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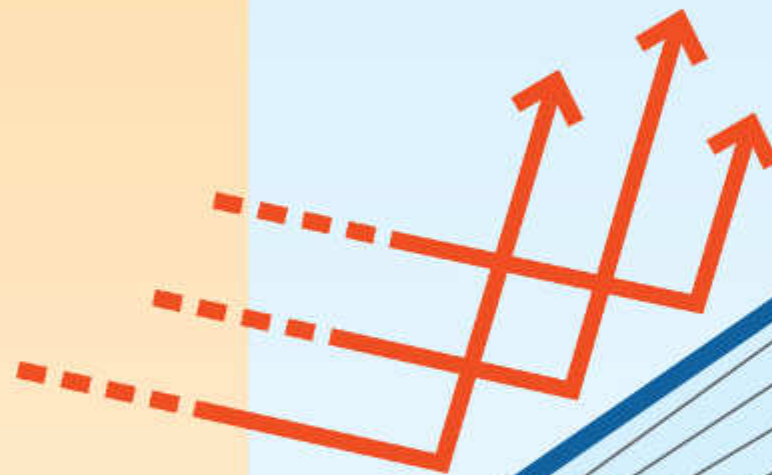
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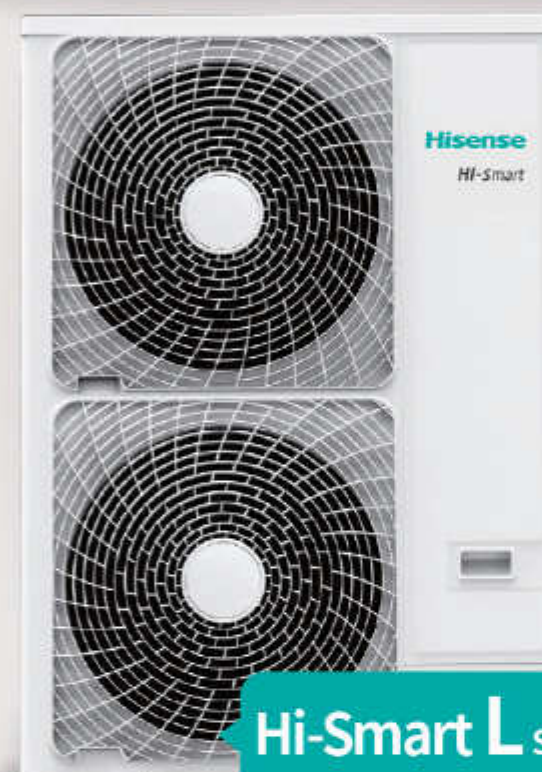
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by Ir. Lau Tai Onn

Ir. Lau Tai Onn is the Secretary of the Standing Committee on Information and Publication, a post he continuously held since Session 2007/2008.

Combating the 'Inconvenient Truth'

Global warming was the subject of the famous 2006 documentary film titled "An Inconvenient Truth", about former U.S. Vice President Al Gore's campaign in raising international public awareness of this environmental issue.

The global warming is real, potentially catastrophic and human-caused as suggested in the film. It is undeniable and appropriate action must be taken to address this increasing "planetary emergency" before it is too late.

Al Gore, who became more prominent as an environmentalist than a politician, concluded: "Each one of us is a cause of global warming, but each one of us can make choices to change that with the things we buy, the electricity we use, the cars we drive... The solutions are in our hands; we just have to have the determination to make it happen."

Engineers, endowed with the mission of fostering technological innovation and excellence for the benefit of humanity are, needless to say, duty-bound to play a more active role in combating this "inconvenient truth" of global warming. With this in mind, this issue of *JURUTERA* is devoted to this topic with articles contributed mainly by members of this Standing Committee.

It is hoped that we will be able to inspire and influence the engineering community to mitigate, if not eradicate, the effects of global warming.

Let us reflect on Native American Chief Seattle's quote made two centuries ago: "Humankind has not woven the web of life. We are but one thread within it. Whatever we do to the web, we do to ourselves. All things are bound together. All things connect."

If we do not protect Earth from global warming caused by our actions, it is only a matter of time before we perish along with it. ■



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Consequences of Climate Change

“Human influence on the climate system is clear. The more we disrupt our climate, the more we risk severe, pervasive and irreversible impacts.”



Prof. Dr Joy Jacqueline Pereira, FASc.

Prof. Dr Joy Jacqueline Pereira, a Fellow of Academy of Sciences Malaysia (FASc) is currently a Principal Research Fellow at the Southeast Asia Disaster Prevention Research Initiative (SEADPRI-UKM), Universiti Kebangsaan Malaysia. Prof. Joy Pereira who is a Member of the IPCC Bureau was elected as Vice-Chair of Working Group 2 at the 42nd IPCC Session in Dubrovnik in October 2015. On the nomination by the Ministry of Natural Resources and Environment (NRE), Malaysia, she was also elected to the IPCC Executive Committee to represent the South-West Pacific (Region V), which comprises 22 countries.

This key message was delivered by the Intergovernmental Panel on Climate Change (IPCC) after conducting the most recent comprehensive assessment on the state of climate in the world. Yet, there are those who question findings based on scientific evidence. They are probably misguided by non-peer reviewed articles with a political agenda designed to influence ongoing international negotiations on issues related to compensation, transfer of technology and resources.



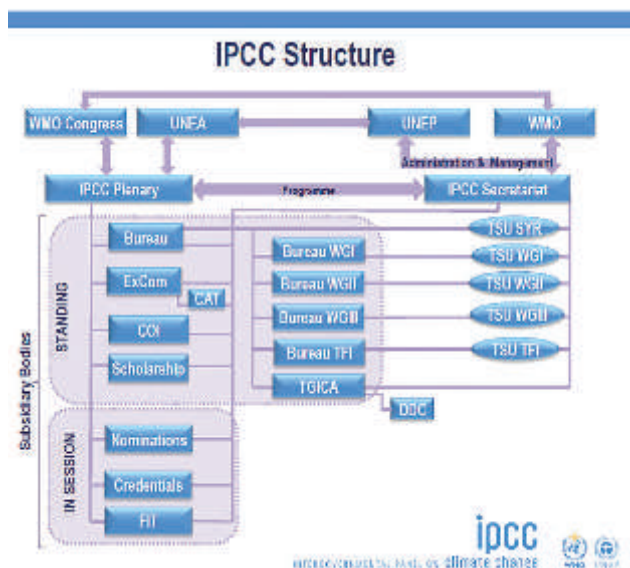
The most recent assessment on global climate change is documented in reports of the IPCC Working Groups 1, 2 and 3 as well as the Synthesis Report, which was released in late 2013 and 2014. The entire reports are available at <http://www.ipcc.ch/>.

This article will provide some background on the IPCC and highlight key issues related to Malaysia. The information is derived from the most recent IPCC reports. We start with a brief description of the IPCC and the role of Malaysia. This is followed by a short discussion on key terms related to the climate change discourse, highlighting the need to clarify terminology for operational purposes. The final section focuses on the climate prognosis for tropical Asia. The implications for Malaysia can be inferred implicitly and some recommendations are made on the way forward.

IPCC, THE GLOBAL CLIMATE INSTITUTION

IPCC was jointly established by the United Nations Environment Programme (UNEP) and the World Meteorological Organisation (WMO). It was endorsed by the UN General Assembly in 1988. Its 195 member states navigate the science-policy interface via the IPCC Plenary, with support from an elected IPCC Bureau and IPCC Executive Committee as well as three Working Groups and a Task Force, as well as assistance of the IPCC Secretariat and Technical Secretariat Units. The IPCC Working Group 1 covers The Physical Science Basis. Working Group II covers Climate Change Impacts, Adaptation and Vulnerabilities. Working Group III covers Mitigation of Climate Change. The Task Force focuses on National Greenhouse Gas Inventories. The IPCC Plenary comprises National Focal Points from member states which elect scientists and experts to its various bodies on a cyclic basis.

The role of IPCC is “to assess on a comprehensive, objective, open and transparent basis, the scientific, technical and socio-economic information relevant to understanding the scientific basis of risk of human-induced climate change, its potential impacts and options for adaptation and mitigation.” Since 1990, IPCC has produced five Assessment Reports (1990, 1995, 2001, 2007, 2013/14) and other documents (Special Reports, Guidelines and Technical Papers) to support these assessments. The First Assessment Report (1990) led to the establishment of the United Nations Framework Convention on Climate Change (UNFCCC). Since then, four assessment reports have provided inputs for the UNFCCC and the latest Fifth Assessment Report (2013/2014) provide the scientific foundation for negotiating the Paris Agreement. The reports are neutral with respect to policy and deal objectively with scientific, technical and socio-economic factors relevant to the application of particular policies.



Malaysia is represented in the IPCC Plenary by the Ministry of Natural Resources and Environment, which serves as the National Focal Point.



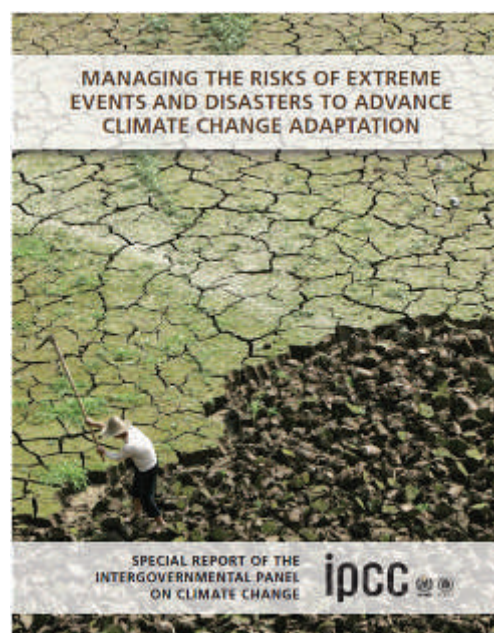
The new IPCC Bureau held its first session since the election in April 2016. Malaysia is represented for the first time in the Executive Committee (ExCOM) and Working Group 2 on Climate Change Impacts, Adaptation and Vulnerabilities.

CLIMATE LINGO – AN EVOLVING DEBATE

An appreciation of the climate change discourse requires an understanding of the terms and definitions of some key concepts used by IPCC and its subtly different interpretation in other key platforms. IPCC issued the Special Report on Managing Risks of Extreme Events and Disasters to Advance Climate Change Adaptation in 2012.

This report was momentous in that it integrated the perspective of three historically distinct groups of scientists: Specialists in disaster risk reduction, who are mostly new to IPCC, authorities in the areas of the physical science basis of climate change, who are generally associated with Working Group 1 of the IPCC, and experts in climate change impacts, adaptation, and vulnerability, who work under the auspices of Working Group 2.

Some key terms used that are of relevance to Malaysia are highlighted below, with differences in other platforms highlighted briefly.



The SREX (2012) bridges gaps in terminology between specialists in disaster risk reduction, physical climate science and climate change adaptation. The entire report can be downloaded at <http://www.ipcc.ch/>

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Climate Variability refers to variations in the mean state and other statistics (such as standard deviations, the occurrence of extremes, etc.) of climate at all spatial and temporal scales beyond that of individual weather events. This covers short-term changes. Climate Extremes refers to the occurrence of a value of weather/climate variable above (or below) a threshold value near the upper (or lower) ends of the range of observed values of the variable.

Climate Change in IPCC refers to change that can be identified (e.g. by using statistical tests) by changes in the mean and/or the variability of climate properties and which persist for an extended period, typically decades or longer, and may be due to natural variability or a result of human activity. This broad definition covers the long-term, including natural and human causes.

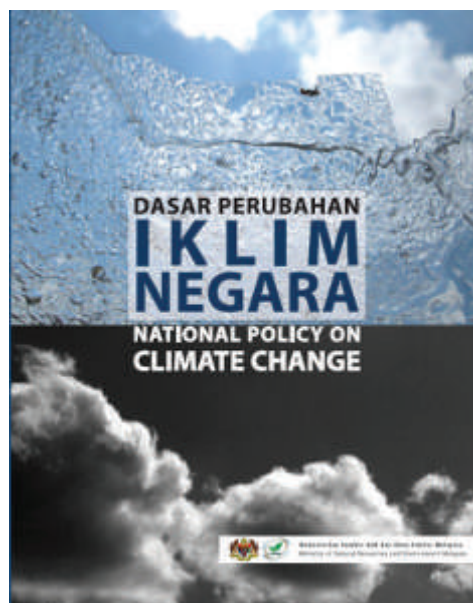
Climate Change in Article 1 of the UNFCCC refers to “a change in climate attributed directly or indirectly to human activity which alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods”. This narrow definition leaves out natural causes and has implications on negotiations on compensation for loss and damage, from developed to developing countries.

Climate change mitigation is restricted to human intervention to reduce the sources or to enhance the sinks of greenhouse gases.

Disaster mitigation refers to the lessening of potential adverse impacts of physical hazards (including those that are human-induced) through actions that reduce hazard, exposure and vulnerability. Thus, climate change mitigation and disaster mitigation are two different concepts that occasionally cause confusion when disaster management specialists interact with climate change adaptation experts.

Climate Change Adaptation refers to both human and natural systems. In human systems, it is the process of adjustment to actual or expected climate and its effects, in order to moderate harm or exploit beneficial opportunities. In natural systems, it refers to the process of adjustment to actual climate and its effects; human intervention may facilitate adjustment to expected climate.

Climate Change in the National Policy on Climate Change (2008) refers to any change in climate over time that directly or indirectly affects humans and their activities as well as natural systems and its processes. This definition is silent on the causal element. The goal of the National Policy is climate resilient development. In Malaysia, this refers to development that takes into account measures to address climate change and extreme weather in line with national priorities. This broadened definition enables the National Policy to serve as an instrument to harmonise and integrate to the extent possible and corresponding to national priorities, measures on climate change adaptation, climate change mitigation and disaster risk reduction.



The National Policy on Climate Change contains 5 Principles, 10 Strategic Thrusts & 43 Key Actions to be undertaken by a variety of stakeholders.

In order to make this goal operational, there is a need to develop a lexicon of concepts that can accommodate the variety of disciplines and perspectives of practitioners working on these areas in Malaysia. Examples of such concepts include susceptibility, exposure, vulnerability and risk, among others.

CLIMATE PROGNOSIS FOR ASIA: A FUTURE INFERENCE FOR MALAYSIA

The Fifth Assessment Report of the IPCC Working Group II on Climate Change Impacts, Adaptation and Vulnerabilities for Asia (Chapter 24) reports with high confidence that warming trends and increasing temperature extremes have been observed across most of Asian in the past century. Increasing numbers of warm days and decreasing numbers of cold days have been observed, with the warming trend continuing into the new millennium. Precipitation trends including extremes are characterised by strong variability, with both increasing and decreasing trends observed in different parts and seasons of Asia. The report states that “there is evidence that climate has changed in Asia and future changes can be expected which will increasingly challenge the resilience and undermine the development that has been achieved in the region”.

The report identifies 10 Key Risks for Asia, based on available literature and expert judgment. They are in no particular order of importance and cannot be compared to other regions. Of these, 8 have a direct impact on society in terms of health, well-being and security while two are related to ecosystems and their services, which will indirectly affect the resilience and sustainable development in the region.

Climate Extremes: Five of the 10 Key Risks are related to extreme climate events linked to precipitation and

high temperatures. The report concludes that “extreme climate events will have an increasing impact on human health, security, livelihoods, and poverty, with the type and magnitude of impact varying across Asia. More frequent and intense heat-waves will increase mortality and morbidity in vulnerable groups. Increases in heavy rain and temperature will increase the risk of diarrhoeal diseases, dengue fever and malaria. Increases in floods and droughts will exacerbate rural poverty in parts of Asia due to negative impacts on the rice crop and resulting increases in food prices and the cost of living.”

Evidence from an earlier IPCC Report (2012) indicates that fatalities from climate-related hazards are higher in developing countries (In 1970-2008, over 95% are in developing world). However, economic losses are highest in middle income countries such as Malaysia, with losses amounting up to 1% of the GDP. In low income countries, losses amount to about 0.3% of the GDP and in high income countries they are 10-fold lower, at 0.1% of the GDP. The National Disaster Management Agency (NADMA) is taking serious consideration of climate-related hazards such as floods and flash-floods and its cascading effect such as landslides and environmental pollution. A National Disaster Risk Reduction Platform has been established, bringing together stakeholders, including government and non-government agencies, universities, research institutes and the private sector, to review the problem in a holistic manner and to implement coordinated actions, from national to local levels. In Malaysia, disaster risk reduction is viewed as the first step to climate change adaption.

The 10 Key Risks For Asia

1. Increased (coastal, riverine and urban) flooding leading to widespread damage to infrastructure and settlements (medium confidence)
2. Increased risk of heat-related mortality (high confidence)
3. Increased risk of drought-related water and food shortage causing malnutrition (high confidence)
4. Increased risk of flood-related deaths, injuries, infectious diseases and mental disorders (medium confidence)
5. Increased risk of water and vector-borne diseases (medium confidence)
6. Increased risk of crop failure and lower crop production could lead to food insecurity (medium confidence)
7. Water shortage in arid areas (medium confidence)
8. Exacerbated poverty, inequalities and new vulnerabilities (high confidence)
9. Coral reef decline (high confidence)
10. Mountain-top extinctions (high confidence)

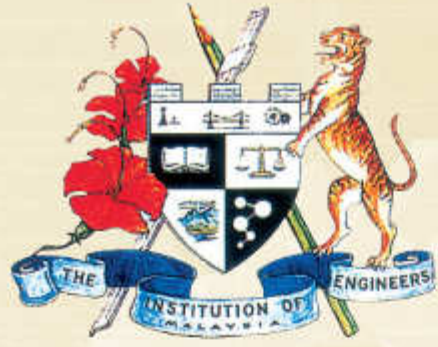
Source: Chapter 24 (Asia), *Climate Change 2014, Impacts, Adaptation and Vulnerability (Volume II)* available at <http://www.ipcc.ch/>

Food and Water Security: Water scarcity is expected to be a major challenge for most of the region. However, for tropical Asia (including Malaysia), this is not attributed to climate change but rather to increased demand and poor management. Current management practices cannot continue and must be improved to support sustainable development. Increase in population and demand arising from higher standards of living, may worsen water security in many parts in Asia. Integrated water management strategies can help adapt to climate change, including developing water saving technologies, increasing water productivity and water reuse.

The impact of climate change on food production and food security in Asia will vary from region to region, with many areas to experience a decline in productivity. This is evident in the case of rice production. Most models show that higher temperatures will lead to lower rice yields as a result of shorter growing periods. A number of regions are already near the heat stress limits for rice. However, CO₂ fertilisation may, in part, offset yield losses in rice and other crops. The rise in sea levels will inundate low lying areas and affect rice growing regions.

Poverty, Inequalities and New Vulnerabilities: There is a high level of confidence that key risks related to climate extremes, food and water security are expected to exacerbate poverty and inequalities as well as create new vulnerabilities. This will most certainly undermine all the achievements in Asia so far. Climate change will compound the various stresses caused by rapid urbanisation, industrialisation and economic development. It is expected to adversely affect the sustainable development capabilities of most Asian developing countries by aggravating pressures on natural resources and the environment. Development of sustainable cities with fewer fossil fuel driven vehicles and with more trees and greenery will have a number of co-benefits, including improved public health. The push for low carbon development is critical in this context. Malaysia has announced an ambitious reduction in carbon intensity but this is subject to availability of international resources particularly technology.

Biodiversity and Ecosystem Services: Rising sea-levels are expected to cause a decline in mangroves, salt marshes and seagrass beds unless these can move inland, while coastal fresh water swamps and marshes will be vulnerable to saltwater intrusion with rising sea-levels. Widespread damage to coral reefs, correlated with episodes of high sea-surface temperature, has been reported in recent decades and there is high confidence that damage to reefs will increase in the 21st century as a result of ocean warming and acidification. Marine biodiversity may decrease if thermal tolerance limits are exceeded. There are major research gaps in the tropics and these include the temperature dependence of carbon fixation by tropical trees and



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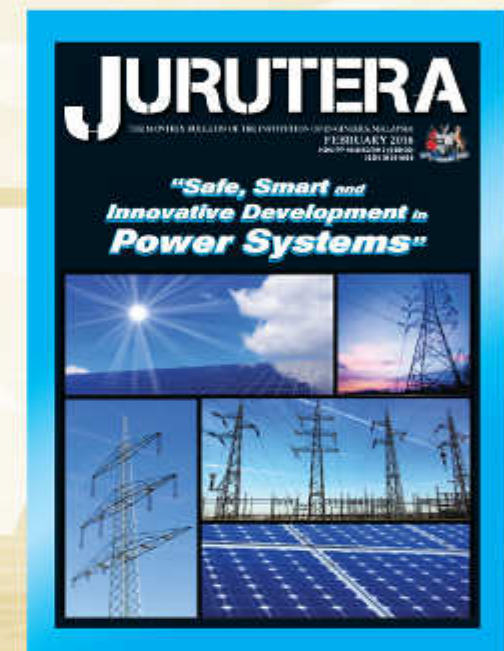
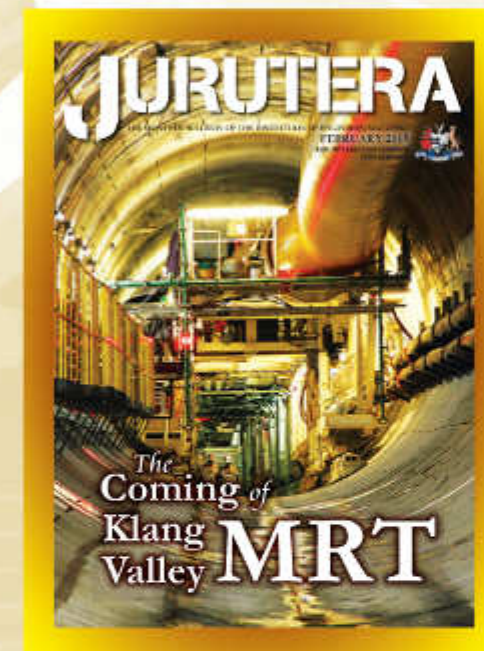
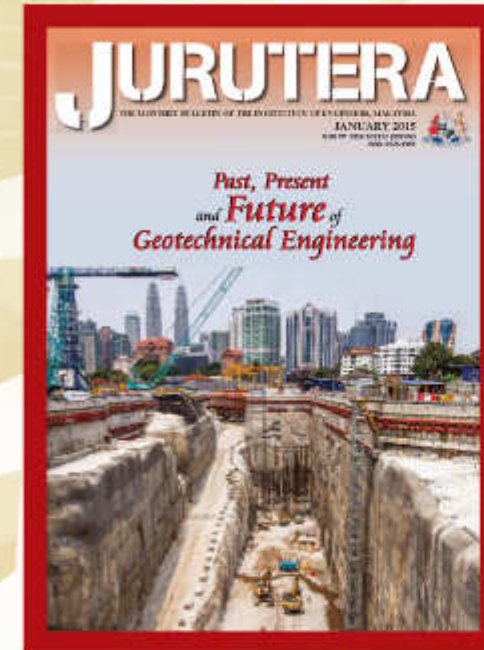
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the thermal tolerances and adjustment capacities of both plants and animals. Interactions between climate change and the direct impacts of carbon dioxide on crops and natural ecosystems are also currently poorly understood. In Malaysia, research has to be prioritised to assess the potential impacts on biodiversity in a warming world.

THE PATHWAY FORWARD

Given the scenario of a warming world and limits to adaptation, the international community, and in particular developed countries have to accelerate efforts under the Paris Agreement to achieve greater emission reduction. Malaysia has embarked on an economic transformation plan that emphasises green technology and low carbon development. It is critical to accelerate low carbon development to ensure inclusive and sustainable development while building resilience to climate change and disaster risk reduction, as we are exposed primarily to climate induced hazards.

The Ministry of Natural Resources and Environment (NRE), in its capacity as the National Focal Point for critical climate change platforms such as the UNFCCC and IPCC, has a critical role to play. There is ongoing collaboration with other Ministries to fulfill national commitments under the Paris Agreement. It also has to engage more with the National Disaster Management Agency and other agencies working on climate change adaptation on an operational level, to manage the risk of impacts due to climate extremes and climate change. One aspect that is critical for enhancement is coordination of multi-disciplinary research involving multi-sectoral research institutes, universities, professional bodies and knowledge societies. No one entity can work

alone to address the challenges of climate change. NRE should consider engagement with multi-sectoral and multi-disciplinary platforms such as the Academy of Sciences and the National Council of Professors to advance the research agenda on building climate and disaster resilience. ■

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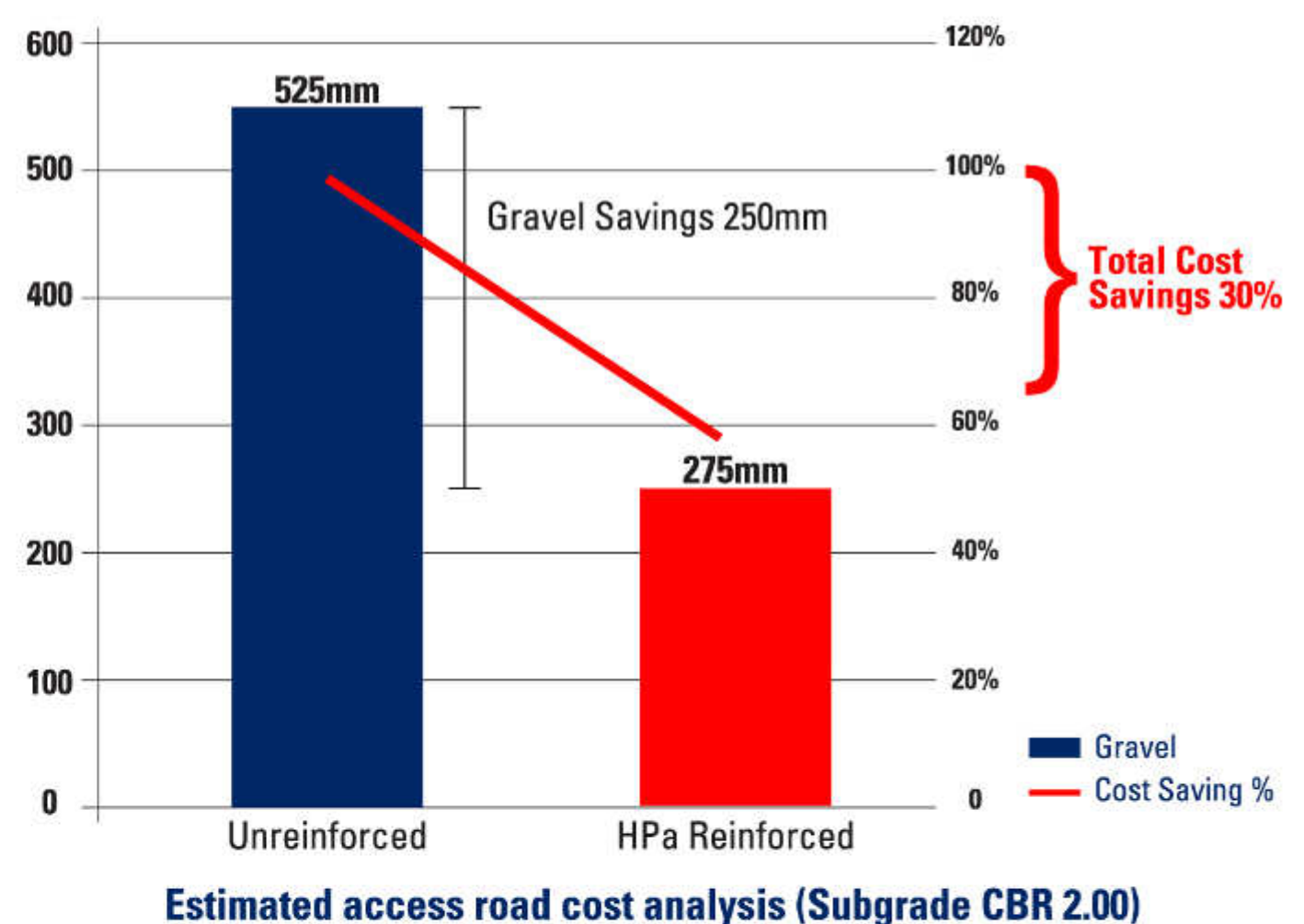
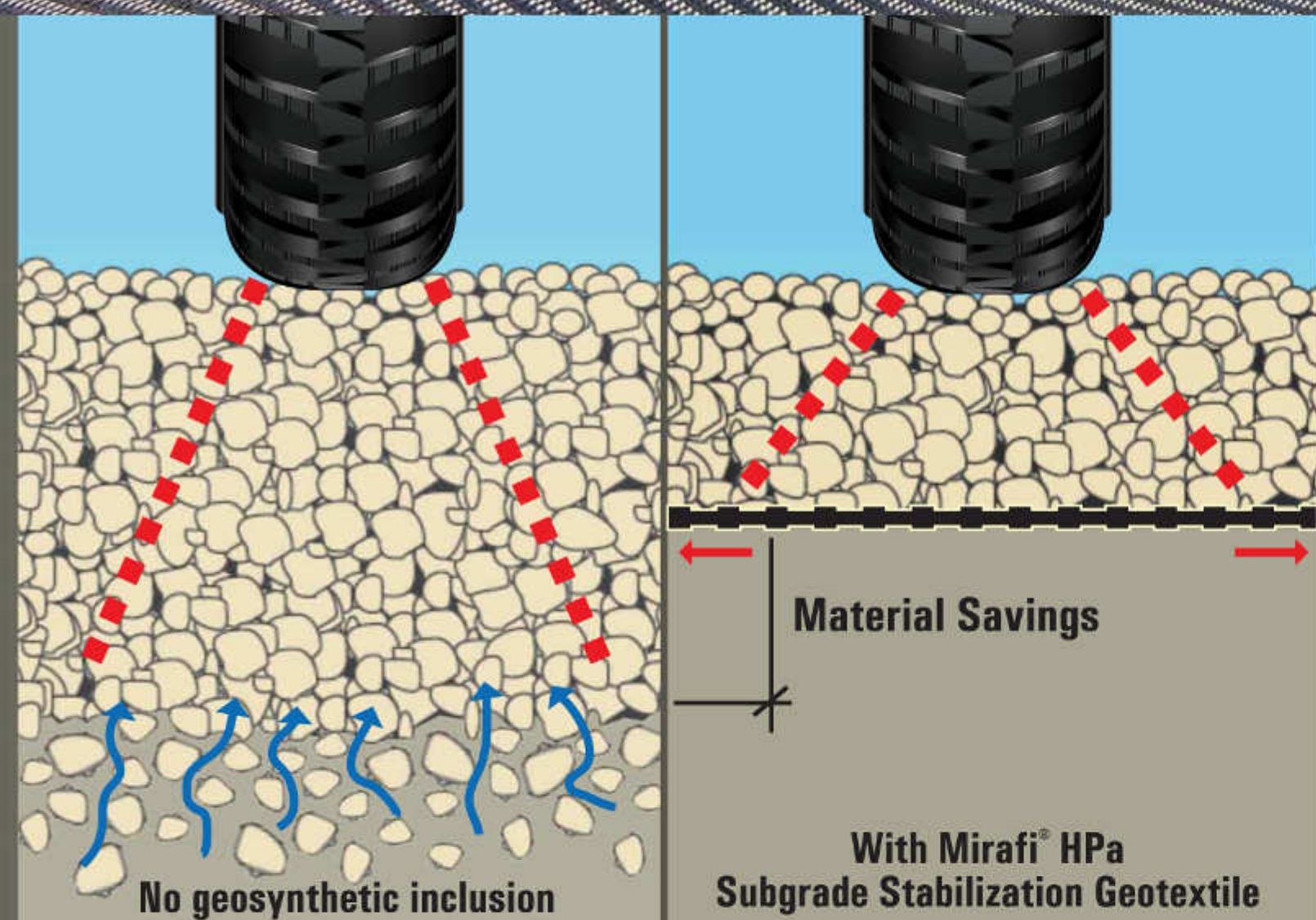


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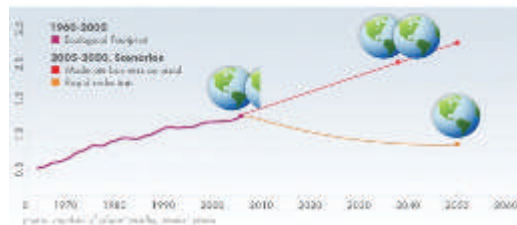


Ir. Prof. Dr Ruslan Hassan

Ir. Prof. Dr Ruslan Hassan is currently the IEM Vice President and a Fellow of Academy of Sciences Malaysia. Presently he is attached to the Malaysia Institute of Transport (MITRANS) and Universiti Teknologi MARA (UiTM). He researches, consults and teaches Sustainability Design in Practice.

Sustainability emerged from the “sustainable development” concept. Sustainable development¹ is defined in the Brundland Commission Report (1) as meeting the needs of the present without compromising the ability of future generations to meet their own needs.

At present, the human population is not approaching sustainability. Wackernagel *et al.*, (2) provides evidence that our demand for natural resources has rapidly increased in the last few decades. In 1961, demand corresponded to 70% of Earth’s capacity for biological productivity; by 1980s, demand began to exceed the biosphere’s capacity, and by 1999, we were using 120% of Earth’s natural resources. In other words, it would require 1.2 earths to regenerate what was used in 1999. Clearly, this does not meet the test of sustainability.



Source: Wackernagel *et al.*, [2]

ENGINEERS AND SUSTAINABILITY

Sustainable development must achieve the due balance of environment, economy and the society. Development is the sum of our products and projects, i.e. application of technology. In these applications, engineers carry out, influence or decide on the options evaluated, the decision making criteria as well as the detailed design and implementation/production.

For the development to become sustainable, engineers must incorporate ‘sustainability’ into the planning and engineering of products and projects. Sustainability is the ability to maintain to perpetuity or the capability of being maintained whereas sustainable design goal is to produce objects using only renewable resources and which, in operation, will deplete only renewable resources.

SUSTAINABILITY DESIGN PRINCIPLES AND APPLICATION

The design perspectives should be able to achieve the following:

1. Long-term design
2. Use more from less
3. Closing loop

1. Long-term design through Nature-Inspired Algorithms

Through years of evolution, Nature has been surviving. Biomimicry is emulating Nature’s best biological ideas to solve human problems. The popularity of the Nature-Inspired Algorithms is primarily influenced by the ability of biological systems to effectively adjust to a frequently changeable environment. Swarm intelligence has been of great interest for many research scientists in the last decade. Bonabeau (4) has defined swarm intelligence as designing algorithms or distributing problem-solving devices based on the collective behaviour of animal societies and social insect colonies. The core of this study is to develop meta-heuristics by adopting the insect problem solving abilities.

Many studies have been conducted on social insects such as termites, bees, wasps and ants. A good example is a beehive. However the logic can also be extended to other insects with similar behaviour. An ant colony and a flock of birds can be categorised as “a swarm”. The Particle Swarm Optimisation (PSO) Algorithm was developed based on the social behaviour of flocks of birds or schools of fish. Some of other algorithms developed are Ant Colony, Wasp Nests and Firefly Algorithms. An artificial Bee Colony Algorithm is a population-based swarm intelligence optimisation technique developed by Karaboga in 2005 (5). This algorithm is based on the behaviour of honey bees when foraging for food. The honey bees use different methods such as a waggle dance to locate optimal food sources and reaching new ones (6).

Termite-Inspired Air Conditioning Simply by Architecture

The Eastgate Centre & Office block in Central Harare, Zimbabwe, is modelled after the local termite (*Macrotermes michaelseni*) mounds. It is ventilated and cooled entirely by natural means. Air is continuously drawn from the open space by fans on the first floor and pushed up vertical supply sections of ducts located in the central spine of each of the two buildings. The fresh air replaces stale air which rises and exits through exhaust ports on the ceiling of each floor. Ultimately this stale air enters the exhaust section of the vertical ducts before it is flushed out via chimneys.



Figure 1: Termite-Inspired Building [3]

2. Efficient Design: Use more from less

Solid versus Hollow Section/Column

Solid circular columns are very popular for bridge pier designs, due to simplicity of construction and because its strength characteristics under wind and seismic loads, are similar in any direction. Circular elements are also used extensively as columns in buildings or as piles for foundations. Hollow core circular concrete members are used less structurally than solid circular cross sections. However, these can be found in concrete chimneys, concrete pipes and elevated water tanks, as well as in large bridge columns and offshore platforms.

Some savings can be obtained when using hollow core circular columns. The economical convenience in the use of hollow columns is due to the cost saving afforded by the reduced section area (up to 70%). Furthermore, hollow columns are more efficient than solid ones from a structural point of view. When the weight of the vertical members is relevant in the performance of the entire structure, a significant reduction in the seismic mass may be attained by using this structural type.

Even though shear transfer mechanisms are qualitatively well known, there is no agreement on the quantification of the shear strength of concrete members. Shear stress distributions on solid and hollow core circular cross-sections are very different. Whereas in the first, shear stresses are mainly vertical, in the second, shear stresses are assumed to act parallel with the boundaries of the section. In the former, shear crack pattern will be contained in a plane. In the latter, the crack pattern will not be contained in a plane but will form a helix of constant pitch in the space, and will form a straightline in the surface of the unfolded cylinder.



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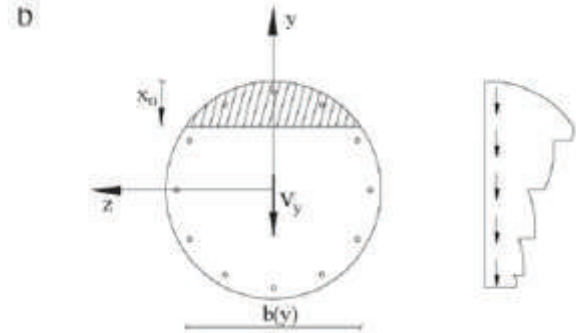
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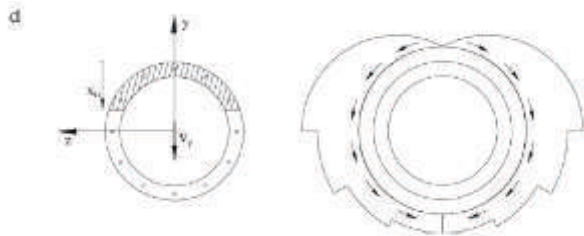
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This statement has been proven theoretically and is experimentally correct (7).



Shear stresses in cracked solid circular cross-section,



Shear stresses in cracked hollow core circular cross-section with approximation-values for maximum shear stresses [7]
Where x_n = depth of compression zone, V = shear force

The fact that shear stresses have a different orientation in both section types, linked to the fact that the shear reinforcement does have the same geometry for both structural types, leads to the evidence that the stirrups or spiral reinforcement are not equally effective in solid and hollow core circular sections. Transverse reinforcement will be more efficient in those section types where shear stresses better align with the shear reinforcement. Circular or spiral stirrups will be more efficient in hollow core circular specimens than in solid ones (7).

3. Closing the loop design through Ecological Engineering

Ecological Engineering Principles.

Ecological Engineering is defined as the design of sustainable ecosystems that integrate human society with its natural environment for the benefit of both (8). The design consists of Energy Augmentation Self-organisation/self-design and adaptation (9).

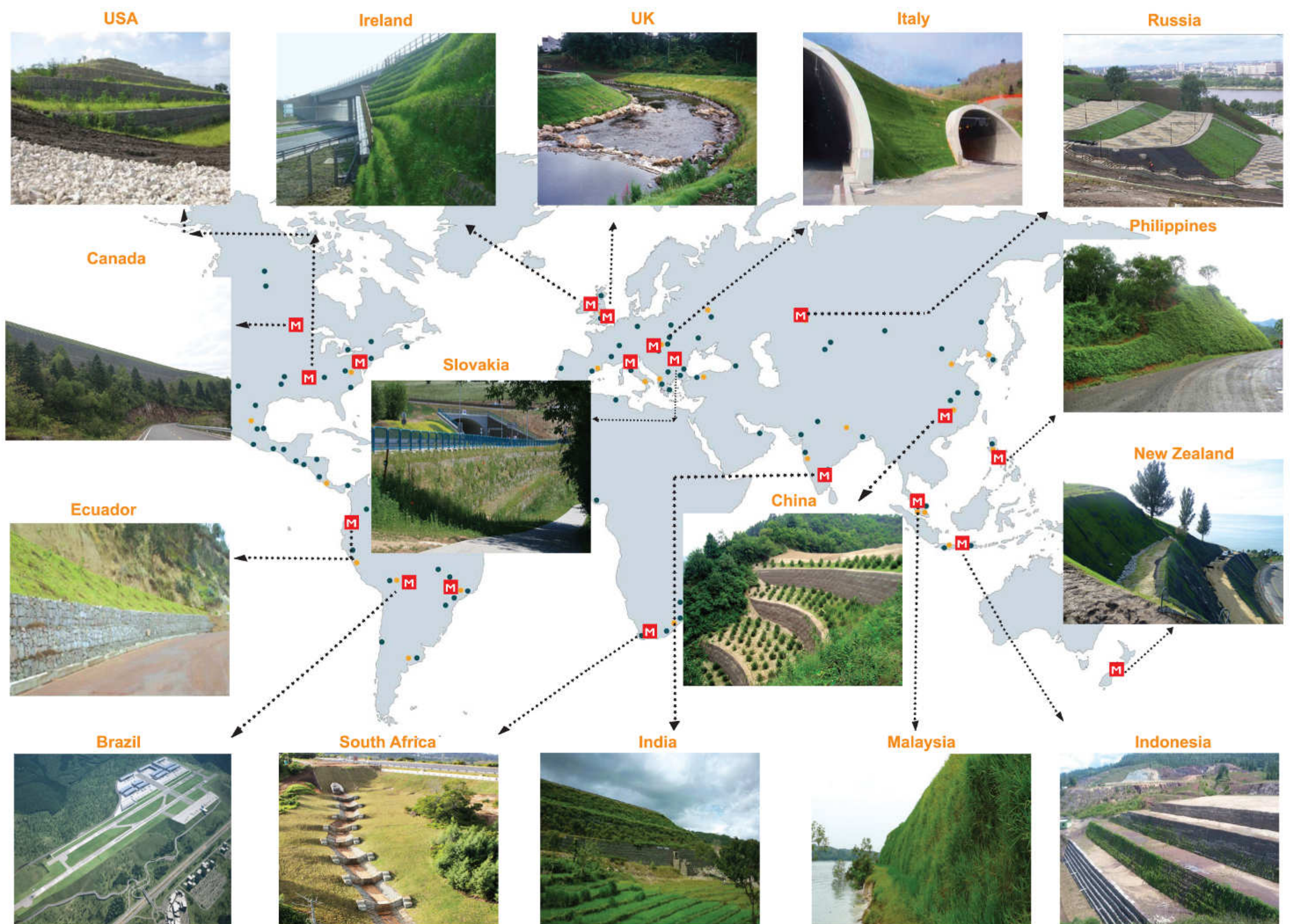
a. Energy Signature: The set of energy sources or forcing functions which determine ecosystem structure and function. Energy Sources that affect an ecosystem are:

- Sunlight as primary energy source of the ecosystem
- Organic inputs, which is detritus concept in stream ecology and estuaries
- Auxiliary energies (apart from sunlight and organic matter) which reduce the cost of internal self-maintenance and increase the amount of other energies which can be converted to production.

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The augmentation of energy through design by existing appropriate energy signatures to support the ecosystem being created. The subsidies are water, fertiliser, aeration or turbulence for encouraging wetland species by adding these to the source of water. Stressors can be added, such as pesticides to limit the development of the ecosystem (i.e. adding herbicides to control invasive, exotic plant species).

b. Self-organisation: The selection process through which ecosystems emerge in response to environmental conditions by filtering of genetic inputs (seed dispersal, recruitment, animal migrations etc.). Self-organisation is the process in which species composition, relative abundance distributions and network connections develop over time. The mechanism of self-organisation is a form of natural selection of these species which reach a site through dispersal. The species in the ecosystem has found a set of favourable environmental conditions to support a population of sufficient size for reproduction.

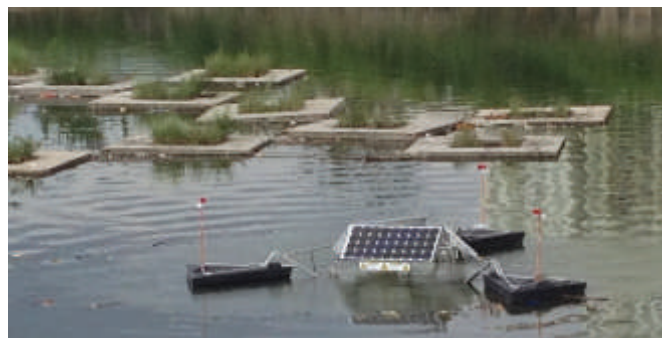
Self-organisation helps to guide self-design by allowing natural selection to organise the systems. The best species can be preferentially seeded into a particular design or Nature can be allowed to choose the appropriate species. Excess seeding of many species is provided and self-design occurs automatically.

c. Pre-adaptation: The phenomenon of adaptation that arises through natural selection for one set of environmental conditions just happen also to be adaptive for a new set of environmental conditions that the organism has not been previously exposed to. Self-organisation can be accelerated by seeding with species that are preadapted to the special conditions of the intended system. It requires the knowledge of design conditions of the ecosystem to be constructed and the adaptation of species. Adaptation by species occurs through Darwinian evolution along environmental gradient.

Pre-adaptation by design is done by taking advantage of the principle of biodiversity prospecting and knowledge of the niche concept. New systems developing with pollution are sources of preadapted species for treatment ecosystems. Invasive exotic species are successful due to preadaptation to human disturbance and the seed sources through ecological engineering.

Application

The principles are then adopted in the design of the ecosystem in the improvement of water quality (10).



The Solar Aerator and the Floating Wetland are now operating fully at Kolam Takungan Banjir Air Leleh [10]

The energy augmentation through solar aerators allows for self-organisation or self-design and the vertiver plants adapted for the present environment thrive in the pond ecosystem.

CONCLUSION

Engineers need to play more active roles in the use of renewable resources of nature for a balance approach to development. There is a need to be resilient and innovative as well as to design for impact-proof and to take the no-regrets options route. Sustainability design will achieve the objectives by adopting the approaches presented, namely:

- Long-term design through biomimicry
- Structural optimisation through using less materials
- A close system, not unlike ecosystem, to be used through ecological engineering for a closed-loop approach. ■

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Title: 30th Annual General Meeting of Building Services Technical Division, IEM

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Organised by : Building Services Technical Division
Time : 11.00 a.m. – 1.00 p.m.
CPD/PDP : 2

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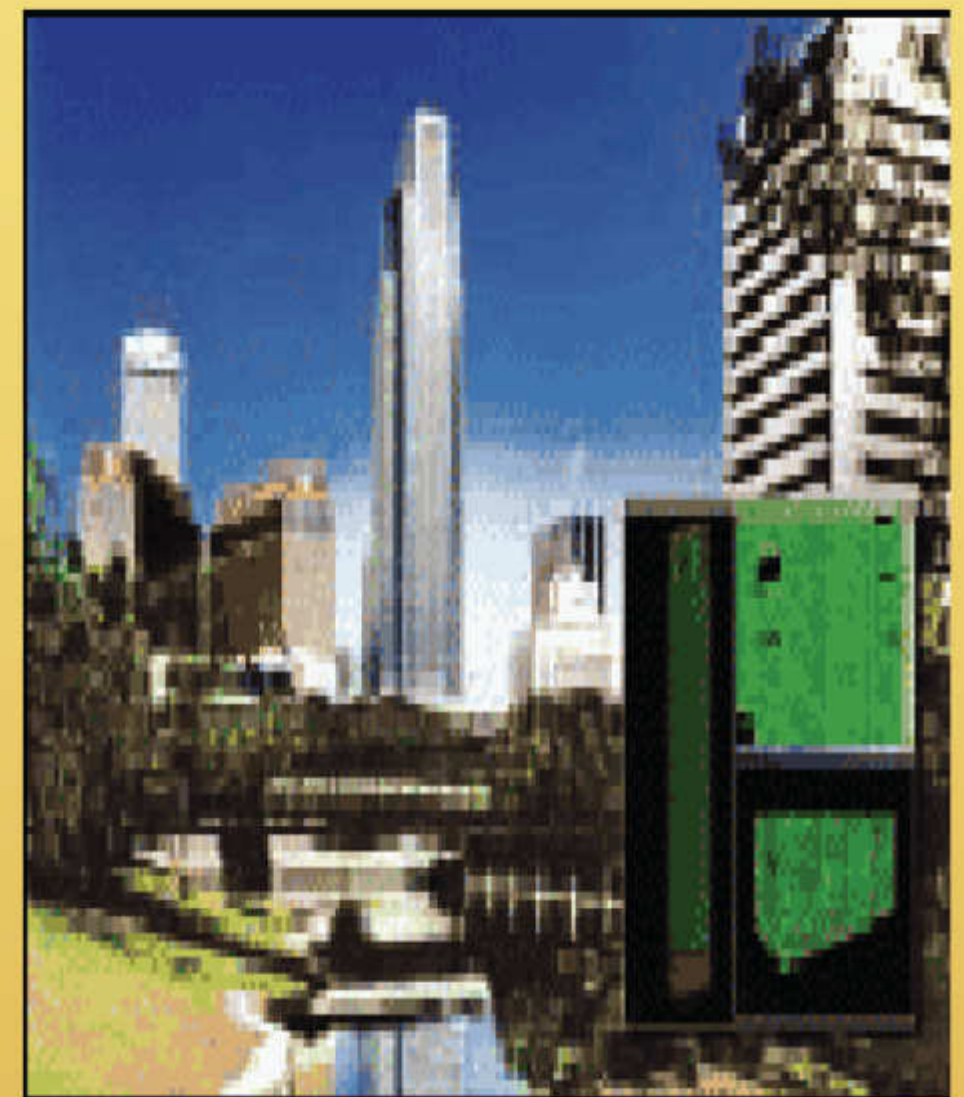
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Passive Cooling System in Terrace Houses: Towards Collective Action



Pang Hui Na

Pang Hui Na is a quantity surveyor in MMC Gamuda KVMRT.



Janaky Nair

Janaky Nair is a senior lecturer in Tunku Abdul Rahman University College (TARC).



Dr Wang Hong Kok

Dr Wang Hong Kok is a principal lecturer in Tunku Abdul Rahman University College (TARC) and currently Honorary Treasurer of IEM.

The recent heat wave that hit Peninsular Malaysia from February to May 2016 resulted in a 100% hike in electricity consumption per household as more people switched on air-conditioners to make their homes more comfortable. While accepting that energy cost would be proportionate to the amount used, what house owners had not expected was that Lembaga Letrik Negara (LLN) would impose a tariff hike if the electricity consumed was above average. There was a huge uproar and lots of complaints via the media.

In his press statement released on 26 April 2016, IEM President Ir. Tan Yean Chin, called for a re-examination of this issue of high energy cost attributed to climate change. What kind of collective action is required to reduce electricity cost due to high consumption of air-conditioning? Why collective action?

Without doubt, the recent heat wave is a phenomena of extreme environmental degradation experienced in various parts of the world which includes flooding (south China), cyclones (United States and Australia) and forest fires (United States, Australia and Canada), etc.

Closer home, as recently as 2014, the whole of Kota Baru and many parts of Kelantan, Terengganu and Pahang were submerged in flood waters for days. The calamity resulted in huge losses in assets. On 19 September 2015, Dato' Ir. Lim Chow Hock, former IEM President, said the advent of climate changes had brought untold miseries to mankind due to our poor adaptation, but added that the root cause could be traced to irresponsible activities of mankind themselves. Uncontrolled deforestation, for instance, might have contributed to the flooding in Kota Baru. "The whole data set needs to be revised in assessing the flood occurrence," Dato' Ir. Lim pointed out.

Is the building of more terrace houses in urban areas an act of irresponsibility?

TERRACE HOUSES, CULPRITS OF CLIMATE CHANGE

A number of studies conducted in the past, concluded that large urban centres that were geographically wide-spread with landed properties (such as Los Angeles, United States) emitted more greenhouse gas (GHG) than urban centres with vertical high-rise buildings (such as Hong Kong and Singapore). See (Sullivan 2015). The logic in effect, is easy to explain. Typically,

the roof/envelop area of a terrace house is 2.5 times larger than a unit of eight-storey high-rise apartment (Straube 2006). As a result, it emits more heat into the immediate environment after absorbing heat from the sun. To compound the issue, residents of terrace houses in Los Angeles and Kuala Lumpur had a tendency to drive cars to work and this resulted in more GHG emitted per person. On the other hand, high rise city dwellers in either Hong Kong or Singapore, usually took public transport to work, contributing less GHG per person.

Given the gravity of the situation, a large amount of research has been done in UCLA since 1981 on climate changes in Los Angeles (Boxall 2016). Climate scientists at UCLA's Institute of the Environment and Sustainability (IoES) predicts a rise of 3-5°F in southern California in the next 30 years. And mind you, one can expect the temperature to exceed 95°F (32°C).

Unfortunately, the Greater Kuala Lumpur is in the same category as Los Angeles in terms of energy utilisation, though on a smaller scale. According to the 11th Malaysian Plan, 25% of the total residential houses in Greater Kuala Lumpur comprise terrace houses. It's the same situation in Los Angeles where 26% of total residential houses are landed properties.

During the hot season, as in February-May 2016, 24.7% of residents of terrace house in Greater Kuala Lumpur switched on 8-12 hours of air-conditioning a day at home to create a more conducive indoor environment (Pang 2016) and 61.8% of terrace house dwellers turned on the air-conditioning for 4 hours or more a day (Pang 2016). This meant the national grid line was put under acute stress during that period since it had not anticipated that 50% of the optimum capacity would be used by household consumers alone (Pang 2016). What then are the mitigation measures implementable in terrace houses?

Very little effort is evident as M.M.Tahir (2010) remarked: "The liveability index for terrace housing in Malaysia, in this respect, has never been analysed. Mundane design, inflexibility of spaces, ad-hoc renovations as well as poor ventilation, lighting and thermal comfort have resulted in an unacceptable housing culture in urban and sub urban community areas in Malaysia."

PASSIVE COOLING SYSTEM IN TERRACE HOUSES, A BRIEF REVIEW

A passive cooling system is one that will cool a building to an acceptable temperature without the use of mechanical means such as air-conditioning. The concept of a passive cooling system is achieved in two ways: To prevent heat from entering a building or to eliminate heat that enters a building (Choudhary *et al.*, 2014).

To do this, one way is to use better materials of lower U-values. The second is to consider the function of a heat sink so that excess heat is transferred to a heat sink. For example, if the outside air is cooler, heat is transferred outside through convection.

We will discuss briefly some of the materials commonly used to prevent heat entering a building (walls, roofs, and windows, as these materials can relate to our daily experience) as well as a more holistic way of viewing heat flow.

Using lower U-values materials: For walls, materials having lower U-values are more resistive to heat flow. Figure 1 shows that softwood is better than lightweight concrete (Wong & Chan 2012). So a terrace house with a large panel of glazing is hardly a good choice. More findings from Mallick (1996), Tenorio (2002), and Mahlia *et al.*, (2007).

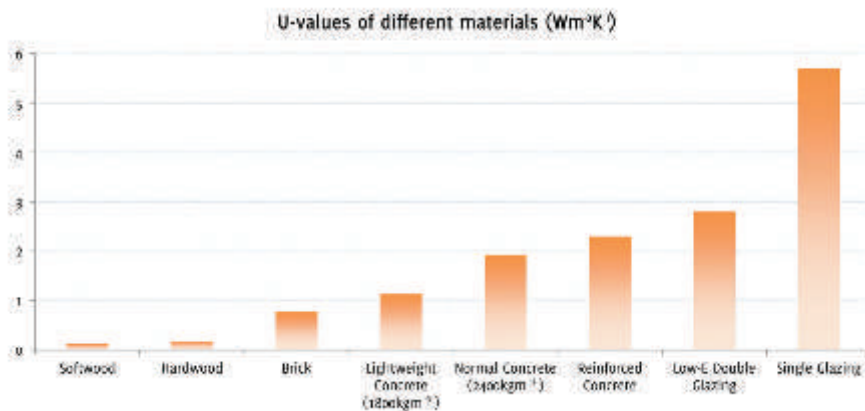


Figure 1: U-values of different materials.

Source: Wong and Chan (2012)

For the roof, Quick's (2012) new roofing system includes a passive ventilation system that pulls air that has gone inside the house from the underbelly of the attic, up into an inclined air space above the roof so it can be carried up and out. It also features controls for radiation, convection and a foiled covered polystyrene insulation. See Figure 2. More findings from Straube (2006), Bahrami (2008), Ahmad Al-Yacoubi *et al.*, (2011), and Lau *et al.*, (2008).

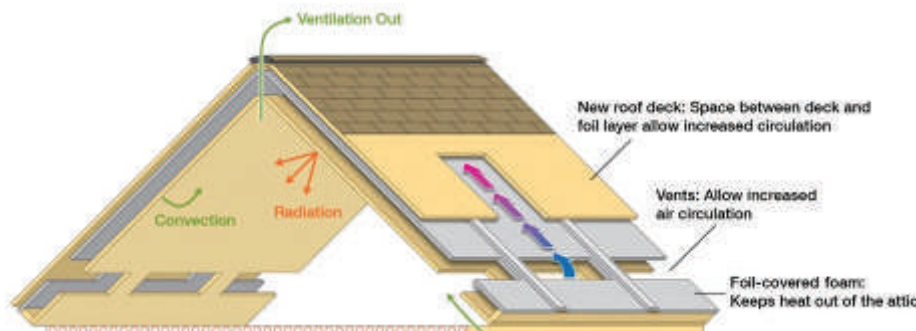


Figure 2: New roof system includes controls for radiation, convection and insulation as well as a passive ventilation system.

Source: Quick (2012)



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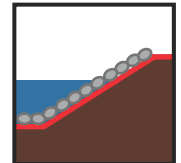
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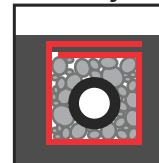
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For windows, Figure 3 shows that replacing single clear glass with single tinted glass reduces the annual cooling energy consumption by 7% to 9.5%. In addition, using double clear glass results in reduction of about 10% to 13.5% in energy consumed. More findings from Moorjani (2014), and Kim *et al.*, (2012).

This also explains the large number of cars in Malaysia fitted with tinted glass.

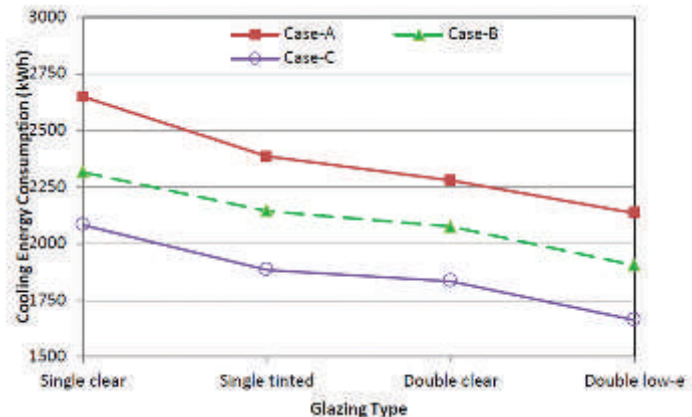


Figure 3: Effect of various glazing types on annual cooling energy consumption.

Source: Hassan & Al-ashwal (2015)

Holistic way of viewing heat flow: Why holistic? If we focus on savings derived from individual components (walls, roofs, and windows), this may mar us from seeing the big picture.

The energy crisis of 1970s promoted the development of environmentally friendly buildings that took the style of passive thermal designs, energy efficient buildings, and green buildings (Zhu & Lin 2004). However, these concepts were not applied to the local scene for terrace houses due to high initial capital costs (Pang 2016). House-owners who do, however, may be amply rewarded in the long-run in terms of reduced operating costs (Choudhary 2014; Markus & Morris 1980; Santamouris *et al.*, 1998).

If one relaxes the criteria for passive cooling systems to include installing a heat exchanger, a more pleasant indoor environment may be created (Ludeman 2008). See Figure 4. In a similar vein, the "Passivhaus" design standard proves its effectiveness in the West as the ultra-low-energy buildings provide excellent indoor ventilation (Puckett 2016).

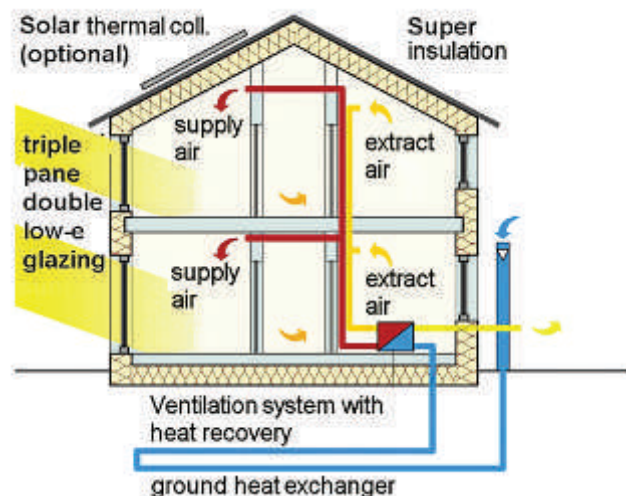


Figure 4: Passive thermal design

Source: Ludeman (2008)

For research in this area in Malaysian context, see Arif (2010), Asif (2006), and Zaki *et al.*, (2012). Clearly, more research and more promotion by stakeholders such as consultants, developers, and the State in this area are required.

How did residents of terrace houses in Greater Kuala Lumpur cope with the heat wave? Did they understand that materials and house design could have an impact on indoor air quality?

According to Yuan (1987, cited in M.M. Tahir *et al.*, 2010), the main causes of climatic stress in Malaysia are high temperatures, solar radiation, humidity and glare. Yuan (1987) also noted that to achieve thermal comfort in our warm, humid climate, solar heat gain by the building and the human body must be minimised while heat dissipation from the body must be maximised by ventilation and evaporative cooling.

RECENT FINDINGS IN TERRACE HOUSES

In a survey conducted in Greater Kuala Lumpur in 2015, survey questionnaires were sent to 100 terrace house residents by mail to solicit their response on the level of comfort (Pang 2016). Of these, 81 responded. See Figure 5.

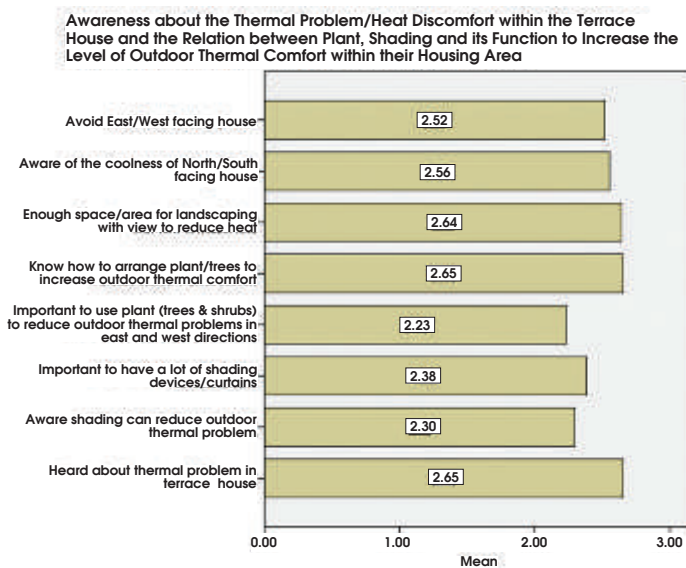


Figure 5: Awareness about the thermal problem or heat discomfort
Source: Pang (2016)

From the survey, it appeared that most terrace house residents understood the factors affecting thermal comfort (example, mean score of 2.65 about thermal problem in terrace houses). But as houses were purchased from developers, there was little they could do about the design. Therefore, any approach to mitigate climate change where terrace houses play a part, necessitates the participation of developers.

Separately, a panel of 10 experts from the built environment industry was asked about the current issues with respect to climate change and its impacts on residents of terrace houses (Pang 2016).

These experts shared the same view as the 81 residents in at least five areas. First was that more vent blocks would improve cross ventilation. Second, window design should preferably be in the direction of the wind. Third, a large overhang will shield the house from the sun's rays. Fourth, the internal layout should allow cross ventilation. Fifth, a "stack effect" can be achieved in the presence of a courtyard or

air well (James 2007). Sadly, most terrace houses no longer incorporate this feature in their designs to produce a stack effect. See Figure 6.

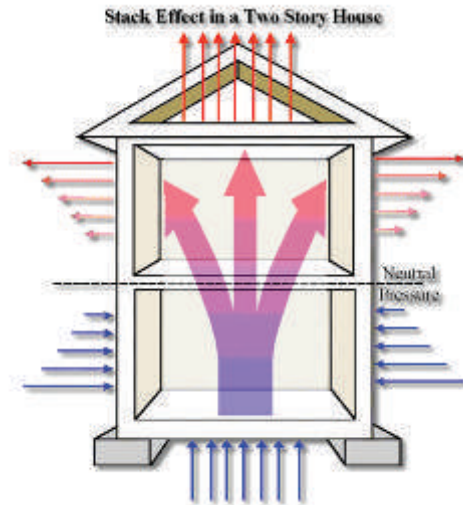


Figure 6: Natural ventilation-Stack Effect.

Source: James (2007)

As mentioned, most developers went for aesthetics rather than function, so most terrace houses were uncomfortable for the inhabitants.

IS COLLECTIVE ACTION POSSIBLE?

The term "collective action" may be new to the average reader. To an economist, it refers to the rational behaviour expected in the use of general, public goods. Public goods belong to the state; they are not private-owned. Examples of public goods are the air that we breathe, the water that we get from rivers and neighbourhood parks where residents can spend their leisure hours. Unlike private goods (such as cars and houses), public goods are often subjected to abuse, waste and under investment for obvious reasons.

Since local air quality is a form of public goods, it calls for extraordinary effort by all stakeholders to keep temperatures from rising beyond control, which is the focus of this article.

If terrace houses are private goods or private properties, the excessive use of air-conditioning by the inhabitants raises the pertinent question about the latter's role in development. There must be ways to reduce the use of air-conditioning in terrace houses, especially during a heat wave and the ability to create a local quality environment calls for solutions beyond materials used and design as proposed by developers.

The key, among others, is the behaviour of stakeholders such as consultants, developers and residents of terrace houses. How can less air-conditioning be used in terrace houses?

In the common pool resources (CPR) literature, public goods, such as air, are CPR. The most well-known theoretical framework that helps researchers investigating the CPR is Ostrom's (2005, cited in Poteete, Janssen, and Ostrom, 2010, p. 41) institutional analysis development (IAD) framework, where four determinants are studied: Context, nature of products, attributes of the community and rules of use.

First, when terrace houses are dominant in urban settings such as in Greater Kuala Lumpur, more sensitivity is required. Should we build less terrace houses? Second, the public policy on the use of air-conditioning must be re-defined. Should a surcharge be imposed? Third, since occupants of terrace houses belong to the middle income group, how can they be made more sensitive about climate change and the use of air-conditioning? Obviously, a new approach to education must be introduced.

Fourth, while formal rules to curb the use of excessive air-conditioning appear to make little sense, informal constraints must be promoted. We should cultivate a new culture with regards to the use of air-conditioning. To put it differently, a new paradigm shift where there is less use of air-conditioning in terrace houses, must be promoted.

CONCLUSION

Given the monstrous tasks that challenge our ability to manage climate change due to excessive use of air-conditioning in terrace houses, a new understanding about our habitat, which is formed by terrace houses, must be further researched. To allow the unlimited use of electricity "as long as one can afford it" is clearly an act of irresponsibility. We ought to move upwards, and hopefully be more enlightened to place society's greater interest above our personal comfort in keeping a conducive indoor environment. Climate change means global warming. As it is, there are signs that the trend is becoming irreversible. ■

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Lean Product Design and Competitiveness: A Green Technology Approach



Ir. Dr Oh Seong Por

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Green Technology, as defined by the Ministry of Energy, Green Technology & Water, is the development and application of products, equipments and systems used to conserve the natural resources and environment, thereby reducing the negative impact on humans.

The key approaches in green technology are:

- To eradicate or replace ways of doing things, which can pollute the environment.
- To reduce waste such as excessive consumption of materials or ineffective utilisation of energy that contributes to global warming.

After the industrial revolution, the rapid development and mass production of a variety of goods had exponentially increased the use of raw materials and energy. As more products are manufactured, more residual waste is generated, posing a greater risk of damage to the environment. While efforts to reduce waste help to improve product competitiveness, these also contribute a positive spillover effect to protect the environment. As such, responsible manufacturers are adopting total waste reduction product management or industrial ecology. It involves total product life cycle thinking, starting with product design and ending with its disposal at the end of its operational life.

Total waste reduction means designing, manufacturing and distributing products in a way that utilises less materials, less energy and, if possible, a high proportion of recycled materials without comprising intended function or quality of the product. One such green technology in product development is the Lean Product Design.

1.0 LEAN PRODUCT DESIGN

Lean Product Design or LPD was established using the lean principle as mooted by James Womack. It is a systematic approach to identify and eliminate waste or non-value-added design features embedded in a product, with the objective to save resources, therein improving product competitiveness. It aligns to the green technology initiative

in product designs which strive to conserve resources like material, human effort, energy and space while speedily creating product value that excites customers. LPD consists of 7 steps in which the design engineer can gather valuable information about the product, interpret it into technical attributes with an acceptable lean level and later integrate it into the manufacturing of product.

This article has been prepared to illustrate LPD flow developed by Oh (2011). It is organised in 2 sections. Section 1 describes the 7 steps of LPD while Section 2 demonstrates the case study of a major electronic manufacturing company in the country which enjoys higher product competitiveness while at the same time fulfills the corporate vision to adopt green technology to protect environment from excessive pollution and global warming.

2.0 SECTION 1: LEAN PRODUCT DESIGN

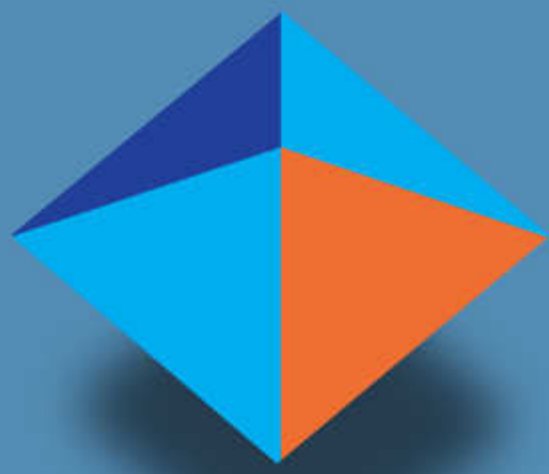
The following sub-sections offer a brief description of the 7 steps of LPD.

2.1 STEP 1 – PRODUCT TEAR DOWN

It uses the product tear down technique to dissect completely a product under study, down to every individual component or part. Product tear down serves 3 primary purposes:

- To gather the baseline information pertaining to the evolution of a product and its related components.
- To understand how things work.
- To exercise competitive benchmarking whereby similar products or components manufactured by competitors are compared, measured and examined.

Before this is done, several important preparations are needed. First is to determine the testing sample such as quantity, type, model etc. Next is to identify the best method



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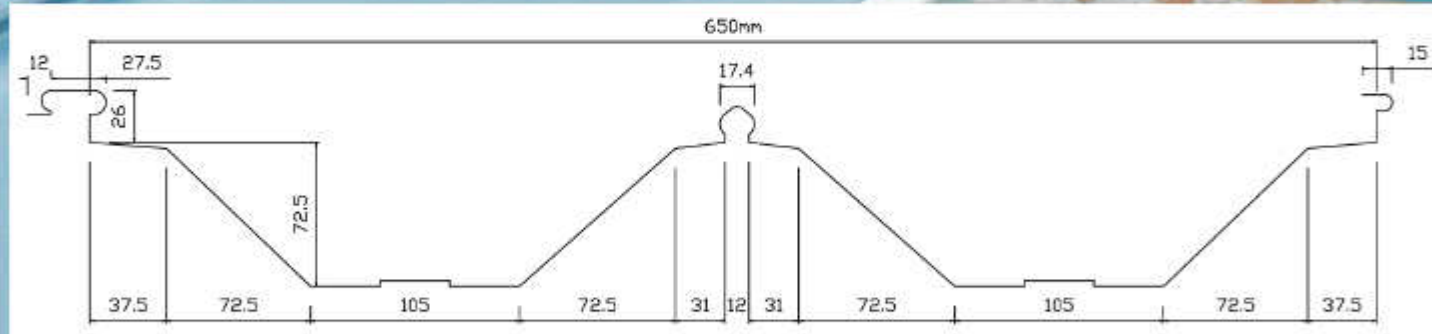
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of dissecting the product. A non-destructive method is preferred so that components can be reassembled to its original form for further comparative analysis. However, if this is not possible, the raw components (before processing) can be utilised for investigation.

The product tear down also puts stress on visible management. The intention is to have all the dissected individual components displayed in an orderly manner and visible to the design team members. The components are exposed and easily accessible for design team members to hold, feel and examine. The idea here is to create a conducive environment for the team members to use their senses (such as vision and touch) to the fullest, thereby allowing them to generate creative and innovative new design.

2.2 STEP 2 – PRIORITISATION

Tear down components are numerous and improving them all together poses not only great difficulty but also ineffectiveness. Therefore this step is necessary to prioritise all components and to identify the major ones for improvement. Since the ultimate goal is to reduce cost associated with material usage, it is natural to prioritise components according to the component cost per unit of product. The statistical tool used for this exercise is the Pareto Chart. Once completely constructed, this chart will display the principle 80/20, which simply states that 80% of the total product cost is contributed by 20% of a few vital components. Focusing on re-designing vital few components is essential in lean product design.

2.3 STEP 3 – FUNCTION ANALYSIS

The objective of function analysis is for the design team to understand what and how every vital component works. The verb-noun expression, which originates from “value analysis” is applied to describe “what” is the use of a component and “what” it is designed for. It is the Voice Of Product (VOP). Another accompanying adverb-adjective expression is also used in LPD to assess component function from the customer’s perspective. This is the Voice Of Customer (VOC). It states the customer’s wishes on the function of a component. Three situations involving the relationships between VOP and VOC can occur that will trigger different design improvement approaches.

Case 1: $VOP < VOC$. Customer expectation is higher than what the component function can provide. Therefore redesigning to improve or add better function is the main priority.

Case 2: $VOP = VOC$. The component function fulfills the requirements of the customer. New or added functions may not be necessary. However re-designing the component to reduce the cost or resources of creating the function can be applied, for example, using alternative lower cost materials or recycled materials to make the component while maintaining the same function and quality level.

Case 3: $VOP > VOC$. There is excessive or non-value-added design in the component which does not serve the needs of the customer. This is a good opportunity to seek out the excessive design and conserve resources while driving



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down cost, for example, using thicker material to make component although a thinner dimension is sufficient to serve the same purpose required.

2.4 STEP 4 - COMPARATIVE ANALYSIS

Comparative analysis is adopted from the Tear Down Design concept. Here, similar products from rival competitors are dismantled, exposing all the components (see Step 1). The tear down components which correspond to the vital ones, are compared so that new breakthrough improvement ideas can be developed fast. Four probing questions are used as guidelines in comparative analysis. These are:

Q1. What feature can be reduced/removed to cut down weight or processing resource like energy or water?

Q2. Is there any design geometry that can be minimised or simplified to reduce material consumption or human effort to make?

Q3. Is there a cheaper alternative material to replace existing material or can existing material be recycled without causing degradation to the basic function of the component?

Q4. Is there an alternative method which can be applied to cut down raw material scrap residual without incurring high investment?

2.5 STEP 5 - CREATION

This is where design targets generated from the comparative analysis study, are put into practical design attributes of component. Every idea is thoroughly discussed, debated and scrutinised before the final design is picked for implementation. The decision is mainly influenced by the following factors:

- Four guiding questions related to the reduction of weight or processing resources, minimisation of geometry or simplification of shape, replacement with cheaper material or recycling material and effective manufacturing method to make component with minimal scrap residual.
- Ability of supplier to manufacture the proposed new design of component.
- Acceptance of customer to use new component in the product.
- Adaptation of the proposed new design to the existing machine, process and method of production without incurring high cost.

2.6 STEP 6 - VALIDATION

This is the design refine phase to validate the design attributes. The results of the validation conclude the integration of design attributes into the manufacturing of the product. As such, strict procedures are to be observed, such as:

- Identifying or predicting the ways in which the new design can fail and prioritising an action plan to reduce the risk by using Failure Mode and Effect Analysis or FMEA.
- Conducting a pilot production using sample new design components to build the prototype. This is to verify the actual performances against the design intended functions.

- Drafting and finalising the specifications needed to govern the "effective" usage of the new design component in the process and production lines. The main specifications are:

- Standard working manual for operators to handle product.
- Process and machine setting specifications of each work station.
- Incoming quality control specification of new design component.

The verification of real life prototype running data from internal and external sources is another important task of validation. Essential internal data is quality reliability, defect rate, incoming quality (CpK value) of new components, process specification and overall machine efficiency. Important external data is fallout rate at customer line. The above validation procedures are illustrated in Figure 1.

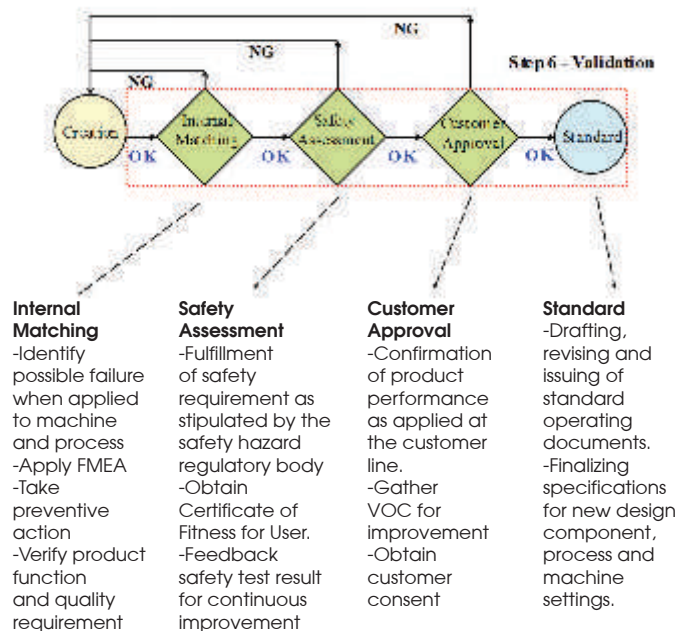


Figure 1: Validation Phase

2.7 STEP 7 - COMPLETION

In this final phase of the LPD, two major tasks are required, namely follow-up and reporting. The main follow-up areas are:

- Consistency of supplier in supplying new component that complies to new design specification.
- Adaptability and suitability of component being used in the work stations for making finished product.
- Final product quality performance at customer side.

The completion of the project needs to be documented and reported to the management. The contents of the report comprise design changes, appointed suppliers, financial impact gained from product leaning, investment, quality performance of the product and impact to environment. Figure 2 summarises the 7 Steps of Lean Product Design.

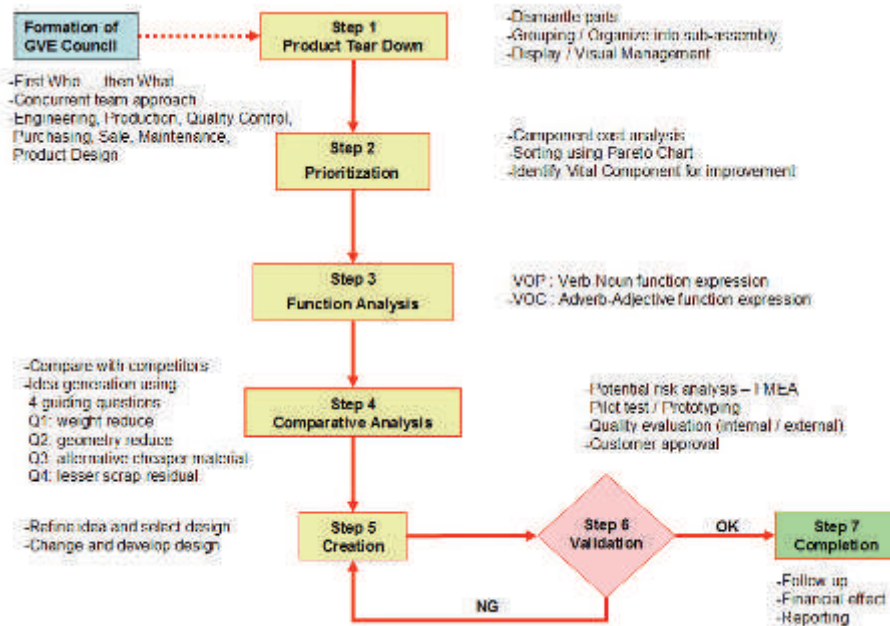


Figure 2: Roadmap of Lean Product Design (LPD)

3.0 SECTION 2 – CASE STUDY

Company A (not the actual name) was a major electronics company which had been manufacturing display components for television sets since 1991 but it restructured its business operations in 2012. The company has now embarked on LPD to innovate its products, with the aim to improve product cost competitiveness as well as meet the organisation's green policy to protect the environment by reducing waste and conserving resources such as energy and water. Table 1 describes the new design attributes created through the rigorous execution of LPD and its contributions to manufacturing and environment advantages.

Product Component	Redesigned Attributes	Impact	Manufacturing Advantage	Environment Benefit
Glass Panel	Excessive design. Reduced center thickness : 13mm → 9.5mm Unit weight reduced by 600g.	Reduction in process heating time and temperature by 33min and 15 degree Celsius.	Gained energy cost saving by 5.5%.	Reduction in energy consumption by 1.925 million kW/month.
Steel Mask	Replaced harder invar material with aluminum killed steel.	Eliminated redundant heat treatment process for invar.	Gained energy cost saving by 1.3%.	
Filming Solution	Benchmarked competitor. Replaced filming solution B74 → BFE.	Eliminated baking process to diffuse filming coating.	Screen process lead time reduced by 2hrs. Gained energy cost saving by 0.9%.	
Steel Frame	Excessive thickness design. Reduced raw material cold rolled carbon steel : 1.0mm → 0.8mm.	Reduction in scrap residual weight from the frame press forming process : 70g/unit.	Unit price reduction. Gained cost saving by 15%.	Waste reduction by 108,500 kg/month.
Deflection Yoke	Redundant function part. Removed balance copper coil which function can be cover by cheaper existing ferrite sheet.	Reduction in copper material consumption.	Unit price reduction. Gained cost saving by 6.25%.	Conservation of copper raw material.
Rare Earth Red Phosphor	Excessive high spec mixing of phosphor solution. Changed mixing recipe to fit for reclaimed phosphor application.	Reduction in the usage of fresh red phosphor material.	Gained cost saving through reclaim and reuse of phosphor.	Reduction in slurry waste discharge to waste treatment pond by 3000kg/month.
Steel Part Lubricant	Benchmarked from competitor. Replaced lubricant for steel part press forming with vegetable based oil.	Vegetable oil based lubricant easily diffused thru heat treatment process. Eliminated the usage of TCE to degrease steel parts.	Shortened steel part processing time by 45min (no degreasing). Gained cost saving.	Eliminated the usage of TCE, ozone depleting chemical/ Protect environment.
Complete Display Product	Reduction in weight with slim geometry shape.	Reduction in water usage to wash and process product.	Reduction in water consumption by 9.7%. Gained cost saving.	Reduction in water usage by 34,920 m3/month. Conservation of water.
Complete Display Product	Slim geometry shape and size.	Increased the stuffing quantity of display product into 40ft container: 1344 units → 1512 units. Required container unit to transport product reduced.: 893 units → 794 units.	Gained transportation cost saving by 6.7%.	Reduction in the number of container used contributes to lesser gas emission to environment.

Table 1: New Design Attributes Developed LPD.

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Figure 3 : Tear Down of Display Component.

4.0 CONCLUSION

Lean product design, which incorporates lean principles to eradicate design waste and create better value products for customers, is a noble approach that strives to not only improve business competitiveness but also to support the green technology initiative by effectively utilising energy and conserve resources. It fits in well with the lean thinking adage of "do more and more, using less and less while becoming closer to what customer wants". Therefore it is worthwhile to pursue the lean product design. ■

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ITEM DIARY OF EVENTS

Title: Pre AGM Talk & 18th AGM of Agricultural & Food Engineering Technical Division, IEM

3 December 2016

Organised by : Agricultural & Food Engineering Technical Division
Time : 9.00 a.m. – 1.00 p.m.
CPD/PDP : Applying

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Engagement Safety Trainings Part 3: A New Beginning



by Ir. Shum Keng Yan

Ir. Shum Keng Yan is a chemical engineer and a certified accident prevention and safety practitioner. He advises on EHS in the chemical, fast moving consumer goods, heavy metal manufacturing and building services industries across Asia Pacific and beyond. He regularly delivers talks at conferences, forums and universities.

In this the last part of the “Our Journey” exercise, let us see how we can move participants to the Acceptance phase.

Acceptance

The final lap, moving participants towards Acceptance, is to let them feel an actual situation that they might have gone through. At this stage, use stories again. We can easily link Our Journey to Driving Safety. It has all the elements for how to ensure a safe journey. At this stage, ask the participants’ what is the most precious item that they have transported in real life?

Some may be able to make a link between the item in the exercise with their loved ones whom they drive around on a regular basis. Ah, the light bulb moment!

Now invite each one in the group to share his/her story of an incident experienced when transporting the “item”! As the sharing begins, the participants will, inwardly, begin to feel their minds moving from Acknowledgement to something closer to Acceptance.

As I have discussed earlier, Acceptance is strongest when the person does it. Wrap up the workshop by asking participants to come up on stage to share the one thing they will do after the workshop! Since the participant is sharing “publicly” with friends/colleagues, his/her commitment will be higher.

For a nice, appropriate souvenir, offer a small photo frame for the car where participants can place a photograph of their loved ones. This will be the Mental Hook. Each time the participant sees the photo, he/she will get a flashback of the Engagement Safety Training and the safety message will be reinforced.

Reinforce the lesson with reminders such as posters with pictures of the participants during the training or follow up with lessons on vehicle inspection to keep the engagement going. Invite some of the participants to be Driving Safety Champions to influence their own networks. It takes a bit of effort to keep the momentum going.

You do not need to show too many slides during the training. Much of the learning will be through activities and self-discoveries during the workshop. This is more fun than sitting through and listening to a lecture format.

I hope that the above example has clearly demonstrated the concepts on how to use a story/role play in designing Engagement Safety Training. We have used the 3As concept as well as planted some Mental Hooks along the way.

Are you ready to create some Engagement Safety Trainings of your own? If you want to discuss your ideas, contact me at: pub@iem.org.my.

The real journey starts after the end of the lesson. ■

The safest risk is the one that you do not take. Often, it is the gap in the risk perception that leads to a gap in risk control.



EXAMINING METHODS FOR CREATING 3D MODELS OF COMPLEX MODELS

BY CYRIL NOVEL,
SENIOR SOFTWARE ENGINEER, BENTLEY SYSTEMS

The evolution of computing power over the past decade has advanced the development of photogrammetry software to the point where it can turn a set of photos of an object or an area into a 3D model. These software products compete with laser scanners, which are widely used throughout design, construction, and operations of infrastructure assets due to their fast acquisition time and remarkable accuracy. We can assess the accuracy of photogrammetry reconstruction by comparing outcomes when capturing and processing various scenes using Bentley's ContextCapture software and laser scanner-generated point clouds.

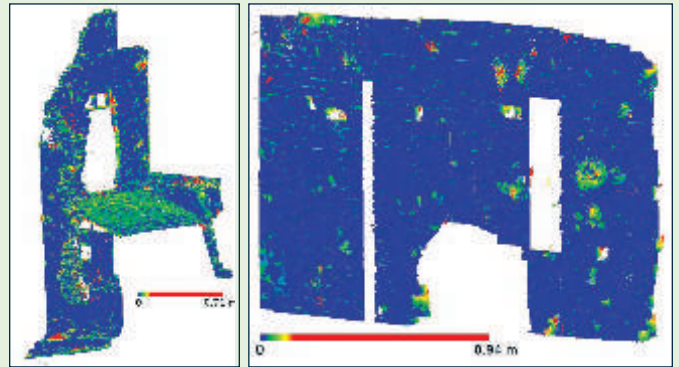
For years, laser scanners have been widely used to capture existing conditions because they are fast, versatile for surveying purposes, and are accurate within millimeters. However, the scanning process can be tedious and the technology requires highly skilled, well-trained individuals in order to obtain a virtual 3D representation of the real world. In contrast, producing an accurate 3D model using photogrammetry requires only a camera of reasonable quality. Photogrammetric software can then automatically build the model using multiple pictures of the same object.

COMPARISON USING THE PENNE CASTLE

To assess the accuracy of photogrammetric reconstruction, we compare 3D models reconstructed using ContextCapture with a 3D model created from terrestrial LiDAR point clouds. All of the datasets discussed were captured to determine whether photogrammetry can be used professionally to digitally document the types of complex projects usually completed with laser scanners.

The Penne Castle in the south of France was selected for comparison. The pictures for the reconstruction were taken with a typical digital camera, and the LiDAR data was captured using a terrestrial laser scanner. Gerpho, a team of professional aerial photographers, captured pictures of the castle from a plane at a distance of roughly 400 meters. The team used a Nikon D800 camera with a 36MP full frame CMOS sensor and a Nikon 70-200 lens. The photographers took 249 pictures with a focal length ranging from 139 millimeters and 201 millimeters. The picture dimensions were 7,360 by 4,912 pixels.

To perform the laser scanning data collection, Sompayrac Cianferani Prieu, a professional land surveyor, acquired a LiDAR point cloud processed by Geovast 3D. The 3D model features approximately 1 billion points after data unification. A Leica HDS 7000 scanner was used with a ranging error within 2 millimeters. The surveyor registered 46 different scans – all within a maximum constraint of 6 millimeters deviation.



The scientific comparison of the photogrammetric 3D reconstruction and the point cloud capture of the Castle of Penne demonstrated that the models produced by both techniques are very similar.

Using traditional laser scanning, the castle structure was captured in three parts:

- The corner wall with 4,991,330 points in the point cloud.
- A wall and a rooftop viewed from the bottom of the castle tower. This point cloud contained 27,831,695 points.
- Another wall from the tower in a point cloud containing 9,802,203.

Alternatively, Gerpho used ContextCapture to reconstruct ordinary digital photographs into a 3D model. The parameters for the aerotriangulation process (to compute the orientation and position of the pictures) were set to the defaults, and the parameters for the 3D reconstruction were set to "highest." All 249 pictures were used for the reconstruction. The aerotriangulation functionality of the software made it possible to estimate the pixel resolution of the pictures – also called ground sample distance. The pixel resolution ranged from 8 millimeters to 1.5 centimeters, which meant that a pixel was roughly equal to 1 centimeter.

The images were georeferenced using seven ground control points established by Geovast 3D. The results of the photogrammetric processing was good; the model did not have holes and there were no other obvious errors in the reconstruction of the castle.

The results of the 3D photogrammetric reconstruction and the LiDAR point cloud were compared using CloudCompare. The 3D photogrammetric model was set as the reference and CloudCompare computed the distance from each point of the LiDAR point cloud to the surface mesh of the 3D model. The mesh (M) is made up of interconnected triangles (t), and the distance between a point (p) and the mesh (M) is computed as: $\text{dist}(p, M) = \min(\text{triangles}(\text{dist}(p, t)))$ where the

distance between a triangle and a point is defined by the distance between the plane containing the triangle and the point.

DEVIATION COMPARISON

There was no attempt to align the point cloud and the 3D model directly, both of which were georeferenced in the RGF93 CC43 coordinate system. The alignment was instead made using the seven control points. The photos and the point cloud were not captured at the same time, which led to differences between the two data captures. Some objects had moved, and there was "noise" featured in the LiDAR data, but not the photographs. Also, objects like planks had been moved, and there were other outliers in the scan data due to the weather and various material properties.

For these reasons, the comparison between the photogrammetric 3D model and the LiDAR data was made on the parts of the structure that were the same between the two captures, enabling the elimination of noise and other artifacts such as moving objects.

When comparing the ContextCapture mesh with the point cloud, the average deviation between them was 2.5 centimeters, or the equivalent of just 2 pixels of the input photography. So, the conclusion is that the precision of photogrammetric reconstructions produced with ContextCapture is dependent upon the resolution of the input imagery and can be calculated as approximately 2 times the pixel size of the imagery.

ACQUISITION AND PROCESSING DURATION

The time required to reconstruct the castle using LiDAR versus photogrammetry was also compared, and the results showed that:

- The 46 LiDAR scans required four hours of labor and an additional two hours of labor for processing to complete scan registration. The total labor required to produce the complete point cloud was six hours.
- Using photogrammetry, the flight time needed to acquire the pictures involved one hour of labor and the production of the 3D model required 20 minutes of labor plus two hours and 30 minutes of computer processing time.

This comparison indicates that photogrammetry enables faster production of 3D models – and with 80% less labor and much less expensive equipment required. Moreover, the results found photogrammetry to be a more viable method for generating useful site surveys and documentation. Although LiDAR point clouds produce accurate models they require more time and more sophisticated, expensive, and difficult-to-operate equipment than the photogrammetric reconstruction. Photogrammetric reconstructions achieve accuracy similar to point clouds when very high-resolution photography is captured. Photogrammetry also allows for quicker data acquisition and easier processing because users do not need any particular training to do it. Lastly, photogrammetry produces a photo-textured mesh that is



In addition to requiring much less labor and expensive hardware to acquire, the 3D photogrammetric reconstructions are much more visually understandable than point clouds while being light enough to view in a web browser.

much more visually understandable. Reality meshes are also easier for CAD and GIS applications to analyze and process since they contain a real shape and information on existing conditions.

These benefits make photogrammetry a viable and cost-effective option for large and small projects that could benefit from 3D models of existing conditions and sites. Now, smaller projects that would not warrant the costs of a point-cloud capture can be captured using a digital camera.

For more information please visit www.bentley.com/contextcapture or call +603-7940 3400

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Evidence of Past Sea Level Change and the Formation of Recent Coastal Alluvial Deposits in Peninsular Malaysia

GEOTECHNICAL ENGINEERING TECHNICAL DIVISION



reported by
Ir. Yee Thien Seng

Ir. Yee Thien Seng is currently the chairman of Geotechnical Engineering Technical Division (GETD) and the principal of Geo. Consult.



Photo 1: Professor Tjia Hong Djin presenting his talk at Wisma IEM.

On 24 March 2016, Professor Tjia Hong Djin (Photo 1), Professor Emeritus of Geology at Universiti Kebangsaan Malaysia, presented the evening talk on Evidence of Past Sea-Level Change and the Formation of Recent Coastal Alluvial Deposits in Peninsular Malaysia at the Tan Sri Ir. Prof. Chin Fung Kee Auditorium, Wisma IEM, Petaling Jaya. The talk started at 5.30 p.m. and had an attendance of 35 participants.

Prof. Tjia pointed out that the landmass of the peninsula had been stable, elevation-wise, for the last 20,000 years with no earth crustal movement, so any indication of sea levels along the coastline represent the true sea levels threat.

He used paleoshoreline indicators like abrasion benches and marine-life fossils such as oysters, molluscs and barnacles as markers of past sea surface levels. Radio metric dating was used to establish the age of the shoreline indicators. There are more than 80 such datings. Land surfaces above sea level would experience erosion.

Along the coast, the sea would carve into the rocky cliff and leave erosion features which indicated whether the sea level had been at a constant level for a long period of time or otherwise.

Prof. Tjia said that 18,000 years BP (Before Present; with zero year BP = 1950 AD) the sea level was at its lowest, 130m below the present day sea level) and after which had risen to the maximum of about 5m above the present day level 4,400 years BP as shown in Photo 2. Thereafter, the sea subsided in 2 quick episodes before rising again to the present level about 400 years BP.

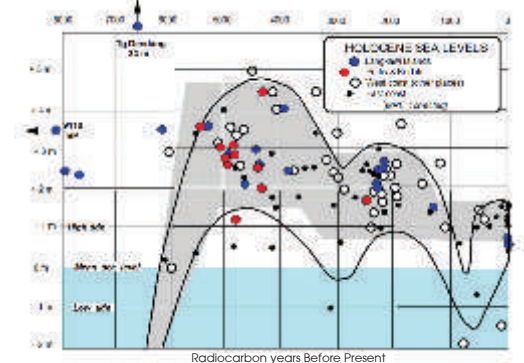


Photo 2: Past 8,000 year sea levels.

The industrial revolution/age, which marked the beginning of large scale human related emission of greenhouse gases, dated back to just 1,800 years AD (less than 200 years BP) yet the sea level had been rising long before this.

Changes in sea level causes the shoreline to change and changing shorelines are indicative of climate change. Prof. Tjia left it to the audience to judge for themselves if human activities had caused the changes in the climate and sea level.

He also presented the graph of sea level variations up to 800,000 years from present (Photo 3). It showed cycles of sea levels

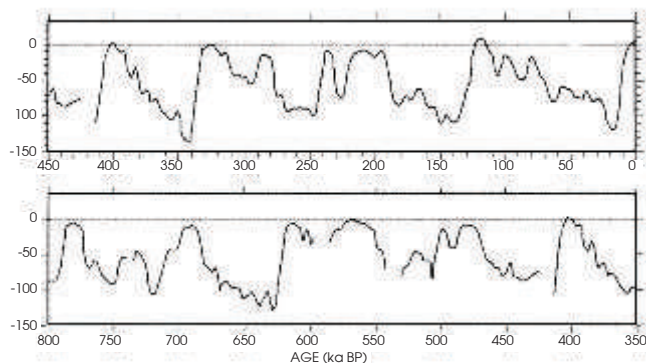


Photo 3: Past 800,000 year sea levels.

dropping to the lowest and rising to the highest about once every 110,000 years. The sea levels always rose considerably faster than the descending rates.

Previously dry land surfaces which were undated by the sea, would be buried over by marine sediments from the sea water.

About 5,000 years ago, the sea submerged all the current coastal plains of the peninsula. The presence of marine sediments along coastal plains is the result of this submergence.

Such sediments present considerable challenges to construction activities and completed facilities.

After his talk, Prof. Tjia was engaged in a very enthusiastic discussion with the audience. However, he declined to comment on the possible connection between global temperature changes and sea level changes, saying that it was outside his field of expertise.

To conclude the evening's event at 7.20 p.m., Dr Ooi Teik Aun presented a certificate of appreciation and a memento to Prof. Tjia on behalf of IEM. ■

(Prof. Tjia passed away in his sleep on 9 June 2016).

REFERENCE

Tjia, H.D and Syed, S.M.A. (2013). Sea Level Changes in Peninsula Malaysia: A Geological Record. Penerbit Universiti Kebangsaan Malaysia.

IEM DIARY OF EVENTS

Title: Pre AGM Talk & 4th AGM of Public Sector Engineering Special Interest Group, IEM

27 August 2016

Organised by : Public Sector Engineering Special Interest Group
Time : 9.00 a.m. – 1.00 p.m.
CPD/PDP : Applying

Title: Pre AGM Talk & 31st AGM of Mechanical Engineering Technical Division, IEM

15 October 2016

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

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The Institution of Structural Engineers

YOUNG STRUCTURAL ENGINEERING PROFESSIONAL AWARD

The IStructE Malaysia Regional Group Young Structural Engineering Professional Award 2016 is now open for entries to Engineers residing in Malaysia.

We want to promote the accomplishments of YOU, the young structural engineers – showcasing the diverse and skilled individuals who are driving the profession forward. Winning the award is a unique opportunity to be marked out as "one to watch" among the Institution's global membership, and an internationally recognised mark of achievement in structural engineering.

Structural engineering is an exciting career and that is why winners of this award have the opportunity to act as an ambassador for the Institution and the profession – showcasing the crucial role engineers play in shaping the built environment and providing identifiable role models for young people interested in engineering.

The scheme is open to Engineers Registered with the Board of Engineers aged 30 years or under. To enter the competition, complete your submission and send to: The Honorary Secretary, IStructE Malaysia Regional Group at "istructe.md@gmail.com" by midnight **Monday 31 October 2016**.

THE SUBMISSION MUST INCLUDE:

- **250 word opinion piece** on what structural engineering means to you.
- **Poster presentation.** You may submit up to four posters in pdf format (A1 size) about three projects that you have been involved in. The posters should show the technical aspects of the design, and also shout about your own input into the project. It is up to you to decide how you split up the posters – focus more heavily on one project or equally across the three.
- **Video recorded presentation (max. 5 minutes).** At the end of your presentation, please answer the question "what does structural engineering mean to you?" (This is based on your opinion piece and should last no more than 20 seconds).
- **CV.**
- **Endorsement from your employer (max. 300 words).**

Entries will be reviewed by the judging panel against the following criteria:

- I. Creativity and originality
- II. Personal involvement on one specific project
- III. Knowledge of structural engineering and the profession
- IV. Quality of written and verbal communication
- V. Clarity of presentation

The winner shall be awarded with a prize value worth of at least RM 2,000

Managing Energy Saving Project for Telecom Towers in Asia

ELECTRICAL ENGINEERING TECHNICAL DIVISION



reported by
Dr Siow Chun Lim

Dr Siow Chun Lim
B. Eng (Electrical & Electronic) and Ph.D. (Univ. Putra Malaysia), is a lecturer at the School of Engineering, Taylor's University, and Associate Editor of Journal Of Engineering Science & Technology.

Energy costs eat up a sizeable portion of the total costs bearable by telecom operators. Energy efficiency (or rather energy inefficiency) is one of the major culprits. As such, various engineering efficiency related policies have been put into practice since 1973, resulting in a credible reduction in worldwide energy consumption by 56% (IEA, 2007a). This was the main highlight of the talk by Ir. Noor Iziddin Abdullah bin Ghazali, the Regional Head of Electrical System in the edotco Group of companies specialising in integrated telecommunications infrastructure services.

In line with the focus on enhancing energy efficiency, telecom operators have had to ride on the technological evolution of energy-related equipment which can be categorised into energy generation or energy storage. Due consideration has to be given when it comes to deciding which energy source to tap from. These can typically be diesel generator, fuel cell, wind, solar or even hybrid system. This decision is largely influenced by cost, on-site conditions as well as local regulations. Deployment of AC or DC diesel generators, transportation of fuels to the fuel cells, wind speed and partial shading of solar cells are some of the issues which a telco engineer has to deal with pertaining to energy generation at the tower site.

From the perspective of storage technology in the context of telecommunication service



EETD Session Chairman Mr. P.J. Low presenting a token of appreciation to Ir. Noor Iziddin Abdullah bin Ghazali

operators, self-healing silicon batteries, sodium metal hydride batteries, lithium ion batteries, sodium sulfur batteries, T-gel batteries and AGM batteries are some of the additions to the traditional lead acid batteries which telco engineers can choose from. The main criteria which aid in the decision-making process are the depth of discharge, charging time and battery lifecycle. Lithium ion battery is a more attractive option over lead acid battery due to its higher depth of discharge, shorter charging time as well as longer lifecycle. In some countries where theft of lead acid battery is prevalent, the use of lithium ion battery also makes more sense, economically.

The design of the tower site has also evolved over the years. Table 1 depicts such comparison.

Table 1

Traditional Site Design	Modern Site Design
Single technology for Base Transceiver Station	Multiple technology for Base Transceiver Station
Indoor type equipment (cabins)	Outdoor type equipment (cabinets)
Air conditioners for cooling	Emphasis on free cooling/fan cooling/intelligent ventilation system
Distributed Generators to serve as backup	Increased utilisation of batteries as backup
Limited deployment of renewable energy sources	Increased deployment of renewable energy sources
Aesthetic value is not emphasised	Aesthetic value is emphasised with attempts to blend the tower design into ecosystem

Upon realising the available technologies for the operation of telco towers, engineers must then design the energy system. As mentioned, the total cost plays a pivotal role when it comes to designing the optimum system. One approach which engineers can use is the Total Cost of Ownership (TCO) approach which provides a comprehensive method to evaluate different components when designing for a particular site.

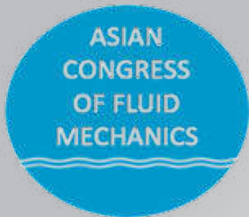
Key considerations when using Total Cost of Ownership (TCO) approach are:

- Initial CAPEX Cost of Components
- Installation/Civil works costs associated with components
- Maintenance cycles and costs associated with components
- Manpower costs for operations and maintenance associated with components
- Lifetime/life cycles of components/equipment

- Ambient temperature and humidity have effect on lifetime
- Cost of fuel (diesel/octane/hydrogen/methanol) and grid
- Operational parameters of components (charging rate/fuel consumption)
- Economic factors (inflation rate, duties and taxes)

As one examines these factors further, it can be seen that proper selection of equipment is important as every single piece will affect the direct and indirect cost of the service which buyers have to pay as estimated by the TCO. In turn, this will affect the competitiveness of the telco provider.

All in all, designing an energy system for a telco tower is an arduous task as many factors have to be taken into account with energy efficiency and cost being two of the most challenging ones. The TCO approach may be of great help from the economical side of the project. ■



15th ASIAN CONGRESS OF FLUID MECHANICS

21-23 NOVEMBER 2016

Pullman Hotel, Kuching, Sarawak, Malaysia

Conference Themes

- | | |
|---|---|
| <ul style="list-style-type: none"> ➤ Aeroacoustics and aerodynamics ➤ Astrophysical fluid mechanics ➤ Boundary layer flows ➤ Compressible flows and gas dynamics ➤ Computational fluid dynamics ➤ Combustion ➤ Environmental and natural fluid mechanics ➤ Fluid machinery and industrial fluid mechanics ➤ Flow control and measurement | <ul style="list-style-type: none"> ➤ Flow induced noise and vibration ➤ Flow visualization ➤ Geophysical fluid mechanics ➤ Membrane and porous media flows ➤ Multi-phase and reacting flows ➤ Non-Newtonian flows ➤ Unsteady flows and rotating flows ➤ Other topics related to fluid mechanics |
|---|---|

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Technical Visit to Unfired Pressure Vessel Manufacturer

AGRICULTURAL & FOOD ENGINEERING TECHNICAL DIVISION



reported by
Ir. Hor Kok Luen

Ir. Hor Kok Luen is currently the secretary of Agricultural and Food Engineering Technical Division (AFETD). He has more than 16 years of working experience in the palm oil mill & related downstream industries, inclusive of biogas power plant.

The Agricultural and Food Technical Division (AFETD) organised a visit to SEPEN Engineering Sdn. Bhd. in Rawang, Selangor, on 23 April 2016 for 11 participants.

The introduction session started with a briefing on the company which was incorporated in 2008. As a licensed Unfired Pressure Vessel (UPV) manufacturer, its core business activities are mainly in design and fabrication of processing equipment in the food based industries, larger scale bulk storage tank(s) which require in-situ erection and installation, general steel structures for machineries and buildings and the provision of maintenance shutdown services for various plants upon request.

The participants were briefed on company organisation and the various licences obtained, including those for Unfired Pressure Vessel (UPV) manufacturer issued by Jabatan Keselamatan and Kesihatan Pekerja (JKKP), Construction Industry Development Board, Malaysia (CIDB), Halal, Good Manufacturing Practice (GMP) and others.

SEPEN director Mr. Wong Kah Poh explained about the design process flow and the fabrication process, particularly the storage tank, mixing tank, silos and spray dryer as well as the fabrication and installation method of all kinds of stainless steel auger conveyor, chimney, ducting and piping work and erection of stainless steel structures and platform.

In particular the fabrication and installation of food process plants' sanitary tubing, valve, fitting and Clean in Place (CIP) systems, fabrication and installation of reactor, vessels and deodoriser, polishing works (hairline, mirror and etc..) and maintenance shutdown works for plants, machinery parts and equipment were also discussed.

The company's clients are mainly from the chocolates, yoghurt, palm oil, sauces and oil and gas based industry.

Mr. Wong talked about the challenges faced during the delivery of the finishing products, particularly on the issue of mobilisation and transportation of heavy vessels with large diameter and dimensions.

At the factory floor, production lines were segregated into two different sections: Food based equipment and non-food based equipment. It was observed that good-finishing epoxy flooring was used at the food-based equipment manufacturing line so as to produce safe and hygiene products.

At the end of the technical visit, a token of appreciation was presented to Mr. Wong Kah Poh on behalf of IEM. ■



Production line cum semi finishing products



Front view of SEPEN ENGINEERING SDN. BHD.,
Rawang, Selangor.



Session Chairman Ir. Hor Kok Luen presenting a token of appreciation to Mr. Wong Kah Poh, Director of SEPEN ENGINEERING SDN. BHD.



Southern Branch's Efforts in Fight Against Dengue

*Reported by Ir. Assoc. Prof. Hayati Abdullah,
Immediate Past Chairman, Southern Branch*



The IEM Southern Branch has been working closely with the Johor Health Department to fight dengue. Realising that engineers can play a role in this fight, its Executive Committee formed a Special Committee On Dengue last October 2015 with Ir. John Cheah Kam Loong as its chairman.

The other committee members are Ir. B.K. Teoh, Ir. Mohd Salehuddin bin Abdul Hamid, Ir. Derek Cheah Kong Yew, Ir. Tay Tuck Puang, Ir. Lam Ah Hang, Ir. Dr Stephan Tan Boon Kean, Ir. Goh Kae Wan, Ir. Thayala Selvadurai and Mr. Lim Chin Chuan.

Prior to the formation of the committee, an International Conference On Dengue Situation And Its Control was jointly organised by the Southern Branch, Rotary International and Universiti Teknologi Malaysia (UTM) at UTM in September 2014.

Johor Chief Minister YAB Dato' Mohamed Khaled Bin Nordin, who officiated at the conference, was happy that engineers were promoting awareness of the disease. He believed that with the appointment of Ir. John Cheah as IEM representative in the Jawatankuasa Khas Tindakan Denggi Peringkat Negeri Johor, engineers, especially those in Johor, would be encouraged to play a positive role in helping the Government to combat the disease. (The proceedings of this conference is available upon request).

Engineers in Johor have been recognised for the role they play in combating dengue, especially in the Gotong Royong – Search & Destroy method. The following awards have been presented to engineers:

- Anugerah Aspirasi Combi Harapan Negeri Johor 2015 Award, presented by the speaker of Johor State Assembly, Tan Sri Mohammed bin Haji Aziz, on behalf of the Johor Chief Minister on 18 October, 2015, at Combi Convention, Pasir Gudang, Johor.

- Warga Kota Prihatin Award, presented by Chief Minister YAB Dato' Mohamed Khaled Bin Nordin on 3 January, 2016, at Hotel Paragon, Johor Bahru.

Four engineers have been appointed district representatives in the Jawatankuasa Tindakan Wabak Denggi Daerah of Johor. They are Ir. John Cheah (Johor Bahru), Ir. Tay Tuck Puang (Batu Pahat), Ir. Lam Ah Hang (Segamat) and Mr. Lim Chin Chuan (Kulai).

Ir. Thayala also successfully organised and led a Gotong-Royong – Search & Destroy event at Majidee Park, Johor, in September 2015. According to him, there is now "zero incidence" at the previous hotspot areas.

A past chairman of southern branch, Ir. Joseph Puen, also successfully organised a Gotong-Royong & Dengue Campaign at Orkid Flat, Desa Cemerlang, Johor Bahru in April 2016. At the same time, he donated two fogging machines to Combi Desa Cemerlang.

Ir. John Cheah spoke on "Methods of Vector Control On Dengue Eradication" during a session on Dengue Control & Its Situation at the Rotary International District 3310 Conference in Chiang Mai, Thailand in May 2016.

The engineers will continue to play active roles to combat and eradicate dengue. ■



Johor Chief Minister YAB Dato' Mohamed Khaled Bin Nordin officiating at the opening ceremony of The 2nd International Conference at Universiti Teknologi Malaysia, Johor Bahru.



Ir. John Cheah receiving a certificate of appreciation from the Johor Chief Minister in January 2016.



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Mendenhall – A Shrinking Glacier



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.



We are pleased to announce that a travel coffee-table book, published by IEM, is now available for purchase at the Secretariat:

"A Globe-Trotting Engineer's Footprints"
by Ir. Chin Mee Poon

The selling price is as follows:

Members : RM50
Non-Members : RM55

All proceeds will go to the IEM Building Fund.

For more information, kindly contact IEM Secretariat via telephone 03-7968 4001 and email address at : sec@iem.org.my

Thank you.

In Juneau, the capital of Alaska, my wife and I visited the world-famous Mendenhall Glacier 19km away, one of the most easily accessible glaciers in the world.

A 45-minute bus ride brought us from downtown Juneau to the junction between Mendenhall Loop Road and Glacier Spur Road, where we alighted and walked 2km along Glacier Spur Road that cuts through Tongass National Forest to the glacier car-park. The Mendenhall Glacier Recreation Area is part of the Tongass National Forest. We took an hour to cover the 2km walk because I spent much time photographing the mushrooms we saw on the way.

The Glacier Visitors Centre provides a superb view of the glacier and the lake as well as Nugget Falls nearby. Seven hiking trails radiate from the Centre. Because of our slow pace, we only had time to walk two of them – the 800m round-trip Photo Point Trail and the 3.2km round-trip Nugget Falls Trail. Both are very easy trails.

The Photo Point Trail led to a viewing platform for an unobstructed view of the magnificent glacier and waterfalls across the lake. The longer trail took us through some interesting landscape and vegetation before we ended up in front of the waterfalls and the glacier. Other than more mushrooms to add to my photograph collection, we also saw a porcupine busy feeding on a high branch of a Sitka spruce tree.

The 22km Mendenhall Glacier is one of the glaciers originating from the Juneau Icefield. The lake in front of the glacier was first formed in 1958. It has since grown to its present size as the glacier keeps retreating.

A glacier will retreat if the amount of snowfall in winter is less than the amount of snow and ice melted away in summer. It will advance if the snowfall is more than the meltwater. The difference between the snowfall and the meltwater is known as mass balance. A glacier



with a negative mass balance retreats and a glacier with positive mass balance advances. The negative mass balance of glaciers is a strong indicator of the effects of global warming.

Mendenhall Glacier has retreated 2.8km since 1958, and it will continue to retreat due to global warming, just like Franz Josef Glacier in New Zealand and many other glaciers in the world. Some of these retreating glaciers may eventually reach a new equilibrium and stop retreating, but others will continue to retreat until they disappear altogether. The loss is irreversible. ■

TEMUDUGA PROFESIONAL

Tarikh: 19 Julai 2016

Kepada Semua Ahli,

SENARAI CALON-CALON YANG LAYAK MENDUDUKI TEMUDUGA PROFESIONAL TAHUN 2016

Berikut adalah senarai calon yang layak untuk menduduki Temuduga Profesional bagi tahun 2016.

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 2016.

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. Yam Teong Sian

Setiausaha Kehormat, IEM,

PERMOHONAN BARU	
Nama	Kelayakan
KEJURUTERAAN AWAM	
MOHD SUHAIRI BIN RAMLI	BE HONS (UITM) (CIVIL, 2006)
KEJURUTERAAN BANGUNAN	
MOHAMMED IZRAI BIN ABD RAZAK	BE HONS (UITM) (CONSTRUCTION, 2015)
KEJURUTERAAN KIMIA	
NGOH GEK CHENG	BE (BELFAST) (CHEMICAL & FOOD, 1990) PhD (BELFAST) (1995)
ROZITA BINTI YUSOFF	BE (NOVA SCOTIA) (CHEMICAL, 1992) MSc (MANCHESTER) (1996) PhD (UMIST) (2004)
KEJURUTERAAN ELEKTRIKAL	
AHMAD JAZIM BIN ZAKARIA	BE HONS (USM) (ELECTRICAL & ELECTRONIC, 1999)
AZRA DAHIYAH BINTI ALIAS	BE HONS (UTP) (ELECTRICAL & ELECTRONICS, 2009)
GANESAN A/L KADIRGAMA	BSc (WESTERN MICHIGAN) (ELECTRICAL, 1999)
MOHAMAD FARHAN BIN YUSOF	BE HONS (UTM) (ELECTRICAL, 2009)
MOHD FIRDAUS BIN MOHD FAUZI	BE HONS (UITM) (ELECTRICAL, 2009)
MOHD YA'ACOB BIN SIRON	BE HONS (UTM) (ELECTRICAL-INSTRUMENTATION & CONTROL, 2001)
ZEENATHUL BASHEERA BINTI MOHAMED ALI	BE HONS (USM) (ELECTRICAL & ELECTRONIC, 2001) ME (UTM) (ELECTRICAL-POWER, 2011)
KEJURUTERAAN ELEKTRONIK	
AIDA RAZANA BINTI OMAR	BE HONS (UITM) (ELECTRICAL, 2000) MSc (UITM) (TELECOMMUNICATION & INFORMATION, 2010)
SUADI BIN WAHAB	BE HONS (USM) (ELECTRICAL & ELECTRONIC, 2000)
KEJURUTERAAN MEKANIKAL	
LEW HENG MUN	BSc (ALABAMA) (MECHANICAL, 2000)
MUHD NOR RIDHWAN BIN ZAINAL ABIDIN	BE HONS (UTM) (MECHANICAL, 2008)
KEJURUTERAAN SUMBER MINERAL	
TANG @ TAN HAI HONG	BE HONS (USM) (MINERAL RESOURCES, 1999)

PERPINDAHAN AHLI		
No. Ahli	Nama	Kelayakan
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35604	AZEEZUL HAKIM BIN AB KARIM	BE HONS (MALAYA) (CIVIL, 2003)
55819	LEE LAI HAA	BE HONS (UKM) (CIVIL, 2007)
20013	LIM CHIN CHIAT	BE HONS (UKM) (CIVIL & STRUCTURAL, 1998)
33522	NORLIZA BINTI MOHAMAD RASOL	BE HONS (UITM) (CIVIL, 2009)
56557	RAZALI BIN KASSIM	BE HONS (UTM) (CIVIL, 2007)
54981	SITI AMINAH BINTI ABBAS	BE HONS (UTP) (CIVIL, 2009)
26515	SYAIFUL ISKANDAR BIN YAHAYA	BE HONS (UITM) (CIVIL, 2003)

24576	TAN POH SOON	BE HONS (USM) (CIVIL, 2004)
23752	TANG SOONG HWANG	BE HONS (UTM) (CIVIL, 2005)
24576	TAN POH SOON	BE HONS (USM) (CIVIL, 2004)
23752	TANG SOONG HWANG	BE HONS (UTM) (CIVIL, 2005)

KEJURUTERAAN AUTOMOTIF		
81306	MOHD YUSOP BIN MOHAMAD	BE HONS (IUM) (MECHANICAL-AUTOMOTIVE, 2007)

KEJURUTERAAN PEMBINAAN		
51278	ALBERT VIVIAN A/L THOMAS PATRICK	BE HONS (COVENTRY) (CIVIL, 1998) ME (UTM) (CIVIL, 2011)

KEJURUTERAAN ELEKTRIKAL		
53709	AMIERUL HISYAM BIN MOHAMED	BE HONS (UTM) (ELECTRICAL-INSTRUMENTATION & CONTROL, 2008)
49252	KOO KUAN YONG	BE HONS (USM) (ELECTRICAL, 2010)
38329	MD. HAJUPERI BIN MD. ALI	BE HONS (USM) (ELECTRICAL, 2006)
33923	MOHD SHAFIEE BIN ALMUNIR	BE HONS (UITM) (ELECTRICAL, 2007) ME (MALAYA) (POWER SYSTEM, 2014)
56486	MOHD ZAIDY BIN MAT RAJALI	BE HONS (UNITEN) (ELECTRICAL POWER, 2007)
58697	MUHAMMAD ZAIDI BIN MAHMOOD	BE HONS (UTM) (ELECTRICAL, 2012)
48031	TANG JUN HUAT	BE HONS (UTAR) (ELECTRICAL & ELECTRONIC, 2012)
58012	WONG HOWE NGIING	BE/ME HONS (LEEDS) (ELECTRONIC & ELECTRICAL, 2011)

KEJURUTERAAN ELEKTRONIK		
27568	MOHD FARED BIN ABDUL KHIR	BE (YAMAGATA) (ELECTRICAL & INFORMATION, 1996)

KEJURUTERAAN KIMIA		
62040	AZLIN SUHAIDA AZMI	BSc (WIDENER) (CHEMICAL, 1998)
42242	LOO KHENG HOOI	BE HONS (UTAR) (CHEMICAL, 2012)
61115	SARINA BT SULAIMAN	BE HONS (UPM) (CHEMICAL, 2004)

KEJURUTERAAN MEKANIKAL		
70465	FRANCIS VINCENT ARIFFIN JNR	BE HONS (UTM) (MECHANICAL, 2001)
61154	KHOO ENG SHYUAN	BE HONS (UniMAP) (MECHANICAL, 2012)
29105	MHD FAREED FAHMY MHD YUNIN	BE HONS (UTM) (MECHANICAL-MANUFACTURING, 2006)
40908	MOHAMAD KAMARUL BIN SHAMSUDDIN	BE HONS (UMP) (MECHANICAL-AUTOMOTIVE, 2010)
30327	MOHAMAD SAIFUL BIN ABDUL RANI	BE HONS (UITM) (MECHANICAL, 2008)
50126	MOHD ISRAQ HAFRIZ B KHAMIS	BE HONS (UPM) (MECHANICAL, 2009)
81850	ONG TENG CHUAN	BSc (NATIONAL TAIWAN) (MECHANICAL, 2005)
59178	YUEN TIAN YI	ME HONS (IMPERIAL COLLEGE LONDON) (MECHANICAL, 2012)
37670	LEOW CHEE HUAN	BE HONS (UTAR) (MECHANICAL, 2011)

KEJURUTERAAN PEMBUATAN		
17338	MOK SOON HONG	BE HONS (CNA-COVENTRY POLYTECHNIC) (MECHANICAL, 1991)

PERMOHONAN BARU/PEMINDAHAN MENJADI AHLI KORPORAT		
KEJURUTERAAN ELEKTRIKAL		
19207	AZLAN BIN MD. SHARIPIN	BE HONS (UMIST-MANCHESTER, ELECTRICAL & ELECTRONIC, 1997)

IEM DIARY OF EVENTS

Title: Conference of the ASEAN Federation of Engineering Organisations (CAFEO 34)

21 - 24 November 2016

Venue : Citystate Asturias Hotel, Puerto Princesa, Palawan, Philippines

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

CALL FOR NOMINATIONS OF IEM AWARDS

IEM ENGINEERING HALL OF FAME AWARD 2017

The Sub-Committee of Engineering Hall of Fame under the auspices of the Standing Committee on Professional Practice is proud to invite nominations for the IEM Engineering Hall of Fame Award 2017.

It is timely and expedient to induct and to record the accomplishments of engineers in the country who have or had demonstrated particularly outstanding professional achievements and provided excellent services to the Institution, the engineering industry and the Nation.

The IEM Engineering Hall of Fame is established with the aim to confer recognition and to celebrate the accomplishments of members of the IEM:

- Who have demonstrated outstanding

professional achievements.

- Who have made significant contributions to the engineering profession, the Institution of Engineers, Malaysia (IEM) and the Nation.
- Who have rendered valuable service to the Community.

The Engineering Hall of Fame will serve as the focal point or showcase of outstanding Malaysian engineers, past and present, who had or have made great contributions to the engineering profession and to the quality of life in Malaysia. Engineers honoured in the Engineering Hall of Fame will also serve as a beacon and as role models for young engineers as well as create greater interest in engineering in general and awareness

of the contributions made by outstanding engineers in the country.

Nominations for the Award are open to Malaysian citizens who are or have been Corporate Members of the IEM.

The closing date for receipt of nominations for IEM Engineering Hall of Fame Award is **30 September 2016**.

Please submit nominations to:

Hon. Secretary
The Institution of Engineers, Malaysia
Bangunan Ingenieur, Lots 60&62
Jalan 52/4, Petaling Jaya, Selangor.

The nomination form can be downloaded from the IEM website at www.myiem.org.my

IEM AWARD FOR CONTRIBUTIONS TO THE ENGINEERING PROFESSION IN MALAYSIA 2017

To encourage an interest in engineering and to recognise important services or contributions to engineering in Malaysia, the IEM Award for Contribution to the Engineering Profession in Malaysia is to be presented to the person(s), who has:

- Contributed to the advancement of engineering in Malaysia, and/or
- Designed and constructed an original engineering device or system of merit and applicability to industry.

This Award is open to all Malaysian citizens and permanent residents.

NOMINATIONS

- Nominations will be invited annually. The closing date for receipt of nominations for each year is 30 September.
- Nominations shall be made through a member of the Institution. Each member is restricted to one nomination per year.
- Each nomination shall be accompanied by a brief write up of the services rendered or contributions made or system designed and/or constructed together with relevant photographs and other documents.

AWARD

- The Award is to be made by the Council upon recommendation by the Awards Committee.
- The Award shall comprise a metal plaque, a scroll and a sum of RM1,000.

The closing date for nominations is **30 September 2016**.

Please submit nominations to:

Hon. Secretary
The Institution of Engineers, Malaysia
Bangunan Ingenieur, Lots 60&62
Jalan 52/4, Petaling Jaya, Selangor.

The nomination form can be downloaded from the IEM website at www.myiem.org.my

IEM OUTSTANDING ENGINEERING ACHIEVEMENT AWARD 2017

The IEM Outstanding Engineering Achievement Award is created to confer recognition to an organisation or body for outstanding engineering achievements within Malaysia. The award will be given to an organisation or body responsible for an outstanding engineering project in the country.

The basis for the award shall be an engineering achievement that demonstrates outstanding engineering skills which has made a significant contribution to the profession and to the quality of life in Malaysia. In making the selection, the following criteria will be given special consideration:

1. Contribution to the well-being of people and communities,
2. Resourcefulness in planning,
3. Creativity in the solution of design problems,
4. Pioneering use of materials and methods,
5. Innovations in planning, design and construction,
6. Unusual aspects and aesthetic values.

Engineering achievements which include, inter alia, the following can be submitted for

consideration:

- Bridges, Tunnels, Waterways Structures, Roads
- Telecommunications of national/international character, Power Transmission and Transportation
- Dams and Power Stations
- Ports and Harbours
- Building and Structures
- Airports
- Water Supply, Waste Disposal Projects
- Military projects such as bases, launching units, harbour facilities
- Drainage, Irrigation and Flood Control Projects
- Local design and manufacture of high technology products
- Energy, Heat, Mass Transfer
- Outstanding work in engineering research and development
- Chemical processing of indigenous raw resources such as rubber, palm oil and various other local plants
- Innovative use of local engineering materials
- Outstanding contribution in engineering education
- Original discovery of useful engineering theory

Nominations are invited from all members of the Institution. Each nomination submitted should contain a brief summary/write-up of the project in approximately 1,000 to 2,000 words together with full relevant reports on the project and three copies of supporting documentation including photographs. A project or component part thereof which has received an earlier award, from IEM does not qualify for nomination.

- The award in the form of a metal plaque, naming the achievement shall be given to the organisation or body responsible for the project for permanent display.
- The award shall be presented with due ceremony at an appropriate function of the IEM.

The closing date for nominations is **30 September 2016**.

Please submit nominations to:

Hon. Secretary
The Institution of Engineers, Malaysia
Bangunan Ingenieur, Lots 60&62
Jalan 52/4, Petaling Jaya, Selangor.

The nomination form can be downloaded from the IEM website at www.myiem.org.my

CALL FOR NOMINATIONS OF IEM AWARDS

IEM YOUNG ENGINEER AWARD 2017

The objective of the Award is to encourage interest in engineering and to recognise potential among young engineers in Malaysia. The Award will be presented to the person who has shown outstanding ability and leadership qualities, **either**

- i. in the design and/or construction of an engineering device or system of merit; **or**
- ii. in the research and development or teaching of engineering.

In any one year, the Award may be made in either one or both of the categories mentioned above. If the Award is to be made in only one of the two category may

be made in the year. The Award is open to candidate who are:

- i. Registered member with the Board of Engineers, Malaysia and under 35 years of age
- ii. Malaysian citizens or permanent residents of Malaysia
- iii. Graduate or Corporate Members of IEM.

The Proposer may or may not be a member of IEM. However, each nomination shall be supported by a brief recommendation from two Referees who are Corporate members of IEM. If the Proposer himself is a Corporate member of IEM (or higher),

then he may also act as one of the two required Referees.

The Award will comprise a cash prize of RM500.00, a scroll and plaque, to be presented with due ceremony to each recipient of the Award.

The closing date for nominations is **30 September 2016.**

Please submit nominations to:

Hon. Secretary
The Institution of Engineers, Malaysia
Bangunan Ingenieur, Lots 60&62
Jalan 52/4, Petaling Jaya, Selangor.

The nomination form can be downloaded from the IEM website at www.myiem.org.my

IEM WOMAN ENGINEER AWARD 2017

The primary objective of the Award is to recognise the contributions by women engineers. This Award may also incidentally encourage interest in engineering among women and encourage them to strive towards greater excellence. The Award will be presented to the woman engineer who has shown outstanding ability and leadership qualities, or has been a pioneer in any more of the following areas:

- In the design and/or construction of an engineering device or system, structural system, planned development, environmental improvements or,
- In the research and development of engineering device, systems, processes and/or materials, publication of paper or,
- In the teaching of engineering or,
- In the management of engineering projects,
- Entrepreneurship in the commercial sector.

In making the selection, the following criteria will be given special consideration:

- Contribution to the well-being of people and communities
- Resourcefulness in planning and in the solution of design problems
- Pioneering in use of materials and methods
- Innovations in planning, design and construction
- Unusual aspects and aesthetic values

The Award is opened to candidates who are:

- Registered members of the Board of Engineers, Malaysia,
- Malaysian citizens or permanent residents of Malaysia,
- Graduate or Corporate Members of The Institution of Engineers, Malaysia.

The Proposer may or not be a member of IEM or BEM, or an engineer. However, each nomination shall be supported by a brief recommendation from two Referees

who are Graduate or Corporate member of IEM. If the Proposer is herself either a Corporate or Graduate member of IEM (or higher), then she may also act as one of the two required Referees.

The Award shall comprise a cash prize of RM800.00, a scroll and and plaque, to be presented with due ceremony to each recipient of the Award.

The closing date for nominations is **30 September 2016.**

Please submit nomination to:

Hon. Secretary
The Institution of Engineers, Malaysia
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Jalan 52/4, Petaling Jaya, Selangor.

The nomination form can be downloaded from the IEM website at www.myiem.org.my

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(ANOTHER RM 2,973,170.14 IS NEEDED)

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(The donation list to the Wisma IEM Building Fund is published on page 47)

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78499	FADWA SAMEEHA BINTI ISMAIL	4TH YEAR (UMP) (CHEMICAL)	78619	KHADIJAH BINTI MOHAMAD ARIS	4TH YEAR (UITM) (CHEMICAL)		LOW MENG LAI	3RD YEAR (UTAR) (CHEMICAL)
78564	FARAH SYAHIRAH BINTI YAHYA	4TH YEAR (UMP) (CHEMICAL)		KHAIRUNNISA BINTI MOHAMAD	4TH YEAR (UMP) (CHEMICAL)		LOW SER CHYEN	2ND YEAR (UTAR) (CHEMICAL)
78602	FARAHIN BINTI M MIZI	1ST YEAR (UMP) (CHEMICAL)		LAI YUEN YEE	1ST YEAR (UTAR) (CHEMICAL)			
78727	FATEN AZWANI BINTI ABD. AZIZ	1ST YEAR (UMP) (CHEMICAL)		LARENNA JEFFRESON	4TH YEAR (UITM) (CHEMICAL)			
78505	FATIMAH AZ ZAHARAH BINTI MOHAMAD	4TH YEAR (UMP) (CHEMICAL)	78604	LEE CHEA HUI	3RD YEAR (UMP) (CHEMICAL)			
	FATIMAH MAHIRAH BINTI ABU HASSAN ASHAARI	4TH YEAR (UITM) (CHEMICAL)						
	FATIN LIYANA BT MAMAT @ ARIFFIN	4TH YEAR (UITM) (CHEMICAL)						
	FOO JIAN QI	1ST YEAR (UTAR) (CHEMICAL)						
78696	FOO KATHLEEN	1ST YEAR (UMP) (CHEMICAL)						
	GAN HONG KEAT	3RD YEAR (UTAR) (CHEMICAL)						
78565	GAVSALYA A/P THILLAI VILLALLAN	1ST YEAR (UMP) (CHEMICAL)						
	GOH EU-NICE	2ND YEAR (UTAR) (CHEMICAL)						
78613	GOO BOON CHIN	3RD YEAR (UMP) (CHEMICAL)						
78567	GURVINDER SINGH A/L SUKHCHARAN SINGH	3RD YEAR (UMP) (CHEMICAL)						
	HAFIFAH AMIRAH BT AKHAWAN	4TH YEAR (UITM) (CHEMICAL)						
	HAH HUAI HUI	1ST YEAR (UTAR) (CHEMICAL)						
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	HANIRA BINTI RAMLI	4TH YEAR (UITM) (CHEMICAL)						
78709	HANIS NAZURA BINTI MOHD TAMIZI	1ST YEAR (UMP) (CHEMICAL)						
78570	HARIDASS A/L MH. GANASAN	3RD YEAR (UMP) (CHEMICAL)						
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78632	HEAMAMALINI A/P PARATHEHASAN	2ND YEAR (UMP) (CHEMICAL)						
78655	HOO POH YING	1ST YEAR (UMP) (CHEMICAL)						
	IRRA NABILAH BINTI MD ISA	4TH YEAR (UITM) (CHEMICAL)						
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78584	JAGATHEES KUMAR A/L SANNA MOURTHY	2ND YEAR (UMP) (CHEMICAL)						
78638	JASMIN A/P TRAMARAJH	3RD YEAR (UMP) (CHEMICAL)						
78698	JASMIN BINTI ILYAS SUSAI DEVAS	1ST YEAR (UMP) (CHEMICAL)						

**Pengumuman
yang ke-94**

SENARAI PENDERMA KEPADA WISMA DANA BANGUNAN IEM

Institusi mengucapkan terima kasih kepada semua yang telah memberi sumbangan kepada tabung Bangunan Wisma IEM. Ahli-ahli IEM dan pemilih yang ingin memberikan sumbangan boleh berbuat demikian dengan memuat turun borang di laman web IEM <http://www.iem.org.my> atau menghubungi sekretariat di +603-7968 4001/5518 untuk maklumat lanjut. Senarai penyumbang untuk bulan Januari 2016 adalah seperti jadual di sebelah:

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Note: Remaining list would be published in the September 2016 issue. For the list of approved "ADMISSION TO THE GRADE OF STUDENT", please refer to IEM web portal at <http://www.myiem.org.my>.

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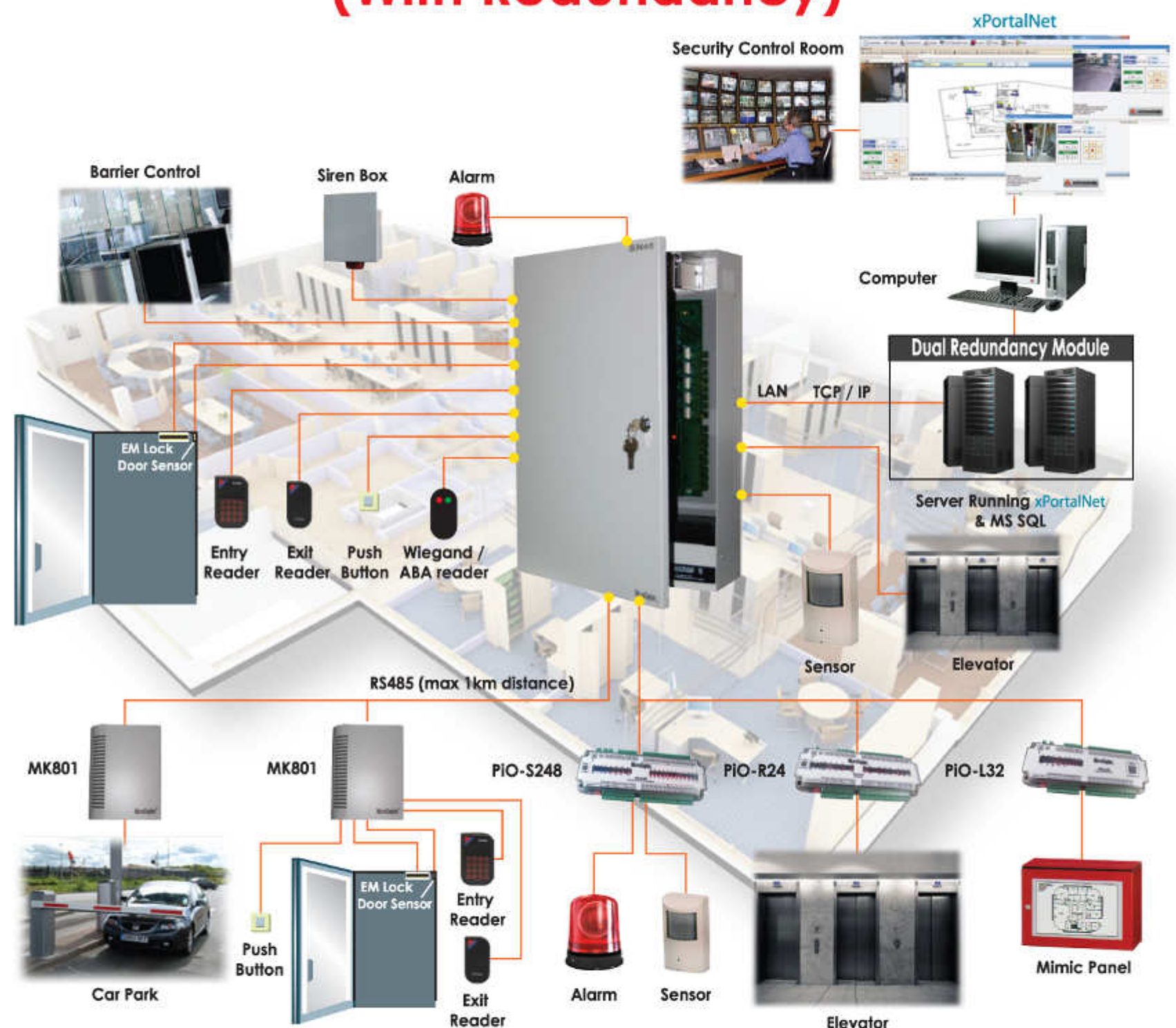
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