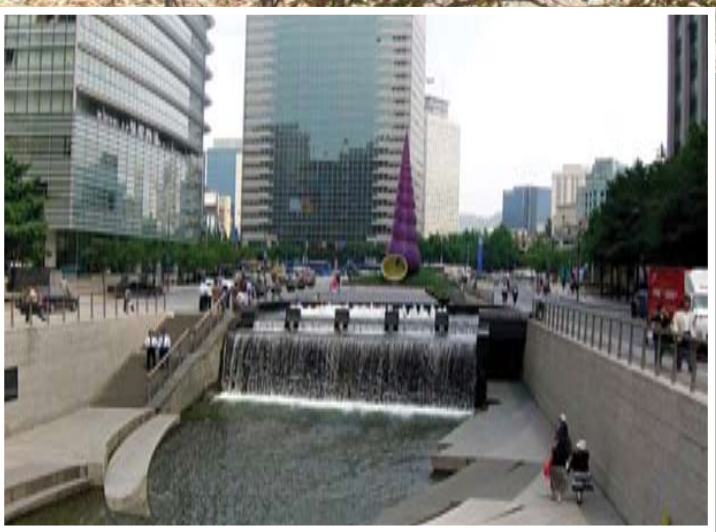
LEMBAGA JURUTERA MALAYSIA
BOARD OF ENGINEERS MALAYSIA

The Ingenieur

KDN PP11720/01/2010(023647) ISSN 0128-4347 VOL.42 JUNE-AUG 2009 RM10.00

Public Amenities



Volume 42 June - August 2009
The Ingenieur

contents

INVITATION TO SERVE IN INVESTIGATING COMMITTEE

The Board of Engineers Malaysia would like to invite all Professional Engineers of **not less than ten years** standing as Professional Engineers to serve as members in Investigating Committee.

The Committee's prime duty is to investigate into complaints involving professionalism and breach of ethics of professional engineers.

If you are interested in serving this Committee, kindly fill in the form below and return to the Secretariat. Training would be given to potential members.

To:

Chairman
Professional Practice Committee
Board of Engineers Malaysia
17th Floor JKR HQ Building
Jln. Sultan Salahuddin,
50580 Kuala Lumpur.
Tel. No: 03-26912090
Fax. No: 03-26925017
e-mail: ppc@bem.org.my

I am interested to serve as a member of Investigation Committee.

Name: _____
PE Registration: _____
Discipline: _____
Date Registration: _____
Tel. No.: _____
Fax. No.: _____
E-mail: _____
_____
Office Address: _____
_____
_____
Home Address: _____
_____
_____
Specialization: _____

_____
Signature

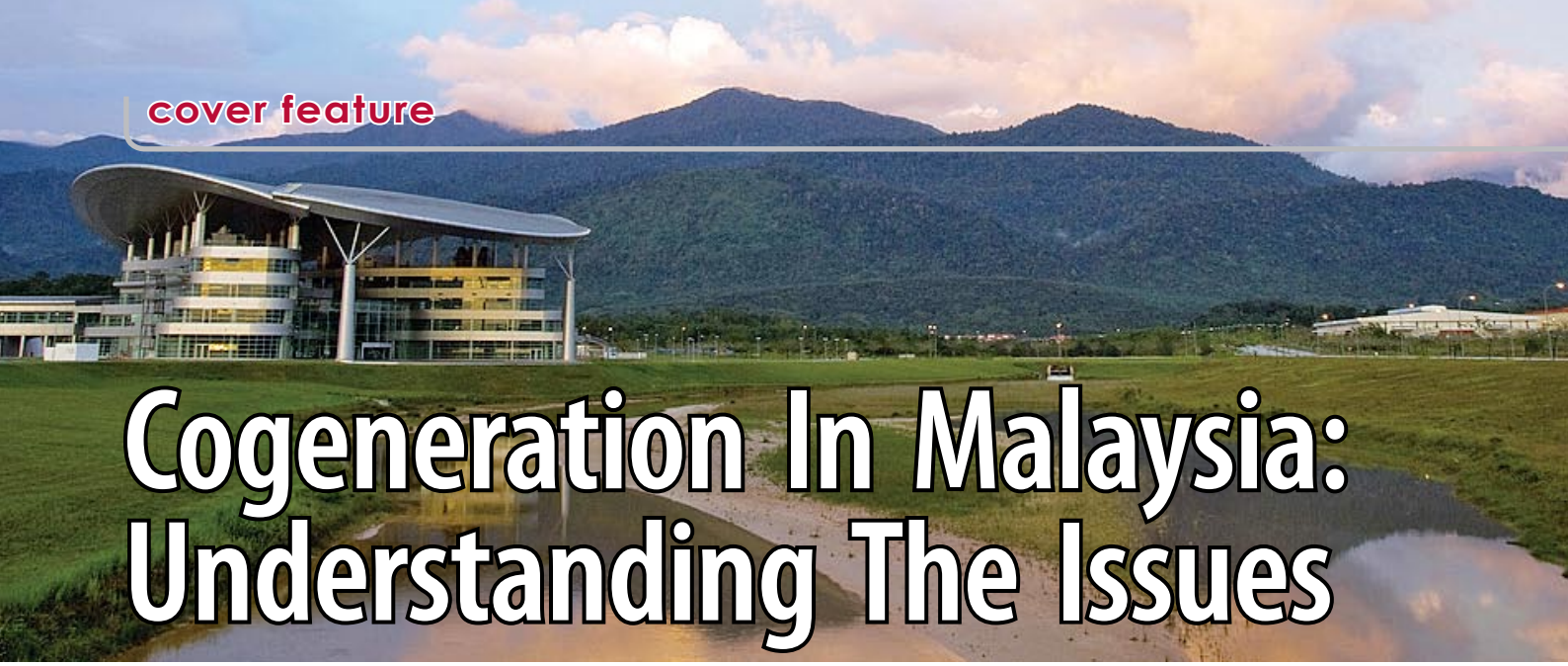
Publication Calendar

Sept 2009: SAFETY & HEALTH
Dec 2009: SUSTAINABLE DEVELOPMENT
March 2010: FACILITY ASSET MANAGEMENT
June 2010: WATER
Sept 2010: HILL-SLOPE DEVELOPMENT
Dec 2009: TRANSPORTATION & SAFETY

announcement

Event Calendar

Event	**Design Course & Practical Workshop: Design of The Reinforced and Prestressed Concrete Structures to Eurocodes**
Date	July 30-31, 2009
Venue	Penang
Organiser	Housing Research Centre, Universiti Putra Malaysia; mSET & CREAM Tel: 03-89467849 / 7856; Fax: 03-89467869; Email: *illiana@eng.upm.edu.my*
Event	**Design Workshop: Design & Construction of Precast Concrete Structures**
Date	August 6-7, 2009
Venue	Kuala Lumpur
Organiser	Housing Research Centre, Universiti Putra Malaysia & CREAM Tel: 03-89467849 / 03-26170362; Fax: 03-89467869 / 03-40456828; Email: *illiana@eng.upm.edu.my, hazim@cidb.gov.my*
Event	**7th Asia Pacific Structural Engineering and Construction Conference (APSEC) & 2nd European Asian Civil Engineering Forum (EACEF) 2009**
Date	August 4-6, 2009
Venue	Awana Porto Malai, Langkawi
Organiser	Faculty of Civil Engineering, University Technology Malaysia & Universitas Pelita Harapan Fax: ++6(07)-5566157; Email: *apsec2009@utm.my;* Website: *http://www.apsec2009.com*



Cogeneration In Malaysia: Understanding The Issues

By Ir. Ali Askar Sher Mohamad

As a signatory to the Montreal and Kyoto Protocols, Malaysia has been promoting renewable energy as the fifth fuel while encouraging greater energy efficiency. This has contributed to the increasing number of co-generation facilities as well as renewable energy (RE) plants operating in parallel with TNB or the utility distribution network, resulting in the phenomenon known as embedded or distributed generation. Traditionally, electrical power has been generated at large power stations away from the load center. Embedded generation is characterised by the following:

- Not planned by the utility but proposed by independent developer or large power consumer
- Does not involve central dispatch
- Generating capacity quite small, normally between 50-100 MW
- Connected to the nearest local distribution network, or sometimes the transmission network, if operating at transmission voltage.

There are some who predict that embedded generation will be the way of the future due to big savings in transmission costs and reduced emissions. To avoid confusion, it is best to understand some common terms in the industry in Malaysia.

Renewable Energy (RE)

Renewable energy sources like hydro, solar, biomass and wind are utilised to generate electric power. Installations which generate with RE sources for the sole purpose of selling the electric power to the utility come under REPPA (Renewable Energy Power Purchase Agreement) where the selling price is 17 sen per unit for hydro and 21 sen per unit for non-hydro sources. License for RE Independent Power Producer is issued by the Ministry for Energy, Green Technology and Water

Cogenerators

Industrial or commercial installations which generate electric power and consume all or part of this power are defined as cogenerators, even though they may be using a renewable energy fuel like biomass, or a fossil fuel such as gas or coal. They are not entitled to sell their excess power under REPPA but need to negotiate a Power Purchase Agreement with the utility on an individual basis.

Basically cogeneration is defined as simultaneous production of two or more forms of usable energy from a single energy source. More popularly known as Combined Heat and Power (CHP), it refers to the sequential generation of thermal and electrical energy from the same amount of fuel input within a manufacturing process. Energy efficiency is greatly increased using this mode of generation, from 35% to as high as 80%.

Figure 1 shows that in the conventional generation system, 100% input of fuel energy will produce around 35% usable electrical energy with 61% heat waste. On the other hand, a cogeneration system can produce 75% usable energy, both electrical as well as thermal, with the same amount of energy input. Therefore the cogeneration mode of operation that generates both electrical power and thermal energy increases plant efficiency.

There are two types of cycles in cogeneration, the topping cycle and the bottoming cycle.

- **Topping Cycle**

In this cycle, fuel is burnt to produce electrical energy. The fuel may be gas, coal, biomass, etc. The waste heat is supplied to an

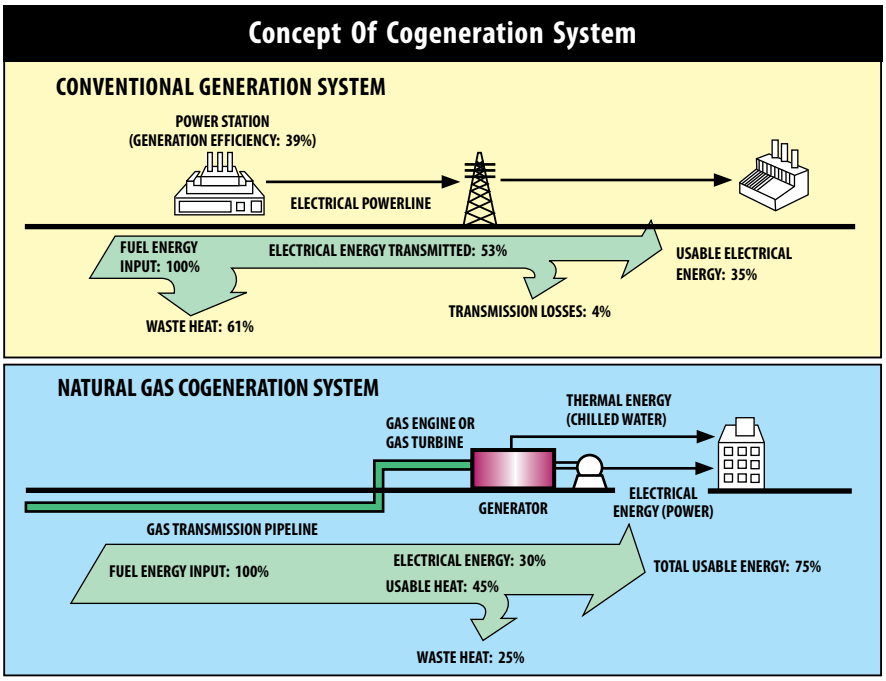


Figure 1

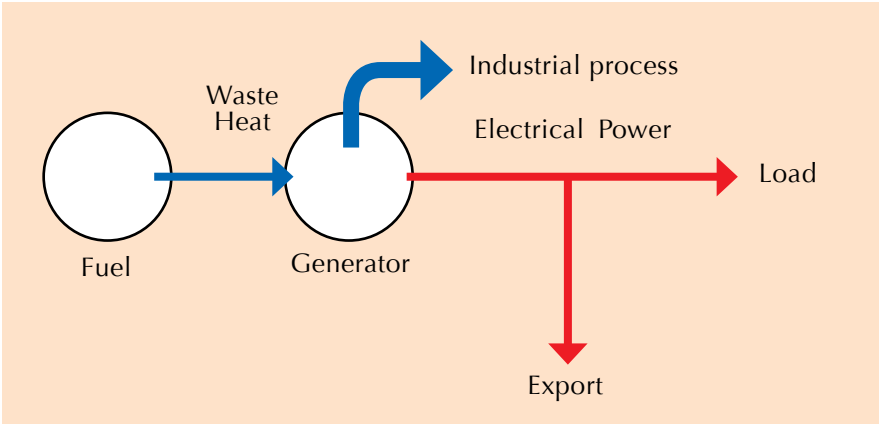


Figure 2

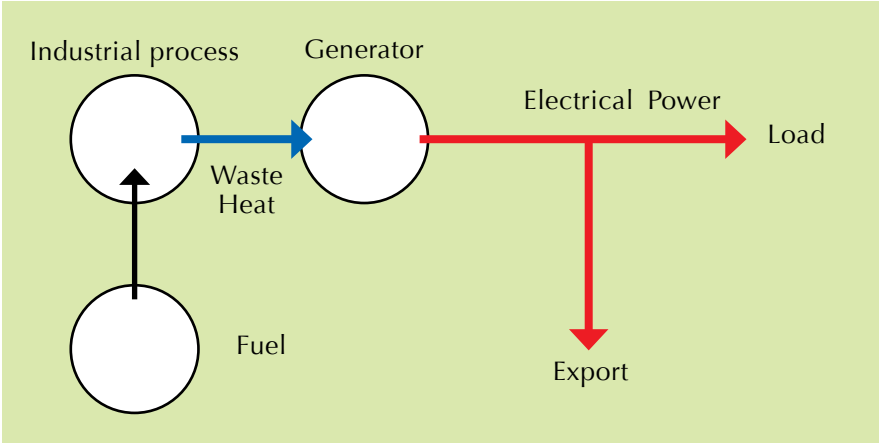


Figure 3

industrial process in the plant. The capacity of the Topping cycle plant is matched to the electrical load or demand. *Figure 2* shows the flow in a Topping cycle.

• Bottoming Cycle

In this cycle, the fuel is primarily burnt for a useful industrial heating process. The waste heat from the industrial process is then used to generate electrical power. Capacity of the plant is matched to the thermal load. The flow in a bottoming cycle is shown in *Figure 3*.

The different types of cogeneration plants common in Malaysia are shown in *Figure 4*. The fully integrated cogeneration plant which produces electricity, heat and chilled water is sometimes referred to as *Trigeneration*.

Typical use of cogeneration in Malaysia is shown in *Table 1*. Due to the tropical climate, District Cooling is the most popular, especially in terms of installed capacity.

Cogeneration issues

The Government encourages cogeneration and the Energy Commission has issued not less than 40 licenses for installations in Peninsular and East Malaysia, with an installed capacity of about 1,300 MW. Slightly more than half of these are private licenses, i.e. they generate only for self consumption, while the rest have a public license, i.e. they can sell their excess to the utility. The approved capacity for an installation ranges from a few hundred KW to more than 100 MW.

Whether public or private, in Peninsular Malaysia if the cogen facility wants to connect to the TNB network, the utility requires

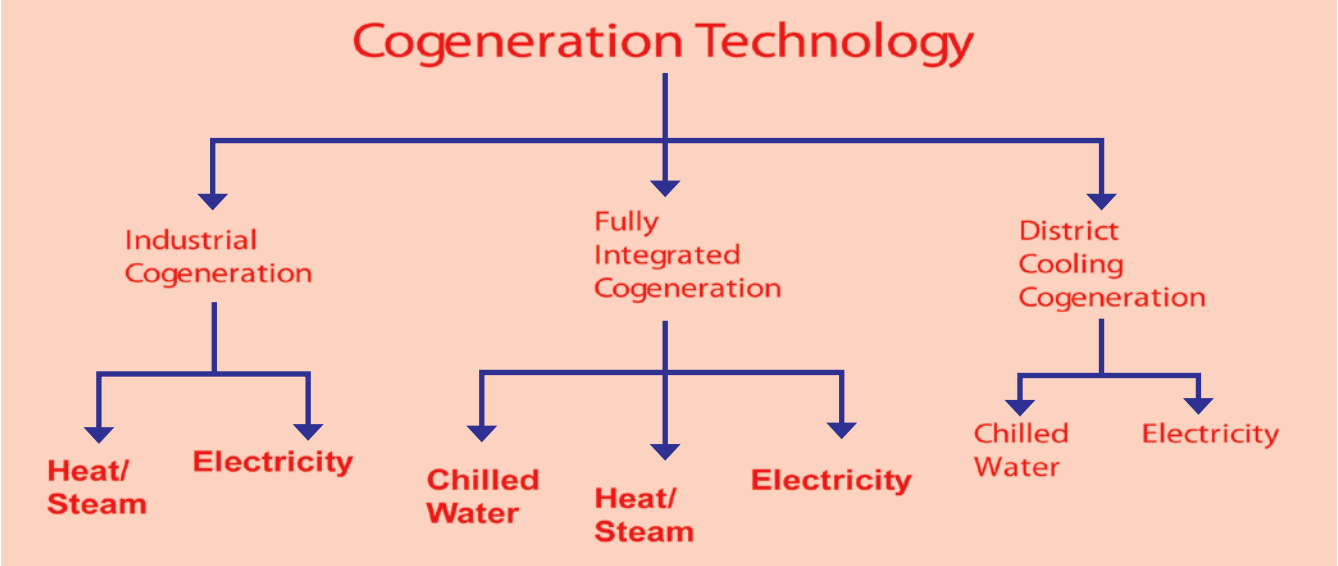


Figure 4

Table 1

Type of Cogen	Industry	Examples
Industrial Cogen	Pulp & Paper, Cement, Steel, Glass, etc	Perwaja Steel, Shell Refining, Titan Petrochemical
Fully Integrated Cogen	Large industrial complexes requiring heating, cooling and electricity	Petronas CUF, Proton City
District Cooling Cogen	Large commercial complex or high rise office buildings	KLIA, KLCC, KL Sentral, Tractors Malaysia

it to submit detailed data as laid out in TNB Electricity Supply Application Handbook (ESAH). Some of the data required is as below:

- Terminal voltage
- Rated KVA and KW
- Maximum reactive power sent out and absorbed
- Type of generating unit – synchronous, asynchronous, etc

It needs this data to model the plant and carry out detailed engineering studies for planning purposes like determining the method of connection as well as the impact on its network. Even if the plant does not intend to export to TNB's system, the generator will need the utility supply for starting, and TNB needs to determine the impact of this starting period on its distribution or transmission system, depending on voltage level of connection.

Cogen Tariff

TNB has a special tariff for cogenerators which require TNB supply for top-up or standby. TNB's tariff book defines a cogenerator "as a generator who uses a single primary energy source to generate sequentially two different forms of useful energy for its own use at an efficiency rate of more than 70%." Definition of top-up and standby:

Top-up Supply – the additional supply required by a cogenerator who does not produce sufficient electricity for its own use.

Standby supply – the supply that TNB provides a Co-generator in the event that the Co-generator does not generate due to plant failure or planned shutdown for maintenance. The Co-generator has a choice of firm or non-firm supply. Non-firm supply means that TNB does not guarantee that supply can be given when the cogeneration system fails or is shutdown for maintenance.

The tariff is given in *Table 2*. It can be seen immediately that

Table 2

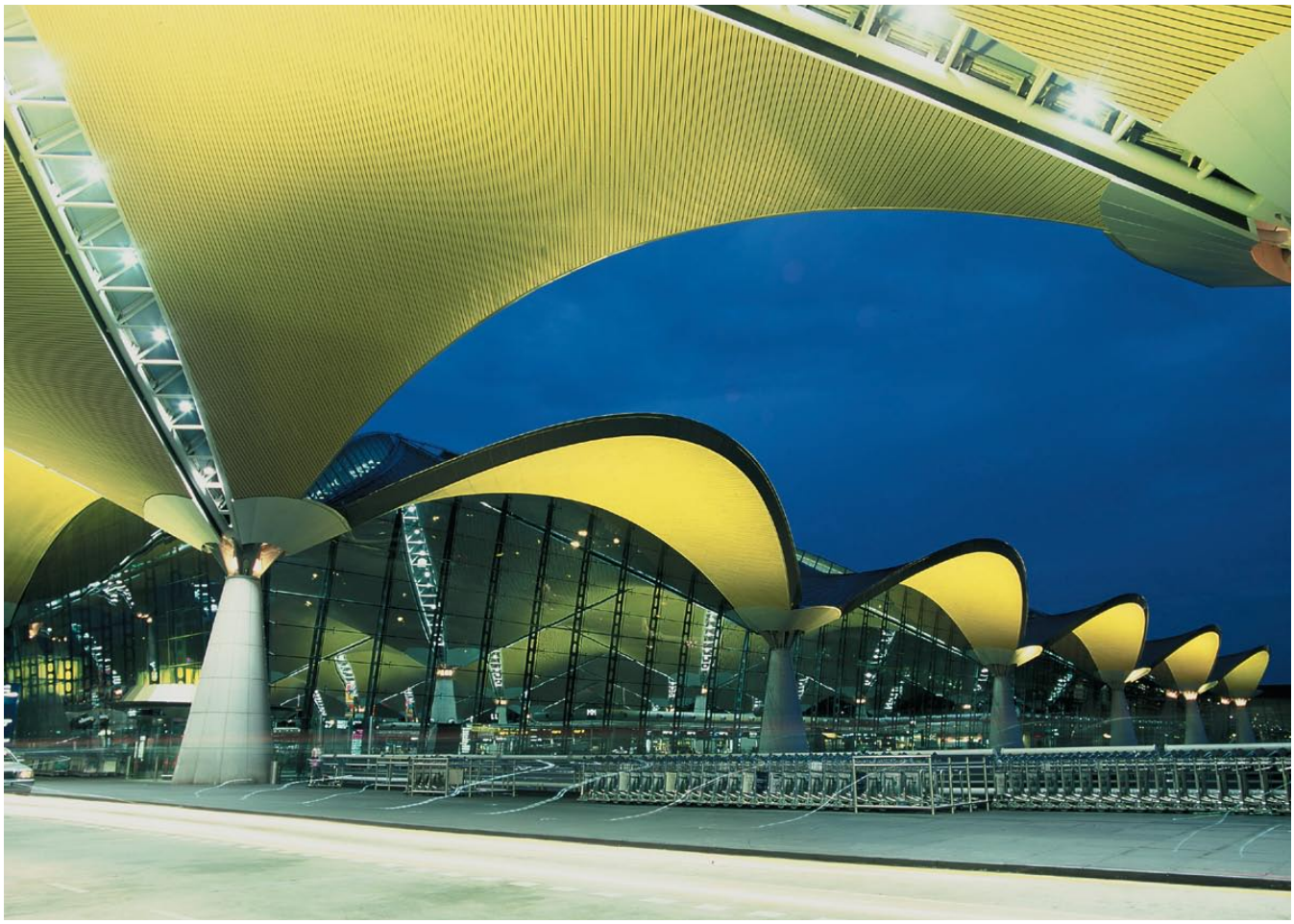
Tariff Category	Unit	Top-up	Standby	
			Firm	Non-firm
Tariff C1 - Medium Voltage General Commercial Tariff				
Maximum demand charge per month	RM/kW	23.93	25	10.4
For all kWh	sen/kWh	28.8		
Tariff C2 - Medium Voltage Peak/Off-Peak Commercial Tariff				
For each kilowatt of maximum demand per month during the peak period	RM/kW	35.6	25	11.8
For all kWh during the peak period	sen/kWh	28.8		
For all kWh during the off-peak period	sen/kWh	17.7		
Tariff E1 - Medium Voltage General Industrial Tariff				
Maximum demand charge per month	RM/kW	23.4	25	9.9
For all kWh	sen/kWh	26.6		
Tariff E2 – Medium Voltage Peak/Off-Peak Industrial Tariff				
For each kilowatt of maximum demand per month during the peak period	RM/kW	29.3	25	9.7
For all kWh during the peak period	sen/kWh	28.1		
For all kWh during the off-peak period	sen/kWh	17.3		
Tariff E3 – High Voltage Peak/Off-Peak Industrial Tariff				
For each kilowatt of maximum demand per month during the peak period	RM/kW	28.1	25	8.5
For all kWh during the peak period	sen/kWh	26.6		
For all kWh during the off-peak period	sen/kWh	16		
Tariff F1 – Medium Voltage General Mining Tariff				
Maximum demand charge per month	RM/kW	16.7	25	5.4
For all kWh	sen/kWh	24.7		
Tariff F2 – Medium Voltage Peak/Off-Peak Mining Tariff				
For each kilowatt of maximum demand per month during the peak period	RM/kW	23.5	25	7.5
For all kWh during the peak period	sen/kWh	24.7		
For all kWh during the off-peak period	sen/kWh	13.6		

there is basically no difference between the tariff for a cogen and a normal customer from the same tariff category. The only major difference is in the MD charges for non-firm standby supply, which is much lower.

Conclusion

While the Government encourages cogeneration to achieve better energy efficiency, there are major issues to be resolved before embedded generation can really take off.

- There is a need to balance the growth of Cogeneration and the National Grid so that the existence of one does not jeopardize the other.
- The country needs a stable, reliable and viable grid to provide electric power to the masses. With



KLIA, Sepang

the ever increasing reserve margin, we hardly need back-door IPPs in the guise of cogenerators.

- The ideal cogeneration site should have a relatively steady thermal and electrical energy demand pattern, with a higher demand for thermal energy, *and most importantly, the site should be inaccessible to the Grid.*
- It is essential to consider the effect of embedded generation on the existing system. Even if the cogen is not connected to the grid, its existence means that planned grid capacity for that area will not be be taken up, thus increasing the reserve margin. Grid capacity planning and cogen capacity planning should thus be synchronized. If the cogen is connected to the grid, the grid operator additionally has to deal with unreliable capacity and power quality issues of the cogen.
- Ideally, the Energy Commission should make it a requirement for any proposed cogeneration plant to get approval/comments from the grid operator to ensure synchronization of capacity planning.

It is widely known that there are many cogen plants operating on the quiet, without any license. Most of these plants are connected to the grid, especially at low voltage. They use the power generated for their internal consumption, without any export. The grid operator is therefore ignorant of its existence or powerless to act even if it knows. However, these plants have an effect on the grid, in terms of capacity planning as well as operations, as mentioned above. It is time for the country to have a clear policy on cogeneration which takes heed of the legitimate concerns of the grid operator while encouraging greater energy efficiency and ensuring comprehensive capacity planning. BEM

REFERENCES

TNB Electricity Supply Application Handbook, 2nd Edition.
TNB Tariff Book (revised 1 March 2009)

Sanitary Landfill: A Strategic Approach Towards Solid Waste Management

By Nadzri Yahaya, Ph.D
Director General, Department of National Solid Waste Management, Ministry of Housing and Local Government

The management of solid waste does not stop at the collection and transportation of the waste. It goes far beyond the generation of the waste. Under the Solid Waste and Public Cleansing Management Act 2007 (Act 672), "solid waste management services" means the separation, storage, collection, transportation, transfer, processing, recycling, treatment and disposal of controlled solid waste. "Disposal" means the disposal of any solid waste by any means including destruction, incineration, and deposit or decomposing. In this regard, land filling is one of the means of disposal. Basically, a sanitary landfill is a carefully engineered depression in the ground into which wastes are put. The aim is to avoid any water-related connection between the wastes and the surrounding environment, particularly groundwater. It is also to mitigate other environmental and health issues arising such as air pollution, global warming and vector- borne diseases from the deposition of large amount of wastes within a specified area.

Disposal of solid waste

Land filling is the most common method of disposal particularly in developing countries since other methods such as incinerator is expensive and requires the technological know-how to design, build, and operate. In addition, it is subjected to various compliance mechanisms such as emission standards and is more vulnerable to public scrutiny and objection compared to landfill. However, in some countries such as in Europe, landfill is regarded as the last solution and landfill Directive 99/31/EEC requires pre treatment of waste including sorting, and prohibits mixing of different types of waste on one site and land filling of tires. In addition, the Directive also requires the formation of strategy to reduce

Number of Landfills in Malaysia

State	Operational Landfills	Non- Operational Landfills
Perlis	1	1
Kedah	11	4
Pulau Pinang	1	2
Perak	20	9
Pahang	19	13
Selangor	7	12
Federal Territory Putrajaya	0	0
Federal Territory KL	0	7
Negeri Sembilan	8	10
Melaka	2	5
Johor	13	21
Kelantan	13	4
Terengganu	9	12
Peninsular Malaysia	**104**	**100**
Federal Territory Labuan	1	0
Sabah	20	1
Sarawak	51	12
Total	**176**	**113**
OVERALL TOTAL		**289**

Transporting waste to landfill

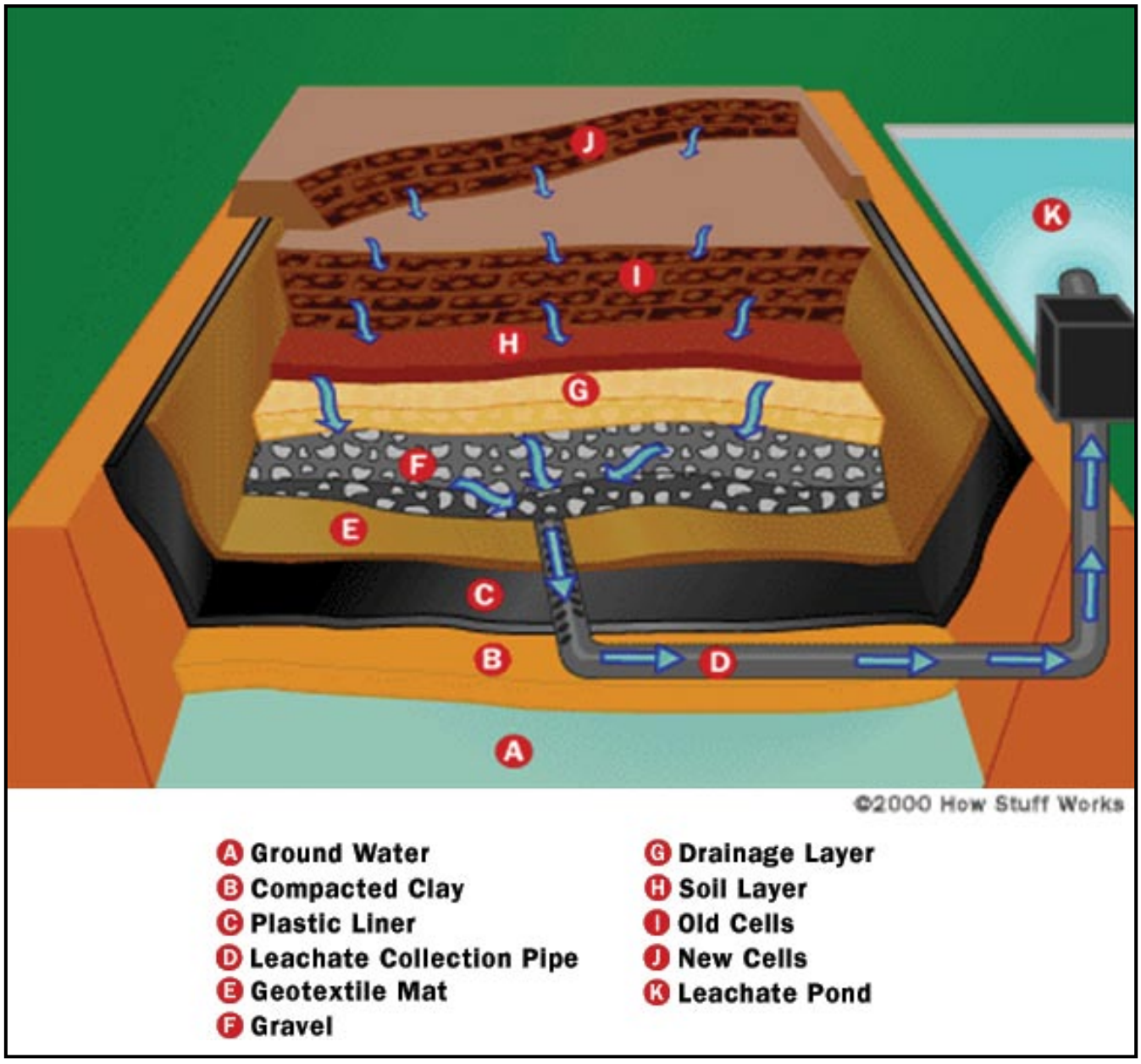
the biodegradable waste going into the landfills.

Landfills in Malaysia

In Malaysia, there are about 289 landfills all over the countries and 113 of these landfills are no longer in operation. The 176 landfills which are in operation are either dumpsites or controlled tipping areas and only seven of the operating landfills are classified as sanitary landfills.

As most of the landfills are dumpsites, they have none of the properties of sanitary landfill such as bottom liners and leachate collection system and they are built without any environmental impact assessment (EIA) study. Hence, some of them are located in sensitive areas such water catchment and near water intake points. Therefore, any leakages of leachate to the sensitive surrounding are very detrimental.

At present, almost all landfills are owned by local authorities except a few new sanitary landfills that are owned by the Federal Government. They are operated by the concession companies or the local authorities themselves. In the southern part of Peninsular Malaysia, most landfills are operated by Southern Waste Management Sdn Bhd, a concession company appointed by the Government to handle privatization of solid waste management whereas in the central region there is mixture of operator between Alam Flora Sdn Bhd (concessionaire), World Wide Holding and the local authority. A landfill within a particular local authority is meant for the disposal of solid waste from that area. There are few occasions when a couple of local authorities shared a landfill, but solid waste from one state does not cross over to



Sanitary landfill

be disposed in a landfill in another state.

Under the federalisation of solid waste management under Act 672, the Department of National Solid Waste Management decides on location, type and size of landfills and the coverage area of each landfill. The building of new landfills, alteration and closure need an approval from the Department and the operator of landfill will also be required to apply for licence. Disposal of solid waste will be allowed only at landfills designated by the Department.

The federalization of solid waste management will enable disposal of solid waste to be carried out across state borders. Under this approach, regional landfills complete with centralised treatment plant will be build. In this regard, several local authorities either from same states or from neighbouring states and situated near the border may share the same sanitary landfill. This approach is to capitalize on the short distances between the source of waste and the landfill and thus keep the cost of transportation low.

While in the midst of planning and building new landfills, existing landfills which are not sanitary are

undergoing several developments, such as:

(i) safe closing of landfills which are in sensitive areas;
(ii) safe closing of non-sanitary landfills which are no longer operating; and
(iii) upgrading non-sanitary landfills that are still operating

The constraints faced in the closure of non-sanitary landfills are the difficulties in finding suitable sites for new landfills. As a result, existing landfills continue to be used and temporary measures are taken to upgrade these landfills so as to mitigate further environmental degradation especially leachate problem. Since the time taken to plan and build a new landfill is approximately 2.5 years, non-sanitary landfills identified to be closed will be upgraded and continue to be used at the most another three years. However, in the future, sanitary landfills which are safely closed, can be utilised as recreational areas as well as green lungs.

Sanitary Landfill

Generally, landfills can be classified into anaerobic, semi anaerobic and aerobic with forced aeration. There are four critical elements in a sanitary landfill: a bottom liner, a leachate collection system, a cover, and the natural hydrogeologic setting. The natural setting can be selected to minimize the possibility of wastes escaping to groundwater beneath a landfill. Three other elements must be engineered. Each of these elements is critical to success.

In pursuance to a better management of solid waste disposal, there are two levels of sanitary landfill that are being built by the Department. Sanitary landfill Level 3 is complete with retaining structure; clearly defined cells, surface water drainage, and daily soil cover together with liner system, leachate collection and recirculation system. The leachate is collected through a series of collection pipes and recirculated back to the waste layer so that it may be reprocessed and further decompose to improve leachate quality. Recirculation will also promote faster evaporation and thus reduce the quantity of the effluent. The Level 4 sanitary landfill is an improvement of the Level 3 landfill with leachate treatment facilities.

Non-sanitary landfill

Site for landfill

Sanitary landfill is a potential source of energy. In a safely closed and properly managed landfill, the methane gases produced in the landfill can be harnessed to provide electricity.

Issues Pertaining To Sanitary Landfill

The shortage of suitable sites and high building and operation cost are the main constraints to the building of sanitary landfills. Therefore, the life span of a sanitary landfill must be stretched to the maximum. In some countries, only certain type of wastes are allowed to be landfilled. For instance, waste that can be recycled such as paper, plastics and glass are not allowed to be disposed at landfill. Organic waste which can be composted is also prohibited from entering the landfill. However, in Malaysia solid waste collected is not sorted. Therefore all types of waste ended up in the landfill which include plastic that take hundreds of years to decompose. Construction and demolition waste such as concrete and metals, which can be recycled, further shorten life span of a landfill.

Another issue that has often been overlooked is the management of the sanitary landfill. There are instances that the landfill is constructed as a sanitary landfill complete with EIA study. However, in the management of the landfill, conditions stipulated in the EIA are not adhered to, and the landfill can no longer be categorised as sanitary.

The existence of a buffer zone is one of the main criteria during the planning and building of a sanitary landfill. However, time and again, the encroachment of buffer zone through other development activities has been a serious issue to be addressed by the local authorities. Housing development often come too close to a landfill and conflict between the operator and the local community often causes tension.

Conclusion

Sanitary landfill is one of the popular means to address the disposal of solid waste particularly in developing countries in comparison with incinerators. Although, it is much cheaper, it is faced with land constraint and continuous management for 20-30 years throughout its active operating time. After it is no longer in operation; post closure management has to be in place to address any environmental pollution that may arise. Nevertheless, sanitary landfill ensures that solid waste is to be disposed off in an environment friendly manner. Leachate is contained and treated by the treatment plant and the incidence of vector borne diseases is addressed. In addition sanitary landfill is a potential source of renewable energy where the methane gas can be harnessed into providing electricity. BEM

REFERENCE

THE BASICS OF LANDFILLS: How They Are Constructed and Why They Fail

Source: Environmental Research Foundation, P.O. Box 5036, Annapolis, MD 21403, Fax (410) 263-8944; Internet: erf@rachel.org, Phone: (410) 263-1584; Fax: (410) 263-8944, Web site: *www.rachel.org*

The Technical Guideline for Sanitary Landfills, Design and Operation. Department of Local Government, Ministry of Housing and Local Government, 2006

Wasteguide: Framework and Strategies for Waste Management in European Cities. EPA Copenhagen, 1999

Centralized And Decentralized Wastewater Management In Malaysia - Experiences And Challenges *(Part 1)*

By Ir. Haniffa Hamid, Ir. Dorai Narayana & S. Anusuyah Bai
Indah Water Konsortium Sdn Bhd

Malaysia has undergone various experiences and challenges in managing their centralized and decentralized wastewater management systems. Before 1994, sewerage was managed at Local Authority (LA) level and this compounded issues over the years due to numerous limitations. During this time, constructions of sewerage systems in Malaysia were almost entirely developer driven. Moreover most LAs lacked ability and resources to manage the sewerage systems and the systems nationwide were in direstraits. A large part of the sewerage infrastructure in Malaysia has been built by developers, who construct most sewerage infrastructure to serve their own schemes. This has resulted in an ad-hoc and chaotic collection of networks and treatment systems in most parts of the country resulting in sewerage systems not well designed and built, and performing poorly. The fact that there were no proper guidelines in place contributed further to these issues. Some systems are inherently defective in design. In addition a substantial percentage of the population continues to use even less satisfactory systems such as primitive systems and septic tanks. Although many Sewerage Masterplans were prepared, only a few regional systems were implemented .There was no proper sewerage planning and strategy, and this resulted in lack of reserved sites for sewerage purposes. Due to weaknesses in financing, manpower, technology and management, the Government saw a need to make changes in this arrangement.

This led to the Federalisation and Privatisation of sewerage services beginning in 1994, via the enactment and gazettement of a new act, namely the Sewerage Services Act, 1993. The Government privatised the Operation and Maintenance of the public sewerage system to Indah Water Konsortium (IWK), under a 28-year concession period. Since then much improvements have taken place, whereby money was invested for refurbishment, upgrading and operations of sewage treatment plants. Sewerage Catchment Planning was done incorporating land acquisition and reservation. Other than that, developer guidelines were published whereby it enabled better quality of developer built system. Today sewerage infrastructure in Peninsular Malaysia is far superior to what it was in the early 1990s, and also in comparison to most of our neighbouring countries. The current sewerage systems in Malaysia consist of a combination of centralized system, decentralized system and onsite systems. All these systems function at various degrees of efficiency. The progress of the sector from the basic objective of public health protection to the wider needs of protecting water resources and environmental preservation has in effect increased the range of interested stakeholders, as well as broadened their demands and expectations. The choice between centralized sewerage systems or decentralized sewerage system will need to take into consideration the existing situation and also the needs which differ based on location.

This paper will consider the appropriate strategies to be adopted, particularly with respect to the

centralized and decentralized systems, and the experiences and challenges faced in formulating and implementing these strategies.

STATUS OF SEWERAGE SYSTEMS IN MALAYSIA

Types and Coverage of Sewerage Systems in Malaysia (as of December 2008)

As of today, IWK manages the public sewerage systems in 86 out of 144 Local Authorities, in the whole of Peninsular Malaysia and Federal Territory of Labuan, except Kelantan, Johor Baru and Pasir Gudang. The operational areas are confined to the Local Authority operational areas only, and rural areas are not served under the concession. Commencing January 1, 2008, the Water Services Industry Act (WSIA) and Suruhanjaya Perkhidmatan Air Negara (SPAN) Act have been gazetted. Public plant operators are required to migrate to the new Service Licensee Regime under WSIA. The integration of water and sewerage sector is expected to eventually see the restructuring of the Licensees on State basis.

The total number of sewage treatment plants (STPs) in Peninsular Malaysia at present is estimated to be more than 12,000 (as of December 2008). Of these, a total of about 5,222 STPs are public plants operated by IWK, serving a total Population Equivalent (PE) of approximately 18 million. Previously Communal Septic Tanks (CSTs) were classified as public STPs, but with the new WSIA Act (Section 62), CSTs are to be treated as Individual Septic Tanks (ISTs). Currently there are around 3,635 CSTs in Peninsular Malaysia. In addition there are an estimated 1.1 million ISTs, with a connected PE of almost 5.5 million, of which only 35% are receiving regular desludging services. There are also an estimated four million PE using pour flush or other primitive systems. The distribution of sewerage systems in Peninsular Malaysia is tabulated in *Table 2.1*. The coverage of sewerage services is shown in *Figure 2.1*.

Table 2.1: **Distribution of the Sewerage Systems in Peninsular Malaysia. (December 2008)**

Asset	Number	Population Equivalent (PE)
Regional STPs (Public)	74	5,600,000
Multipoint STPs (Public)	5,148	12,300,000
Pump Stations (PS)	668	3,600,000
Private STPs	3,415*	2,000,000*
Communal Septic Tanks (CST)	3,635	434,000
Individual Septic Tanks (IST)	1,100,000	5,500,000
Pour flush (PF)	761,000	3,800,000
Sludge Treatment Facilities (STF)	40	-
Sewer Networks (km)	14, 000	-

**based on identified Private Plants*

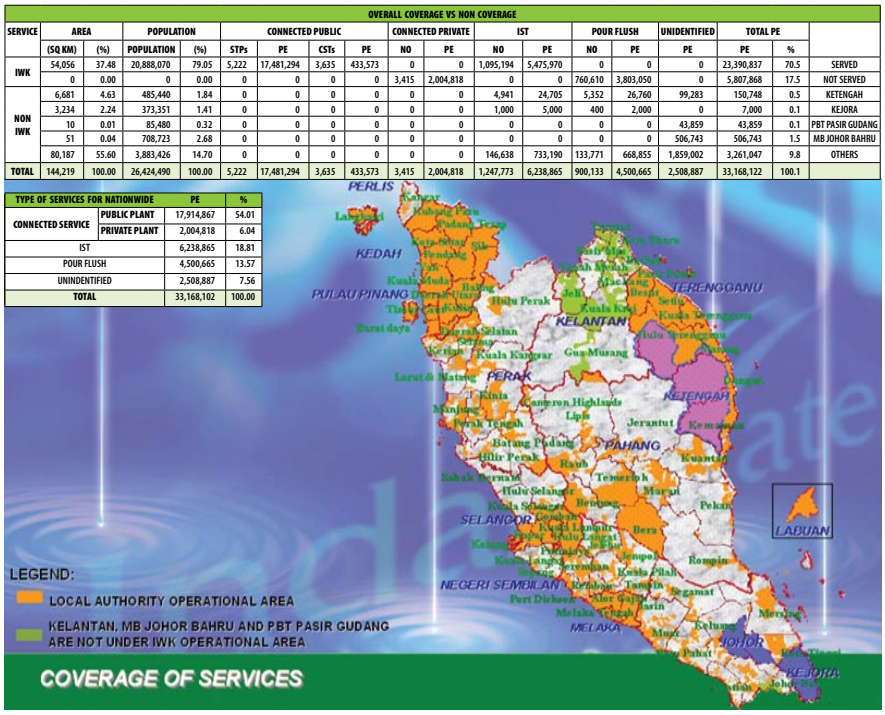


Figure 2.1: Coverage of Service Area

Profile of Public Sewage Treatment Plants

Figure 2.2 shows the growing number of public sewage treatment plants in terms of number of plants and PE from year 1998-2008.

The lack of investment in construction of large centralized treatment systems have resulted in

the proliferation of small plants for new development by developers. On average about 300 STPs are built by developers and handed over to the public operators. 85% of these are STPs less than 5,000 PE. At present, completed public STPs are required to be taken over irrespective of resource and financial constraints.

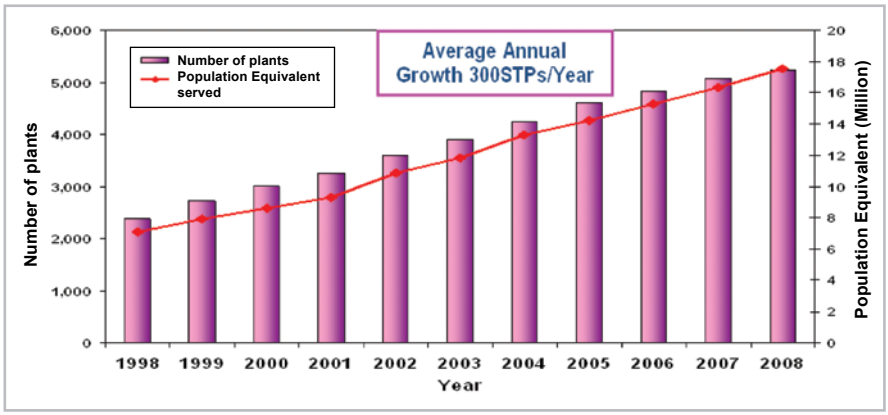


Figure 2.2: Annual Growth Of Public Sewerage Treatment Plant (1998-2008)

Table 2.2: **STP Classifications and Population Equivalent Served (December 2008)**

Group	Capacity Range	No of STP	Population Equivalent (PE)
A	> 20,000 PE	105 (2%)	7,273,267 (42%)
B	10,001 - 20,000 PE	166 (3%)	2,227,788 (13%)
C	5,000 - 10,000 PE	370 (7%)	2,576,155 (15%)
D	< 5,000 PE	4581(88%)	5,404,084 (30%)

Table 2.3: **Direct O&M Cost and Total Sewerage Management Cost (per PE) (December 2008)**

All Plants	Connected PE	Cost Per PE	
		Direct O&M Cost (RM)	Total Sewerage Management Cost (RM)
PE range > 50k	5,130,341	X	Y
PE range 20k – 50k	2,142,926	1.9X	1.8Y
PE range 10k -20k	2,227,788	2.2X	1.9Y
PE range 5k-10k	2,546,155	2.5X	3.3Y
PE range 2k-5k	2,692,903	3.0X	2.7Y
PE range <2k	2,741,181	5.5X	5.3Y
Total	17,481,294	2.5X	2.4Y

Classification of Plants (as defined by SPAN Guidelines)

Sewage treatment plants are classified in accordance to the design capacity in terms of PE. *Table 2.2* tabulates four classifications of sewage treatment plants (based on the revised SPAN guidelines) and the PE served as of December 2008.

Large Plants (> 20,000 PE) constitute 2% of total STP numbers but serve 42% of the total connected PE and thus have greater impact in terms of pollution discharge into water bodies (rivers, lakes, streams). Small plants (< 5,000 PE) constitute 88% of total STP numbers but serve only 30% of PE and have lesser impact on pollution into water bodies. Focus for operation and maintenance should therefore be on bigger plants (Group A to Group C) which serve 70% of the total PE; where more attention and budget should be allocated.

Cost Implication of Managing Centralized and Decentralized System

Managing centralized and decentralized system varies in terms of unit cost. *Table 2.3* shows the cost per PE for all plant levels in terms of Direct Operation and Maintenance (O&M) Cost and Total Sewerage Management Cost. Direct Operation and Maintenance (O&M) cost covers all direct and indirect cost involved in the running of the treatment plant but excluding the associated sewer network maintenance cost. For plants that were subjected to refurbishment or where capital investments were incurred, depreciation values have also been included in the computation. The Total Sewerage Management Cost per PE column

has added the apportioned cost of other support departments in the company so as to reflect the integrated cost of running the sewerage operations as a standalone business itself.

Based on *Table 2.3*, it can be concluded that the cost per PE for plants which are smaller in size, eg: PE range <2k (all decentralized system) is much higher comparatively to bigger size plants, eg: PE range >50k (centralized system).

Existing Sewerage Catchment Strategies

The Sewerage Catchment Strategy (SCS) outlines the strategies and guides for a systematic and integrated development of sewerage infrastructure including sludge management facilities. The SCS also identifies the evolvement of the sewerage infrastructure from the current system to the long term solution, identifying Permanent Works for all existing, current and future development with its whole life cost kept to a minimum by minimising capital and operational costs. There are a total of 97 SCS reports which have been completed as of December 2008. The development of SCS is a dynamic programme as it needs to adapt to development changes and requires periodic updates. *Table 2.4* below shows the number of SCS report completed and the number of Sewerage Catchment areas identified in each State.

Table 2.4: **Sewerage Catchment**

Negeri	Completed Sewerage Catchment Strategy Report	Sewerage Catchment Area	
		Main Sewerage Catchment Area	No. of Identified Sub-Sewerage Catchment Area
Johor	11	28	93
Melaka	6	8	8
N.Sembilan	10	16	15
Selangor	17	42	89
W.P.K.L	12	11	20
W.P.Labuan	1	1	9
Terengganu	11	7	7
Pahang	14	15	24
Perlis	0	1	1
Kedah	6	11	19
Penang	2	15	29
Perak	7	11	20
Total	97	166	334

Note: *The Main Sewerage Catchment areas are where regional STPs are already in place/ earmarked to have regional STPs by 2035 based upon National Sewerage Development Plan.*

The basis of recommending a centralized system or decentralized system very much depends on the:

(a) Catchment area
(b) Land use of the area (current & future)
(c) Population & PE projections
(d) Existing sewerage systems in study area (STP public/private, IST, PF or no system at all)
(e) Sewerage issues faced by the area
(f) Land availability for sewerage use or future centralized STP or sludge facilities.

All of the above criteria have been taken into consideration in the SCS reports together with options and recommended strategies. Based on that, SCS reports must be used as a decision making tool in terms of having a centralized system or decentralized system for a particular Sewerage Catchment area, as well as the timeframe for strategy implementation.

The SCS reports provide the base information and strategy framework which can be the basis for the formulation of Action Plans to meet Strategic Goals set by SPAN. This will be done as part of the business plan formulation process, with targets including coverage, regionalisation, growth coverage, sullage issues, property connection and provision of basic systems for all areas.

CENTRALIZED SEWERAGE SYSTEM

Centralized sewerage system is defined as a sewerage collection and treatment system containing collection sewers and a centralized treatment facility. The systems are used to collect and treat large volumes of sewage from a catchment specified as per the

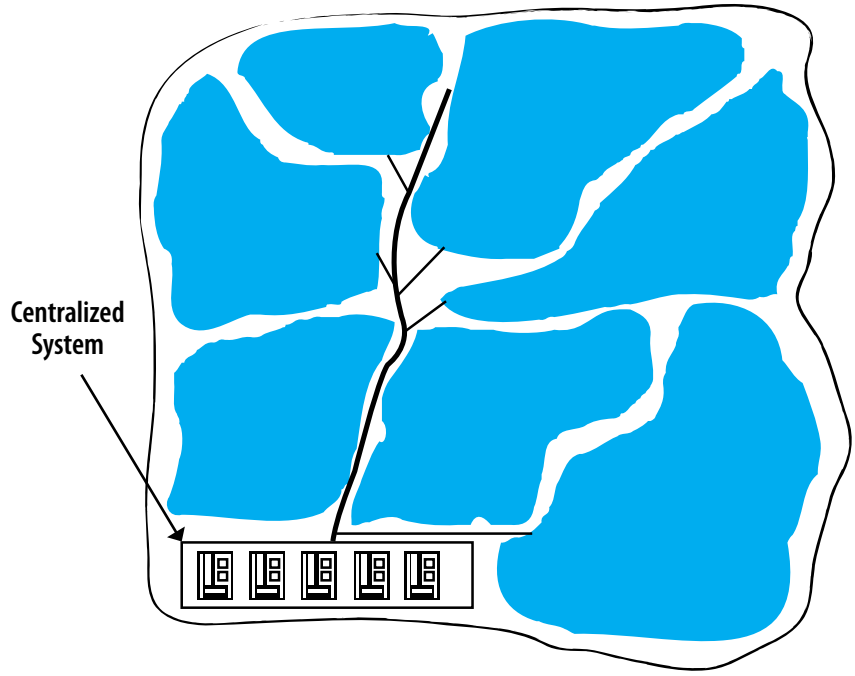


Figure 4.1: Centralized Sewerage System

Sewerage Catchment Strategy for the area. The collection system typically requires large-diameter deep pipes and major excavation. At the treatment facility, the wastewater is treated to standards required for discharge to a surface water body. Currently the total number of centralized systems in Peninsular Malaysia is 74 (as of December 2008). *Figure 4.1* is an illustration of an area with centralized sewerage system.

The advantages of centralized sewerage system are:

(i) Improved reliability
(ii) Reduced impact on environment
(iii) Greater buffer distance
(iv) Greater operational efficiency
(v) Opportunity for rationalization of small inefficient STPs and on site systems
(vi) Operation and maintenance cost is focused on core activities rather than logistics and travel

The disadvantages of centralized sewerage system are:

(i) Requires big land area
(ii) High construction costs
(iii) Longer time spent on construction

DECENTRALIZED SEWERAGE SYSTEM

The concept of decentralized sewerage system refers to sewage treatment and disposal systems from the individual on-site treatment system (commonly know as the septic tanks) to small community collection and treatment systems. *Figure 4.2* is an illustration of an area with decentralized sewerage system.

The advantages of decentralized sewerage system are:

(i) Easy installation (package plant)
(ii) Best solution for slow paced development area
(iii) Initial construction cost cheaper.
(iv) Fast implementation

The disadvantages of decentralized sewage treatment plant are:

(i) High cost of visitation and operations
(ii) Plants are located close to communities, and this raises

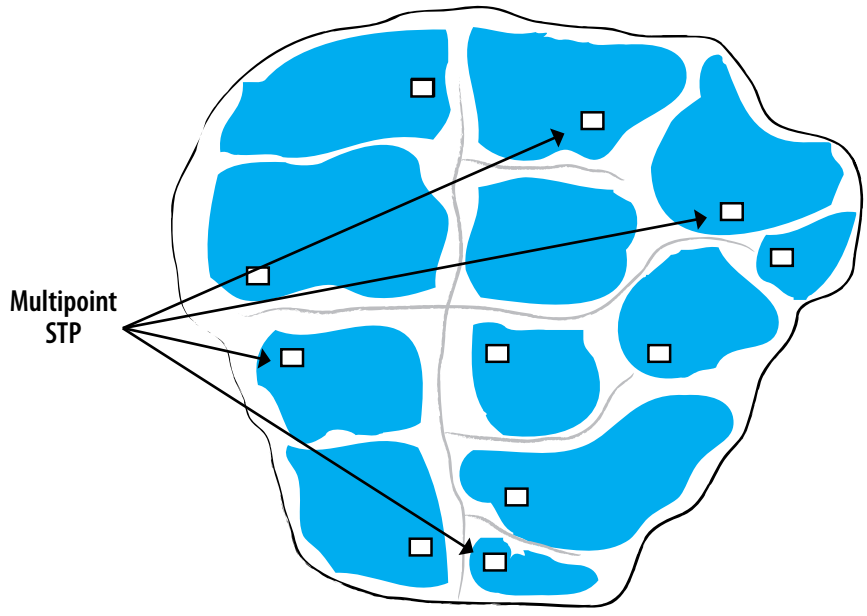


Figure 4.2: Decentralized Sewerage System

many social and environmental concerns.

(iii) Longer time spent on construction

(iv) Types of plants and equipment vary according to Developer

EXPERIENCES & CHALLENGES

In the last 15 years in business, Malaysia has undergone various experiences and challenges in managing their public sewerage systems. With vast insights and knowledge of the overall sewerage industry gained over the years, Malaysia is well positioned to drive towards achieving a highly efficient sewerage industry. However, for effective sewerage services, the challenges and issues stated below need urgent attention.

Imbalance of sewerage facilities for all areas

In spite of the advances made in sewerage development over the several decades, many areas continue to use unsatisfactory systems of sewerage management, including direct discharges and primitive systems such as pit and pour flush latrines. Most such systems are in squatter areas or kampong or semi permanent type of dwellings. This is because to centralized systems do not cover all areas but only identified service areas. Other than that, developers who construct sewage treatment plants only cater for their own development and this has resulted in the increase of multipoint systems in the country today. Another aspect is the discharge of sullage or grey water to surface drains. This occurs in the older developments, which were constructed before regulations requiring all domestic wastewaters to connect to sewerage systems

Sewerage facility

were enacted. The practise is also prevalent in many new areas, where individual houses have carried out modifications or renovations, and conveniently connect sullage wastes to the drain.

Individual Septic Tanks

There is an estimated 1.1 million Individual Septic Tanks (ISTs) in the country, and the number is growing. Besides that, currently there are around 3,635 Communal Septic Tanks (CSTs) in the country. The increase of ISTs in the country might be due to centralized systems not covering all areas and developers constructing new sewage treatment plants only to cater for their own development. Besides that, some of the developments are done on a very small scale that the best option would be just to build ISTs. The growth of new ISTs must be controlled through strict policy and enforcement. Besides that, regulations to ensure these existing septic tanks are regularly desludged must be enforced to reduce the total pollution from this source.

Further enhancement needed in public sewerage facilities

The large number of public sewage treatment plants, their geographical spread and varied designs coupled with poor quality of inherited facilities makes effective and efficient operation and maintenance extremely difficult. Refurbishment programmes have been initiated to bring these facilities to working conditions, and a gradual upgrading programme will enable standards to be met.

The sewer network has its share of problem. Many sewer pipelines are old and in poor condition. This causes problems of infiltration and inflow which in turn affects the treatment facilities and pump stations. Other problems include blockages, surcharging and overflows and also exfiltration. Identifying the critical sewers, carrying out investigations and instituting rehabilitation programmes are required.

Proliferation of sewerage facilities

Prior to 1994, many decentralized systems were built by the LAs just to cater for small growth which have resulted in proliferation of sewerage facilities in Malaysia today. The large number of inherited public sewage treatment plants presents logistical problems, which need to be addressed through a capital works programme to consolidate and rationalise them. For new facilities, planning control with an adequate mechanism of incentives and disincentives can be utilised to encourage developers to construct shared facilities, while also integrating with the existing facilities in the vicinity. BEM

Note: *Part 2 (Final Part) of this article will be published in Vol.43, Sept-Nov 2009.*

Guidelines On Demolition Works

Submitted by Pang Soo Mooi

Extract from Guidelines for Public Safety and Health at Construction Sites issued by Occupational, Safety and Health Department. For further information, refer to http://dosh.mohr.gov.my/

1. General

1.1 The selection of demolition method should take into consideration the size, strength and location of the structure to safeguard the safety and health of the employee and public.

1.2 The risk assessment study should be done to determine possible causes for structural instability and provide the action plan to ensure safety and health.

1.3 Demolition work should be carried out in such a way so as not to affect the stability of the structure or adjacent structure, which may cause the structure to collapse unplanned.

1.4 In demolition of structures that are in close proximity to public area, demolition work should be carried out during non-peak hours.

1.5 All demolition work should be done by trained personnel under the supervision of a designated person.

1.6 Demolition activities should not be continued under adverse weather conditions, such as high winds, storm, which could cause collapse of already weakened structures.

2. Preparatory Work

2.1 Before demolition operations begins:
(a) adequate inspection should be made by designated person
(b) if necessary to prevent danger, unstable parts of the structure should be made secure; and
(c) all utilities should be effectively disconnected or shut off at or outside the property line.

2.2 The danger zone around the structure should be adequately fenced off or warning sign posted.

2.3 Before the commencement of demolition work, the structure should be free from any toxic or hazardous substance (e.g. asbestos materials).

2.4 Where applicable metal scaffold enclosed with peripheral nettings should be erected around the building or structure to be demolished.

2.5 Before demolition is carried out, ensure that these materials are removed:
(a) glass in doors, windows, etc
(b) loose objects
(c) projecting parts and
(d) explosive, inflammable, toxic and harmful substance

3. Catch platforms for demolition operations

3.1 During the demolition of the exterior wall of a structure originally more than 12.2 meters high, catch platforms shall be provided along the exterior, faces of such wall, where necessary, to prevent injury to the public. (*Reg 43(1), Building Operation and Works of Engineering Construction (Safety) Regulations, 1986*)

3.2 Such platform shall be designed by a Professional Engineer and certified for safety prior to erection and use. (*Reg 43(2), Building Operation and Works of Engineering Construction (Safety) Regulations, 1986*)

3.3 Such platform shall be maintained not more than six meters below from which the exterior walls are being removed. (*Reg 43(3), Building Operation and Works of Engineering Construction (Safety) Regulations, 1986*)

3.4 Catch platform shall not be used for storage of materials or be used as working platforms or walkways. (*Reg 43(4), Building Operation and Works of Engineering Construction (Safety) Regulations, 1986*)

4. During Demolition

4.1 During demolition work, the contractor should:

(a) provide the workers and public the appropriate information related to safety and health hazards during demolition works.

(b) follow demolition sequence and method as provided by demolition/ structural engineer.

(c) ensure the site is in a safe condition and in compliance with safety and health plan requirements.

(d) provide workers with all the appropriate personal protective equipment (PPE) related to safety and health risk they are exposed to.

(e) take necessary steps to keep the debris or area being worked on sufficiently moist to lay the dust.

Update On Certificate Of Completion And Compliance

By Ir. Chen Thiam Leong

The issuance of CCC in lieu of Certificate of Fitness for Occupation (CFO) came into effect on April 12, 2007. The first CCC to be issued by an engineer was on March 4, 2008, and as of May 30, 2009, a total of 206 CCCs have been issued by engineers.

In May 2008, upon review of the CCC documents (Form F and Gs) received by the Board of Engineers Malaysia (BEM), it was apparent that many PSPs (Principal Submitting Persons) were not fully conversant with filling up the various forms properly and some defaulted on enclosures.

Examples of errors detected were:

- Inserting PSPs design drawing nos. instead of Local Authority's Approval Reference no.
- Inserting Contractor with Company Name instead of the required Individual Name with NRIC no.
- Name of Local Authority not inserted
- Wrong discipline of Professional Engineer signing as SP (Submitting Person) in Form Gs
- Non submission of Form Gs
- Non enclosure of Clearance Letters from Utilities

To overcome the problem, the BEM CCC Sub-Committee published a comprehensive Guide to filling up CCC Forms F/F1 and G1 to G21 in May 2008 which to-date remains posted on the relevant websites of BEM, BAM, ACEM, IEM and PAM. The footnotes on this Guide also carry the following reminders;

(1) PSP shall notify the local authority through OSC (in writing or using prescribed form) after Forms G1-G3 are certified (i.e. after completion of Earthwork, Setting Out and Foundations)

(2) Form F/F1 and Form G-1 to G-21 shall be forwarded to the Local Authority and BAM/BEM within 14 days of the issuance of Form F/F1

With the publication of this Guide and footnotes, all PSPs should have no more excuse of not knowing about the intricacies of CCC. Meanwhile, BEM has issued warning letters to PSPs who failed to submit their Form F/F1 or Gs within the prescribed deadline of 14 days from the date of issuance of CCC. BEM had decided to let all first time offenders off but will refer second time offenders for disciplinary action.

However, now with this special update in The Ingenieur, BEM will no longer be lenient on first time defaulters as well. Engineers are also reminded that only Civil Professional Engineers may issue CCC (Form F/F1) and only for Appendix B & C types of buildings/projects. It is an offence for engineers to issue CCC for Appendix A type of buildings.

The JKR/PWD Forms (Rev. 2007): An Overview *(Part 3)*

By Ir. Harbans Singh K.S.
P.E., C. Eng., Advocate and Solicitor (Non-Practicing)

This is the final part of the paper presented on November 8, 2008 at a talk organised jointly by the Bar Council Malaysia, The Society of Construction Law (KL & Selangor) and The Chartered Institute of Arbitrators (Malaysia Branch). The first part appeared in the Dec 2008 - Feb 2009 issue while the second part appeared in the Mar-May 2009 issue.

3.0 JKR/ PWD FORM DB (REV. 2007): MAIN CHANGES

3.1 General

The new Form has been relabelled "PWD Form DB (Rev. 2007)" instead of the previous "PWD Form DB/T (2002 Edn.)"; presumably being now confined to only "Design and Build" Contracts. There is some overhaul in its content and form to bring it in tandem with the new 203 & 203A Forms as far as the common provisions are concerned with the addition/substitution of particular provisions to cover the D&B element. In terms of the total length, the new Form has been expanded by about 14 new clauses.

An in-depth study of the revised Form will exhibit some positive modifications which had been long overdue. However, a much better job could have been done if other areas of weaknesses in the previous DB/T (2002 Edn.) Form could have been suitably addressed. Notwithstanding the instant revisions, there remain unfortunately inconsistencies, deficiencies and omissions that may compromise the effectiveness of the said Form.

The principal changes which are common to the other Forms such as the 203 & 203A Forms will not be repeated here but only such changes which are peculiar to the instant Form. These are adumbrated in the subsequent write-up.

3.2 Sufficiency of Contract Documents: Clause 7.0

This Clause is a reformulation of the previous provision bearing the same label and number. It now encompasses six sub-clauses.

An interesting new provision in the form of sub-clause 7.3 deals with the effects of discrepancies or ambiguities between the Governments's Requirements and the Contractor's Proposals. Presumably this sub-clause has been drafted in response to the decisions in *John Mowlem & Co. Plc v Akeler* [2002] Scotcs 150 (28th May 2002) and *Cable (1956) Ltd. v Hutcherson Brothers Pty Ltd.* (1969) 43 ALJR 321.

The sum total of this new provision is that the bulk of the risks involved are transferred to the Contractor.

3.3 Rights of P.D.: Clause 8.0

This new Clause is a consolidation and reformulation of the following previous provisions:

(a) Clause 3: P.D.'s right to take action;

(b) Clause 4: P.D.'s Instructions, and

(c) Clause 5: Notices

Other than the above, there are no material changes to the content.

3.4 Performance of the Works: Clause 13.0

This new provision is a reformatting and amplification of a number of previous provisions inclusive of:

(a) Clause 2: Contractor's Obligations; and

(b) Clause 8: Materials, Goods and Workmanship.

In its new form, Clause 13.0 comprises the following sub-clauses:

(a) 13.1: Submission of Supervision Reports;

(b) 13.2: Quality Assurance System;

(c) 13.3: Contractor to be Responsible for the Works, Materials, etc.;

(d) 13.4: Accident, failure, etc. to the Works; and

(e) 13.5: Programme of Works

Of particular interest is sub-clause 13.1 which may be consequent to the judicial pronouncement in *High Mark v Patco (m) Sdn. Bhd.* (1987) 2 MLJ 85 and mandates the Contractor to submit a wide range of supervision reports under the umbrella concept of "Single Point Responsibility". Sub-Clause 13.5 on the Programme of Works is generally incomplete and shares similar deficiencies as the corresponding provision in the JKR 203 & 203A Forms (See para 2.6 above).

3.5 Design: Clause 14.0

The new Clause 14.0 comprises three sub-clauses, namely:

(a) Sub-clause 14.1: Design;

(b) Sub-clause 14.2: Design Guarantee; and

(c) Sub-clause 14.3: Design Guarantee Bond

Sub-Clause appears to be the reformulation of the previous sub-clauses 2.2, 2.3.1, 2.3.2, 2.4.1, 2.5 and 2.6 and exhibits no significant change. On the other hand, sub-clauses 14.2 and 14.3 are new requirements and cover the essential obligations of the Contractor pertaining to design.

The Contractor is now obligated to provide both a Design Guarantee as well as a Design Guarantee Bond for a duration of five years from the date of the issue of the Certificate of Practical Completion (CPC). The latter is stipulated to be in the form of a bank guarantee; failure to deposit one attracting possible calling in of the Performance Bond.

The reintroduction of the Design Guarantee Bond is a welcome move as it is more effective than any Collateral Design Warranties given by the designers, or Professional Indemnity Insurance. Practically, it affords the Employer a very tangible and easily enforceable remedy.

3.6 Non-Removal of Materials and Goods on Site: Clause 18.0

Clause 18.0 is a revision and amplification of the previous Clause 11: Non-Removal of Materials and Equipment on Site.

It has been expanded to include a total of four sub-clauses, namely:

(a) Sub-clause 18.1: Exclusive use for the Works;

(b) Sub-clause 18.2: Passing of Proprietary Rights and Vesting;

(c) Sub-clause 18.3: Government not liable for Damage; and

(d) Sub-clause 18.4: Incorporation of Clause in sub-contract

Of particular interest are sub-clauses 18.2 and 18.3 which attempt to deal with issues pertaining to retention of title, liens, etc. Whether these provisions in their current form and content are legally effective is a moot point and is left to be seen when put to test in the foreseeable future.

3.7 Variations: Clause 23.0

This Clause is a redrafting and revision of the previous Clause 27 bearing the same label.

The definition of the term "variation" has been reformulated and abbreviated in sub-clause 23.1. Sub-clause 23.2 is rather disappointing, as contrary to contemporary practice, the P.D. is obliged, vide sub-clause 23.2 to consult the Contractor prior to the ordering of a variation only where elements of design are involved.

Sub-Clause 23.4 is a mere reformatting and abbreviation of the previous sub-clause 27.4 and now places the consequences of a variation solely on the Contractor not surprisingly. Save for the above, the new clause suffers from similar deficiencies as for the corresponding clause in the 203 & 203A Forms (see para 2.11).

3.8 Valuation of Variations: Clause 24.0

Once again, this new Clause is a redrafting of the previous Clause 28 bearing the same title.

Essentially, it has deleted the following previous sub-clauses:

(a) Sub-clause 28.5: Variation by Contractor affecting other works; and

(b) Sub-clause 28.6: Fair Valuation

The sum total of the new revisions is that:

(a) The new valuation formulae are nebulous and susceptible to misinterpretation and possible disputes/ claims;

(b) It does not incorporate contemporary methods of valuation used for similar contracts i.e. "quotation method", use of agreed rates, etc.; and

(c) It appears to be harshly one-sided and apparently increases the Contractor's overall financial risk.

3.9 Consultants: Clause 35.0

Clause 35.0 is a revision and redrafting of the previous sub-clauses 29.1 to 29.3.

Comprising in total five new sub-clauses, it covers a range of matters such as the qualification of consultants, their engagement and the liability of the Contractor vis-à-vis these Consultants. Despite its shortcomings, this new provision is a marked improvement on the previous clauses.

3.10 Direct Payments to Contractor's Consultants: Clause 36.0

This clause is an apparent revamp of the previous Clause 60 entitled "Direct Payments and Consultancy Agreement with Contractor's Consultants".

It prescribes a mechanism/formula for reimbursing the Contractor's Consultants direct vide a Deed of Assignment to an Escrow Account opened jointly by the Contractor and the Consultants. It is said that the new clause was influenced by the local decisions in:

(a) *High Mark v Patco (M) Sdn. Bhd.*; and

(b) *Muzqi Holdings (M) Sdn. Bhd. v Ibrah (M) Sdn. Bhd.* (1996) 1 LNS 21.

It attempts to circumvent the doctrine of privity of contract, whilst at the same time affording direct payment dealings between the Employer and the Consultant. Whether the above position is legally tenable is a moot point; so too the likely compromise of the core principle of "Single Point Responsibility" for a contract of this particular species.

3.11 Bumiputera Participation: Clause 41.0

Clause 41.0 is an amplification of the previous sub-clause 2.10.1 bearing a similar title.

It now comprises a total of four sub-clauses; the first of which is basically a reproduction of the previous sub-clause 2.10.1. All in all the new provisions amplify the timing, procedure and consequences of a default in meeting this requirement of the New Economic Policy.

3.12 Extension of Time: Clause 49.0

This Clause is a reformulation of the previous Clause 45 but modelled along the new Clause 43.0 of the JKR Forms 203 & 203A (Rev. 2007).

As compared to the previous Clause 45, a ground for the delay i.e. 45.1(c) has now been omitted but two new grounds i.e. 49.1(c): Inclement Weather and 49.1(j): Suspension, have been added. Despite these changes, there are no other material revisions and the new clause has similar shortcomings to the corresponding clause 43.0 in the new JKR 203 & 203A Forms (See para 2.22 above).

3.13 Procedure for Claims: Clause 50.0

This clause is a reformulation and expansion of the previous Clause 46 bearing the same label.

The total number of sub-clauses has been increased from two to three, with the main changes being:

(a) The surprising omission of the term "direct loss and/or expense" in sub-clause 50.1;

(b) The positive inclusion of a default provision in sub-clause 50.2 whereby upon the expiry of the stipulated 90-day period, the Employer can unilaterally proceed with the ascertainment of the quantum of the claim; and

(c) The inclusion of a default provision in sub-clause 50.3 whereby the Employer's liability is deemed discharged should the Contractor fail to comply with sub-clauses 50.1 and 50.2. Whether this also extinguishes the Contractor's common law rights is a moot point.

3.14 Interim Payments: Clause 53.0

This Clause is a redrafting and revision of the previous Clause 50 entitled "Interim Payments".

Most of the changes are merely cosmetic, save for the following:

(a) The deletion of the previous payment based on "Payment Schedule"; and

(b) The increase in the content/details required for the Contractor's written application for payment

As for the other comments, those in para 2.14 above for Clause 28.0 of the JKR Forms 203 & 203A are equally applicable in the instant case.

3.15 Advance Payment: Clause 57.0

This new clause is basically similar to the previous Clause 62 bearing the same label.

The principal changes include:

(a) The value of the Advance Payment has been increased from 15% to 25%; and

(b) There is the inclusion of an additional pre-condition in the form of sub-clause 57.1(c): Submission of Banker's Guarantee, etc.

3.16 Bills of Quantities: Clause 58.0

This clause is a complete revamp of the previous Clause 61 and may be a consequence of the decisions in *Chong Ah Kwee & Ors v Viva Realty Pte. Ltd.* (1990) 2 MLJ 389 and *Tham Kwai Chin v The Government of State of Perak* (Civil Appeal No. 1690 Year of 1984).

The numbering of the sub-clauses is a bit odd and totally out of tandem with the remaining provisions of the Form. Notwithstanding the above, sub-clause 58.0(a) stipulates that:

(a) Unless stated 'provisional', quantities stated shall not form part of the Contract; and

(b) Where stated 'provisional', quantities shall be considered to be only estimated quantities of the Work.

The following sub-clause 58.0(b) further deals with "provisional" quantities in that:

(a) They are stipulated to be subject to remeasurement provided their preparation does not involve any default on the Contractor's part; and

(b) If they result in a reduction of cost, the Contract Sum has to be accordingly adjusted.

The ultimate sub-clause 58.0(c) addresses the issue of the rates to be used in the remeasurement process.

3.17 Environmental Matters: Clause 69.0

This is a new provision dealing with the necessity for the Contractor to conform with the relevant laws, in particular the Environmental Quality Act 1974.

3.18 Law Governing This Contract: Clause 70.0

This provision is a revision of the previous clause 50 bearing the same label.

3.19 Confidentiality: Clause 73.0

Also a new clause dealing with information generated, published or acquired by the Contractor during the course of undertaking the Works under the contract.

4.0 JKR FORM 203N (REV. 2007): MAIN CHANGES

4.1 General

The new form has attempted to revamp the format and content of the previous Form 203N (Rev. 1983). Whether this has been satisfactorily achieved is arguable.

The total number of clauses has been increased by 13 to 50 all in all. The final layout is a patchwork of the previous 1983 Form and the current 203 & 203A (Rev. 2007) Forms. There appears to be a general lack of cogency and "flow" with quite some "cutting and pasting" of the provisions. Areas of deficiencies and omissions still abound.

The main changes peculiar to this particular Form of Conditions of Contract are dealt with in the subsequent write-up.

4.2 Sub-Contract Documents: Clause 2

A new clause, relocated from the previous Recital's Section stipulating the various components of the Sub-Contract Documents. Interestingly, contrary to the 203 & 203A (Rev. 2007) Forms, it does not include 'Treasury Circulars'.

4.3 Employment of Workmen: Clause 14.0

This provision is a reformulation and renumbering of the previous Clause 12 bearing the same label.

The main changes introduced are:

(a) The abbreviation of sub-clause 12(a) with the deletion of the stipulation pertaining to non-Malaysian workers; and

(b) Omission of two previous sub-clauses i.e.:

(i) Sub-clause 12(b): Ratio of Workmen; and
(ii) Sub-clause 12(d): Source of Labour.

4.4 Wage Books and Time Sheets: Clause 16.0

This clause is a revision and redrafting of the previous Clause 14 having a similar description.

In this case, the main revisions are:

(a) The obligation of the Nominated Sub-Contractor (NSC) also extends to its sub-contractors, and includes in addition the furnishing of relevant information; and

(b) Parties that are empowered to demand and be furnished with the relevant information have been extended also to the S.O.'s Representative and the S.O.

4.5 Default in Payment of Wages: Clause 17.0

It is essentially similar to the previous clause 17, except that in the event of the NSC's default now:

(a) The S.O., instead of the Contractor, can make direct payment to the EPF Board and/or the Director-General of Labour; and

(b) Such payment can be deducted from any monies due to the NSC or from the Performance Bond.

4.6 Discharge of Workmen: Clause 18.0

A wholly new provision encompassing the pertinent requirements pertaining to the engagement, discharge/removal of competent staff, Workmen, etc. It comes in the form of two sub-clauses, generally in tandem with similar provisions in the 203, 203A and DB Forms.

4.7 Variations: Clause 19.0

This clause is the reformatted previous Clause 16 bearing the same label.

Generally, it suffers from the same deficiencies and omissions of the corresponding clause in the 203 & 203A Forms. In addition, it suffers from another material lacuna, in that, it does not provide for variations initiated solely due to or arising from the Main Contractor itself.

4.8 Defects Liability: Clause 21.0

Clause 21.0 is the reformatted and revised version of the previous Clause 18: Defects Liability.

The main revisions introduced include:

(a) The proviso to the previous sub-clause 18(a) has been deleted and a maximum period of three months for compliance now prescribed; and

(b) The proviso to the previous sub-clause 18(b) is now replaced with a requirement for the Contractor to pay the Employer the rectification cost if either the former or the NSC defaults.

Save for the above, clause 21.0 suffers from similar deficiencies/omissions as have been highlighted for the corresponding clause 48.0 in the 203 & 203A Forms (see para 2.26 above).

4.9 Sub-contracting: Clause 22.0

This clause is the previous Clause 19: Sub-letting, renumbered, relabelled and reformatted.

A new sub-clause 22.0(b) reinforcing the NSC's continuing liability in the event of any sub-contracting, etc. has now been introduced.

4.10 Employer's Social Security Act 1969: Clause 25.0

This Clause is the reformulated old Clause 22 with the addition of a new sub-clause 25.2 governing contributions to SOCSO and the effects and consequences of any default on part of the NSC.

4.11 Performance Bond: Clause 27.0

Clause 27.0 is the reformulation of the previous Clause 24 bearing the same title.

The principal revisions introduced include:

(a) The period of validity of the Bond has been now stipulated to be 12 months after the expiry of the Defect Liability Period;

(b) As for the sub-clause on the Application of Performance Bond, a new provision in the form of sub-clause 27.2(b) has now been included requiring the submission of additional Performance Bond in the event a call is made on the earlier Bond; and

(c) An additional provision i.e. sub-clause 27.2(d) has been included governing the situation where the sub-contract is terminated pursuant to Clause 32.

Interestingly, there is no option in the 203N Form, as is the case of the Main Contract using the 203 & 203A Forms, for the submission of a Performance Security in lieu of the Performance Bond.

4.12 Suspension of Sub-Contract Works: Clause 31.0

This is a whole new provision comprising three new sub-clauses and is in tandem with the corresponding provision in the 203 & 203A Forms. Accordingly, the comments for the latter in para 2.27 apply *mutatis mutandis*.

4.13 Termination of Nominated Sub-Contractor's Employment: Clause 32.0

This Clause is the reformulation and revision of the previous Clause 28 bearing the same label.

The main revisions include:

(a) The addition of two new performance defaults i.e.

(i) Sub-Clause 32.1(a)(i): Failure to commence work, and
(ii) Sub-clause 32.1(a)(vii): Failure to comply with any terms and conditions;

(b) The addition of two new financial defaults i.e.

(i) Sub-clause 32.4(a)(iv): Failure to pay its debt; and
(ii) Sub-clause 32.4(a)(v): Levying of distress or execution against NSC

(c) The introduction of a new consequence of termination in the form of sub-clause 32.3(a)(iii): Immediate vacation of the Site.

Otherwise, the general comments as outlined in para 2.22 for the 203 & 203A Form apply equally in this case.

4.14 Termination of the Contractor's Employment Under the Main Contract: Clause 33.0

The previous Clause 29 has been severed; the earlier part being now reproduced in the new Clause 33.0 and the latter part in Clause 32.0.

4.15 Final Payment: Clause 35.0

This Clause is in tandem with the corresponding clause in the 203 & 203A Form; the comments of which are equally applicable in the instant case. However, direct payment to the NSC pursuant to clause 34.0 is fortified and maintained.

4.16 Arbitration: Clause 39.0

This Clause is a revision of the previous Clause 38 bearing the same title. It is generally in tandem with the corresponding provision in the 203 & 203A Forms whose comments apply *mutatis mutandis*.

4.17 Miscellaneous Provisions

A number of wholly new provisions have been introduced in line with the corresponding provisions of the 203 & 203A Forms perhaps for the sake of consistency and/or completeness. These are:

(a) Clause 42.0: Compliance With the Law
(b) Clause 43.0: Force Majeure
(c) Clause 44.0: Governing Laws
(d) Clause 45.0: Notices
(e) Clause 46.0: Severability
(f) Clause 47.0: Amendment
(g) Clause 48.0: Waiver
(h) Clause 49.0: Successors Bound; and
(i) Clause 50.0: Time

The comments generally made for the corresponding provisions of the 203 & 203A Forms are applicable in the instant case.

5.0 JKR/PWD FORM 203P (REV. 2007): MAIN CHANGES

5.1 General

The number of clauses have been said not to have been revised. The previous Schedules I & II have been maintained but Schedule II has been deleted and subsumed as a specific clause in the Conditions of Contract. An attempt has been made to have some provisions similar to those in the 203 & 203A Forms incorporated into the revised 203P Form. Nevertheless, the changes appear to be merely cosmetic with the revised Form still having material deficiencies and omissions.

Interestingly the Form is entitled "PWD Form 203P" in direct contrast with the other revised Forms which carry the "JKR" label; so much for consistency. The other principal changes are outlined below.

5.2 Recitals

The previous first Recital has been now deleted whilst the second Recital has been reformulated and in the sub-clause: Definitions. Accordingly, the third and fourth Recitals have now been reformatted and relabelled as the new sub-clauses 3.0(a) and (b) of Clause 3.0: Consideration.

5.3 Definitions and Interpretation: Clause 1.0

The sub-clause 1.1: Definitions, has been expanded to include further terms such as drawing, site, etc. The definition of the term "Sub-contract" has been revised.

The next sub-clause i.e. 1.2: Interpretation, has also been revised to include new items such as schedules, shoulder notes, etc. although reference to shoulder notes seems superfluous especially in view of the absence of any of these in the new Form.

5.4 Sub-Contract Documents: Clause 2.0

This is a wholly new clause although it appears to mirror the definition of "sub-contract" in Sub-Clause 1.1. As for the 203N Form, it also interestingly avoids the including of "Treasury's Instructions" as part of its contents.

5.5 Nominated Suppliers Liabilities: Clause 5.0

This Clause is a word for word reproduction of the previous Clause 3 bearing a similar label except that it is now reformatted into 2 sub-clauses, namely:

(a) Sub-Clause 5.1: Compliance with the Provisions of Main Contract; and

(b) Sub-Clause 5.2: Indemnity to the Contractor (with a proviso)

5.6 Sample, Testing and Access to the Factory, etc.: Clause 8.0

Clause 8.0 is the reformulation and renumbering of the previous Clause 6 bearing the same title.

The main changes are:

(a) The previous sub-clause 6(a): Sample and Testing; has now been broken into two new sub-clauses i.e. 8.1(a) and (b); and

(b) The previous sub-clause 6(b): Access to Factory, has now been renumbered as Sub-Clause 8.2.

5.7 Deliveries: Clause 13.0

This clause is basically a reformatting and renumbering of the old Clause 11. The only difference is the introduction of the new requirement in sub-clause 13.2 for the Nominated Supplier to submit the original certificate as to quality of the Articles to the S.O.

5.8 Payment to Nominated Supplier: Clause 14.0

This Clause has been revised to bring it in line with the new 203N Form.

It facilitates the direct payment formula/mechanism for the Nominated Supplier and to give effect to the above intent, the new provision has been reformulated into four new sub-clauses, namely:

(a) Sub-Clause 14.1:Payment to Nominated Supplier;

(b) Sub-Clause 14.2:Payment shall not be construed as evidence of quality

(c) Sub-Clause 14.3:Contractor's Right to set-off; and

(d) Sub-Clause 14.4:Payment by the Government

It should be noted that the new sub-clause 14.2 is a mere restatement of the previous sub-clause 13(b).

5.9 Delay in Supply and Delivery: Clause 16.0

Clause 16.0 is a mere reformatting and renumbering of the previous Clause 14 bearing the same label. It comprises two new sub-clauses, that is:

(a) Sub-Clause 16.1: Notice to Contractor; and

(b) Sub-Clause 16.2: Reasonable adjustment.

5.10 Performance Bond: Clause 18.0

The previous Clause 16 has been revamped to bring it in tandem with Clause 27.0 of the JKR 203N (Rev. 2007) Form. The comments on the latter Clause (see para 4.11) are equally relevant to the instant provision. Curiously, contrary to the 203N Form, there is an absence of any period been stipulated as to the validity of such a Bond.

5.11 Assignment: Clause 19.0

A rather peculiar provision combining elements of the previous Clause 17 with Clause 22.0 (sub-contracting) of the new JKR 203N Form, save for the difference between the latter's particular label. All in all, it does not auger well in terms of maintaining consistency.

5.12 Suspension of Sub-Contract: Clause 21.0

A new clause modelled along the Clause 31.0 of the JKR 203N (Rev. 2007) Form, but with the necessary changes made to reflect the differing nature

of works in question. Another material difference is that the consequences of mutual termination as provided for in sub-clause 21.2 are not similar to the other forms; once again being peculiar to the different scope of works.

5.13 Termination of Supplier's Employment: Clause 22.0

This clause combines elements of the previous Clause 19: Determination of Nominated Suppliers' Employment with Clause 32.0 of the new JKR 203N Form.

The main differences between Clause 32.0 of the JKR 203N Form and the instant Clause is in the nature and enumeration of the defaults as well as the consequences of the termination. Save for the above, the comments for the new 203N Form as well as 203 & 203A Forms equally apply.

5.14 Arbitration: Clause 39.0

Is a complete revamp of the previous Clause 23 bearing the same title. The new Clause is in line with similar provisions of the new 203, 203A, DB and 203N Forms; whose comments apply *mutatis mutandis*.

5.15 Miscellaneous Provisions

Some new clauses have been incorporated; these being very similar to the other revised Forms and include the following:

(a) Clause 29.0: Compliance With the Law;
(b) Clause 30.0: Force Majeure;
(c) Clause 31.0: Governing Law;
(d) Clause 32.0: Severability;
(e) Clause 33.0: Notices;
(f) Clause 34.0: Amendment;
(g) Clause 35.0: Successors Bound;
(h) Clause 36.0: Waiver; and
(i) Clause 37.0: Time

6.0 CONCLUDING COMMENTS

Although, the revised Forms are a much welcome change, on the whole, they fall short of the expectations of a professionally drafted family of Forms that are to be employed for the bulk of the public sector projects in the country for the coming years. There are material omissions, deficiencies and shortcomings that need to be acknowledged, rectified and then implemented. Not being overly negative, these include the following:

(a) There is no consistency either in the drafting philosophy, or content between the various Forms that have been revised. Even terms employed for similar situations/applications differ between the various Forms e.g. use of the term "Termination of Contract" in the 203 & 203A Forms and "Termination/ Determination of Employment" in the 203N and 203P Forms.

(b) Prima facie, each Form appears to be revised on a "stand alone" basis and often employing a "cut and paste" arrangement. The contents of all the finished products i.e. the revised Forms 203, 203A, DB, 203N and 203P bear ample evidence of the same.

(c) The language used in the drafting is full of legalese and gobbledygook. The language is not plain enough for the lay contract administrators and ultimate users to easily read, readily comprehend and properly and efficiently implement the many provisions.

(d) There is an unduly overuse of the word "shall" without defining its exact contract effect as to whether it is intended to be mandatory or directory in nature; thereby leading to foreseeable unclarity in its interpretation and eventual implementation.

(e) Seemingly overuse of legally motivated "provisos" instead of simple words such as "if" or "when" thereby leading to uncertainty as to their intended effect/effects. For example, does the "proviso" employed introduce a condition precedent or condition subsequent, etc.

(f) The layout and design of each of the new Forms is inadequate and inconsistent. Although previous "marginal headings" have been deleted, the sub-clauses have not (except oddly for some provisions in the 203N and 203P Form) been given proper headings. This omission seriously compromises proper navigation of each document/

Form by the users and prevents ease of reading and perhaps, even reference.

(g) The numbering system employed within each Form and between the different Forms is neither logical nor consistent, bearing in mind these are purportedly prepared by the same body.

(h) The punctuation used again exhibits both deficiencies and inconsistencies; thereby compromising the due construction that is to be afforded to the various provisions. Ultimately the efficiency in implementation of the said Forms is bound to suffer.

(i) Contrary to good drafting practice, there is an inefficient and underuse of definitions in the Forms leading to "wordiness" and redundancy. For example in Clause 48.1 of the new JKR 203A Form, the phrase "any defect, imperfections, shrinkage or other fault whatsoever" is repeated at least five times instead of just being explained in the definitions as "the term defect shall mean any defect, imperfection, shrinkage or any other fault whatsoever", etc.

(j) There is a predominant use of terms and expressions that are inherently vague to lay persons e.g. forthwith, reasonable, wherein, herein, etc. leading to lack of clarity, precision and disputes as to their interpretation; and

(k) There is a marked absence of inclusive or gender-neutral language in direct contrast to the contemporary style of drafting such documents. BEM

Utilisation Of Rice Husk Waste And Its Ash *(Part 2)*

By M. Rozainee, S. P. Ngo, A. Johari, A. A. Salema and, K. G. Tan
Department of Chemical Engineering, Faculty of Chemical Engineering & Natural Resources Engineering, Universiti Teknologi Malaysia

The first part of this paper appeared in the Mar-May 2009 issue of the Ingenieur.

- **Production of sodium silicate from RHA**

The combustion of rice husk in fluidised bed also produce amorphous RHA of varying colours - black, grey and white. The residual carbon content varies according to the colour with black RHA containing the highest amount of carbon at 24%, followed by grey RHA, 3% and white RHA with the least carbon content of 0.2%. These amorphous RHA was used to produce sodium silicate and the quality of the product was compared to the commercial grade.

Silica in RHA was dissolved using sodium hydroxide (NaOH) in an autoclave. The process is known as caustic digestion. It was found that grey RHA produced clear and colourless sodium silicate solution (*Figure 5*). It is believed that during the digestion process carbon residue in grey RHA helped to clean impurities in the solution. On the other hand, white RHA produced amber solution, while black RHA produced dark brown solution which was undesirable in the sodium silicate industry. The results showed that certain amount of carbon was beneficial to produce clear and colourless sodium silicate solution. It was found that sodium silicate could be produced at temperatures as low as 115°C and concentration of 15 % w/w (15g RHA in 100 ml NaOH solution). The silicon dioxide to sodium oxide (SiO_2:Na_2O) ratio of sodium silicate obtained was 2.48 whereby the optimum ratio in industry is 3.22.

A study was also carried out to produce sodium silicate using RHA obtained from rice mills (*Table 1*). Out of the four samples tested under similar conditions, only sample RHA 3 could be digested with NaOH to produce sodium silicate with SiO_2:Na_2O ratio of 3.00 at temperature of 120°C and concentration of 15 % w/w. the solution was clear and colourless. It was found that not all RHA could produce sodium silicate because the ability to turn RHA into sodium silicate largely depended on the properties of ash. Crystallisation of ash was another factor that hindered the formation of sodium silicate due to low activity and solubility.

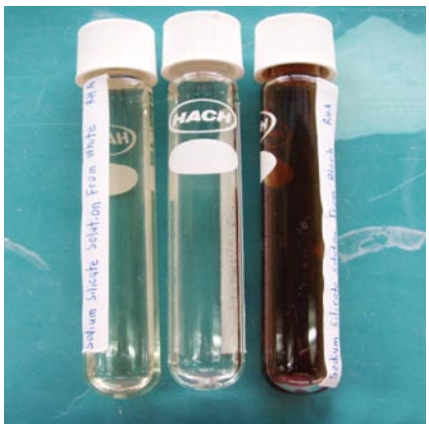


Figure 5: Effects of carbon content in RHA to the quality of sodium silicate solution. From left: Sodium silicate solution of white, grey and black RHA

- **Adsorption capability of RHA**

Capability of RHA as an adsorbent and the effect of caustic digestion to produce sodium silicate on adsorption capacity of RHA were also investigated. Methylene blue (MB) test was conducted to determine the adsorption capacity of RHA obtained from fluidised bed UTM. Methylene blue is a dye in powder form. The test was carried out using concentration of 30mg/L methylene blue solution and that of sorbent was 0.5g RHA in 1L methylene blue solution. *Figure 6* shows the methylene blue colour removal within 40 minutes contact time with grey RHA.

Table 1: RHA obtained from rice mills and its description

RHA	Description
 RHA 1	- Produced by combustion of rice husk in fluidised bed. Burning temperature around 700-800°C. - Coarse black and white particles. Mean particle size of 525µm. - Carbon content of 8.38 %
 RHA 2	- Produced by combustion of rice husk in large cyclone type furnace. Burning temperature around 700-800°C. - Fine black ash with slight white particles. Mean particle size of 324.9µm. - Carbon content of 9.21 %
 RHA 3	- Produced by combustion of rice husk in small cyclone type furnace. Burning temperature around 700-800°C. - Fine black ash with slight grey particles. Mean particle size of 443.8µm. - Carbon content of 5.73 %
 RHA 4	- Produced by combustion of rice husk in large cyclone type furnace. Burning temperature around 700-800°C. - Coarse black ash with slight white particles. Mean particle size of 524.9µm. - Carbon content of 7.67%

Referring to *Figure 6*, it can be seen that the removal of methylene blue colour increases with increase of contact time. After 40 minutes contact time, the blue solution turned into almost clear solution. The time taken for the disappearance of the blue colour varied with the type of ash used. Within 10 minutes of contact time, it was found that grey RHA adsorbed more methylene blue colour compared to black and white RHA.

Table 2 shows the mean particle size and adsorption capacity of RHA obtained from fluidised bed UTM for both raw RHA and caustic digested RHA. The adsorption capacity was measured after 70 minutes of contact time.

For raw RHA, grey RHA has the lowest adsorption capacity. But after caustic digestion process, it showed the highest adsorption capacity. This might be due to reduction of ash particle size after caustic digestion where grey RHA has the lowest mean particle size. In their work of methylene blue adsorption using RHA, *Chandrasekhar and Pramada (2006)* found that RHA that has smaller particles size has higher adsorption capacity than RHA that has bigger particles. Smaller ash particles have larger surface area and adsorb more rapidly than bigger particles thus increasing adsorption capacity. In the production of highly activated carbon from caustic digestion of RHA, *Stephens (2000)* suggested that caustic digestion reduced the size of activated carbon particles.

Methylene blue test was also carried out on RHA obtained from rice mills. Adsorption capacity of the ash was tested using 20 mg/L methylene blue solution and sorbent of 0.5g RHA in 1L methylene blue solution. The adsorption capacity was measured after 20 minutes of contact time. *Table 3* shows mean particle size and adsorption capacity of RHA obtained from rice mills for both raw RHA and caustic digested RHA.

Based on the results in *Table 3*, it was found that caustic digestion reduced the particle size of ash and the trend of increasing adsorption capacity with decreasing particle size can be seen for caustic digested RHA. RHACD2, which has the smallest mean particle size, has the highest adsorption capacity amongst all samples. This is in agreement with the results obtained using RHA from fluidised bed in UTM that caustic digestion reduced

particle size of ash thus increasing adsorption capacity. The finding also agree with *Chandrasekhar and Pramada (2006)*.

In addition, four types of RHA from rice mills (*Table 1*) were subjected to Scanning Electron Microscopic (SEM) study to observe morphology of the ash. *Figure 7* shows the SEM images of each raw RHA.

The pore structure and the surface chemistry of the ash have significant effect on molecules like methylene blue (*Yupeng et al., 2003*). Pores within porous material are classified into three groups called micro-pores (radius lower than 2nm), meso-pores (radius about 2 to 50nm) and macro-pores (radius more than 50nm). The micropores and mesopores give the carbon its adsorption capacity (*Stephens, 2000*). Methylene blue molecule has a minimum molecular cross section of about 0.8 nm and cannot enter pores less than 1.3 nm. Therefore, it can only enter into the larger micro pores (*Daifullah et al., 2003*).

Referring to *Figure 7*, only RHA 4 showed obvious appearance of pores. The size of pores is about 4 to 7 µm (4000-7000nm) at 2000X magnification factor.

Table 2: **Mean particle size and adsorption capacity of raw RHA and caustic digested RHA (fluidised bed UTM)**

Sample	Mean particle size (µm)	Adsorption capacity (g MB/kg ash)
Raw RHA		
Black	369.27	12.43
Grey	184.72	2.57
White	212.60	12.69
Caustic digested RHA		
Black	289.62	51.39
Grey	126.27	53.87
White	185.90	51.39

Table 3: **Mean particle size and adsorption capacity of raw RHA and caustic digested RHA (rice mills)**

Sample	Mean particle size (µm)	Adsorption capacity (g MB/kg ash)
Raw RHA		
RHA 1	525.0	19.79
RHA 2	324.9	16.21
RHA 3	443.8	16.12
RHA 4	524.9	13.69
Caustic digested RHA		
RHACD1	355.5	29.29
RHACD2	228.7	35.55
RHACD3	310.9	34.01
RHACD4	385.9	24.90

(a) **(b)** **(c)** **(d)** **(e)**

Figure 6: Photographs of methylene blue colour removal. The colour removal was observed in 25ml sampling bottle. Contact time: (a) before putting the ash, (b) after 10 minutes, (c) after 20 minutes, (d) after 30 minutes, (e) after 40 minutes

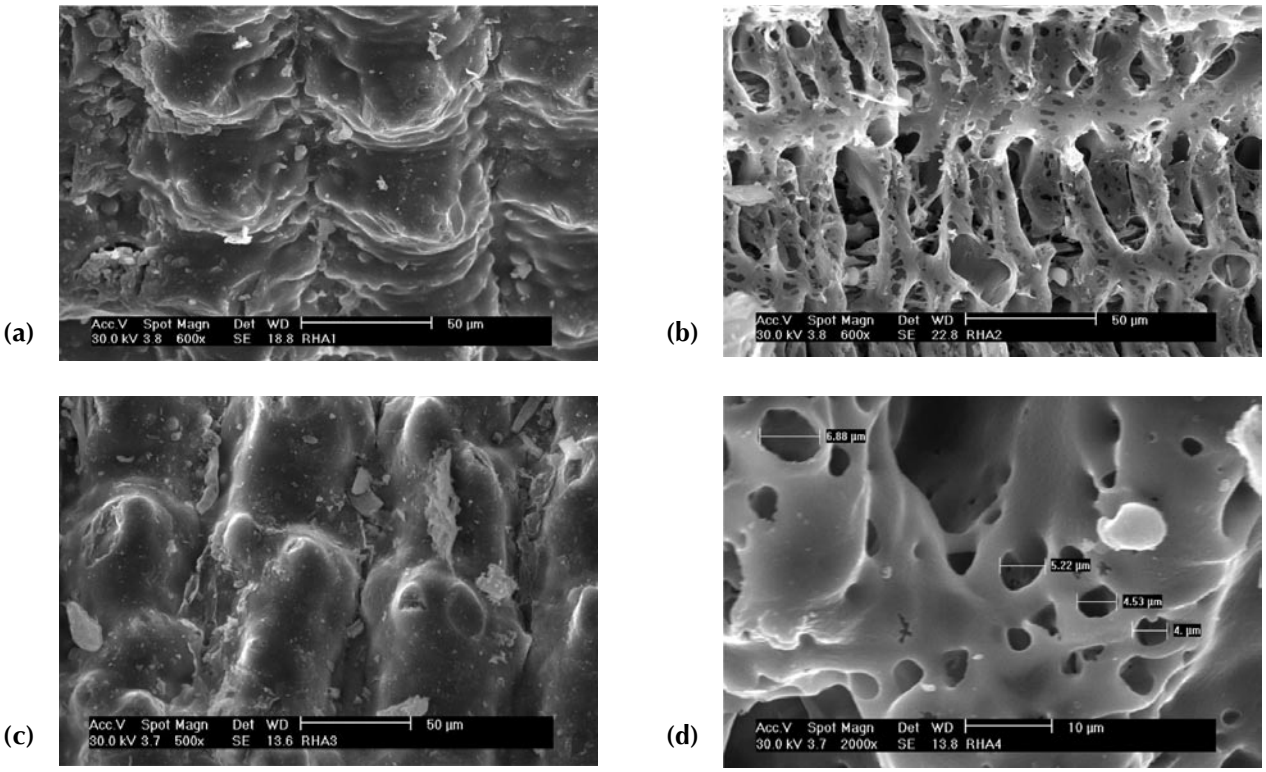


Figure 7: (a) SEM image of RHA 1 at 500X magnification factor, (b) SEM image of RHA 2 at 500X magnification factor, (c) SEM image of RHA 3 at 500X magnification factor, (d) SEM image of RHA 4 at 2000X magnification factor

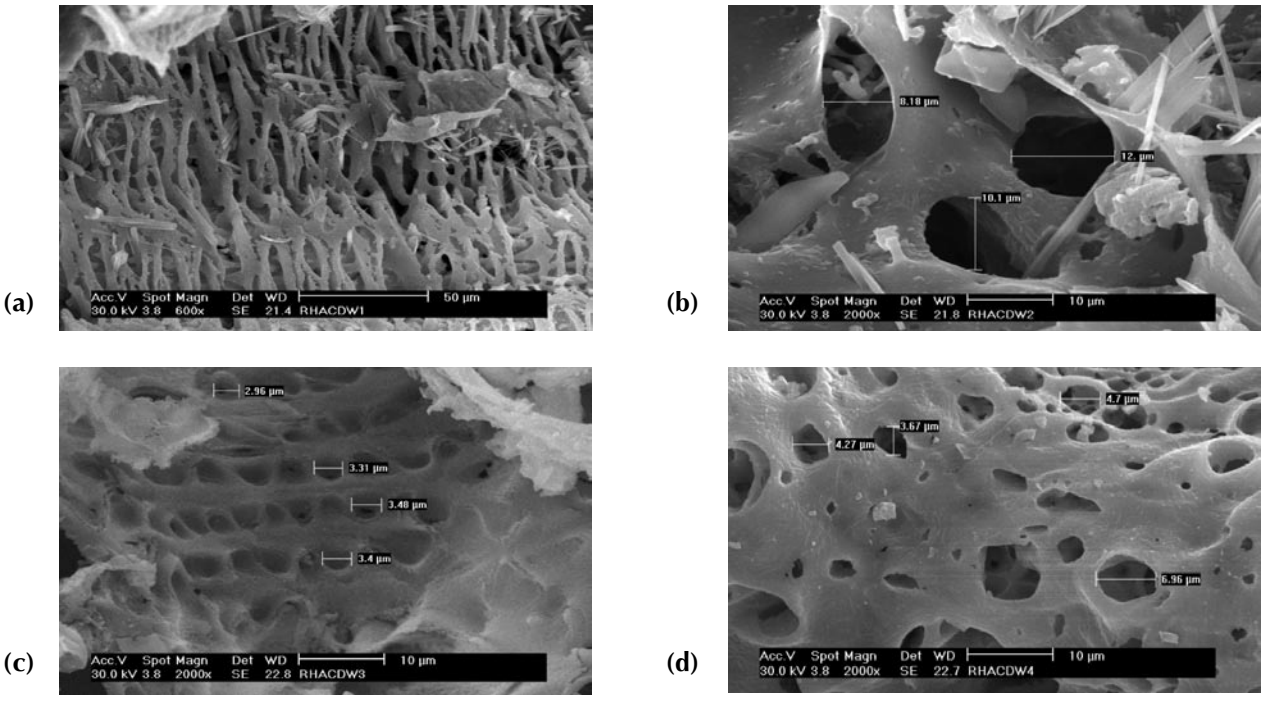


Figure 8: (a) SEM image of RHACD1 at 1000X magnification factor, (b) SEM image of RHACD2 at 2000X magnification factor, (c) SEM image of RHACD3 at 2000X magnification factor, (d) SEM image of RHACD4 at 2000X magnification factor

Methylene blue test using these raw RHA samples showed that RHA1 has higher adsorption capacity followed by RHA 2, RHA 3 and RHA 4 (*Table 3*). This was expected as RHA 4 has too large pores, thus the adsorption cannot occur effectively. Meanwhile, RHA 1, RHA 2 and RHA 3 may have very fine pores that cannot be seen by SEM analysis which effectively adsorbs methylene blue.

The SEM images of the RHA after caustic digestion process were also obtained to be compared with SEM images of raw RHA. *Figure 8* shows the SEM images of each type of RHA (*Table 1*) after caustic digestion process labelled as RHACD1, RHACD2, RHACD3 and RHACD4.

Referring to *Figure 8*, RHACD1 did not show the appearance of pores while RHACD2, RHACD3 and RHACD4 revealed obvious appearance of pores. The pores size is about 3 to 12 µm (3000-12000nm) at 2000X magnification factor. The highest adsorption capacity was achieved by RHACD2, followed by RHACD3, RHACD1 and RHACD4 (*Table 3*). It was found that the caustic digestion process has increased the adsorption capacity of all RHA. However, the increase in adsorption capacity after caustic digestion was not clear. The pores size observed from the SEM study was too large for the adsorption of methylene blue. Probably, the caustic digestion created more micropores and mesopores that are responsible for adsorption but could not be observed from the current image of SEM.

In this morphology study, pores that are responsible for adsorption capacity were not known. The pores that were observed were too large (1,000 times larger than adsorptive pores) which did not influence the adsorption capacity. Further studies regarding surface area, total pore volume, micro pore volume and average pore radius need to be conducted in order to justify the adsorption capacity.

Conclusion

Research work conducted in UTM showed that rice husk could be a good source of renewable energy and raw material for the production of amorphous silica and sodium silicate. Such purposes could be achieved through the proper combustion of rice husk in fluidised bed which could produce RHA for commercial utilisation. The possibility of using RHA as a raw material is of interest to replace conventional method of producing sodium silicate, which is high-energy intensive. Furthermore, RHA has the potential as a cost-effective adsorbent. Such practices eliminate environmental and health problems associated with the disposal of rice husk (i.e. field dumping and open burning). From the economic standpoint, these practices have the potential of fuel cost savings in paddy drying as well as revenue generating from the sale of valuable materials (i.e. amorphous silica). BEM

REFERENCES

Bronzeoak Ltd. (2003). *Rice Husk Ash Market Study*. Doc. Ref. No. ETSU U/00/00061/REP, DTI/Pub URN 03/668.

Chandrasekhar, S. and P. N. Pramada (2006). *Rice Husk Ash as an Adsorbent for Methylene Blue - effect of ashing temperature*. Springer Science. 12: 27-43

Daifullah, A.A.M., B.S. Girgisand H.M.H Gad (2003) *Utilization of agro-residues (rice husk) in small waste water treatment plans*. Material Letters. 57: 1723-1731.

Department of Statistics Malaysia (2005). *Key Statistics*. Website: http://www.statistics.gov.my/English/keystats.htm (accessed on 30th May 2006)

James, J. and Rao, M. S. (1986). *Silica from Rice Husk through Thermal Decomposition*. Thermochimica Acta. 97: 329-336.

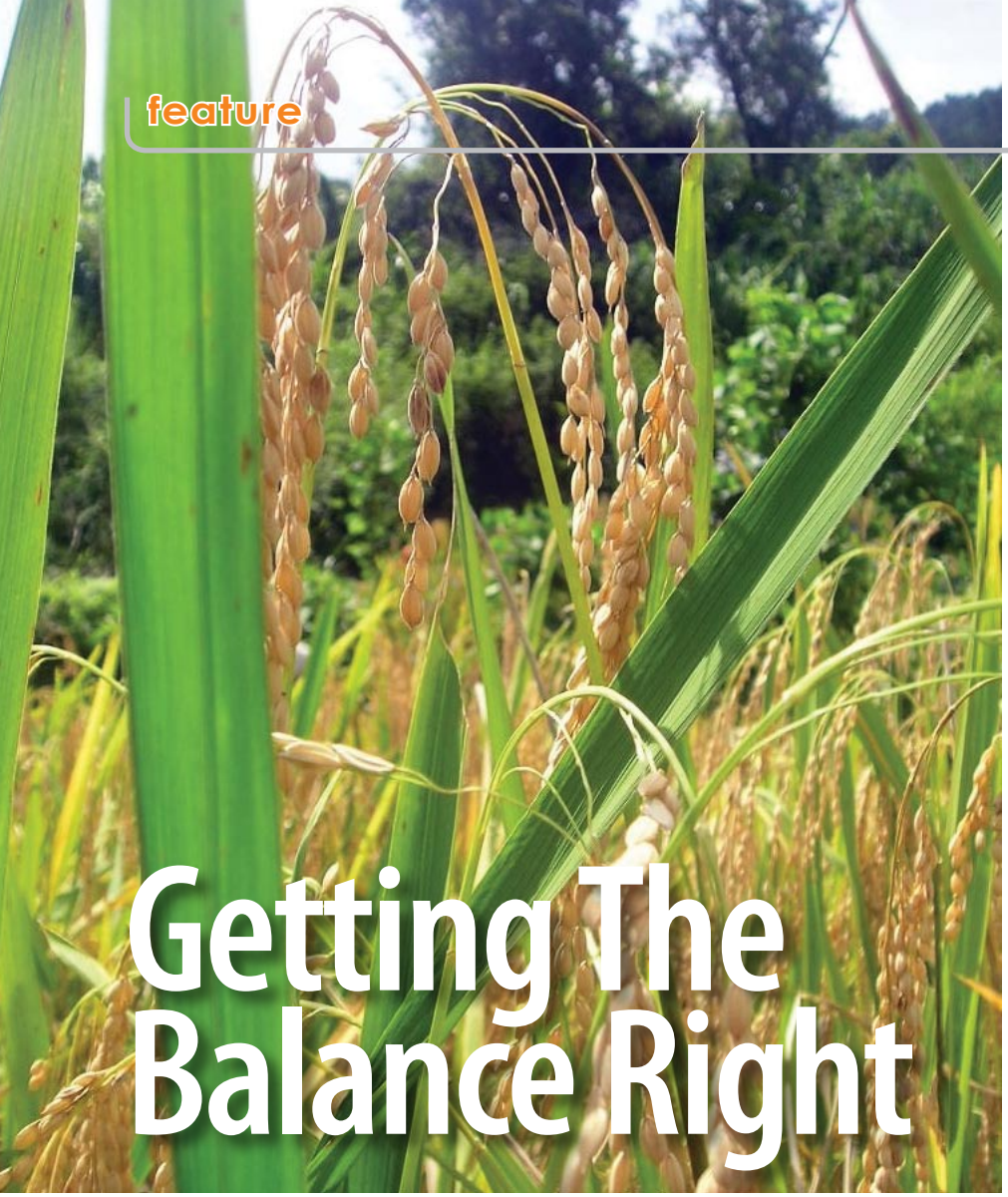
Kapur, P. C. (1985). *Production of Reactive Bio-Silica from the Combustion of Rice Husk in a Tube-in-Basket (TiB) Burner*. Powder Technology. 44: 63-67.

Kaupp, A. (1984). *Gasification of Rice Hulls: Theory and Practices*. Eschborn: Deutsches Zentrum Fuer Entwicklungs Technologien (GATE).

National Energy Balance Malaysia Year 2000 Report. Ministry of Energy, Communications and Multimedia, Malaysia. pg 3. Website: http://ns2.ptm.org.my/medishomepage/PDFReport/NEB2000.pdf (accessed on 26th March 2003)

S. P. Ngo. (2006). Production of Amorphous Silica from Rice Husk in Fluidised Bed System. Universiti Teknologi Malaysia: PhD Thesis.

Stephens, D. K. (2000). *Highly Activated carbon from Caustic Digestion of Rice Hull Ash and Method*. (U.S. Patent 6,114,280)



Getting The Balance Right

By Larry C.Y. Wong
Senior Fellow, ISIS Malaysia

Text reprinted with permission from AsiaViews, May-June 2008

Recently, there has been a deluge of opinions on the causes and impact of the global food crisis and spiralling prices. When we take a closer look at rice in Malaysia, there is an invariable sense of *déjà vu*.

We witnessed a rice crisis in 1972/73, with only a few rice exporting countries them. Thailand had a bad crop and banned exports. China followed suit, as did the United States. Prices jumped four-fold. There were rice riots and rationing, including mandatory mixing of rice with corn in the Philippines and South Korea. Malaysia pulled through by arranging special Government-to-Government supply, especially from China. A consequence of this crisis was the withdrawal of import licenses from private importers and the sole-importer right accorded to the National Padi Board (better known by its Bahasa Malaysia acronym, LPN).

The next rice crisis occurred in 1997/98. LPN was corporatized as Bernas in 1994, and privatized in 1996, and allowed to retain its import monopoly till 2010 in return for performing a set of social functions. The effect of El Nino in 1997 on rice production and exports was compounded by the Asian Financial Crisis. Although rice prices rose only slightly, the sharp re-alignment of US$ to Asian currencies, with the Ringgit depreciating from 2.5 to 4.8 to a US$, meant a doubling of prices. Again, Malaysia came out of it relatively unscathed. Bernas was able to withhold the pass-through of prices for more than six months in 1998, especially for lower grades rice by cross-subsidizing them from exporters' margins from its overseas joint-venture rice exporting companies in Thailand and Pakistan, as well as from the margins for high-end imported rice grades. This underscored the relevance and importance of supply chain management in turbulent times.

How different is it this time around, especially in terms of causes and impact? Are there any relevant lessons from the previous crises?

Confluence of Factors

This time, beyond the usual causes of production shocks, trade policy and low stocks, high input and transportation costs coupled with population growth, income growth and demand causing the imbalances and volatility in the world food market, there are some new dimensions that have accentuated it. These include the frenzy over biofuels, weakening of US$ (in which most food commodities are denominated), and the shifting of investment funds from stocks to commodities (with rice being the latest commodity play). Human folly and greed were also manifested in the unprecedented level of hoarding at the various levels of the rice supply chain in Thailand, and the "run on rice" or unbridled panic buying witnessed, of all places, in Ho Chi Min city in late April.

Impact and response

Despite equating food security with sufficient supply of rice, only 415,000 ha (half of which is double cropped) is planted to the crop in Malaysia as compared to some 4 million ha under oil palm and 1.2 million ha under rubber, underscoring Malaysia's comparative advantage in tree crops. Rice's contribution to GDP is merely 0.2% in 2006 which is disproportionate to the extent of Government intervention and support. The price of only one grade of rice, ST15%, targeted at the lower income and disadvantaged group is controlled, the rest, including all imported rice, are floated. The Malaysian Rice Supply Chain comprises 27 million consumers, 44,637 retailers, 1,239 wholesalers, 204 millers, and 155,990 farm families.

In tandem with recent increases in global prices, there is an increase in the price of all grades of rice except for the control grade, maintained at RM1.65 to 1.80 per kg according to zones. Other grades of local rice have increased to RM3.20 per kg as compared with RM3.70 per kg for imported rice. Padi prices have also increased in tandem, from RM0.75 per kg to RM1.20 per kg in areas currently being harvested. With this steady increase in local paddy prices, a supply response in terms of increased production is expected.

In view of an anticipated increase in demand for the controlled grade, the Government is requiring all millers to produce a minimum of 10% of total output as ST15%. The Government has also increased the national stockpile with a special G-to-G arrangement with Thailand. The Government has also announced a RM4 billion package comprising increased allocation for R&D and irrigation infrastructure/facilities for existing and new areas as well as a range of subsidies. On the demand side, campaigns are conducted to reduce wastage along the supply chain and in eating habits as well as to reduce consumption and diversify diets. Concerted efforts are also directed at developing, managing and orchestrating supply chains so that they can compete with each other and in that process help drive efficiency increases and innovativeness. In this regard, there have been repeated calls to open up the monopoly in imports currently held by Bernas.

My Take

Consequently, the current crisis is not one of shortage but rather one of prices. Malaysia, a small open economy of 27 million people is a large trading nation with trade exceeding one trillion Ringgit for the past two years. Per capita consumption has also declined from 88.4kg in 1999 to 77kg currently. So, Malaysia

Rice milling

should easily be able to source the 600,000 to 800,000 tons it requires from a global market of 28 to 30 millions tons. Any transient 'shortage' would largely be due to greed, hoarding, and panic buying arising form misinformation and speculation. In this regards, we are reminded of the Gandhian adage that there's always 'enough for everyone's need, BUT never enough for everyone's greed'!

In relation to rising prices, we have to accept that the era of cheap food is over. While international prices of the various types and grades of rice are expected to retreat from their peaks by as much as 20% by June/July and more than 40% by the end of 2008, they are expected to stabilize at a level higher than before, at least for the next two to three years. Therefore, we need to have a safety-net for and leave the cheaper controlled grade to the vulnerable and disadvantaged.

Once again, and as in the 1997/98 crisis, the importance and relevance of supply chain management in turbulent times in mitigating impact is underscored. How well the various stakeholders along the rice supply chain do in the present crisis hinges on how well Bernas manages (or mismanages) it as well as in the performance of the Ministry of Agriculture and Agro-based Industries' Paddy & Rice Division in regulating the industry.

There is a potential blessing accompanying this latest crisis, for with higher paddy prices and hence farm incomes, there are distinct opportunities to drive the transformation of the Malaysian Rice Industry while getting the balance right. Getting the balance right in the Malaysian context means that no one group along the rice supply chain gets everything it wants. Stakeholders must be convinced that sacrifices are necessary but temporary, in order to accommodate new dimensions.

White rice ready for packing

However, there are always factors that can derail the above expectations, such as the recent Cyclone Nargis that hit Myanmar and the proposed future trading of rice in the commodity markets in Pakistan and China besides that of Thailand. Consequently, we need to be more vigilant, improve our monitoring and response capacity and capability as well as hone our ability to respond to future challenges as a nation.

Latest Development

Prime Minister Abdullah Ahmad Badawi's announced on May 12 a comprehensive package to keep rice price low, supplies high and ensure better prices to farmers. The package comprises the assurance of sufficient supply of controlled grade; capping of other local rice prices; floating of imported rice prices; increase in Guaranteed Minimum Price of Padi; gradual removal of restriction of interstate movement of Padi; and increase in the national rice stockpole.

Meanwhile, a review of the role of Bernas is being conducted by the Economic Planning Unit of the Prime Minister's department. This, coupled with the Prime Minister's announcement on May 10 that Sime Darby would be involved in the development of the rice industry in Sabah and Sarawak may well be the harbinger that Bernas' monopoly is on the line. In many important ways, it would indeed be ironical that it took a major rice crisis in 1973 for LPN to be made the sole importer, another in 1998 to vindicate the Government's boldness in privatizing a national food corporation, and finally the current crisis for the monopoly to be removed earlier than planned, opening the way for future competition between rice supply chains which as a central tenet of supply chain management, should augur well for the future development of the Malaysian rice industry. BEM

Safe Hill-Site Development Seminar

By Geotechnical Technical Division, The Institution of Engineers, Malaysia
Rapportuers: Ir. Chua Chai Guan, Suvarna Ooi and Ir. Sridhar Krishnan

The Board of Engineers, Malaysia (BEM), the Public Works Department, Malaysia (JKR), the Institution of Engineers, Malaysia (IEM) and the Association of Consulting Engineers of Malaysia (ACEM) co-organised a seminar on '*Safe Hill-Site Development*' at Holiday Villa Subang, Selangor, on Feb 14, 2009. The seminar was attended by more than 450 participants comprising consultants, developers, planners, contractors, geologists, local authorities and social activists.

Participants at the seminar

Four speakers were invited to deliver three keynote lectures and one special presentation, followed by a forum on 'Safe Hill-Site Development'. The three keynote speakers were Ir. Raymond KS Chan, Head of Geotechnical Engineering Office (GEO), from the Hong Kong Special Administrative Region, Prof Dr Faizal Haji Ali from University of Malaya (UM) and Ir. Dr Ooi Teik Aun from TAO Strategic Solutions Sdn Bhd. The other speaker was Dato' Ir. Dr Ashaari bin Mohamad from the Slope Engineering Branch (Cawangan Kejuruteraan Cerun) of Jabatan Kerja Raya (JKR).

The forum panellists were Ir. Dr Ting Wen Hui, Past President of IEM; Dr Dahlia binti Rosly, Director of Research Development Department from the Federal Department of Town & Country Planning, Peninsular Malaysia; En Zakaria bin Mohamad, Director of Mineral & Geosciences Department Malaysia (JMG); Datuk Eddy Chen, Past President, Chairman and Board of Trustees of REHDA, Institute of the Real Estate & Housing Developers' Association (REHDA); Mr Kwan Foh Kwai, Deputy President of Master Builders Association Malaysia (MBAM) and Ar. Ng Yean Shiunn, a committee member of the National House Buyers Association (HBA). All sessions were chaired by Datuk Paduka Ir. Haji Keizrul bin Abdullah, the current President of IEM.

The seminar started with a welcoming speech given by the President of the Board of Engineers of Malaysia, Dato' Sri Prof Ir. Dr Judin Abdul Karim. He emphasised that the main objective of this seminar was to provide a platform to exchange opinions and to collect suggestions from the speakers, the panellists and the floor, particularly expertise from Hong Kong on landslide management, prevention, mitigation, public education and rehabilitation of failed slopes. He urged local authorities, developers, contractors,

Participants at the seminar

professionals, Government agencies and participants to work together to achieve the theme of the seminar which is 'Safe Hill-Site Development'.

Minister's Speech

The seminar was then officiated by the Minister of Works YB Dato' Sri Ir. Mohd Zin bin Mohamed. He said that the idea of having this seminar was conceived after the three incidents of landslide, which occurred towards the end of last year, which has raised public concerns on the safety of hill-site development. The relevant Government agencies were studying how to mitigate landslide incidents as it was not practical to freeze all hill-site developments which are demanded by the free market as well as the increase in land use by the growing population in urban areas.

He elaborated that Government agencies such as the JKR, CIDB, JPS, town planners, developers, architects, engineers, contractors and house owners should work hand-in-hand in dealing with the safety of hill-site developments. Developers should be more careful with hill-site developments by realising the associated risks and providing sufficient budget to hire geotechnical engineers and contractors who have the relevant experience and knowledge. Developers were urged not to compromise on any safety issues which will put public safety at risk.

Engineers as well as contractors were also asked to put more emphasis on public interest, especially slope safety during construction activities. He also stressed that existing rules and laws related to hill-site developments should be strictly enforced, particularly for maintenance works required by the local authorities. This includes routine inspections on the drainage system at landslide prone areas. In addition, earth filling works by end tipping method (tip-fill without compaction) had caused several slope instabilities and should be banned immediately. However, enforcement lies with the local authorities.

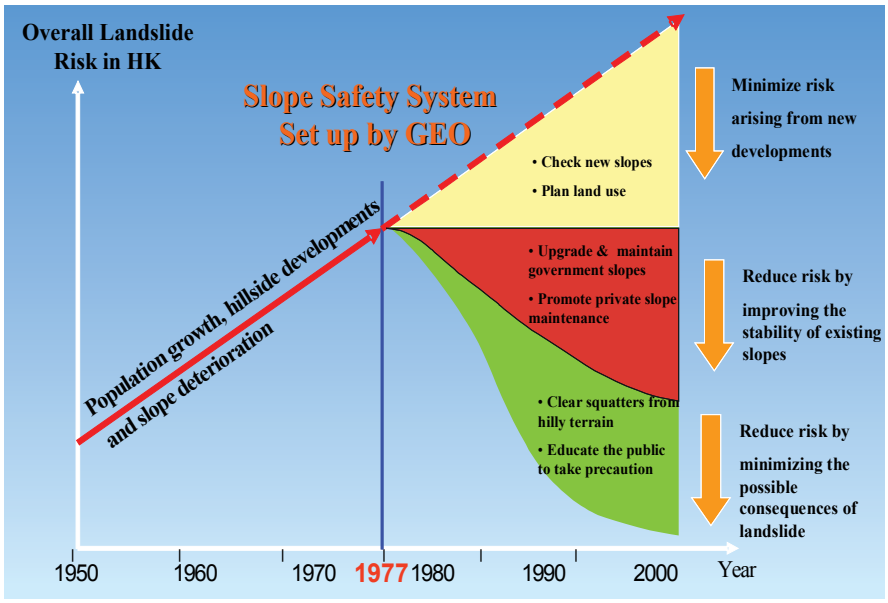


Figure 1: Landslide Risk Reduction Strategy

The Minister pointed out that, at the current stage, the criteria for allowing new hill-site development have become more stringent as there are 13 Government agencies carrying out evaluation. A 'Professional Engineer's Due Diligence Report' is required for hill-site development to ensure public safety. Besides that, a comprehensive infrastructure master plan should be in place before a hill-site development is approved. This means that access roads, irrigation and drainage, retaining structures, water and power supply, and telecommunication would have to be built first prior to the development of buildings/ structures.

Keynote Lecture: Challenges in Slope Engineering in Hong Kong

The first keynote speaker, Ir. Raymond Chan, presented his paper entitled 'Challenges in Slope Engineering in Hong Kong'. First, Ir. Raymond Chan introduced Hong Kong which, by nature, is an environment particularly prone to landslide due to its extremely hilly terrain, deep weathered rock profiles, high seasonal rainfall, dense population and developments close to the hillside. In 1970s, many filled slopes were formed with little geotechnical input and construction control, resulting in a major slope safety problem in Hong Kong.

Two major landslides in 1972 and 1976 claimed a total of 138 fatalities and drew major media coverage and public concern. Subsequently, this led to the setting up of the Geotechnical Control Office in 1977 (renamed Geotechnical Engineering Office or GEO in 1991). Since then, after many years of concerted efforts the

risk of landslides in Hong Kong has been reduced significantly to a manageable level through a slope safety system, see *Figure 1*.

Ir. Raymond Chan said that one of GEO's main functions in the early days was to introduce and exercise a control system over all new geotechnical works in order to contain the landslide risk at the 1977 level, and to ensure a sustainable urban development on Hong Kong's hilly terrain. GEO has been able to exercise geotechnical control over private projects through the statutory authority of the Buildings Department (legal basis), and public projects through Government administrative requirements.

This was extended from new slopes to cover other geotechnical works including tunnels and deep excavations. GEO also provides advice to Government departments on site usages as well as geotechnical constraints, and special lease conditions at land-use planning stage. This can minimise the risk arising from new developments by planning land use and the inclusion of relevant geotechnical clauses into land disposal documents. GEO imposes rigorous submissions and processes for the control of private development, see *Figure 2*.

Ir. Raymond Chan also stated that Geotechnical Investigation (GI) works are to be carried out by registered specialist contractors, and laboratory and field tests are to be carried out by accredited laboratories in Hong Kong. GEO also adopts special geotechnical control in some scheduled areas, e.g. limiting excavation level in slope areas and setting a minimum of 20m socketting in sound rock for limestone formation. He revealed that the control on public development by GEO is the same standard and level as for private development.

There are 57,000 man-made slopes in Hong Kong. Ir. Raymond Chan reported that an on-going Landslip Preventive Measures (LPM) programme has been implemented to upgrade substandard man-made Government slopes. Slopes are selected from the Slope Catalogue based on a risk-based priority classification system. This enables an effective reduction in landslide risk. Inadequate slope maintenance is a contributory factor in many landslides in Hong Kong. The 39,000 Government slopes are maintained by seven maintenance departments. GEO provides them with guidelines and conducts audits to help them improve their slope maintenance works.

GEO carries out safety screening for private slopes as part of the LPM programme and gives advice to the Buildings Department on the issuing of Dangerous Hillside Orders for substandard private slopes. GEO also conducts a systematic public education programme to encourage private owners to maintain their slopes. GEO's experience in reducing the consequence of landslides is to clear squatters from hilly terrain and maintain public vigilance on landslide risk. It also can be reduced by providing landslip warnings, emergency service and information for the public. The approaches taken by GEO also include free slope safety information through the Hong Kong Slope Safety website *(http://hkss.cedd.gov.hk)* and the Emergency Control Centre.

Ir. Raymond Chan mentioned that by 2000, the Slope Safety System had reduced the overall landslide risk of old man-made slopes to less than 50% of that in 1977. GEO strives to reduce it further to less than 25% by 2010. Although landslide fatalities have been greatly reduced, the public has become less tolerant of the occurrence of multi-fatality landslides and secondary impact of landslides such as road closure and building evacuation. The public is

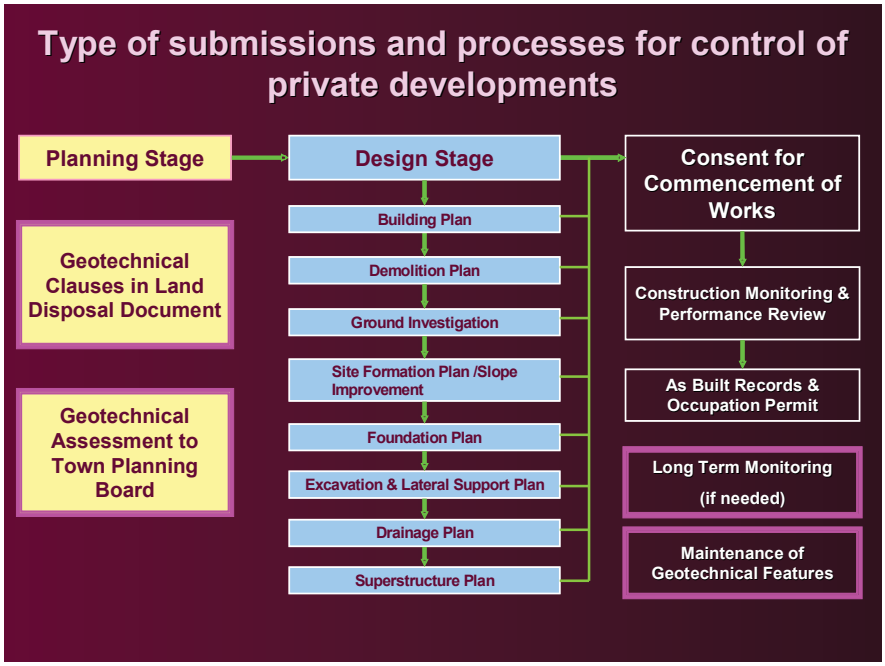


Figure 2: Control processes for private developments

Key contributory factors to failure of engineered soil cuts in Hong Kong

Contributory factor	All failures	Minor failures	Major failures
Adverse groundwater conditions	30%	38%	75%
Weak geological materials	46%	40%	67%
Inadequate slope maintenance	45%	55%	19%
Inadequate surface drainage provisions	5%	7.5%	Nil
Uncontrolled, concentrated surface water flow	2%	2.5%	Nil

Figure 3: Key factors of engineered slope failure in Hong Kong

demanding a better and greener living environment. GEO takes a leading role in making the man-made slopes look as natural as possible and blending them with their surroundings.

Ir. Raymond Chan reported that since its establishment, GEO has been undertaking geotechnical research and development projects with an aim to set the geotechnical standards for Hong Kong and prepare professional guidance documents for practitioners. GEO also compiled the key contributory factors to the failure of engineered soil cuts in Hong Kong as shown in *Figure 3*.

The three major factors are adverse groundwater conditions, weak geological materials and inadequate slope maintenance. GEO also carried out systematic research and development (R&D) on natural terrain landslide hazards. This is to improve the understanding of the types, mechanisms and causes of natural terrain landslides.

Ir. Raymond Chan concluded that a key to success is the rich geotechnical expertise embodied in GEO and the geotechnical community gained over the past 30 years, through the implementation of slope projects, research and development work, learning from landslides and interaction with international geotechnical experts.

Special Presentation: Landslides and National Slope Policy

With a view of sharing local experience in dealing with landslides and slopes, Dato' Ir. Dr Ashaari from JKR was invited to give a presentation entitled 'Landslides and National Slope Policy'.

Dato' Ir. Dr Ashaari started his presentation by introducing the history of the Slope Engineering Branch. It was established by the Malaysian Government after the Bukit Lanjan landslide in 2003. It is tasked with the administration of all slopes in Malaysia and the implementation of the National Slope Master Plan (NSMP) spanning 2009 to 2023 (15 years).

He also reported that past landslides (including debris flows) had killed about 500 people in Malaysia since 1961. The resulting economic loss was estimated to be about RM2.5 billion, see *Figure 4*. Most landslides occurred on man-

Place	Date	Consequences	Estimated loss (RM Million)
Ringlet, Cameron Highlands	1961	16 deaths	35
Highland Tower, Selangor	1993	48 deaths	185
Genting Sempah jalan ke Genting Highlands, Selangor.	1995	20 deaths	48
Lebuh Raya Utara Selatan di GuaTempurung, Perak.	1996	1 death, expressway closed for 15 days	17
Aliran puing Pos Dipang, Perak.	1996	44 deaths	69
Aliran puing Keningau, Sabah.	1996	302 deaths	459
Simunjan, Sarawak.	2002	16 deaths	32
Km 44 Jalan Spg. Pulai Cameron Highlands	2000	Road opened in 2004 (4 yr delay)	355
Bukit Lanjan, Lebuhraya NKVE	2003	Expressway closed for 6 months	860
Kg. Pasir, Ulu Kelang	2006	4 deaths	21
Bukit Antarabangsa, Selangor	2008	5 deaths	200

Figure 4: Major Landslides in Malaysia since 1961

made slopes, triggered by heavy rainfall.

Dato' Ir. Dr Ashaari further elaborated that the main objective of the implementation of the NSMP is to provide a comprehensive and effective national policy, strategy and action plan for reducing risks and losses from landslides. He concluded that the successful implementation of the NSMP depended on the political will of the Malaysian Government, co-operation and interaction between the various relevant agencies, engaging the public, and the formation of a dedicated agency to administer and co-ordinate all slope works and guidelines.

Keynote Lecture: Unsaturated Residual Soil Hill-Site and Safety of Slope

Prof Dr Faisal Ali from UM presented the second keynote lecture entitled 'Unsaturated Residual Soil Hill-Site and Safety of Slope'. He reviewed the important features of unsaturated residual soils, field measurement of the soil matric suction and laboratory determination of their strength properties. He also outlined the difficulty in assessing slope stability using analytical methods, as well as the use of vegetation for the prevention of slope failures. He concluded that the heavy rainfall in tropical areas is largely responsible for the many slope failures that occur in steep terrain; the rapid infiltration of water is due to the high permeability of residual soil material.

Collapse of Block 1 Highland Towers Condominium

Keynote Lecture: Some Cases of Mitigation and Rehabilitation of Slope Failures in Malaysia

Ir. Dr Ooi presented the third keynote lecture entitled 'Some Cases of Mitigation and Rehabilitation of Slope Failures in Malaysia'. He shared his opinions on three major fill-slope failures in Malaysia and the relevant ensuing mitigation and rehabilitation works. One of the cases was the landmark retrogressive landslide which caused the collapse of Block 1 of the Highland Towers Condominium in which 48 people were killed in 1993.

He quoted the High Court Judge's sentences which concluded that drainage and its maintenance were principally responsible for the landslide and apportioned the blame on the various parties that were involved in and around the Highland Towers development site. The residents of Block 1 of the Highland Towers Condominium lost their home, while Block 2 and 3 are still abandoned buildings after 15 years. Rehabilitation work to Block 2 and 3 is dependent on a master drainage plan to be prepared by the local authorities, but it has yet to be done.

The other case was the landslide which occurred at Taman Zooview in Ulu Klang killing four people in 2006. The rehabilitation work was completed in early 2008 and residents have moved back to their terrace houses with spacious backyard garden in

July 2008. The Zooview slope rehabilitation uses the ancient philosophy of reinforced soil with modern geogrids reinforcement instead of the reeds and twigs used in ancient time.

The third was the Gasing Height fill-slope failure involving two Government quarters in 1971. The Government took the developer to court. However, the case was settled out of court with the developer rehabilitating the slope with proper compaction and also rebuilding the Government quarters. So far the slope has been stable since rehabilitation in 1970s.

The fourth case was a railway cut slope failure, where the need to protect the railway line from the high cut slope was not recognised. Slope toe softening due to the high ground water table of the slope was responsible for the slope failure during an incessant rainfall period. Besides that, poor slope drainage maintenance also caused localised slope collapses due to the overflow of V-shape berm-drains. Reinforced toe wall was used to rehabilitate the failed slopes. It provided a stabilised slope toe for the high cut slope and also a better sight distance to the railway line.

Ir. Dr Ooi stressed that full time supervision by independent Professional Engineers for hill-site development is crucial for the successful rehabilitation works of failed slope. This is also important for new development as can be seen from the bad practices and case histories of hill-site slope failures.

He observed that the recent Bukit Antarabangsa high profile landslide also happened during a period of incessant rainfall with the failure of a 20-year-old tip-fill uncompacted slope. He pointed out that poor drainage maintenance and tip-fill slopes were again the common factors that caused landslides.

Bukit Antarabangsa landslide

Open Forum

Before the forum session started, Chairman Datuk Paduka Ir. Haji Keizrul reminded all panellists to adhere to the guidelines for the forum. Datuk Keizrul then introduced each panellist to the audience.

- **Institution of Engineers Malaysia**

Ir. Dr Ting Wen Hui revealed that he represented the committee that was drafting and updating the IEM position paper on mitigating the risk of landslide on hill-site development. The committee was assigned many tasks and a large group of geotechnical and civil engineers have been working on the paper. He was hopeful that it could be ready by the end of February.

He said, 'We like to use the word mitigation simply because the complete avoidance of landslide is not possible even in advanced countries where the system is much more sophisticated and detailed than ours.'

Ir. Dr Ting also criticised the fact that the media always seems to go into frenzy whenever any landslide happens. They look for sensational news and for people to supply them with outrageous and sensational comments. At the same time, IEM is very concerned with public safety, which is the reason why the committee sat down to work. He said, 'In 1995, a similar conference was jointly organised by the BEM and IEM. It was the aftermath of the collapse of the Highland Towers. The conference also included regulators, architects, consulting engineers, geoscientists as well as eminent foreign speakers.'

Based on his personal observation, after the 1995 conference, various steps were taken and significant improvement in mitigation was observed. He said, 'We must also realise that hill-site development has increased, therefore, the likelihood

of landslide incidents would also increase.'

With regards to the recent news frenzy mainly focusing on high profile failures in Bukit Antarabangsa and Jalan Semantan, he said, 'I want to finish by examining one management point which I think should be looked into in view of Bukit Antarabangsa and Jalan Semantan, although there are many factors at play.'

He continued, 'As Dr Ooi mentioned, some of them are old projects. The Bukit Antarabangsa project was initiated in the late 1980s. From what we gather, the wall that gave way in Jalan Semantan was constructed before 1995, before the improvements were put in place. As far as Bukit Antarabangsa is concerned, the use of tip fill on hill slope is very common. The hill is also known to be very porous, full of joint and water just goes through. That is the reason why surface water and subsurface drainage is very important.'

In the case of Jalan Semantan, he said, 'I made a personal investigation and found that there was a history of design on that particular anchored wall. Due to a change of owners, I believe that the people who took over tried to improve the site. However, they did not look into how the wall was built and the reasons behind it. In my mind, that contributed to collapse of the wall.'

He quoted Prof T.H. Hanna, the world's leading authority on anchors, who said that there are no permanent anchors. He advised that anybody who attempts to use permanent anchors to reconsider.

Ir. Dr Ting mentioned that soil nails have often been used to maintain slopes of highways. However, these soil nails should be regularly checked, particularly on the corrosion of the head which can weaken the structure. He reiterated the importance of checking the history of someone's work, as well as the need for regular maintenance and monitoring. He advised that a project not only needs a good design from the beginning, but also, more importantly, regular maintenance after the design and construction stage as many failures are long term failures and do not happen immediately.

Federal Department of Town & Country Planning

Dr Dahlia pointed out that the Federal Department of Town & Country Planning places the development of programmes and community related to the conservation of natural resources, environmental protection and social stability as a priority. These priorities are translated into the National Physical Plan and also the National Organisation Plan, as well as the state level plans and district plans.

Dr Dahlia elaborated that the plans for supporting sustainable development were carried out in a precautionary manner. These plans were based on policies and guidance for developmental procedures or planning commission procedures by the local planning authority.

In response to safeguarding the natural environment including hill slopes, she said, 'The National Physical Plan supported environment sensitive areas to be conserved and integrated in the planning and management of land use and natural resources.'

She highlighted that the Town & Country Planning Act Section 52A states that the National Physical Planning Council can provide advice on the application submitted on development affecting hill tops, hill slopes and other areas designated as environment-sensitive areas. There is a very clear directive there by the National Physical Planning Council affecting hill tops, hill slopes and highland in general.

She also pointed out that, in that particular Act, there are provisions for public participation. She said, 'We find early signals on the state of issues on highland developments in certain districts where we prepare local plans. I would also like to highlight that the National Physical Planning Council also gives directives that all development involving hills and sensitive areas be submitted to the council.'

Dr Dahlia pointed out that the training of local authority outfits should be more qualified in terms of monitoring in areas related to slope failures and maintenance. She advised that multi-disciplinary experts be employed by the local authorities.

- **Mineral & Geosciences Department Malaysia**

En Zakaria from JMG was very concerned about the development proposals of very steep and very high cut slopes that do not include comprehensive study on site assessment, especially with the availability of rock blasting technology in Klang Valley. He also mentioned that deep cuttings would require high maintenance cost by the local authorities.

- **Real Estate & Housing Developers' Association**

Datuk Chen from REHDA put forward the developer's perspective

by pointing out that as the number of developments in Klang Valley increases; it is going to extend from the valleys to the hill tops. He said, 'This is where you are going to get more and more hill slope development. Certainly, I agree there should be some form of moratorium; however, I do not believe that a total ban is the solution.'

Even with a moratorium, Datuk Chen believes that we should all be proactive in coming up with solutions. He said, 'For projects that are already under construction, we should not succumb to knee jerk reaction such as stopping the projects which causes more problems than it solves.'

Datuk Chen pointed out that with the existence of so many agencies; everybody wants to be part of the solution. However, they seem to be running in all directions, thus he suggested that perhaps it should be centralised to one agency. He recommended that perhaps the idea of a slope specialist should come from an established panel. He said, 'Certainly there should be some form of competition, we should avoid monopoly by any agency.'

Datuk Chen added, 'If you are only developing part of the hill, just like how Bukit Antarabangsa is part of the main range, I believe a comprehensive master plan needs to be done for the whole hill before anyone decides what they want to do with the tract of slope that they own.'

Datuk Chen mentioned that it is important to look at upstream and downstream development as well, and come up with something comprehensive. He said, 'We should not see unilateral development approved. Of course, often times, developers build and hand it over to the Majlis with the view that these would be maintained for posterity.'

Houses on hill slopes

Datuk Chen believes that zero maintenance is not the solution, as it may be very costly. All hills may end up as concrete hills as a result. He said, 'We should look at how the local Government maintenance contracts are awarded. We want to make sure that when they take over a certain site, that all these are incorporated into the maintenance contract they give out. In actual fact, if you look at it, maintaining hills, cutting grass and clearing the drain is not a big issue. When we notice cracks here and there, it would have been very costly, whereas regular maintenance will not cost very much and can be incorporated into the assessment rates.'

Datuk Chen urged the NSMP by CERUN to be fast tracked and fully implemented before 2023. He said, 'We do not need to reinvent the wheel. There are a lot of things we can learn from other sources. It is such a long time, and we will see more failures before that. The sad thing about this country is that, we are quick to generalise. The way we classify which slopes can be developed, such as restricted development on Class 1 and 2 slopes and no development on Class 3 and 4 slopes; it makes your work child's play.'

Datuk Chen then asked the engineers, 'Where is the engineering creativity and ability? Why is it so easy to classify something so complex in such general terms? All this is within your capability. If the fault lies in the integrity of the engineers as well as the reliability of checkers, then what can the developer do? We cannot design! As a result, the buyers end up blaming us, because they think we design all this. For example, for tip fill, if you engineers notice and believe it will endanger lives, don't you have a moral obligation to do something about it? Where are we now today? We have to bring up the standard. There are lots that need to be done. We cannot point fingers and move backwards, we can only move forward. We are going to encroach on more hills. We need to look clearly at what needs to be done and gather the right engineering data that will help you build well.'

- **Master Builders Association Malaysia**

Mr Kwan from MBAM said that the contractor's role is to construct in accordance to design

specifications. He said, 'In the area of hill-site development, the design should be buildable. Very often, we employ too many foreign workers, and most are not well trained. Secondly, durability is very important. For example, reinforced concrete is better than masonry drain. My third point is maintainability. In other countries, even when you construct drains, there is a need for maintenance. This is all very basic, but sometimes we forget all these principles.'

Mr Kwan pointed out that there must be a proper policy, legislation and regulation governing hill-site development to make it sustainable. He said, 'We should call for a stronger political will, a holistic approach and the involvement of professional and industrial players. We should see how to adopt and adapt best practices including those developed by others. Likewise, there must be an employment of qualified and competent engineers or contractors at all stages of design and construction.'

Finally, on behalf of MBAM, Mr Kwan stressed that emphasis should be put on application and training. He said, 'We need to train fellow young engineers and professionals and impart upon them the experience and expertise or else more mishaps will happen. We would like to work with professional bodies as well as trade associations to enhance the human capital of our country.'

- **House Buyers Association**

Ar. Ng from HBA mentioned that when the Association was newly formed, they were much preoccupied with complains of late delivery, shoddy workmanship and abandoned projects. However, in recent years, more and more land related mishaps were brought to their attention. He said, 'About 16 years ago, we were traumatised by the Highland Towers tragedy. Now, 16 years later, we are traumatised by the Bukit Antarabangsa tragedy and the complete annihilation of properties and human lives.'

Ar. Ng pointed out that hill slope development today was not any safer than it was 16 years ago. He said, 'I did a quick check on the existing laws, rules and regulations on hill slope development. I found that the guidelines consisting of the four classifications of slopes, Class 1-4, which I believe is only applicable to Klang Valley, was the only thing that we could access to. Apart from this, I could not find other proper hill slope development guidelines that are accessible to the public. To us, these classifications do not carry any meaning. We cannot tell from these classifications the hill's suitability for development, how safe is the hill for construction and susceptibility of the hill to land erosion.'

With the present situation, Ar. Ng questioned if the property and safety of house buyers are adequately protected under the prevailing law. HBA highlighted its five wish list.

Ar. Ng said, 'We cannot emphasise enough the importance of such things. As house buyers, we have been compromised enough on late delivery, shoddy workmanship, abandoned projects and not to mention the countless economic loss by errant developers based on the current system of buy at your own risk or 'caveat emptor' (Let the buyer beware). It is high time we should not compromise our health and safety anymore.'

Ar. Ng mentioned that HBA recently proposed a bill of rights for house buyers. He said, 'Among others, we actually proposed, first, a right to safe and sound quality construction. Secondly, we have a right to peace of mind concerning the safety of our families staying in our house. The crux of the whole point I am trying to make is, we must not suffer anymore for any landslide which will cause untold hardship and losses on any of us and the community.' BEM

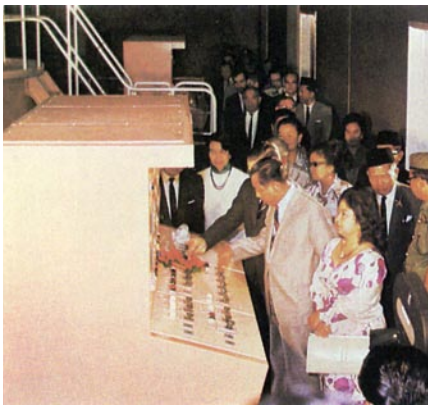
House Buyers Association's Wish List

1. We want the relevant authorities to carry out a survey and classification on existing hill slopes nationwide on the development worthiness and identify those critical areas prone to erosion and landslide, and inform the public of the findings.
2. We urge them to devise a concrete policy and regulation on how hill slope development should be regulated and implemented.
3. We urge the authorities to setup a specialised agency to oversee the formulation of policy rules and regulations on safe development and maintenance on hill slope development as well as the implementation and enforcement of these rules and regulations.
4. We want the developers to ensure that any future hill slope development is safe for the habitation of house buyers.
5. Responsibility and liability are currently insufficient. We want to make those culpable accountable, impose on them a stiffer penalty and imprisonment because we are dealing with human lives.

Construction of Batang Padang Hydro-Electric Scheme

By Ir. Liaw Yew Peng

"Topping up" ceremony to mark the completion of the 147 feet high Jor dam. The final topping up was performed by Tan Sri Raja Zainal bin Raja Sulaiman, the Deputy Chairman & General Manager of NEB.



His Highness the Sultan of Perak, accompanied by His Consort, switching on the 1st of the 350MW generating sets in the Sultan Idris II underground power station, with His Consort.

His Highness the Sultan of Perak inspecting a diagrammatic layout of the scheme, with the Chief Resident Engineer, Mr W. Phillips and other VIPs

His highness the Sultan of Perak inaugurated the Batang Padang Hydro-Electric Scheme on 10th February, 1968.

The Batang Padang Hydro Electric Scheme started almost immediately after the completion of the Cameron Highlands Hydro Electric Scheme. This Scheme had a total installed capacity of 154 MW and can generate more than 480 million units of electricity yearly. The work started in May 1964 and was completed in 1967. The Scheme was officially declared open by H.R.H. the Sultan of Perak on the 10th February, 1968.

Its main civil works are Jor Dam & Jor Saddle earth-fill Dam situated off the 17th milestone; Sultan Idris II underground power station which is 1,380 feet below the level of the Jor reservoir, Mahang Dam, Switchyard, Odak power station situated off the 7th milestone of the Tapah/Cameron Highlands road. The Jor reservoir was formed by the building of the Jor Dam and the Jor Saddle Dam.

At the 17th milestone the waters from Sg. Batang Padang, Sg. Sekam and Sg. Jor as well as the discharge from the Sultan Yussof power station are impounded in the Jor reservoir. The water then flows into the nine mile long Menglang tunnel after which it flows down the twin high pressure penstocks to generate power in the underground power station. The power is then conveyed by the 132kV cables to the main national grid.

Ancillary work included the construction of five side-stream intakes situated along the line of the Menglang tunnel as well as more than 20 miles of access roads to the sites of the side-stream intakes.

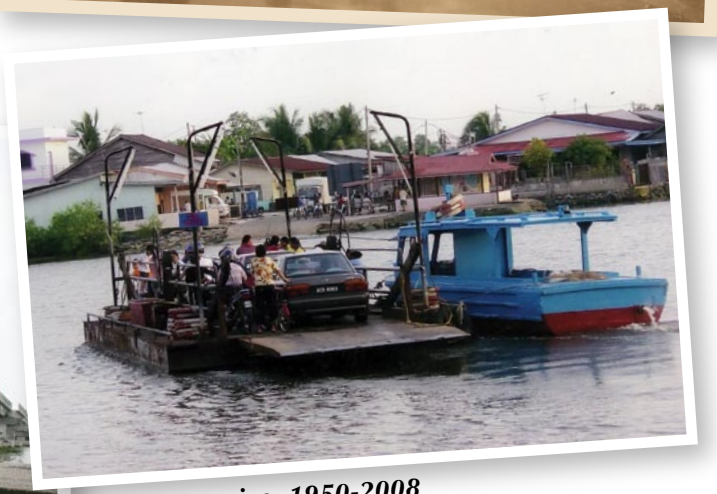
The total cost of this scheme was about RM142 million, the offshore component being financed by IBRD loan. At the peak of construction work in August 1968 no less than 2,000 local personnel and 135 foreign personnel of many nationalities, including Australian, British, German, Italian, Japanese, and Swedish were employed on the Scheme.

Kuala Gula/Kurau Village River Crossing - Changing With Time

Contributed by
Tan Boo Nam, Chuah Hang Meng and Tan Chai Bee

1940

Boat ferrying wedding couple and guests - 1940



Ferry service, 1950-2008

A bridge replacing ferry, 2009

The Ingenieur

Malaysia's Authoritative Source Of Engineering Matters

More than 10,000 copies of The Ingenieur are currently published and distributed to Professional Engineers, Graduate Engineers, Private Sector, Government Departments, Universities, Private Colleges, Libraries and other organisations related to engineering.

Advertisement Rates

Full Colour	Per Insertion
Back Cover	RM3,500
Inside Back Cover	RM2,500
Inside Front Cover	RM2,800
Facing Inside Front Cover	RM2,700
Centre Spread	RM3,300
ROB Full Page	RM2,000
ROB Half Page (vertical)	RM1,100
ROB Half Page (horizontal)	RM1,100
ROB Quarter Page	RM750

Black & White	Per Insertion
ROB Full Page	RM1,100
ROB Half Page (vertical)	RM750
ROB Half Page (horizontal)	RM750
ROB Quarter Page	RM500

Publication Dates
16th March
16th June
16th September
16th December

Advertisement Booking *(Tick the appropriate boxes)*

Issue	
March 2009	☐
June 2009	☐
September 2009	☐
December 2009	☐
March 2010	☐
June 2010	☐
September 2010	☐
December 2010	☐

Full Colour	
Back Cover	☐
Inside Back Cover	☐
Inside Front Cover	☐
Facing Inside Front Cover	☐
Centre Spread	☐
Full Page	☐
Half Page (vertical)	☐
Half Page (horizontal)	☐
Quarter Page	☐

Black & White	
Full Page	☐
Half Page (vertical)	☐
Half Page (horizontal)	☐
Quarter Page	☐

Payment

☐ Enclosed herewith our cheque no: _____ for RM _____ made payable to Lembaga Jurutera Malaysia. *(Please include 50 cents commission for outstation cheques)*

☐ To invoice us. Payment will be made within 1 month from the date of invoice.

Name of Organisation : _____
Contact Person : _____
Designation : _____
Address : _____
: _____
Tel/Fax No : _____

Signature : _____

Send/Mail/Fax this form to: Publication Department, Board of Engineers Malaysia, Tingkat 17, Ibu Pejabat JKR, Jalan Sultan Salahuddin, 50580 Kuala Lumpur
Tel: 03-2698 0590 Fax: 03-2692 5017 E-mail: bem1@streamyx.com

Terms & Conditions

Booking & Copy Deadline:
4 weeks before publication date

Advertisement size:
W: 210mm x H: 297mm (A4)

Bleed size:
W: 216mm x H: 303mm

Type area:
W: 184.6mm x H: 271.6mm

Advertising Materials Requirements:
- High Resolution PDF files (300dpi) with colour proof

Artwork Charges:
- Typesetting, artwork and pdf conversion or any other requested assistance by advertisers will be charged separately at trade rates.
- The positioning of the advertisements, unless specified will be at the discretion of BEM.
- Cancellation will not be entertained.