement of low speed limits in wildlife habitats should therefore be a priority. But even when motorists adhere to speed limits, collisions with wildlife can still happen when motorists fail to perceive and react to the presence of wildlife. When motorists do not anticipate encountering hazards, such as in rural and forest areas, they are prone to "inattentional blindness" (i.e. failure to perceive something that exists in their field of vision). This means that while motorists "see" an animal on the roadside, their brains fail to "perceive" it, so the motorists will either not react or react only when it is too late. The risk increases if motorists are driving faster in rural and forest areas than they usually do in urban areas.

Inattentional blindness can also occur when the driver is fully engaged in focusing on stimuli relevant to driving (e.g. other vehicles on the road) and does not perceive an additional stimulus (e.g. wildlife on the roadside). Cognitive psychology has identified that it is easier for us to detect an additional stimulus that shares features and characteristics with the task at hand than it is to detect a vastly different stimulus. For example, studies have shown that drivers perceive pedestrians and animals more readily in an urban context as opposed to a rural context (Palmer & Blink, 2013), implying that drivers may associate non-urban driving with hazard-free smooth driving. This is indeed a problem when it comes to motorists driving through forested areas with wildlife crossing the road!

A MEME's satellite-collared elephant walking near the barrier along the Gerik-Jeli Highway

Elephants crossing the Gerik-Jeli Highway

To overcome inattentional blindness, one possible intervention is to provide artificial stimuli at the start of the highway (e.g. a life-size elephant statue and sound) to prime the motorist's attention towards wildlife presence in the area. After priming, the driver should be more likely to self-regulate the driving speed and spot wildlife by the road, thereby avoiding collisions. This might help to reduce vehicle accidents, save human lives and avoid wildlife roadkills. Additionally, where appropriate, traffic management during the night may help mitigate the loss of permeability of roads to wildlife.

OUR RECOMMENDATIONS

To mitigate the impact of roads on elephants and other wildlife, we recommend the following:

1. Avoid expanding the number of lanes on the Gerik-Jeli Highway and the creation of new roads in the BTL, as road expansion will further reduce permeability.
2. Encourage responsible driving behaviour on roads traversing important wildlife habitats in Malaysia. Consider the implementation of psychological techniques aimed at safer driving by priming motorists to be more vigilant about their surroundings and to self-regulate their driving speed.
3. Establish low speed limits and enforce them through awareness signs, speed bumps, speed

A family of elephants in the forest within Belum-Temengor Landscape

traps and fines to reduce road accidents and wildlife roadkills. Consider managing traffic volume at night.

4. Consider habitat management (e.g. long-term reforestation) near the road to reduce grasslands and avoid the concentration of elephants on roadsides.
5. Monitor the effectiveness of the viaduct on habitat connectivity for elephants and other wildlife.
6. Implement extensive enforcement patrolling and other anti-poaching efforts along highways and roads bisecting forested areas, especially at viaducts and areas frequently used by wildlife.
7. Recognise the Belum-Temengor Landscape as an important elephant habitat that should be treasured and promoted as part of the country's natural heritage.

CONCLUSION

Our research highlights the importance of considering the impact of infrastructure development on megafauna and other wildlife, especially in South East Asia, a region with a large number of threatened megafauna and with large-scale infrastructure development plans for the coming decades. Instead of working in silo, engineers, wildlife biologists and psychologists should work together to develop creative solutions to help conserve the rich biodiversity for our future generations. ■

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When Abnormal Becomes the New Normal: Coping with Water Hazards

Ir. Dr Wang Hong Kok

Ir. Dr Ooi Teik Aun

On 10 March, 2018, Dato' Paduka Ir. Haji Keizrul Abdullah delivered the Ir. T.T. Chiam Inaugural Memorial Lecture on water hazards and how Malaysia coped with such disasters. The Intergovernmental Panel on Climate Change (2014) reported that "warming of the climate system is unequivocal and, since the 1950s, many of the observed changes are unprecedented over decades to millennia. The atmosphere and ocean have warmed, amounts of snow and ice have diminished and sea levels have risen".

Global warming can produce "Black Swans" where the impact of highly improbable is becoming more frequent – a case of the abnormal becoming the new normal. How do we face the new phenomenon and avoid being a turkey in the eyes of Nassim Nicholas Taleb (2018)? Can we turn Black Swans white?

Four renowned international scientific organisations have discovered alarming evidences of global warming where the temperature rose very fast. See Figure 1. The effects of climate change can be seen from a number of observations such as "shrinking ice sheets, glacial retreat, decrease in snow cover, declining Artic sea ice, extreme events and ocean acidification" (NASA Global Climate Change, 2018).

Dato' Keizrul noted that "global warming/climate change inflicted other equally challenging consequences to Malaysia. Arising from the effect of precipitation, climate change produces floods that cause untold miseries". Precipitation may be explained as water droplets that are formed in the cloud and come down as rainfall, arising from evaporation of water at the earth surface. Global warming and climate change can cause heavier rainfall resulting from rapid evaporation which, in turn, produces floods.

What are the consequences of floods? Citing a source from ICC (2007), Dato' Keizrul said Malaysia's annual damage from flooding is estimated at RM915 million, with a drag impact on economy estimated at RM2 billion.

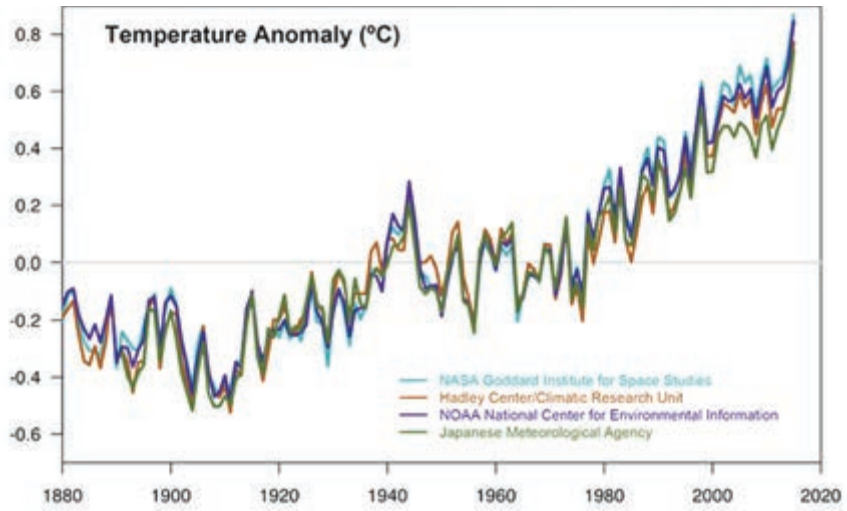

Figure 1: Scientific consensus: Earth climate is warming
Source: NASA Global Climate Change (2018)

Social economic damages from floods have been the focus of recent research ((Chan (2012), Lee and Irma Noorzurah Mohamad (2013), *Sani et al., (2014)* and *Hays (2015)*). However, the estimated economic losses, as reported by the four different sources mentioned below, differ considerably from one to another.

Firstly, Chan (2012) collected and compiled a table of records of floods in Malaysia, dating as far back as 1886. The worst floods occurred in Johor, between December 2006 and January 2007, where damage to property amounted to US$489 million and resulted in 18 deaths.

Secondly, in a study based on UNEP's (2013) Global Risk Data Platform, Lee and Irma Noorzurah Mohamad (2013) found that Malaysia's economic risk index from water-related disasters was estimated at around US$60 million, with at least 10 related deaths per year. This confirms there are huge casualties from flood damage. See Figure 2.

Thirdly, *Sani et al., (2014)* noted that in 1996, a flood took place in Keningau, Sabah, which caused US$300 million in property damages and 241 deaths.

Fourthly, some 9% of land mass or 29, 720 km2 of land in the country is prone to flooding. (*Hays, 2015; Sani*

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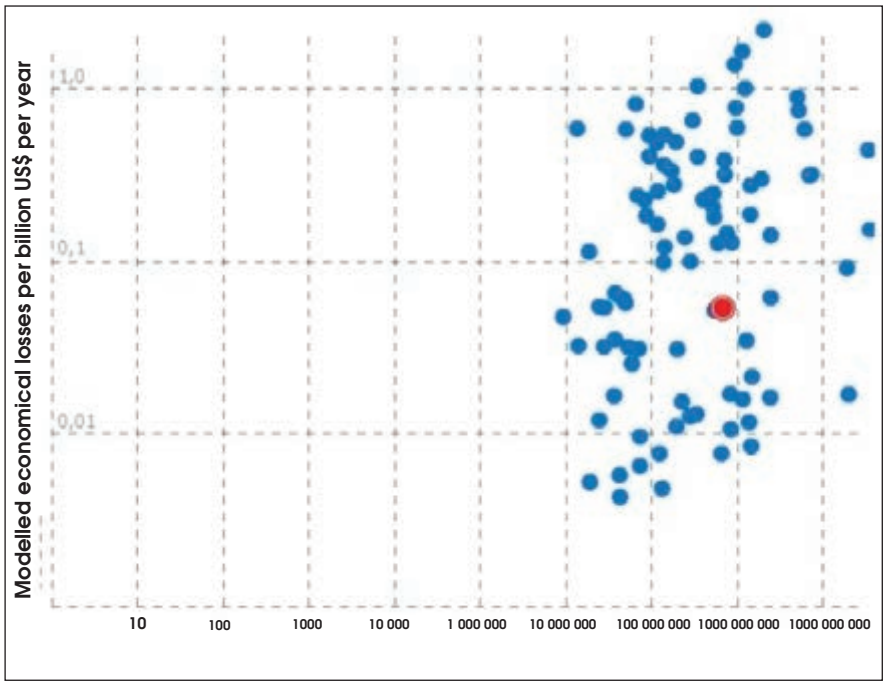

Figure 2: Global flood economic risk index (ERI), with the highlighted point (red) showing Malaysia. Source: Lee and Irma Noorzurah Mohamad (2013), cited from UNEP (2013)

et al., 2014). Hays (2015) provided an account of severe floodings experienced in the late 2004, late 2007, 2009 and 2012, which left many people dead and thousands homeless. For example, in the late 2004 flooding, at least 11 people were killed and 10,000 families evacuated from Kelantan, Terengganu and Pahang.

Indeed, more in-depth research is required in this specific area. What is the way forward? In which areas do we need to do more? This article brings to mind two questions inspired by Dato' Keizrul's lecture: On mitigation measures, what is Malaysia's experience in coping with the water hazards in the context of climate change? On adaptation measures, what should Malaysia do in disaster risk reduction?

MITIGATION EFFORTS IN COPING WITH WATER HAZARDS: GUARDEDLY OPTIMISTIC

According to Dato' Keizrul's lecture, at least six engineering control measures as "cure floods" solutions had been implemented by the Drainage & Irrigation Department (DID) in the past: Widening and deepening of rivers, construction of levees and bunds, upstream stream storage (e.g., the Klang Dam height was increased by 3 metres), off river storage (e.g., constructing the Batu River flood attenuation pond), diversion (flood bypass) and pondering & pumping.

"A point to note is that engineering control measures are capital intensive," said Dato' Keizrul. "As funds from the government are becoming more limited, the priority now is to turn to mitigation measures in order to reduce flood impact." See Table 1. Flood mitigation costs and flood mitigation measures will be discussed below.

Table 1: Flood mitigation expenditure in Malaysia

Period	RM	REMARK
1971-1975	14 million	2nd Malaysia Plan
1976-1980	56 million	3rd Malaysia Plan
1981-1985	141 million	4th Malaysia Plan
1986-1990	155 million	5th Malaysia Plan
1991-1995	431 million	6th Malaysia Plan
1996-2000	845 million	7th Malaysia Plan
2001-2005	1.8 billion	8th Malaysia Plan
2006-2010	4 billion*	9th Malaysia Plan
2011-2015	5 billion*	10th Malaysia Plan

As flood mitigation costs can escalate through time, the government has introduced, among others, Private Financing Initiative (PFI) as a procurement strategy which allows participation by the private sector. One example is the SMART Tunnel in Kuala Lumpur (Lee and Irma Noorzurah Mohamad, 2013).

The word mitigation refers to an act of making a condition or consequence less severe. Thus flood mitigation refers to any act that will lessen the impact of flooding so that it is less severe and harmful to flood victims. Four mitigation measures commonly adopted in Malaysia were discussed: Integrated river basin planning and management, flood risk mapping, flood forecasting and warning as well as control at source.

Integrated river basin planning and management: In the Network of Asian River Basin Organisations (NARBO) Regional Conference held in April 2015, Dato' Keizrul defined a river basin "as geographical areas determined by the watershed limits of the system of waters, including surface and underground waters, flowing into a common terminus". A River Basin Authority is one which is tasked to ensure that water quality is achieved for daily use optimally and sustainably. So far, the River Basin Authority can only be found in the state of Selangor.

Flood risk mapping. Marco (1994) explained flood risk mapping as "a tool for land use planning in flood-prone areas". Based on experiences of previous flood-inflicted disasters, the Malaysian Disaster Management & Relief Committee, with relevant stakeholders, was tasked with overseeing the planning, restoration, reconstruction and delivery in post-disaster recovery exercises. Flood risk mapping is used to lessen the damage of future impact from flood recurrence.

Flood forecasting and warning. This is a flood warning dissemination system relying upon network data, telemetry data, radar data and rainfall forecast that promotes decision support on a timely basis (HR Wallingford, 2017). One such

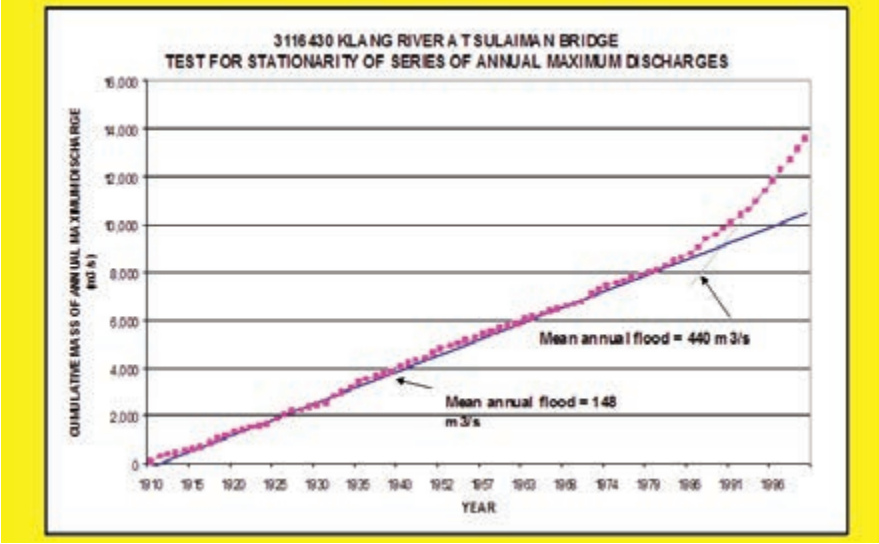

Figure 3: Data from the Klang River at Sulaiman Bridge
Source: The T. T. Chiam Inaugural Memorial Lecture

system was installed in Sungai Muar in 2014.

Control at source. Uncontrolled housing development in low-lying flood plains contributed to floods in urban centres. The key to controlling floods at source is to properly manage runoff quality and quantity in the implementation stage of housing development. One example of flood control at source is the construction of detention facilities.

Dato' Keizrul re-emphasised the impact of development and the side-effects in the urban centres: "As further development takes place, flood magnitude continues to increase, i.e. a case of the goal posts keep getting wider". Academic Dictionaries Encyclopedias (2018) explains that the mean annual flood is "over a series of years, the mean average of the maximum flood discharges experienced in a particular river recurrence interval should be once every 2.33 years". One example in Malaysia was the Klang River under the Sulaiman Bridge where the mean annual flood jumped from 148m^3 per second in 1940 to 440m^3 per second in 1991. See Figure 3 for empirical evidence on the increasing trend of annual flood discharge at the said bridge.

In the next section, flood adaptation measures as a better "cure floods" method than the existing mitigation measures were discussed.

ADAPTATION MEASURES IN DISASTER RISK REDUCTION

The implementation of flood mitigation measures are normally costly and involves elaborate institutional arrangements (integrated river basin planning and management, flood risk mapping, flood forecasting & warning and control at source).

Dato' Keizrul believed that adaptation measures were more cost-effective and included building resilience into the potential flood victims so that they would be better prepared to face the challenges. He offered three examples:

1. The "living in harmony with floods" concept through effective flood plain management, can help control housing developments in the flood plain.
2. A more environmentally-friendly option such as the natural ecosystem, can be adopted to reduce flood threats. An example is the planning of Putrajaya City where existing lakes and wetlands are retained as natural features. See Figure 5.
3. Building resilience into potential flood victims should be emphasised so that they would be better prepared to adapt and able to recover from natural disasters. This approach entails consideration of "risk, insurance, social safety nets/ compensation, relief measures, recovery, and rebuilding for flood

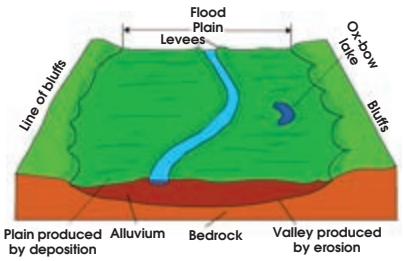

Figure 4: Living in harmony with floods
Source: The T. T. Chiam Inaugural Memorial Lecture

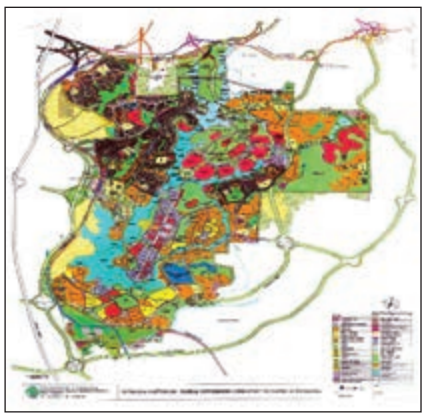

Figure 5: Putrajaya wetlands, use of lake as detention basin and wetlands for water quality improvement

victims well before the occurrence of flood," Dato' Keizrul noted.

4. The recognition of building resilience to disasters, in communities (and nations for that matter) has been the main thrust of the United Nations International Strategy for Disaster Reduction (UNISDR) programme. During the World Conference on Disaster Reduction held in Hyogo, Japan, on 18-22 January, 2005, five priority action plans were identified for immediate implementation by all signatory nations, Malaysia included, reproduced in full here (UNISDR, 2005):

i. Ensure that disaster risk reduction (DRR) is a national and local priority with a strong institutional basis for implementation.
ii. Identify, assess and monitor disaster risks and enhance early warning.
iii. Use knowledge, innovation and education to build a culture of safety and resilience at all levels.
iv. Reduce the underlying risk factors.
v. Strengthen disaster preparedness for effective response at all levels.

Readers keen to learn more about water hazards and climate change adaptation can look forward to a richer field awaiting to be explored further (Fussel, 2007; Silva and Costa, 2016).

CONCLUSION

When global warming and climate change meet at the intersection of urban development, the condition is ripe for extreme floods. The Black Swan Theory was manifested through the onslaught of the 2014 Great Flood in the north-eastern states of the peninsula.

The aim of this article is to find means to turn Black Swans white. Dato' Keizrul, the speaker of the Ir. T. T. Chiam Memorial Lecture, had addressed the two questions in this article in relation to water hazards: Flood mitigation measures adopted in the past by the Malaysian DID and flood adaptation measures more popularly endorsed by UNISDR (2005). While flood mitigation measures are costly, building resilience involving the collective efforts of the affected communities can be a successful adaption solution in the long run for Malaysia. ■

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SECTION A

Elaborate on the entire construction project process from inception to the final handing over. As the Civil & Structural Engineer working for a reputable consulting engineer firm, discuss your roles and responsibilities in handling both Client's and Architect's requirements, liaison with other consultants and ensuring compliance of actual construction works as per your design. What proactive steps can you take to ensure the successful completion of the project within time, cost and quality?

Tan Char Ai

ANSWER:

Every construction project involves preliminary design stage, tender stage, construction stage and the final handing-over stage.

As a civil engineer, it is of paramount importance to ensure that a project is completed successfully within the stipulated time and budgeted cost without compromising on quality. This can be achieved if the following steps are adhered to.

1. STUDY ALL AVAILABLE INFORMATION

The first step is to study thoroughly all the information given, such as architectural drawings, M&E drawings, etc. Look for any insufficient/missed-out information so that this can be highlighted or requested from the related parties. This will ensure all information gathered is sufficient and will be a reliable input during the design stage of the building.

2. ESTABLISH THE COLUMN POSITION

After obtaining sufficient architect drawings, the civil engineer can set up the preliminary layout plan with column position and preliminary column sizing. The column loading will be calculated so that the required column size can be estimated. The most ideal span will be 8m-8.5m, which is more economical and for ease of car park arrangements. Ensure column positions do not obstruct any door or window opening or are in the centre of the lobby etc. The column positions shall be properly planned to avoid long cantilever and, if possible, the beam span shall be economical and yet, looks aesthetically acceptable at the same time.

Usually after the preliminary column beam layout is done, this is sent to the architect for further comment and subsequently for the latter to capture the columns in the architectural drawings.

3. SOIL INVESTIGATION

After the preliminary layout plan is established, the client will be advised to award and commence soil investigation works. Based on the site location, experiences from past projects and by checking with friends/contractors who have done jobs in the area, it is not difficult to roughly predict the soil formation of the project site. The number of soil investigation boreholes required is usually determined based on the magnitude of the column loading, the scale of the project and the predicted soil formation.

The location of boreholes will be marked on the plan and the termination criteria established. After the bore logs are collected from SI contractor, the soil information will be analysed and monitored by plotting out the soil profile of the entire site. If the boreholes give very consistent information, then the numbers of boreholes can be reduced or vice versa.

4. FOUNDATION DRAWINGS AND DESIGN

The foundation design shall commence after obtaining sufficient information from the soil investigation report. Due consideration shall be taken on the site condition, soil profile, column loading and architecture requirements before carrying out the design and choosing the most suitable foundation system.

For example, if a proposed structure is very close to a retaining wall and where the adjacent lot is lower than the proposed structure, piling shall be done instead of footing even though the soil condition is good. This is to prevent pressure from being exerted/spread to the retaining wall if footing is being used to support the proposed structure.

In fact, a civil engineer must be aware of the surroundings of the proposed project before deciding which pile installation method to adopt. For projects close to existing buildings or within a residential area, the pile injection method is normally preferred and adopted instead of the hydraulic hammer method which can cause noise pollution and vibrations.

In cases where there is argument over which foundation system is more economical, for example a 10-pile group of 500mm spun piles or a 2-pile group of 900mm bored piles, a typical detail shall be provided for the QS to carry out cost comparison so that in future, the client will have a clear picture or explanation to why bored piles instead of spun piles are adopted or vice versa.

5. SUPERSTRUCTURE DESIGN

For every floor with a different architectural layout, the framing plan with the beam size shall be set out for comment and coordination from the architect, M&E and client. In most cases, the architect and client will not want to see any exposed beam. Where this cannot be avoided, the ceiling has to be provided for covering such unsightly beams. The beam depth also needs to be checked so that the headroom required by both architect and the authorities can be complied with, for example building By-Laws and Bomba requirements.

As for M&E, coordination needs to be done for M&E services to be cast within the RC structure or if M&E RC openings are required. In some cases, additional beams may be introduced for M&E to fix air-conditioner blowers.

Lots of coordination works need to be done between C&S engineer, architect and M&E consultant so that all items and quantity are captured in the BQ and to avoid any dispute during the construction stage. Most of the time, details that the architect

and M&E may miss out in the tender drawings are lift pit, transfer beam service gap, water tank sump pit, etc., so the C&S engineer shall write to them in black and white to request for details in order for these items to be captured in the design.

6. TENDER DRAWINGS AND TENDER STAGE

If an unreasonable time frame is given to furnish all the tender drawings to QS for calling for tender, it is encouraged to advise the client accordingly on the reasonable time frame required. Requests can be made for tender drawings to be issued to QS in batches so that the QS can proceed with the quantity taking off and, in the meantime, the C&S engineer will still have ample time to come out with a detailed design.

During the tender interview, it is advised to highlight to the contractors any grey area that they may have missed out in their costing where the item is not shown in the drawings. For example, if a building has a piece of RC slab on the floor above but a void area on floors below, then the contractor will need to provide steel beams as temporary structure to carry out the construction.

All this is to prevent VO claim or EOT applied during construction stage. All the tender queries list and reply from the contractor shall also be in black and white and bound together with the contract documents.

7. CONSTRUCTION STAGE

During the construction stage, a C&S engineer shall help advise the proposed work programme for structural work even though the architect (as the project superintendent officer) will monitor the site progress. If the time frame for the RC work is not realistic, this shall be highlighted to all parties in writing.

Random spot checks must be carried out at site by the C&S engineer to ensure contractors are carrying out the works as per drawings and clear communication between Resident Engineer and Clerks of Works is established so that they will carry out their job diligently. Auditing the inspection forms, concrete cube test reports and rebars tensile test report are some of the measures to help ensure contractors have done all the necessary testing and are using the concrete grade for specified elements.

For any discrepancy, the contractor will send the RFI to the C&S engineer and by all means this has to be reviewed and replied to as soon as possible in order to not hinder the site work progress.

For the construction drawing, review the whole design carefully and focus on important structures such as transfer beams, shear walls and columns. Revise accordingly if any item had been overlooked during the tender stage. In addition, if there is still room to optimise the design, the construction drawing shall be revised accordingly to avoid unnecessary wastage of natural and human resources. Normally, after all the adjustments, the final cost should still be almost the same or with slight savings as per tender stage estimation.

8. COMPLETION OF CONSTRUCTION AT SITE

At this stage, all approvals from the authorities shall normally be obtained and the physical works on site already completed. In order to get CCC from authorities such as IWK and Syabas, the as-built drawing needs to be submitted to them and a joint site inspection be carried out. All the respective consultants will have to sign the related CCC form, from G to G13 (for example, G4 is for structure works).

If the project is delayed, the contractor will have to apply for Extension of Time. All respective consultants are required to evaluate the application and give their recommendation based on the related trade.

In conclusion, a C&S engineer has to take proactive steps to work closely with as well as maintain good rapport and clear communication with the architect and M&E engineer throughout the project period.

With close monitoring of site works and team work between the contractor and the consultants' site representatives, a project can certainly be completed successfully in a timely manner and within cost and the desired quality. ■

SECTION B

Engineers are often entrusted with the responsibility of implementing large-scale projects involving millions of ringgit. In view of the large amount of money changing hands, the integrity and ethical standards of engineers are put to the test. What measures can an engineer take to prevent corruption and the unethical practice of cutting corners so as to safeguard the good image of the profession?

ANSWER:

Corruption and the unethical practice of cutting corners are serious issues in the engineering profession, especially in the construction industry. These may be attributed to the following:

1. UNIQUENESS OF THE PROJECT

Every development project is unique. All site soil conditions, building designs and site locations are different and unique. Therefore comparison is difficult and this creates chances for concealing bribes and inflating costs.

2. CONCEALED WORKS

In a construction project, most works are concealed. For example, piles, footing and pilecap are buried underground, the M&E earthing

system is underground, steelbars and tendons are cast inside concrete, M&E services are inside conduits, etc. This creates opportunities for unethical parties to try and make extra profits by claiming more than what has actually been done on site.

For example, an unethical contractor may try to claim for pile penetration of 20m though the pile penetration is only 12m. They may even bribe the Clerk of Works to sign on the pile driving form.

3. LARGE AMOUNT OF MONEY INVESTED

Most engineering projects are big scale projects involving millions of ringgit. This creates chances for unethical people to inflate cost to make extra profits.

4. VARIOUS TRANSACTIONS/ COMPLEX TRANSACTION

A construction project involves various trades and many contract relationships, such as the developer and the main contractor. Under the main contractor, there will be many sub-contractors for different trades, such as concrete works, plastering, tiling, brickworks etc. The contractor will also have different suppliers for different items such as concrete, steel and BRC, aluminium frames and glazing, lifts and formwork.

Each trade will have a contract document and there is always the chance that unethical parties will try to make extra profit by inflating cost or using sub-standard products.

For example, an engineer may specify using a certain waterstop and waterproofing at the RC water retaining structures but, in order to earn more profit, a contractor may propose using a cheaper product, claiming that it is equivalent in quality to the brand specified.

5. VARIOUS STAGES OF AUTHORITY APPROVALS

Approvals and permits from different authority departments and/or government link agencies are required at various stages of construction until the Certification of Completion & Compliance (CCC) stage. As consultants, clients and contractors hope to get the approvals quickly, this creates chances for bribery and corruption.

Listed below are measures that an engineer can take to prevent corruption and the unethical practice of cutting corners.

a) **Education:** Engineers should be taught personal rights, job scopes and responsibilities as well as the code of ethics. All engineers should be encouraged to attend courses on related topics for codes of conduct so that they will have a better understanding and awareness. Then they will be more careful and will always act with the highest integrity when carrying out their daily tasks. For example, there's the Codes of Conducts course by IEM. All engineers should attend this even though it is no longer a mandatory course these days.

b) **Clear and strict protocol:** All engineering firms shall set up a clear and strict protocol for use as a guideline. For example, company specification for concrete works, infrastructure works etc. and company standard inspection forms and checklists, standard drawing for miscellaneous details, etc.

This is to avoid every engineer coming out with his/her own different checklist or different details, which may end up as arguments, discrepancies or conflicts of interest at site.

For example different companies have different details for the brick wall stiffener and lintel beam detail. If it's not mentioned properly in the drawing, it can create an argument between the contractor and Clerk of Works. Then there is the chance that the contractor may try to bribe the Clerk of Works to close the issues.

Besides, if there is no strict protocol in the company, it will be hard to gain the respect of the contractor. For example a contractor deals with Engineer A in the consultant form where A accepts that the wall deviation is 30mm when it is actually 20mm. The contractor will then think that the consultant firm is not strict, so he/she may take the opportunity to use sub-standard materials.

On the other hand, if a consultant firm maintains a strict and good reputation, the contractor will be more careful and will not dare to cut corners.

c) **Spot checks and regular reviews:** An engineer shall always visit the site and communicate with site representatives to ensure that works are done according to the latest construction drawings. Other than relying on site representatives, an engineer shall also carry out spot checks at sites to prevent bribery of the Clerk of Works or the Resident Engineer who then may not carry out their jobs properly.

d) **Take reports or claims seriously:** When a certain party reports to a consultant firm or an engineer that someone at the site is involved in bribery and has not constructed as per drawing, the engineer must take the issue seriously because, if a structure is not done properly, public safety is threatened. If a building is unsafe, the image and reputation of the developer and consultant will also be tarnished.

Therefore all claims and reports must be taken seriously and investigations/verifications carried out. Any unethical practice must be reported to the related authority if proven true so that it will serve as a reminder to all parties to be careful and to act with integrity in their daily works.

In conclusion, all engineers must always be careful and try to avoid any possible conflict of interest. I believe that by taking the above measures, we can prevent corruption and the unethical practice of cutting corners in engineering profession. ■

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ENGINEER'S

Lens

Contributed by
Ir. Dr Oh Seong Por

GUANGJI BRIDGE:
Ancient Open-Close Bridge

Guangji Bridge is one of four famous ancient bridges constructed during the Song Dynasty. It is 517.95 metres long, built across the Hanjing River in eastern Chaozhou, Guangdong Province, China. Initially, it was just a floating bridge comprising 86 connected boats. In 1174, a huge flood destroyed the bridge and it was reconstructed using beam and piers. With improvements made over the years, the bridge now has 24 pavilions on 24 piers. The mid-section is still made up of connected boats which can be opened to allow boats to pass through. This open-close bridge combination of beam and pontoon design is an important engineering heritage in the history of China. ■

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Updated May 2018

Technical Visit to Bukit Tagar Sanitary Landfill

ELECTRICAL ENGINEERING TECHNICAL DIVISION

reported by

Dr Siow Chun Lim

Alex Looi Tink Huey

On 27 April, the IEM Electrical Engineering Technical Division (EETD), in collaboration with Environmental Engineering Technical Division, organised a technical visit to Bukit Tagar Sanitary Landfill (BTSL). The group of 12 departed from IEM at 7.30 a.m. and arrived at 9.00 a.m. There, they were were welcomed by En. Fatimi, who gave an overview briefing on the sanitary landfill.

BTSL is developed by KUB-Berjaya Enviro and KUB-Berjaya Energy Sdn. Bhd. as a proper waste disposal site for wastes from Kuala Lumpur. It occupies 700 acres with another surrounding 1,000 acres acting as a buffer zone. According to En. Fatimi, BTSL has the capacity to process 3,500 tonnes of waste daily.

Ideally, the waste should reach the landfill within 17 hours due to high humidity which will cause rapid decomposition of the waste. Although there are about 150 landfills in the country, BTSL is one of only nine Level 4 sanitary landfills. A Level 4 sanitary landfill controls the impact of leachate on the ground water system by treating the leachate.

Conventional sanitary landfills separate and segregate the waste before this is dumped on the site for decomposition. However, at BTSL, the waste is directly disposed into the landfill and recovery of solid waste material takes place only after the organic waste has decomposed and is leached off as leachate.

First, the waste truck passes through the weighing scale. Then the waste is directly dumped onto the landfill cell and tipping operation commences. Next, the landfill cell is covered with HDPE sheets to prevent seepage of rainwater and finally, the biogas that is produced, will be used for power generation. Currently, a total of 6.4 MW power is generated using 4 gas engines and this is exported to the TNB grid through the Feed in Tariff programme.

BTSL targets to generate up to 10.4 MW when the construction of 2 additional gas engine units is completed in mid-2019. Excess methane gas will be flared to minimise environmental impact. As it is a Level 4 sanitary landfill, the physical, biological and chemical treatment processes are actively monitored by using the SCADA system. With treatment capacity of 2,200m^3, BTSL is the largest in the ASEAN region. The treated leachate will be sent to the reed beds consisting of phragmites plants to further improve the leachate quality by reducing the COD and BOD. This treated effluent will be discharged back to the adjacent 120 acres of forest and plantation in an alternate manner. The sludge, which is a by-product, is currently being researched for other possible applications. ■

The gas engine units

Participants at the landfill cell

Interconnection to the Grid

The SCADA system to monitor the leachate treatment processes

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Sustainable Energy Policy in Malaysia – What's Next?

ELECTRICAL ENGINEERING TECHNICAL DIVISION

reported by

Wong Wai Yin

A pre-AGM talk on "Sustainable Energy Policy in Malaysia – What's Next?" was held at Wisma IEM, on 5 May, 2018. The event, organised by the Electrical Engineering Technical Division (EETD), IEM, attracted 138 participants who later stayed on for the AGM after the talk.

The two-hour talk was delivered by Ir. Akmal Rahimi Abu Samah, Chief Operating Officer of Sustainable Energy Development Authority (SEDA) Malaysia. He began by introducing the two main drivers for sustainable energy development, namely renewable energy (RE) and energy efficiency (EE) as well as the current scenario on RE development in Malaysia, which wais in-line with the 8th to 11th Malaysia Plan.

Currently, the three main RE programmes are Feed-in Tariff (FiT), Large Scale Solar (LSS) and Net Energy Metering (NEM). Ir. Akmal elaborated on the status of each programme, in particular the success of solar PV as a promising renewable energy source, in the FiT projects.

As of January 2018, approximately 90% of the MW projects on solar PV have been completed. He said the slower completion of other renewable energy projects on biogas, biomass, small hydro and geothermal, was partly due to obtaining approvals from various parties involved which, however, were in steady progression.

LSS projects have been awarded for two cycles in 2016 and 2017, targetting to supply a total capacity of 1,200 MW in 2020. Ir. Akmal also highlighted the current challenge in the NEM programme in which utility consumers who had installed PV systems on the roof for self-consumption, can obtain a displaced cost when they export the excess energy to the grid. The displaced cost remains a hot debate subject at present.

The attentive audience

EETD Chairperson 2017/2018 Ir. Chong Chew Fan (right) presenting a Certificate of Appreciation to Ir. Akmal

On RE development, Ir. Akmal said many innovative mechanisms, such as carbon taxes, renewable portfolio standards, green certificates etc., need to be in place to grow the RE capacity. He also said the development of the Renewable Energy Transition Roadmap (RETR) 2050 is currently in progress to determine the future electricity system.

On the demand side, he said the key barrier for the slow reduction in EE is attributed to the absence of a dedicated policy and legal framework. One of the current initiatives is to develop the Energy Efficiency and Conservation Act and Regulations.

The talk was ended with an active question and answer session. The pre-AGM forum concluded with the 33rd EETD Annual General Meeting. ■

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22 September 2018

Organised by: Standing Committee in Examination & Qualifications
Time : 9.00 a.m. - 1.00 p.m.
CPD/PDP : 3

Title: 1-Day Seminar on "Digital Revolution : Embracing Technology and Keeping the Power ON"

27 September 2018

Organised by: Building Services Technical Division
Time : 8.30 a.m. - 5.30 p.m.
CPD/PDP : 7

Kindly note that the scheduled events are subject to change. Please visit the IEM website at www.myiem.org.my for more information on the upcoming events.

THE MONTHLY BULLETIN OF THE INSTITUTION OF ENGINEERS, MALAYSIA

JURUTERA

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The Institution of Engineers, Malaysia

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Climbing Diamond Head to View Waikiki Beach

Ir. Chin Mee Poon | *www.facebook.com/chinmeepoon*

Ir. Chin Mee Poon *is a retired civil engineer who derives a great deal of joy and satisfaction from travelling to different parts of the globe, capturing fascinating insights of the places and people he encounters and sharing his experiences with others through his photographs and writing.*

Mention Hawaii and Waikiki Beach comes to mind. Yes, Waikiki Beach is indeed the most widely known tourist attraction in Hawaii. Most visitors to Hawaii spend a lot of their time on that 530m stretch of golden sand or in the park, zoo and neighbourhood adjacent to it. Waikiki Beach is, however, only one of 6 beaches in Honolulu, the capital and largest city of Hawaii. With a population of about 360,000 people, Honolulu is situated on the southern part of O'ahu, one of the 8 major islands which, together with several atolls and numerous islets and seamounts, make up the archipelago of Hawaii. Hawaii was annexed by USA in 1898 but only became its 50th state on 21 August, 1959.

I first visited Hawaii in the early 1980s, and the only things I remembered from that trip were Waikiki Beach and Pearl Harbour. In July 2016, my wife and I spent 18 days in Hawaii to explore 4 of its major islands: O'ahu, Maui, Kaua'i and the Big Island (which is officially also known as Hawaii, but most people call it Big Island to avoid confusion with the Hawaii state).

Being in the tropics, Waikiki Beach naturally attracts 3S (sun, sea and sand) lovers, especially when the weather is good. My wife and I spent most of our time on the beach near the western end where the crowds were not so intimidating. Looking east from there, the crescent-shaped beach appeared to end at a promontory. We found out later that what appeared to be a promontory was actually the tuff crater of a dead volcano known as Diamond Head. The volcano is known as L 'ahi to the Hawaiians, but British sailors in the 19th century called it Diamond Head because they mistook the calcite crystals on the adjacent beach for diamonds.

We decided to check out Diamond Head in the following morning. From where the bus dropped us, we walked up a road and through a short tunnel. What appeared at the end of the tunnel was an open space surrounded by a continuous ring of hill – we had entered the crater!

The crater was huge and there was no lake in it. Instead there was a Visitor Centre near the northern edge of the open space, with a café, toilets and picnic tables nearby. After paying a park fee of US$1 each, we joined a few others to walk to the observation deck about 1km away on the crater rim. The trail was practically level initially. Then it began to twist and turn up the steep inner slope of the crater rim. Steel handrails were provided here and there for safety. As many people were on their way down as there were going up.

Then we came to another tunnel. This was much longer than the first and it sloped gently uphill. At the end of this was a spiral staircase that led us up to a former US Army lookout post. Getting out of the artificial cave chamber through a narrow opening, we found ourselves on a viewing platform with a panoramic view of the sweeping coastline, the adjacent land and sea. Another platform on a higher level gave an unobstructed all-round view. It was a beautiful, sunny morning and not only could Waikiki Beach be clearly seen but I could also see two beaches further west. The views were simply superb and it was so satisfying and fulfilling to sit atop a dead volcano to enjoy the great weather, even though there were so many other people around and it could be a bit noisy at times. After all, how often does one get to be on top of a volcano? ■

Tarikh: 6 Ogos 2018

Kepada Semua Ahli,

SENARAI CALON-CALON YANG LAYAK MENDUDUKI TEMUDUGA PROFESIONAL TAHUN 2018

Berikut adalah senarai calon yang layak untuk menduduki Temuduga Profesional bagi tahun 2018.

Mengikut Undang-Undang Kecil IEM, Seksyen 3.8, nama-nama seperti tersenarai berikut diterbitkan sebagai calon-calon yang layak untuk menjadi Ahli Institusi, dengan syarat bahawa mereka lulus Temuduga Profesional tahun 2018.

Sekiranya terdapat Ahli Korporat yang mempunyai bantahan terhadap mana-mana calon yang didapati tidak sesuai untuk menduduki Temuduga Profesional, surat bantahan boleh dikemukakan kepada Setiausaha Kehormat, IEM. Surat bantahan hendaklah dikemukakan sebulan dari tarikh penerbitan dikeluarkan.

Ir. Mohd Khir bin Muhammad FIEM, PEng
Setiausaha Kehormat, IEM
(Sesi 2018/2019)

PERMOHONAN BARU

Nama	Kelayakan
KEJURUTERAAN AWAM	
LOKMAN NUR HAKIM BIN HJ ZAHARI	BE HONS (UiTM) (CIVIL, 2012) MSc (UiTM) (GEOTECHNICS, 2014)
MOHD FAIZ BIN ABDUL AZIZ	BE (UMP) (CIVIL, 2009)
MOHD ZAIN BIN ABD RAZAK	ADV. DIPLOMA (UiTM) (CIVIL, 1990)
NORZANI BINTI MAHMOOD	BSc (WISCONSIN-MADISON) (CIVIL & ENVIRONMENTAL, 1991)
NUR NAJWANI BINTI KAMARULZAMAN	BE HONS (UTM) (CIVIL, 2007)
SHERLYE DONOL	BE HONS (MALAYA) (CIVIL, 2006)
TAN CHEK SIONG	BE HONS (LONDON) (CIVIL, 2001)
KEJURUTERAAN ELEKTRIKAL	
ABDUL MALEK BIN ALI	BE HONS (UTM) (ELECTRICAL, 2015)
JEYGANES A/L SUPPAN	BE HONS (UNITEN) (ELECTRICAL POWER, 2013)
MOHD RUZLIN BIN MOHD MOKHTAR	BE HONS (UNITEN) (ELECTRICAL & ELECTRONICS, 2009)
WONG HOCK TZE @ FARRAH WONG	BE HONS (UMS) (ELECTRICAL & ELECTRONIC, 1999) MSc (UMS) (ELECTRONIC, 2001) PhD (UMS) (ELECTRICAL & ELECTRONIC, 2004)
KEJURUTERAAN ELEKTRONIK	
AZIYATI BINTI YUSOFF	BE HONS (IIUM) (COMPUTER & INFORMATION, 2002) MSc (SURREY) (INFORMATION & PROCESS SYSTEMS ENGINEERING, 2012)
IZA SAZANITA BINTI ISA	BE HONS (UiTM) (ELECTRICAL, 2005)
KEJURUTERAAN INSTRUMENTASI & KAWALAN	
RAZALI BIN JIDIN*	BSc HONS (BRIDGEPORT) (ELECTRICAL, 1986) MSc HONS (BRIDGEPORT) (ELECTRICAL, 1986) PhD (KANSAS) (2005)
KEJURUTERAAN MEKANIKAL	
CHONG CHEW FUAI	BE HONS (MALAYA) (MECHANICAL, 2006)
KEJURUTERAAN SUMBER AIR	
SANDRA ANAK LIGONG	BE HONS (UKM) (CIVIL & STRUCTURAL, 2005)

PERPINDAHAN AHLI

No. Ahli	Nama	Kelayakan
KEJURUTERAAN AWAM		
87151	BALYA MULKAN WIJAYA BIN MOHAMMAD YUSUF	BE HONS (UTM) (CIVIL, 2013)
25155	MOHD HAFIEZ BIN HUSAIN	BE HONS (UiTM) (CIVIL, 2005)
80699	MOHD HAIZUL BIN OMAR	BE HONS (UTM) (CIVIL, 2013)
45283	RAGESH KUMAR LINGAM	BE HONS (UTM) (CIVIL, 2004)
KEJURUTERAAN BAHAN		
52487	ANASYIDA BINTI ABU SEMAN @ AHMAD*	BE HONS (USM) (MATERIAL, 1998)
51720	HASMALIZA MOHAMAD*	BE HONS (USM) (MATERIAL, 1997) MSc (USM) (MATERIAL, 1998) PhD (USM) (2005)
KEJURUTERAAN ELEKTRIKAL		
69508	AKMAL ARIF BIN MOHAMMED	BSc (UNIVERSITY OF TEXAS AT AUSTIN) (ELECTRICAL, 2008)
97306	FARAH BINTI ISKHAK	BE HONS (RENSSELAER POLYTECHINC INSTITUTE) (ELECTRICAL, 2001)
KEJURUTERAAN ELEKTRONIK		
72615	AZIZUL BIN AWANG ANAK	BE HONS (UTM) (COMPUTER, 2006)
62062	DANNY NG WEE KIAT	BE HONS (MULTIMEDIA) (ELECTRONICS-BIOINSTRUMENTATION, 2008) MESc (UTAR) (ELECTRONICS-BIOINSTRUMENTATION, 2012)
90132	JULIANA BINTI JOHARI	BE HONS (STRATHCLYDE) (ELECTRICAL & ELECTRONIC, 1992) MSc (SURREY) (BIOMEDICAL, 2001) PhD (UKM) (MICROENGINEERING & NANOELECTRONICS, 2014)
49862	MUHAMAD FIRDAUS BIN IBRAHIM	BE HONS (UTM) (ELECTRICAL, 2002)
49970	WAN KHAIRUNIZAM B. WAN AHMAD	BE (YAMAGUCHI) (ELECTRICAL & ELECTRONIC, 1999) PhD (KAGAWA) (2009)
KEJURUTERAAN MEKANIKAL		
44866	ALBERT HON KAH KIEN	BE HONS (UTM) (MECHANICAL, 2013)
69692	ISHAK BIN HAJI ABDUL AZID	BSc HONS (CLARKSON) (MECHANICAL, 1993) MSc (WALES) (COMPUTATIONAL MODELLING & FINITE ELEMENTS IN ENGINEERING MECHANICS, 1995) PhD (WALES) (1999)
72599	MOHAMAD ALI BIN AHMAD	BE HONS (UM) (MECHANICAL, 2000) ME (UiTM) (MANAGEMENT, 2009) PhD (UiTM) (2015)
59086	MUHAMAD AZRIN BIN MOHD ZAMRI	BE HONS (UNITEN) (MECHANICAL, 2012)
38803	SALIZA AZLINA BINTI OSMAN	BE HONS MECHANICAL-MATERIALS, 2005) ME (UTM) (MECHANICAL-MATERIALS, 2008) PhD (UTM) (MECHANICAL, 2012)
36911	TAN BEE KIAN	BSc HONS (SOUTH ALABAMA) (MECHANICAL, 2001) MSc (KANSAS STATE) (MECHANICAL, 2003)
57100	TAN KIAN GUAN	ME HONS (BATH) MECHANICAL, 2010)
85122	ZAINON SHARMILA BINTI SHAMSUDDIN	BE HONS (UTM) (MECHANICAL, 1998) ME (UiTM) (ENGINEERING MANAGEMENT, 2011)

PERMOHONAN BARU / PERPINDAHAN MENJADI AHLI KORPORAT

No. Ahli	Nama	Kelayakan
KEJURUTERAAN ELEKTRIKAL		
87161	MOHD SHAIRIL BIN AFFANDI	BE HONS (UMS) (ELECTRICAL & ELECTRONICS, 2011)
57567	NOORSHARIN BIN MOHAMED NAWAWI	BE HONS (UMS) (ELECTRICAL & ELECTRONIC, 2000)

ERRATA

Adalah dimaklumkan bahawa terdapat satu kesilapan atas kelayakan calon berikut dalam senarai yang diluluskan untuk menduduki Temuduga Profesional dalam buletin bulan Julai.

PERPINDAHAN AHLI

No. Ahli	Nama	Kelayakan
KEJURUTERAAN AWAM		
93887	NORFISHAH BINTI AB WAHAB	BE HONS (UiTM) (ELECTRICAL, 1992) MSc (UiTM) (TELECOMMUNICATION & INFORMATION, 2008) PhD (UiTM) (ELECTRICAL, 2015)

CONTINUATION LIST FROM AUGUST JURUTERA 2018 ISSUE

PEMINDAHAN KEPADA AHLI 'COMPANION'

No. Ahli	Nama	Kelayakan
KEJURUTERAAN MEKANIKAL		
66819	CHONG MUI SEN	B.SC.(THE UNI. OF MANITOBA) (MECHANICAL, 2007)

PERMOHONAN MENJADI AHLI 'COMPANION'

No. Ahli	Nama	Kelayakan
KEJURUTERAAN AWAM		
99360	MOHD ZAINI BAHARUM	B.E.(POLYTECHNIC OF THE SOUTH BANK)(CIVIL, 1988)
99361	TING KONG SIIN	B.E.HONS.(MALAYA)(CIVIL, 1974)
99362	HANIF BIN HASSIN	B.E.HONS.(UITM)(CIVIL, 2002)
97476	MOHAMAD HELMIY BIN LLAH	B.E.HONS.(UITM)(CIVIL, 2010)
97478	MOHD AZRI BIN HASSAN @ YUSOFF	B.E.HONS.(UTM)(CIVIL, 2003)
99441	LAU THIAN KIAN	B.E.HONS.(UTM)(CIVIL, 2003) M.SC.(NTU)(CIVIL, 2012)
99359	ASMA FARAH BT ISMAIL	B.E.HONS.(UTP)(CIVIL, 2009)
99440	ARNIE INA BT ABDUL RAHIM	B.SC.(UNI. OF NEW BRUNSWICK)(CIVIL, 1993)
KEJURUTERAAN ELEKTRIKAL		
97477	JEMMY @ MOHD JEMMY BIN MOHD ROHANI	B.E.HONS.(UTM)(ELECTRICAL-INSTRUMENTATION & CONTROL, 2009)
99271	EFFENDY BIN MANGSOR	B.SC.(UNI. OF SOUTHERN CALIFORNIA)(ELECTRICAL, 2006)
KEJURUTERAAN ELEKTRIKAL & ELEKTRONIK		
99174	SIVAPALAN A/L V. SEENISAGAM	B.SC.(PORTSMOUTH POLYTECHNIC)(ELECTRICAL & ELECTRONIC, 1977) M.SC.(THE UNI OF WARWICK) (MANUFACTURING SYSTEMS, 1991)
KEJURUTERAAN ELEKTRONIK		
99442	CHOE LIP HAW	B.E.HONS.(MMU) (ELECTRONICS-ROBOTIC & AUTOMATION, 2007) M.SC.(UPM)(ENGINEERING, 2014)
99175	YAP CHEE HAUR	B.E.HONS.(UKM) (ELECTRICAL, ELECTRONIC & SYSTEM, 2002)
99270	DR. MUKHZEER MOHAMAD SHAHIMIN	B.E.HONS.(UNI. OF SOUTHAMPTON) (ELECTRONIC, 2004) PHD.(UNI. OF SOUTHAMPTON) (ELECTRONICS & ELECTRICAL, 2009)
KEJURUTERAAN MEKANIKAL		
99126	MOHD HAFISHAM BIN HASIM	B.E.HONS.(KUITTHO) (MECHANICAL-MANUFACTURING & PRODUCTION, 2006)
99269	ABDUL LATIF BIN YUNUS	B.E.HONS.(UTM) (MECHANICAL-MARINE TECHNOLOGY, 2008)
99439	AHMAD AZLAN BIN AHMAD ADLAN	B.SC.(WESTERN MICHIGAN UNI.)(MECHANICAL, 2004)
KEJURUTERAAN MEKATRONIK		
99127	MUHAMMAD ZAIYAD BIN MUDA @ ISMAIL	B.E.HONS.(IIUM) (MECHATRONICS, 2008)

PEMINDAHAN KEPADA AHLI SISWAZAH

No. Ahli	Nama	Kelayakan
KEJURUTERAAN AEROANGKASA		
45402	CHIN CHEE LEONG	B.E.HONS.(USM)(AEROSPACE, 2014)
KEJURUTERAAN BIOPERUBATAN		
86987	LIM HAN XIANG	B.E.HONS.(UTAR SG LONG) (BIOMEDICAL, 2018)

Note: *Continuation of the Transfer Graduate, Graduate, Incorporated, Affiliate and Associate would be published in October 2018. For the list of approved "ADMISSION TO THE GRADE OF STUDENT", please refer to IEM web portal at http://www.myiem.org.my.*

Pengumuman yang ke-119

SENARAI PENDERMA KEPADA WISMA DANA BANGUNAN IEM

Institusi mengucapkan terima kasih kepada semua yang telah memberikan sumbangan kepada tabung Bangunan Wisma IEM. Ahli-ahli IEM dan pembaca yang ingin memberikan sumbangan boleh berbuat demikian dengan memuat turun borang di laman web IEM http://www.iem.org.my atau menghubungi secretariat di +603-7968 4001/5518 untuk maklumat lanjut. Senarai penyumbang untuk bulan Jun 2018 adalah seperti jadual di bawah:

NO.	NO. AHLI	NAMA
1	20562	ABD. RAHMAN BAKAR @ OMAR
2	80587	AHMAD ZAKI BIN MOHAMAD AFIFI
3	39230	AZWANIZAM BIN CHE ABD RAHMAN
4	71562	BAN YEOW TIEK
5	12279	CHEW AI BENG
6	49450	JAMIL BIN HASHIM
7	7160	KOH JIT HUAT
8	23101	KUEK HANN YIH, KELVIN
9	59190	MUHAMAD HER HJ JANTAN
10	7463	SIM TIAN LIANG
11	15903	WAN HOESNI BIN WAN ZAKARIA

IEM COUNCIL ELECTIONS 2019/2020

NOTICE ON NOMINATION PAPERS FOR COUNCIL ELECTION SESSION 2019/2020

A notice inviting nominations for the Election of Council Members for Session 2019/2020 would be posted on the IEM Notice Board and IEM website from **16 November 2018** for the information of all Corporate Members of IEM. Thereafter, following the close of nominations on **20 December 2018**, the election exercise will proceed. All Corporate Members residing overseas are requested to take note of the requirements of the Bylaw, Section 5.12, as shown below.

> *The voting paper shall, not less than twenty eight (28) clear days before the date of the Annual General Meeting, be sent by post to all Corporate Members residing in Malaysia and to any other Corporate Members who may, in writing, request to have the paper forwarded to him. The voting paper shall be returned to the Honorary Secretary in a sealed envelope so as to reach him by a specified date not less than seven (7) days before the Annual General Meeting.*

Voting papers will be posted out by **25 February 2019**.

Any Corporate Members residing outside Malaysia, who wish to receive voting papers, are advised to write to the Honorary Secretary on or before 10 January 2019.

Thank you.

Election Officer, IEM

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