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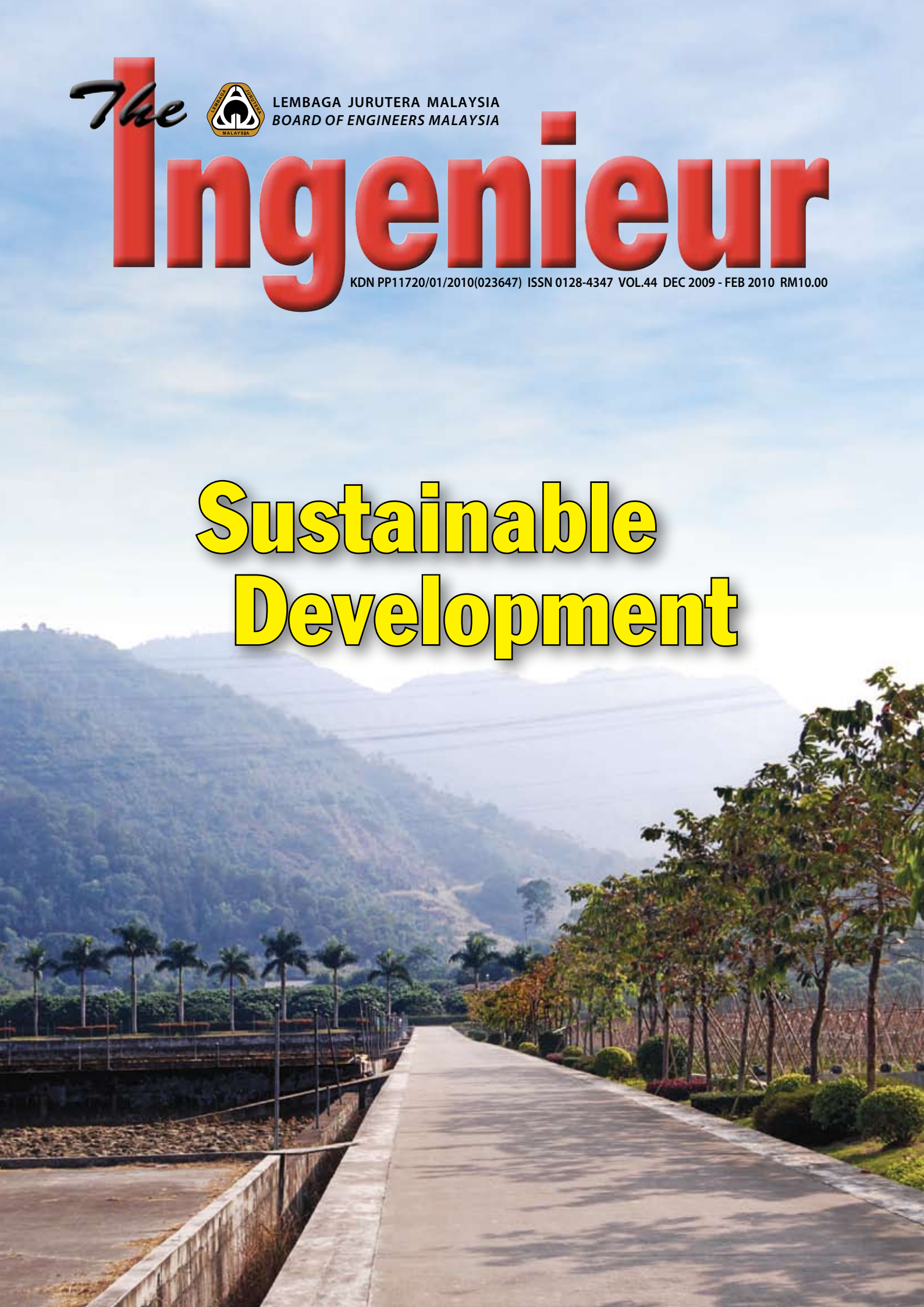
Sustainable Development



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BEM invites all registered engineers to contribute articles or send their views and comments to the following address:

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president's message

Engineers have been credited for their contributions in providing the necessary infrastructure that have resulted in improving the quality of life for modern society throughout the world. The integrated and complex infrastructure systems which can be collectively referred to as the "built" environment have been provided in most instances at the expense of the natural environment. We have now reached a critical juncture in time where Engineers need to review, change and adapt our practices so that the built environment will not be at the expense of, but in harmony with the natural environment. This is the essence of sustainable development. Whatever interventions (that we refer to as designs) that Engineers introduce in improving the built environment, he/she must not diminish or incapacitate the ability of the natural environment to recover and maintain its function as a life supporting system of the Earth.

This issue of the *Ingenieur* calls upon Engineers not only to change their thinking but also to seriously consider and respond to calls for adopting Green Technology and Sustainable Resources Management Systems in providing solutions to engineering problems. Our dependency on non-renewable resources and indiscriminate disposal of wastes cannot be sustained indefinitely. The only way forward for us, as Engineers, is to embrace and practise the principles of sustainable development during the design, construction/production/manufacturing, operation, maintenance and even during the decommissioning stages.

The recently introduced National Green Technology Policy has set targets in four sectors namely the Energy sector, Building sector, Water and Waste Management sector and the Transportation sector in the 10th Malaysia Plan. Engineers should capitalise on these initiatives as the opportunities in this new area can be wide and rewarding.

Sustainable development is after all the key to ensuring that the Earth continues to support and sustain life for us today and for future generations.

Dato' Sri Prof Ir. Dr. Judin bin Abdul Karim
President
BOARD OF ENGINEERS MALAYSIA

editor's note

The recent conference on Sustainable Development 2009 in Cyprus addressed the subject of regional development where planners, environmentalists, architects, engineers, policy makers and economists have to work together in an integrated way and in accordance with the principles of sustainability.

The newly launched National Green Technology Policy as summarized in this issue reflects Malaysian Government's aspiration to achieve some milestones in this direction. The article on Going Green reminds the public and industry players to take this green issue and GBI seriously.

CIDB in its article provides further deliberation on the local initiatives towards sustainable construction. With KPI as the new buzzword in the public sector management, BATC of UTM explains the use of KPI on human capital *modelling* to enhance human capital management and improve organisational performance.

The Publication Committee takes this opportunity to wish all Christian readers Merry Christmas and a Happy New Year to all.

Ir Fong Tian Yong
Editor

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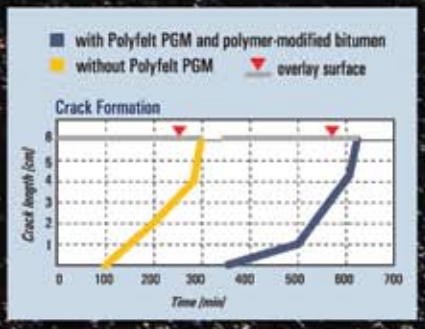

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Publication Calendar

The following list is the Publication Calendar for the year 2010. While we normally seek contributions from experts for each special theme, we are also pleased to accept articles relevant to themes listed.

Please contact the Editor or the Publication Officer in advance if you would like to make such contributions or to discuss details and deadlines.

March 2010:
FACILITY ASSET MANAGEMENT

June 2010:
WATER

Sept 2010:
HILL-SLOPE DEVELOPMENT

Dec 2010:
TRANSPORTATION & SAFETY

APOLOGY

Figures 1,2,3,4,5,6 in the cover feature entitled 'Occupational Safety And Health Forensics' in the Sept-Nov 2009 issue of *Ingenieur* were wrongly inserted into the article. We apologise for the errors.

Going Green

By Ir. Chen Thiam Leong

From greenbacks to green buildings to greenwash – it's our call really. That building green is here to stay is not the result of some overnight development but rather a progression that happens to end up with green as a *de facto* convenience. The built environment is awesomely big (in terms of money as well as in all other aspects) and it represents a prime driver for development in any country. Recall the era of the other fashionable terms of Intelligent Buildings, then Smart Buildings, then Energy Efficient Buildings, then Green Buildings, then Eco Buildings, then Sustainable Buildings, then back to Green Buildings, then High Performance Buildings, then High Performance Green Buildings, and now finally (albeit not forever) settling down with the plain flavour of Green Buildings.

So how serious are we about Green Buildings? Very serious. It is real and tangible unlike the fleeting and opportunistic Y2K fiasco not to mention the imminent (and unfortunately potentially 'successful') carbon traders. It is really our call to ensure Green Buildings do not get abused, disgraced and worst still abandoned. Such a possibility is already in motion faster than you may choose to realize and the following snapshots offer some possibilities around the globe.

Green Certified Homes sell faster, higher price – a media piece 17/4/08;

Green Building: Cheapest, quickest way to cut emissions – 17/3/08;

Record greenwashing complaints hit UK Ad 5/5/08

Green oxymorons: 'Eco' things that make no sense 29/7/09

A 'sustainable' iceberg hotel ... in Dubai. Is it just us, or is the Arctic really the only logical place where an iceberg hotel can be considered sustainable? From that perspective, sticking a piece of frozen architecture under the blazing sun of the Middle East seems the antithesis of 'green,' no matter how much solar energy you harness. But that's the idea behind the *Blue Crystal*, a 'swimming world of ice offshore Dubai' that would feature luxury restaurants, an underwater lounge and a five-level ballroom, among other amenities. Did we mention it would have a 'self-sufficient energy system'?

The solar-powered car carrier This ocean-going vessel designed to ship cars from port to port has enough solar panels to generate as much as 40 kilowatts of energy. That's obviously not enough to provide all the muscle the ship needs to complete a journey — just enough to offset some of

the demand for fossil fuels and reduce emissions somewhat. The real problem, however, lies with the vessel's ultimate purpose: transporting hundreds, if not thousands, of gas-guzzlers to car buyers around the world. Something tells us it's not carrying 100% electric cars.

'Green' McMansions Coming on the heels of the McMansion trend — itself now in its death throes — was the Green McMansion trend. And where better to view an example of this type of architecture than in Las Vegas, home to the 'New American Home 2009,' with its 8.721 sq ft^3 (810 sq m^3) of space, swimming pool, wine cellar, fountains, courtyard waterfall and 10 high-definition televisions? Yes, it's chock-full of photovoltaics, natural ventilation and Energy Star-rated appliance. But it's an *8.721-square-foot* house - in the *desert*. Really, how green can that ultimately be?

Some Buildings Not Living Up to Green Label *(Mireya Navarro August 30, 2009)* The Federal Building in downtown Youngstown, Ohio, features an extensive use of natural light to illuminate offices and a white roof to reflect heat. It has LEED certification, the country's most recognized seal of approval for green buildings. But the building is hardly a model of energy efficiency. According to an environmental assessment last year, it did not score high enough to qualify for the Energy Star label granted by the Environmental Protection Agency, which ranks buildings after looking at a year's worth of utility bills. The building's cooling system, a major gas guzzler, was one culprit. Another was its design: to get its LEED label, it racked up points for things like native landscaping rather than structural energy-saving features, according to a study by the General Services Administration, which owns the building.

Builders covet LEED certification — it stands for Leadership in Energy and Environmental Design — as a way to gain tax credits, attract tenants, charge premium rents and project an image of environmental responsibility. But the gap between design and construction, which LEED certifies, and how some buildings actually perform led the programme last week to announce that it would begin collecting information about energy use from all buildings it certifies. Buildings would provide the information voluntarily, said officials with the United States Green Building Council, the non-profit organisation that administers the LEED programme, and the data would be kept confidential. But starting this year, the programme is also requiring all newly-constructed buildings to provide energy and water bills for the first five years of operation as a condition for certification. The label could be rescinded if the data is not produced, the officials said.

The council's own research suggests that a quarter of the new buildings that have been certified do not save as much energy as their designs predicted and that most do not track energy consumption once in use. And the programme has been under attack from architects, engineers and energy experts who argue that because building performance is not tracked, the certification may be falling short in reducing emissions tied to global warming. Some experts have contended that the seal should be withheld until a building proves itself energy efficient, which is the cornerstone of what makes a building green, and that energy-use data from every rated building should be made public.

LEED energy standards have grown more stringent over the years, and construction like the Youngstown Federal Building, built in 2002, would not be certified

LEED certification seal

under the current version of the programme, the G.S.A. study noted. The LEED standard goes through periodic revisions, and this year, the minimum energy requirements needed for the basic LEED certification for new buildings were raised.

So what lessons can we learn from all these as we embark on our own green adventure? How about the other way round – what experience can we gain from all these happenings? Well, it is easy to cut both ways isn't it?

The 1st GBI rated building – PTM GEO building (GBI Certified) 24.7.09

www.greenbuildingindex.org – The Story Behind

The story began more than a year before PAM and ACEM took the proverbial 'bull by the horns' approach to accelerate the realization of the Green Building Index (GBI) in August 2008 and culminating in its launch on May 21, 2009. But then even before that, various individuals and groups have rightly claimed to have initiated their own perceived green movement in Malaysia. However, without the desired level of passion, leadership, direction and commitment, these early attempts merely drifted along aimlessly. The first serious group (calling themselves, the Malaysia Sustainable Building Council, MSBC) consisting of consultants, academia and building industry representatives emerged in May 2007. What set MSBC apart was their clarity to develop Malaysian's own green rating system as a means to move forward. The author was approached to chair the development of this tool but the process was painstakingly slow without dedicated volunteers and zero funding. Then came PAM (and ACEM which the author teamed up with after consulting MSBC), and the rest is history. MSBC has now evolved legitimately into the Malaysia Green Building Confederation, *www.mgbc.org.my* and is registered with the World Green Building Council.

Because we were behind in developing our own green rating system, we had the advantage of reviewing the success and shortcomings of the various rating systems already in place. One of the initial deliberation included a short-cut conversion to LEED-Malaysia (similar to India's approach) to gain immediate market recognition and acceptance. This idea (and many others) was eventually discarded along the way mainly due to the concurrence that non-localized assessment criteria will not stand the test of time, and may instead lead to point chasing. Such awareness on our part then has now been progressively justified with the preceding articles bordering on Greenwashing.

As more and more of the decisions that were incorporated in the GBI criteria appear to become justified and collaborated by the latest versions of other established tools (e.g. LEED) since our launch, verification, measurement, validity period and weightage of points, the real test can only be realized through time. Nonetheless, we are confident of meeting any challenges ahead. After all, we had achieved what no other rating systems have, in simultaneously launching the rating systems for both Non-Residential and Residential buildings. Everyone else before us had launched their Residential building tool at least three years after their Non-Residential tool.

Our next stop is GBI for Existing Buildings which is very pertinent to the Malaysia scenario as our stock of large buildings are now progressively reaching the 30-year old mark and due for upgrading. Also unique to Malaysia is the Township tool which is under development. BEM

Towards Sustainable Construction: Malaysian Construction Industry Initiatives

By Tan Sri Dato' Ir. Jamilus Hussein, Chairman, Construction Industry Development Board (CIDB) Malaysia,
Ir. Dr. Zuhairi Abd. Hamid, Executive Director, Construction Research Institute of Malaysia (CREAM)-CIDB Malaysia,
Mohd Khairolden Ghani and Maria Zura Mohd Zain, Manager, Construction Research Institute of Malaysia (CREAM)-CIDB Malaysia

The recent Malaysian Government announcement on the creation of the Energy, Green Technology and Water Ministry to spearhead the country's sustainability agenda in the Cabinet line-up is timely and serious in tackling all related green issues in the country that complement the global vision on sustainable development. The construction industry and its related activities are responsible for a substantial amount of global resource usage and waste emissions. As buildings and other structures are planned to last 50 to 100 years, future climate changes derived from construction should be given a high priority. Through anticipating future climatic developments, engineers can minimize their negative effects and benefit from their positive impacts. The construction sector should not be marginalized from the issues on environment. Creating a sustainable construction in Malaysia requires a strategic approach that will benefit current and future issues related to economic, social, environment and quality of life. Construction Industry Development Board (CIDB) Malaysia is obliged to take this issue on board through its Construction Industry Master Plan initiatives under Strategic Thrust 3: Strive for the highest standard of quality, occupational safety and health and environmental practices.

The manifestation of sustainable and built environment is generally associated with one another. Built Environment is a broad concept encompassing man-made artifacts and space at all levels from single items to urban regions (*Chalmers Architecture, 2008*). The world is at a crossroads between the old path of development at the price of environmental degradation and a new one combining growth with sustainability (*Newsweek, July, 2008*). In the scale of maximum score of 100, the Environmental Performance Index (EPI) aims to be a comprehensive assessment of the world's environmental challenges and how individual countries are responding to them. Switzerland and Sweden are the world's green leaders while Malaysia is positioned 26th in the ranking sharing with Denmark (*Newsweek, July, 2008*). This indicates that we as Malaysians are concerned about the environment.

The construction industry generates impetus to the Malaysian economy. For many years it has created important roles in improving the quality of life for Malaysians through multiplier effects to other industries. In this respect, physical development solely would not guarantee the quality of life for future generations. It must also be able to develop and utilize resources effectively in a competitive and sustainable economy.

This paper discusses the role played by CIDB Malaysia to set out an agenda and a strategy to attain current and future sustainability in construction. The policy set by the Government, R&D innovation, domestic skills development and construction capability are all fundamental to the infrastructure that will consolidate and drive the nation's economy forward.

Issues And Challenges In Malaysian Construction

In a developing country like Malaysia, sustainable construction

Construction in Sweden

trend tends to focus on the relationship between construction and human development while marginalising environmental aspects. However, in light of the severe environmental degradation experienced by most developing countries, construction industries cannot continue to ignore the environment (*Begum, 2005*).

Environment encompasses physical and non physical medium such as air, water, solid waste/ land and also noise pollution. Construction, with exploitation of natural resources such as forest for timber, housing and industry without proper control, contributes to environmental problems (*Ibarahim, 1999*). Many of the environmental issues that occur in our country are due to lack of environmental consideration in the exploitation, development and management of resources as well as lack of control of the resulting pollution. These issues if not tackled strategically will further aggravate and exert challenges towards sustainable construction in the following ways (*CIB, 2002*).

(i) Mobilization of resources in order to support research, technological changes and feasibility studies. The sharing of research and educational activities must be taken on board from the Government, universities and related private sector related industries (*CIB, 2002*),

(ii) The pursuance of environmental protection must be in balance with the need for economic development (*CIB, 2002*),

(iii) The use of environmentally appropriate technologies with energy efficiency and full commitment to waste recycling and pollution should be practiced by construction players (*CIB, 2002*),

(iv) Emphasis must be given to the integration of environmental concerns in all project planning and implementation. In this respect, usage and application of information, communication and technology (ICT) in leveraging skills should be introduced to the construction players (*CIB, 2002*),

(v) Construction has to reduce usage of its resources through material consumption, construction costs and wastage rates (*CIB, 2002*). It can be done by way of education, site planning, management and design practices and adoption of new technologies,

(vi) In global environmental sustainability, there is need for construction players to leverage socio-economic equitability as stipulated in the Kyoto Protocol which requires a substantial reduction in greenhouse gas emissions (*CIB, 2002*).

(vii) Improving the quality of the construction process and its products. A first step is to improve the quality of construction products and the efficiency and safety of the construction process.

Malaysian construction industry players need to take a holistic approach along the construction value chain in performing their duties. Within the construction fraternity itself, societies and workers must work together towards sustainable construction in future.

There is a lot of room for improvement in the Malaysian environment scene at large. We could learn from the experience in Sweden that focuses on building sustainable communities by looking at four strategic challenges as follows (*Ministry of Sustainable Development, 2006*):

1 Balancing various interests in terms of physical planning, regional development and infrastructure, along with residential and city planning consistent with sustainable urban development. An overall challenge, both nationally and globally, is posed by demographic change as the result of migration, an ageing population, urbanisation (particularly in the metropolitan areas) and depopulation trends in most Swedish municipalities.

2 Encouraging good health on equal terms requires laying the foundation for decent living conditions – access to gainful employment, decent workplaces, economic and social security, communities in which children can grow up safely, participation and codetermination.

3 Prioritising broad-based initiatives aimed at eliminating health and mortality discrepancies among various social and economic groups. A clean environment and healthy lifestyles are also vital to improve public health that facilitates both national economic growth and more stable household finances.

4 Encouraging sustainable growth implying economic expansion driven by dynamic markets, a forward-looking welfare policy and a progressive environmental policy. The Government's vision is for Sweden to eventually obtain its entire energy supply from renewable sources.

Issues on 3R (reduce, reuse and recycle) can be seen as a way forward for the construction industry to move towards sustainable development. In addressing these issues, efforts must be taken to restore between natural and built environments (*Tse, 2001, Shen and Tam, 2002*).

The Way Forward On Malaysia's Green Strategies

The Malaysian Government's announcement on the creation of the Energy, Green Technology and Water Ministry to spearhead the country's sustainability agenda in the recent Cabinet line-up is timely in tackling all related green issues. The emphasis on creating green or environmentally-friendly buildings was also highlighted during the launch of Green Building Index (GBI) by the Minister of Works and shows the commitment from the construction industry especially from organisations like Association of Consulting Engineers Malaysia (ACEM) and Pertubuhan Arkitek Malaysia (PAM). Buildings will be awarded the GBI Malaysia rating based on six key criteria below:

- Energy Efficiency
- Indoor Environmental Quality
- Sustainable Site Planning and Management
- Materials and Resources
- Water Efficiency
- Innovation

Government policies have been recognised as important instruments in driving the market for sustainable buildings. In Malaysia, there is currently no policy which mandates a sustainable building; the closest we have is the MS 1525:2007 which is the 'Code of Practice on Energy Efficiency and the

Green Building Codes Major U.S. Cities

CITY	YEAR	TARGET Residential (R), Private (P), Gov/Public (G)	MEASURING STICK	KEY FEATURES
Annapolis, MD	2008	R, P, G	LEED	- LEED Silver for public buildings - LEED Certified for new residential construction and commercial projects receiving public funds
Atlanta, GA	2003	G, R	LEED	- City-funded projects of 5,000+ sq ft, or $2 million+ to meet LEED Silver
Austin, TX	2000, 2006	R, P, G	Austin Energy Green Building Rating, LEED	- '00: Municipal buildings must comply with LEED Silver - '06: Requires 1-3 "star" (out of 5) Austin Energy compliance for certain building zones. - '06: Some large commercial and multi-family developments require LEED Certified
Boston, MA	2003	G	LEED	- LEED Certified for 50,000+ sq ft public projects
Chicago, IL	2004	G	LEED	- LEED Silver for new/renovated municipal buildings.
Dallas, TX	2008	P, G	% reduction	Buildings < 50,000 sq ft to use 15% less energy and 20% less water; less stringent for > 50,000 sq ft
Los Angeles, CA	2002, 2008	P, G	LEED	'02: LEED Certified for >7500 sq ft public buildings '08: >50,000 sq ft private buildings follow 'checklist' of requirements
New York City, NY	2007	G	LEED, % reduction	- LEED Silver for $2 million+ projects. Schools and hospitals can meet LEED Certified - Also require 5-30% energy cost reductions depending on building type
Portland, OR	2001, 2008 (possible)	G, R	Portland LEED, fees/rewards	- '01: Public building projects must meet Portland LEED standard - '08: Fees for builders to meet code, no fee for 30% more efficient, rewards for 45%+ more efficient
San Francisco, CA	2004, 2008 (expected)	R, P, G	LEED, GreenPoint	- '04: LEED Certified for municipal construction projects - '08: LEED Certified for large, commercial buildings in '08, LEED gold in '12; GreenPoint ratings for residential
Seattle, WA	2000, 2008	P, R, G	LEED, % reduction	- '00: All city buildings LEED Silver - '08 Goal: reduce energy use in new and existing commercial and residential buildings by 20%
Washington, DC	2007	G, P	LEED	- LEED Certified for projects w/15% public money - LEED Certified for 50,000+ sq ft buildings in 2009

Use of Renewable Energy for Non-Residential Buildings (*Ooi, S., 2007*).

The National Policy on Environment seeks to integrate environment considerations into development activities and in all related decision-making processes, to foster long-term economic growth and human development and to protect and enhance the environment. The integrated considerations will drive Malaysia's Green Strategies towards the following seven key areas *(MOSTE, 2002; CIB, 2002)*:

Education and awareness

In line with the recommendations of Agenda 21 *(CIB, 2002)*, a deeper and better understanding of the concepts of environmentally sound and sustainable development and caring attitude towards nature, environmental education and awareness will be promoted in comprehensive formal and informal education, training and information dissemination programmes.

Effective Management of Natural Resources and the Environment

Effective management of natural resources and the environment protect and conserve the environment and natural resources to meet the needs and aspirations of the country's population, particularly with regards to land, forests, biodiversity and water.

Integrated Development Planning and Implementation

Environmental considerations will be integrated into all stages of development, programme planning and implementation and all aspects of policy making. Environmental inputs shall be incorporated into economic development planning, including regional plans, master plans, structure and local plans (*MOSTE, 2002*).

Prevention and Control of Pollution and Environmental Degradation

Pollution and other adverse environmental impact arising from development activities shall be minimised. Environmental quality monitoring surveillance programmes and environmental auditing systems will be expanded and strengthened to support enforcement programmes, planning and zoning and to enable a comprehensive and regular assessment of the state of environment. Within this context, CIDB has embarked on programmes related to ISO 14001 certification focusing on construction companies involved in large projects which require Environmental Impact Assessment (EIA) (*CIDB, 2007a*). CIDB has also introduced the Environmental Management System (EMS) D.I.Y. Schemes. The aim of this CIDB EMS D.I.Y. Scheme is to facilitate contractors in upgrading their environmental management performance.

Strengthening Administrative and Institutional Mechanisms

Integrated and effective co-operation and co-ordination among Government and other sectors shall be enhanced in order to achieve efficient environmental management and protection. Environment-related legislation and standards shall be reviewed regularly and revised where necessary to ensure the continued effectiveness and co-ordination of laws. Particular attention will be paid to effective enforcement.

Proactive Approach to Regional and Global Environmental Issues

Malaysia will co-operate with other countries, particularly the ASEAN nations, and with relevant regional and international organisations, on global environmental concerns. In other words, Malaysia will adopt a proactive approach in addressing global environmental issues such as the depletion of the ozone layer, climate change, trans-boundary pollution, hazardous chemicals and toxic waste management, marine quality and resource conservation and trade in endangered species.

Formulation and Implementation of Action Plans

Action plans, with adequate resource support for their implementation, will be formulated.

The way forward has to be a responsive one among all stakeholders to ensure the earth is safe and sustainable for future generation.

Industry Strategies

Greater adoption and use of environment-friendly planning techniques, designs and 'green' materials in property projects will go a long way towards promoting green practices in the country. It will be more effective if industry players voluntarily adopt green and environment-friendly designs and concepts in their projects rather than depend on legislation to make it mandatory for them to incorporate pro-environment design features in their projects (*Star 23rd May, 2009*).

Construction Industry Master Plan 2006-2015 (CIMP) Initiatives

Construction Industry Master Plan 2006-2015 (CIMP) has identified the future challenges on environmental aspects in *Strategic Thrust 3: Towards highest standard of quality, occupational safety and health and environmental practices*. Environmental sustainability is necessary to achieve and sustain economic growth and social development (*CIDB, 2007a*). A systematic effort is required to avoid undesirable environmental impact and enhance ecosystem management. Among the major impacts associated with the industry are soil erosion and sedimentation, flash floods, destruction of vegetation, dust pollution, depletion of natural resources and the usage of building materials which are harmful to human health.

The vision of Malaysian Construction Industry Master Plan 2006-2015 (CIMP) is a progressive construction sector that relies on sustainable development. *Figure 1* shows the overall strategic thrusts in CIMP, its critical success factor (CSF) as well as its enabling recommendations.

The importance of standard of quality, occupational safety and health and environmental practices to foster a quality and environmental-friendly culture among construction industry players as outlined in the Strategic Thrust 3 is depicted in *Table 1*. The table summarises action plans and programmes to promote quality and environmental-friendly culture among construction stakeholders. CIMP envisaged that sustainability on construction is vital to the construction players to achieve and sustain economic growth and social development (*CIDB, 2007a*).

Table 1: Strategic Thrust 3 - Strive for the Highest Standard of Quality, Occupational Safety and Health and Environmental Practices (CIDB, 2007a)

Action Plan	Programme
Foster a quality and environment-friendly culture	The need to increase customer demand in the global environment in construction. Necessary to achieve and sustain economic growth and social development.
Encourage external accreditation in quality and environmental management. • Incorporate ISO certification requirements as part of the contractors registration scheme (G7 and G8) • Organise communication plan to promote ISO certification	CIDB will actively encourage local construction companies to attain ISO 9001 and ISO 14001 certifications.
Promote environment-friendly practices. • Recommend to the Ministry of Housing and Local Government to develop guidelines on stage construction • Propose to DOE to review conditional approval provision for EIA reports. • Enforce Tree Preservation Order (Act 1972). • Encourage 'Green Reporting' by public listed companies • Introduce tax incentives for the adoption of ISO 14001	Initiatives of 'Green Building Material' will be promoted to ensure impact activities can be provided in order to spur economy and social benefits at large. Urgent need for self-regulation within construction industry to achieve performance required.

Implementing Strategies On Sustainable Development: CIDB's Initiatives

Sustainable development requires a balance between economic growth, social expansion and environmental protection. In order to pursue sustainable development, the construction industry itself has to be sustainable and give emphasis to environmental matter in addition to economic gains and social obligations.

In 1999 CIDB established a Technical Committee to look into developing good environmental practices in the construction industry. Technical Committee 9 on Good Environmental Practices in the Construction Industry (CIDB/TC9) comprises environmental experts from Government agencies, professional bodies, academia and construction related associations.

The role of CIDB/TC9 is to develop standards to improve environmental issues in the construction industry and advise CIDB in the formulation of programmes to promote good environmental practices. The terms of reference of TC9 is to identify, prepare and develop the Construction Industry Standard (CIS) and Good Environmental Practices in Construction Industry. CIDB/TC9 executes its mandate through the establishment of Working Groups (WG). *Figure 2* shows the strategic recommendation working groups under CIDB/TC9.

Research And Development Initiatives

Currently there are six research projects on Environment and Sustainability managed by Construction Research Institute of Malaysia (CREAM), a research arm

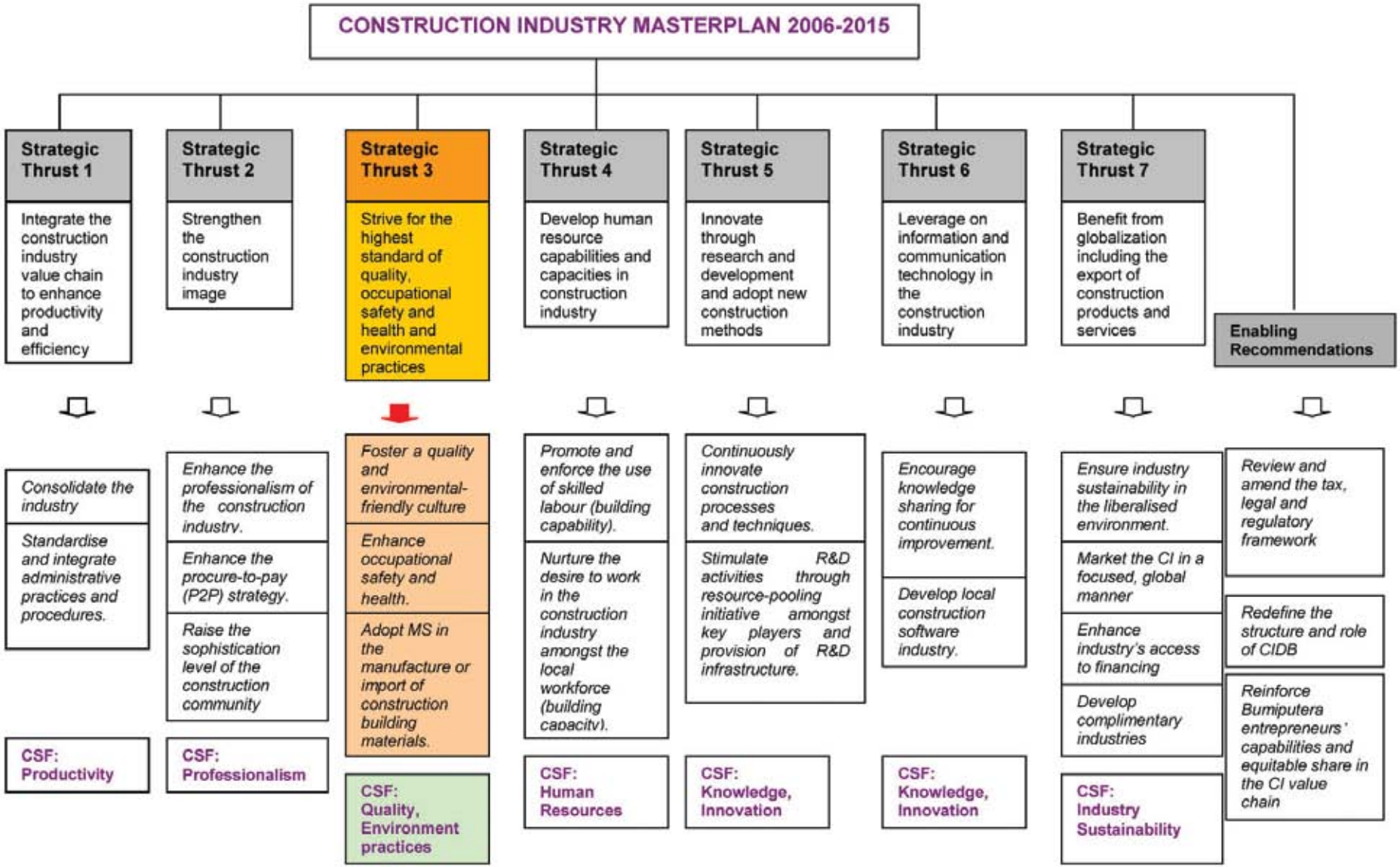

Figure 1: Construction Industry Master Plan 2006-2015 (CIMP) Initiatives (CIDB, 2007a)

Figure 2: Strategic Recommendation Working Group under Technical Committee 9 (CIDB/TC9)

of CIDB. The research topics are as follows:

(i) Construction Practices for Storm Water Management and Soil Erosion Control for the Construction Industry,

(ii) Achieving Sustainability of the Construction Industry via International Environmental Management Systems Standard, ISO 14001,

(iii) Waste Minimisation and Recycling Potential of Construction Materials,

(iv) Materials Security And Waste Management for Industrialised Building Systems (IBS): Towards Sustainable Construction,

(v) Environmental Management Plan in the Contract Tender Document of Construction Projects and

(vi) Utilisation of Waste Materials for the Production of Concrete Pedestrian Block (CPB).

Research on Construction Practices for Storm Water Management and Soil Erosion Control for the Construction Industry focuses on developing good practices in these areas. Data and output from this project are used in the various Working Groups for further development and some of the findings have been disseminated to stakeholders via seminars and workshops.

Research on Achieving Sustainability of the Construction Industry via International Environmental Management Systems Standard, ISO 14001, is aligned to prepare Guidelines on Environmental Management System for Construction Industry (EMSCI). These guidelines assist contractors to be ISO 14001 certified and look into proper environment management systems in the construction industry.

Research on Waste Minimization and Recycling Potential of Construction Materials was completed in 2005 and handed over to the Technical Committee (TC) 9 under CIDB. Some of the documents have been published and disseminated to industry players. TC9 is in the midst of consolidating the research output and will assign Working Group 6 to assist CIDB to prepare 'Guideline and Training Modules on Good Practices on Waste Management at Construction Sites.

Three other researches are still on going. Upon completion, stakeholders will be able to capture some of the local experiences as well as global practices on waste management and sustainable construction through lessons learned and technology transfer of best practices.

Strategic Recommendations

The task to uphold sustainable construction in Malaysia is an enormous undertaking that requires plenty of innovation and commitment from all concerned. Through CIDB's initiatives, R&D initiatives and others, action oriented industry strategies have identified tasks for immediate attention, as well as tasks for medium and long term attention. It is vital that the strategic implementation plan continues to develop tools and technologies and other enablers to lessen the impact on the environment and lead the Malaysian construction to be sustainable.

The commitment from stakeholders, Government authorities and legislators can transform the Malaysian construction industry into one that is not a threat to the environment, but meeting with human need for development in harmony with nature. The combination of CIDB's initiatives and strategies documented in *Strategic Recommendations for Improving Environmental Practices in Construction Industry (CIDB, 2007b)* are recommended as the strategic way forward to be adopted by all players. The strategies identified are summarized as follows:

(i) Strengthening the Development Approval Process,

(ii) Enhancing Law and Enforcement,

(iii) Promoting Self-Regulation and reflecting the best regulatory practices which are necessary to achieve sustainable construction in future,

(iv) Increasing Capacity and Public Awareness and

(v) Addressing Knowledge Gaps.

The strategic direction, the implementation strategies and R&D participation have to be in congruent to ensure continuity and focus. It is envisioned that all initiatives mentioned need to be taken forward simultaneously at both local and international levels. Every stakeholder involved in the green initiatives must stand together and react as a team not as individual champions.

Acknowledgements

The authors would like to express their sincere gratitude to Technology and Innovation Development Sector of CIDB Malaysia, Technical Committee 9 (TC9-CIDB) on Good Environmental Practices in the Construction Industry, all Working Group Committees and also Construction Research Institute of Malaysia (CREAM) for the reports and permission to prepare this paper. Thanks also to CREAM's R&D Project Leaders: Prof. Ir. Dr. Omar Abd. Kadir (USM), Assoc. Prof. Dr. Nik Norulaini Nik Ab. Rahman (USM), Assoc. Prof. Dr. Mashitah Mat Don (USM), Prof. Ir. Dr. Ruslan Hassan (UiTM) and Prof. Dr. Joy Jacqueline Pereira (UKM). BEM

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Reduce, Reuse And Recycle – Alam Flora's Initiatives Towards Sustainable Solid Waste Management

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Solid waste can be turned into a resource. Therefore, the sustainable Solid Waste Management (SWM) Integrated system shall limit the loss of this resource as much as possible in an environmentally efficient and economic way. *Hierarchy of Solid Waste Management* as shown in *Figure 1* is internationally accepted *(Yaacob 2008)*. It is being adopted in many countries throughout the world especially in developed countries to promote waste minimization by maximizing waste diversion from landfills. The ultimate goal shall be zero landfilling. The SWM hierarchy places 'Waste Reduction' at the highest priority, followed with 'Reuse', 'Recycle', followed by 'Treatment' and the least priority is given to 'Landfill'. Application of the concept will ensure sustainable SWM through the 3R concept of reduce, reuse and recycle. By adopting this concept, more solid waste could be turned into resources and less waste would be disposed at landfills.

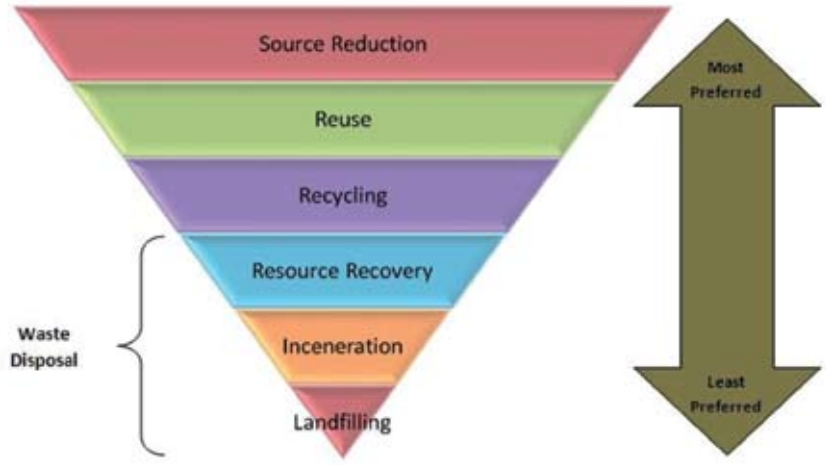

Figure 1 : Solid waste management Hierarchy

Recycle bins

In 1998, after taking over the responsibility of solid waste management in local authorities on interim basis, Alam Flora has initiated several 3Rs programmes in it's entire operational areas which include the states of Kuala Lumpur, Selangor and Pahang in order to maximize collection of recyclable materials and minimise environmental degradation. In 1999, Alam Flora expanded it's operational areas to Federal Territory of Putrajaya. In year 2000, in response to the Ministry of Housing and Local Government's declaration of November 11th as the National Recycling Day, more programmes were planned and implemented in subsequent years. In year 2004, Putrajaya was selected by the ministry to be the model city for recycling. These efforts were in line with Solid Waste and Public Cleansing Management

Act 2007 where separation at source is made mandatory for the waste generators. This paper outlines the economic potential of recycling material from the municipal solid waste stream and highlights efforts made by Alam Flora in promoting and implementing activities to the improve the implementation of 3R concept in Malaysia

Potential of Recycling in Domestic Solid Waste

Recycling potential in domestic solid waste could be determined through the waste composition at the point of waste generation. A solid waste composition study was conducted by the R&D department of Alam Flora Sdn Bhd. on landed residential (bungalow, semi-detached and terrace houses) in Kota Kemuning, Selayang and Putrajaya in year 2009. It was observed that Kota Kemuning residents had been participating in recycling programmes organised by NGO and resident associations. In some areas the material was collected by private recyclers. Whilst in Selayang, and Putrajaya the recycling programmes are mainly conducted by Alam Flora Sdn Bhd, where residents are provided with 120-liter Mobile Garbage Bin (MGB) for organic waste and 2-colored plastic bags for recyclable items (Blue for paper and white for other recyclable items).

The waste composition at Kota Kemuning and Selayang was determined from the discarded waste inside the bins. Recyclable items which were separated at home and not thrown inside the bins are not accounted for in this study. However, for Putrajaya, the waste composition study is done from both containers placed outside their house, i.e., MGB and plastic bags.

Table 1: Household solid waste composition by major categories

Area	Organic Waste (% by weight)	Recyclable Items (% by weight)	Others (% by weight)
Kota Kemuning	58	18	24
Selayang	66	19	15
Putrajaya	63	32	5
AVERAGE	62	23	15

Source: Alam Flora Sdn Bhd, (2009a)

Note:
(i) Organic – vegetables, fruits, food waste from the kitchen, dried leaves
(ii) Recyclable item (based on market demand) – plastic containers, glass bottles, beverages cartons, mineral water bottles, aluminium cans, paper (include newspaper, magazines, envelopes, junk mails, cardboard)
(iii) Others – include polystyrene, plastic bags, disposable diapers, old clothes, rubber, leather, batteries, etc.

Table 1 shows the waste composition from domestic premises in the various locations where the study was conducted. Low percentage of recyclable items in Kota Kemuning is attributed to the presence of other recycling programmes which was not accounted for by the study conducted by Alam Flora Sdn. Bhd. The high percentage in Putrajaya is attributed to the practice of separating at source by the residents prior to being collected by Alam Flora Sdn Bhd.. On average, organic waste is the major component of household waste which is 62%, followed by recyclables at 23% and other wastes at 15%. Other wastes include polystyrene, disposable diapers, old clothes, leather and rubber. It is clear that a significant amount (23%) of recyclable materials could be recovered from the waste stream if separation at source is fully implemented. Another potential of waste reduction to landfill is by separating organic waste which can be composted.

This paper will focus on the recovery of recyclable items which have market demand in Malaysia such paper (including newspaper, cardboards, magazine etc), metal, glass and plastic bottles.

Alam Flora's Initiatives on 3Rs

In promoting 3Rs, Alam Flora had developed and implemented several "separation at source" modules for various target groups as follows:

a) School programmes called KitS (*KItar Semula di sekolah*). As of to date, a total of 200 schools are actively participating in the programme.
b) Community programmes involving kerbside collection, mobile and fixed recycling centers
c) Institutional, Commercial and Industrial (ICI) programmes called Waste Wise
d) Tailgate recycling programme by collection workers

School Programmes (KitS)

KitS which is designed for school children highlights the importance of recycling and provides assistance in recycling activities. This programme is implemented in all Alam Flora's operating areas and in both primary and secondary schools. Incentives based on volume of recyclable materials collected are provided in the form of cash and gifts. Talks on environmental awareness and recycling were also given. Environmental exhibitions, colouring and drawing competitions are held at schools to ensure that they have regular recycling and environmental events.

Community Programmes

Community programmes include fixed community recycling centres (CRC), mobile recycling booth (MRB) and kerb side collection (for selected areas only) to cater to the needs of the public and ensure a wider coverage of Alam Flora's 3Rs programmes. The programmes described above are linked to the "*separation at source*" concept where the public is encouraged to separate recyclables prior to discarding them as solid waste. Most of the activities are concentrated in Klang Valley including Kuala Lumpur, Petaling Jaya, Putrajaya, Subang Jaya, Shah Alam dan Klang.

(1) Fixed Community Recycling Centre (CRC)

CRC is designed for the community where residents can exchange recyclable materials for cash or coupons depending on the weight of the recyclables. The CRC also serves as an information centre to cater to inquiries from the public and for the distribution of awareness materials. The recycling centres are constructed at strategic locations such as hypermarkets where the public can drive through and drop off their recyclable materials before doing their shopping. Incentives in the form of cash are given to encourage more recyclables brought from home or office. The CRC can either be a permanent or semi-permanent structure equipped with reception set-up, weighing scale and storage containers for different types of recyclable materials. Among the main activities carried out at these centres are:

1. Bringing of recyclables to the CRC by the public;
2. Exchanging of recyclables for incentives;
3. Collection and delivery of recyclables to the recyclers.

Currently, Alam Flora has 28 CRC in it's operational areas.. Drop off centres are also placed in strategic location where the public can send their recyclables anytime but no cash incentive is given. A total of 5 drop off Centres is available currently.

(2) Mobile Recycling Booth (MRB)

The mobile recycling booth (MRB) is placed in a strategic location where there is no fixed CRC. They are usually located in suburban or rural residential areas and operated similarly like CRC to receive recyclables and provide incentives to the public.

The MRB typically consists of a collection vehicle and a temporary reception set-up such as large umbrella, table, weighing scale and would be operated by a team of 2 to 3 personnel. The MRB is operated on a scheduled basis that is a few hours weekly or monthly. A total of 60 MRB are operating in all service areas.

(3) Kerb side collection (KSC at selected areas only)

Collection of recyclables from door to door or Kerb Side collection has been introduced in selected residential areas in Petaling Jaya, Putrajaya and Shah Alam. A collection truck is dedicated to collect the commingled recyclables weekly based on a pre determined schedule. The recyclables will be sorted further prior to transporting to recycling factories. Selected residential premises are given containers such as recycling box, plastic bags or bins for their convenience.

Based on year 2009 record, the above community programmes managed to collect an average of 325 tonnes of recyclable materials.

Industrial, Commercial and Institutional (ICI) Programmes "WasteWise"

The WasteWise programme is developed for recycling activities and facilities in the industrial, commercial and institutional (ICI) sectors. Participants are encouraged to implement recycling programmes within their premises. Alam Flora will assist in terms of training and logistics support. Major agencies participating in the program include Carrefour Hypermarkets, Jusco shopping complexes, Shangri-La Hotel, Malaysian Airport Berhad (MAB), Malaysian Airlines (MAS), Air Asia, Universiti Kebangsaan Malaysia

(UKM) and all government offices in Putrajaya. WasteWise programmes contributes an average of 131 tonnes of recyclables per month. Alam Flora together with National Solid Waste Department under Ministry of Housing and Local Government has jointly produced an educational CD for ICI premises in order to promote 3Rs, with the theme "Think Before You Throw". The CDs were distributed to various industrial, commercial and institutional organisations beginning year 2009.

Tailgate recycling programme for collection workers (TCW)

Discarded recyclable materials into waste bins by the general public are still very visible and have a high percentage. In order to recover these recyclables, Alam Flora has encouraged collection workers to sort the waste during collection activities with systematic ways and safe conditions. They have to ensure collection route is completed and the bin area is not messed up. Alam Flora will determine the location of buy back centers, a place for them to stop and sell the recyclable materials. Cash incentives are given to motivate them to recover more recyclables. Side and top container on the compactor truck has been designed to cater for storage of recyclables during transportation to the buyback center. The most active areas which generate more than 100 tonnes per month are Petaling Jaya, Selayang and Kuala Lumpur.

Table 2: List of educational programmes participated by Alam Flora in August 2009

No	Events	Venue	Date
1	Exhibition in conjunction with *Kempen Kitar Semula*	SK Taman Tun Dr Ismail 2, Kuala Lumpur	8 August 2009
2	Exhibition in conjunction with *Penggunaan Plastik Tanpa Kawalan Menjejaskan Persekitaran dan Kesihatan* programme	Dewan Hamzah, Klang	9 August 2009
3	Exhibition in conjunction with *Program Minggu Alam Sekitar UiTM*	Dewan Angsana UiTM, Sek 17 Shah Alam	19 August 2009
4	Awareness programme with Zoo Negara and SM Kuen Cheng Jalan Syed Putra Kuala Lumpur	Zoo Negara, Hulu Kelang	24 August 2009
5	Exhibition in conjunction with *Majlis Pelancaran Projek Perintis Pengasingan Sisa Pepejal Di Punca Di Putrajaya*	Lake Club, Putrajaya	29 August 2009

Table 3: Total Recyclables collected by Alam Flora in year 2007 & 2008 (January to December) and 2009 (January to August only) by type of programmes

	Type of programme					
Year	Community (tonnes)	Wastewise (tonnes)	Kits (tonnes)	Landfill (tonnes)	Total (tonnes)	Avg/mth (tonnes)
2007 (Jan-Dec)	2,777	551	480	1,792	5,600	467
2008 (Jan-Dec)	3,067	694	344	2,295	6,400	533
2009 (Jan –Aug)	3,558	941	243	1,258	6,000	750

Source: Alam Flora Sdn Bhd, (2008; 2009b; 2009c)

The record shows an increasing trend when compared to the previous year.

Separation of recyclables at landfill

In certain landfills managed by Alam Flora, the activities of sorting the commingled recyclables will be carried out with serious consideration on safety and health aspects. Workers will get their cash incentive for performing the activities based on total weight of recyclables.

Public Education and 3R Awareness Campaign

For sustainability of 3Rs programmes, continuous public education and awareness are important. To ensure constant participation by the target group, Alam Flora has actively implemented awareness talks, distributed leaflets and brochures and conducted exhibitions. Some of the programmes that Alam Flora participated in August 2009 are listed in *Table 2*.

Achievement

Alam Flora's record shows an increasing trend of recovery of recyclable materials from all activities, *i.e.* from an average of 467 tonnes/month in 2007 to 750 tonnes/month in 2009, which is about a 61% increase. *Table 3* shows the total recyclables collected by Alam Flora in year 2007 & 2008 (from Jan to Dec) and year 2009 (from Jan to August only) by type of programmes.

Concluding Remarks

The potential of the 3R concept to reduce the final amount of waste reaching landfills in Malaysia is high. A good 62% of organic waste could be diverted for composting and 23% can be economically reused or recycled. Various programmes and activities targeted at different groups of the society had indicated that the amount of material being collected under the 3R programmes is on the rise. The amount of recyclables collected had increased by more than 60% in just over 18 months. In order to make the 3R concept more effective, these efforts by Alam Flora must be fully supported not only by the regulators but by the whole society. BEM

Recycling centre

SOURCE/REFERENCES

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National Green Technology Policy

Submitted by Chin Teck Yeow

Definition

Green Technology (GT) is the development and application of products, equipment and system used to conserve the natural environment and resources which minimizes and reduces the negative impact of human activities.

Policy Statement

Green Technology shall be a driver to accelerate the national economy and promote sustainable development. Four pillars of National Green Technology Policy:

- Energy: energy independence and efficient utilization
- Environment: conserve and minimize impact on environment
- Economy: enhance economy through use of technology
- Social: improve the quality of life for all

Objectives

- To minimize growth of energy consumption while enhancing economic development
- To facilitate growth of green technology industry and enhance its contribution to the national economy
- To increase national capability and capacity for innovation in green technology development and enhance Malaysia's competitiveness in green technology in global arena
- To ensure sustainable development and conserve the environment for future generations
- To enhance public education and awareness on green technology and encourage its widespread use

National goals

The national goals of the Green Technology Policy is to provide direction and motivation for Malaysians to continuously enjoy good quality living and a healthy environment

(a) Short term goal (10th Malaysia Plan)

- Energy sector
  - Application of GT in power generation and in the energy supply side management, including co-generation by the industrial and commercial sectors
  - Application of GT in all energy utilization sectors and in demand side management programme
- Building sector:
  - Adoption of GT in the construction, management, maintenance and demolition of buildings
- Water and Waste management sector
  - Technology in the management and utilization of water resources, waste water treatment, solid waste and sanitary landfills.
- Transportation sector
  - Incorporation of GT in the transportation infrastructure and vehicles, in particular biofuels and public road transport.

(b) Mid-term goals (11th Malaysia Plan)

- GT becomes the preferred choice in procurement of products and services
- Has a larger local market share against other technologies, and contributes to the adoption of GT in regional market
- Increased production of local GT products
- Increased Research, Development and Innovation of GT by local universities and research institutions which are commercialized in collaboration with the local industry and multi-national companies
- Expansion of local SMEs and SMIs on GT into the global market
- Expansion of GT applications to most economic sectors

(c) Long Term goals (12th Malaysia Plan and beyond)

- Inculcation of GT in Malaysian culture
- Widespread adoption of GT reduces overall resource consumption while sustaining national economic growth
- Significant reduction in national energy consumption
- Improvement of Malaysia's ranking in environment ratings
- Malaysia becomes a major producer of GT in the global market
- Expansion of international collaboration between local universities and research institutions with GT industries

Strategic Thrusts

(a) Strategic thrust 1: *Strengthen the institutional frameworks*

In nurturing the adoption and growth of GT, it is critical to have strong institutional arrangements to promote GT applications through:

- Formation of GT council
- Cabinet Committee on GT
- Establishment of GT Agency
- Review and establish legal mechanism
- Enhancement of institutional clarity

(b) Strategic Thrust 2: *Provide conducive environment for GT Development*

The growth of GT industry either in manufacturing or service sectors is critical towards fulfilling the objectives of the GT policy. This industry would supply the GT to the local and global markets, create jobs and contribute towards the national economy through:

- Introduction of economic instruments
- Strengthening the understanding of local players in GT industries and their value chain
- Promote FDI on GT
- Establish GT hubs
- Establish GT funding mechanism

(c) Strategic Thrust 3: *Intensify human capital development in GT*

- Design and enhancement of training programme
- Provide financial and fiscal incentives for students to pursue GT disciplines
- Retraining and apprenticeship scheme to enhance semi-skilled labour in GT
- Grading and certification mechanism for competent personnel in GT
- Exploitation of brain gain programme to strengthen local expertise in GT

(d) Strategic Thrust 4: *Intensify GT Research and Innovation*

Research, Development, Innovation and Commercialization (RDIC) is crucial in creating new technologies, technique and applications which would be able to reduce the cost of GT and promote its usage. Research, Development and Innovation (RDI) could be enhanced through:

- Providing financial grants or assistance to public & private sectors in RDIC
- Implementation of GT foresight
- Establish effective coordinating agency for RDI and centre of excellence
- Smart partnership between Government, industries and research institutions
- Establish strong linkages between local research institutions and regional and international centres of excellence in GT RDI.

(e) Strategic Thrust 5: *Promotion and public awareness*

Effective promotion and public awareness are two main factors that would affect the success of GT development. This is particularly significant as such adoption requires the change of mindset of the public through various approaches including:

- Effective, continuous promotion, education and information dissemination through comprehensive roll-out programmes
- Effective involvement of media, NGO and individual stakeholders
- Inculcation of a culture that appreciates GT among students at all levels
- Demonstration programme of effective GT application
- Adoption of GT in all Government facilities and Government linked entities

National Key Indicators

The National Key Indicators are a set of criteria to measure the success of GT Policy and its initiatives. This would provide the Government a feedback mechanism and the opportunity to improve or strengthen the initiatives as necessary. The National Key Indicators for Environment, Economy and Social sectors would be further refined into quantitative and qualitative key performance indicators (KPIs) for each Malaysia Plan, and annual plan for various Government ministries and agencies.

For further details.
Please refer to: webmaster@kttha.gov.my

Assessing Organisational Performance Using Key Performance Indicators And Human Capital Management

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The planning and management of human capital and resources is crucial and complex especially to a large organisation. Its important and essential to measure and manage the use of Key Performance Indicators (KPI) to improve and enhance organisational performance.

Over the years, various methods have been used to improve the delivery systems of organisations and service-oriented businesses. To create healthy economic environment and gain competitive advantages, various initiatives have been implemented by companies and organisations such as Balanced Scorecard, Performance Driven Assessment and Key Performance Indicators (KPI).

KPI is one of the tools that have been used to gauge and improve performance. With emphasis on the need to develop human capital and performance, many research and development programmes have been conducted.

More organisations and companies realise that in today's competitive business environment, the need to develop human capital performance is crucial and must be prioritized to ensure survival.

Considerable research is needed for investigating what type training delivery mechanism and competence requirements are more likely to impact in a cause-effective way on performance improvement such as service excellence, given contingency and situation variation[1] *. [F.M. Horwitz, 1999]*

Emphasis on human capital is becoming increasingly important to compete in global manufacturing industries. Restructuring efforts should also include establishment of a corporate culture which fosters the development of employee with skills and attitudes which are requisite to success in global marketplace. A renewed emphasis on human capital is to encourage learning that requires an investment in employee development [2]*. [M. A.Hitt, R.E. Hoskisson, J.S. Harrison, T.P. Summers, 1994]*

Government Public Service Circular

In the year 2005, the Government through it's Public Service Department Circular introduced the KPI work performance measurement methods aiming to improve overall Government departments' performance.

Four steps were outlined as follows: [3]

1. Create KPI and set the Target Performance
2. Measure and appraise performance
3. Monitor the level of performance
4. Improve performance

According to the Government circular, organisational performance can be monitored and improved by using the following strategies: [4]

1. Set the policies regarding the implementation of performance measurement
2. Form a steering committee to monitor KPI and performance
3. Get feedback from customers through Customer Satisfaction Survey
4. Investigate, analyze and suggest improvement initiatives
5. Monitor and report performance improvement

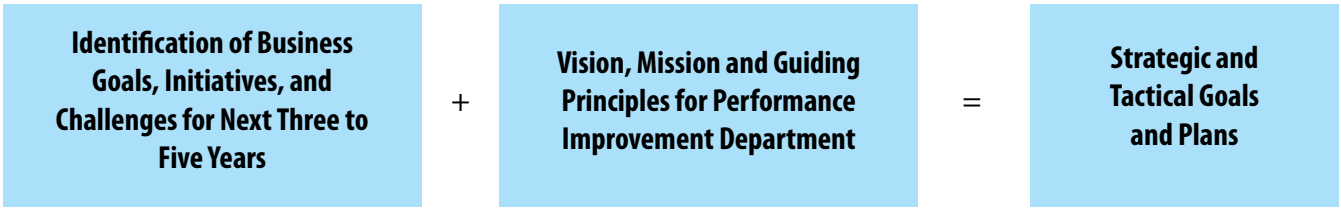


Figure 1: Process of Forming a Strategic Plan

The overall process of forming a strategic plan for the department is similar to the one displayed in *Figure 1* [5].

A strategic plan identifies the hopes and visions for the function and integrate them into the business requirements of the organisation. In this manner a "win-win" plan is formulated [6]. *[D.G/J.C. Robinson, 1995]*

The overall picture of an organisational functions and constituents can be portrayed in *Figure 2* in terms of The Internal Evaluation perspective. SMART (**S**pecific, **M**easurable, **A**ccurate, **R**ealistic, **T**ime bound) and SWOT (**S**trength, **W**eakness, **O**pportunity, **T**hreat) analysis are used to better analyse organisational performance. This will be much needed by an organisation to gauge realtime organisational performance.

Employees who have been trained in a set of skills but who work in an environment that does not support those skills will eventually stop using them. The work environment governs whether or not they will utilize the skills they have learnt during training. The skills and work environment relationship can be expressed in an equation in *Figure 3* [8]:

The formulae shows that if people learn 100% of what is required but the work environment is only 25% supportive, the improvement in on-the-job performance will be only 25% of what is possible [9] [D. G. Robinson, J.C. Robinson 1995]. Ishikawa identified that organisational performance is dependent on these parameters[10]:

- Employees competencies - dependent variable
- Teamwork performance - dependent variable
- Good leadership - dependent variable
- Good policies - dependent variable
- Good organisational - behaviour and norms - dependent variable
- Strong financial - independent variable standing
- Enough facilities - independent variable and equipment

These factors can be drawn into a table as shown in *Table 1*. From this table the overall performance can be calibrated by gauging the

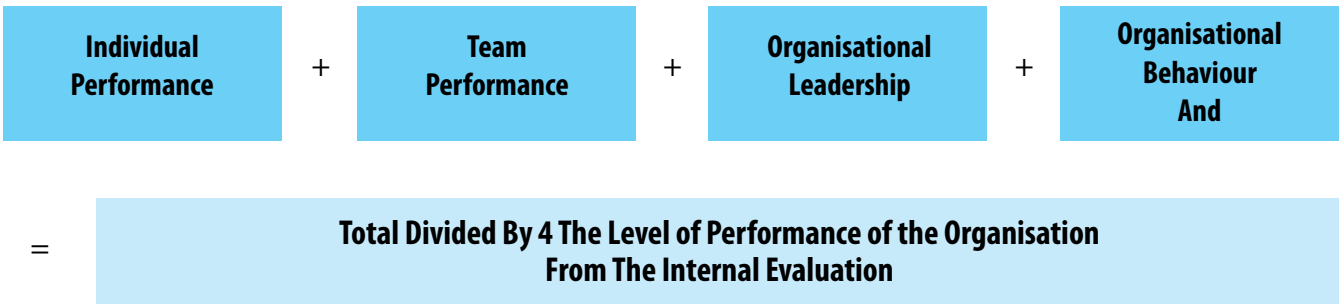


Figure 2: The Internal Evaluation [7]

Figure 3: Skills And Work Environment Relationship

1.	Employees competencies	-	dependent variable	These involve human capital
2.	Teamwork performance	-	dependent variable	
3.	Good leadership	-	dependent variable	
4.	Good policies	-	dependent variable	
5.	Good organisational behaviour and norms	-	dependent variable	
6.	Strong financial standing	-	independent variable	
7.	Enough facilities and equipment	-	independent variable	

Table 1: **Factors Influencing Organisational Performance**

FACTORS	WEIGHTAGE (MARKS)	ACTUAL / MEASURED CONTRIBUTION
Employees competencies	10	7
Teamwork performance	10	7
Good leadership	10	8
Good policies	10	8
Good organisational behaviour and norms	10	9
strong financial standing	10	10
Strong facilities, technology, knowledge, and equipment	10	10
OVERALL ORGANISATIONAL PERFORMANCE	**70**	**59**

actual contribution to the level of performance for each parameter. This is illustrated in the example shown in *Table 1*[11].

From the example shown in *Table 1*, the Organisation's Performance can be calculated as follows:

Organisation's Performance = M_s/M_{max} x 100 %

where

M_s = marks scored by the organisation

M_{max} = maximum marks available can be scored

$$= \frac{59}{70} \times 100\ \% = \mathbf{84.3\ \%}$$

Organisation Matrix Analysis

Organisation Matrix Analysis is used to gauge the performance level of an organisation that involves the calibration of four main parameters. The results from the calibration for each parameter is charted into a matrix chart shown in *Figure 4*. The parameters involved are Target, Enthusiasm, Quality, and Performance. The top performers are grouped into the top right hand corner of the matrix chart. The result of the organisation's performance is obtained by averaging the interpolation of X and Y as shown in *Figure 4* [12].

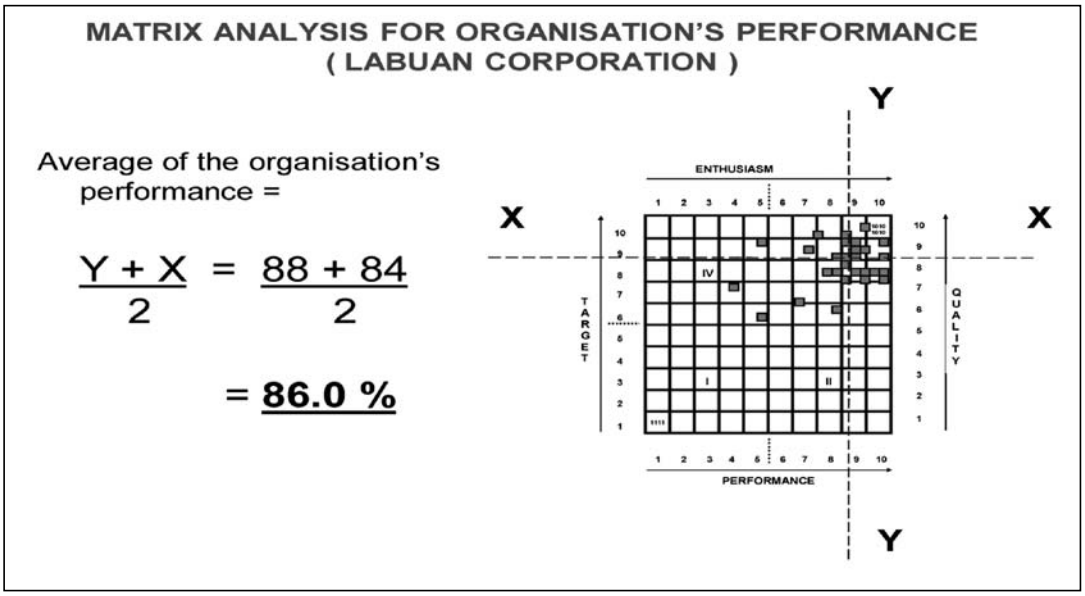


Figure 4: Organisation Matrix Analysis

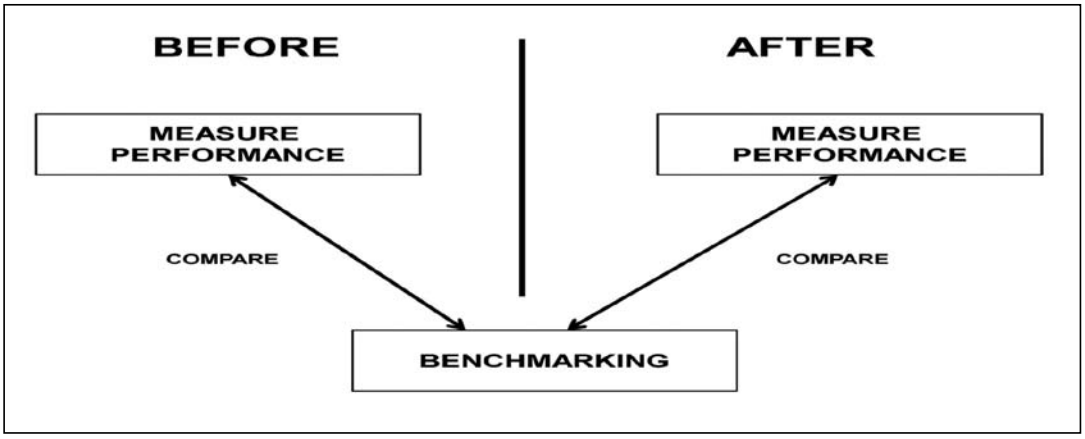


Figure 5: Before And After Analysis[13]

Before And After Analysis

Before and after analysis is used to gauge the success of the organisation's improvement initiatives to see the outcome of the improvement exercise. The analysis will be benchmarked *Figure 5* and compared to a top performing organisation.

This analysis will see results of the improvement exercise and any weakness can be addressed. Reference is made to Ishikawa Fishbone Diagram (*Figure 6*) to identify which section caused the problem.

COMPARE STREAMLINING MODEL WITH ISHIKAWA FISHBONE AND FIND WEAKNESSES

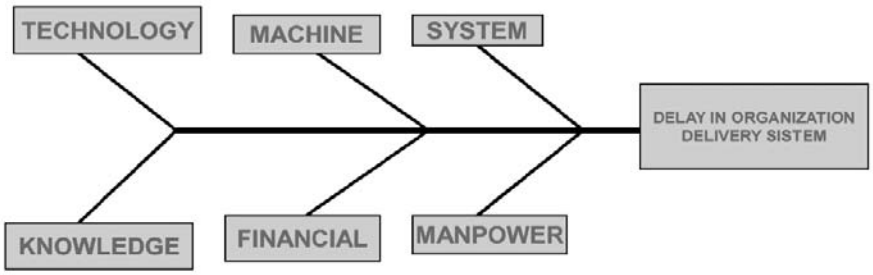


Figure 6: Cause And Effect Analysis [14]

External Evaluation For Organisational Level Of Performance

In order to have a fair and consistent evaluation, an External Evaluation can be carried out regarding 'What Is Said About The Organisation' (*Figure 7*). The result is tabulated in *Figure 8* so that the overall average is obtained for a sensible figure.

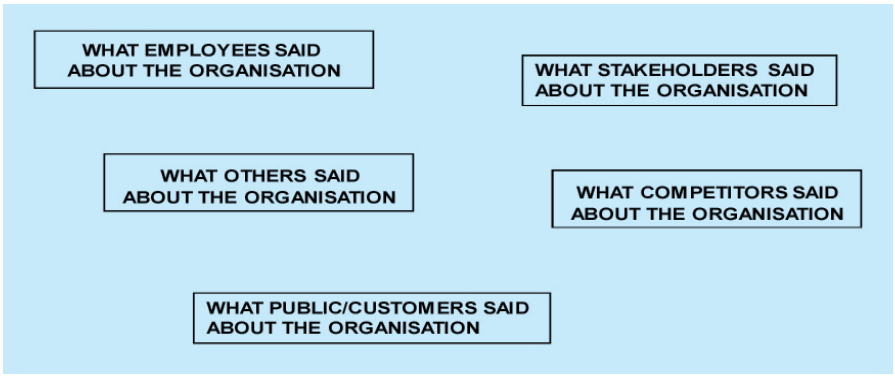


Figure 7 : What Is Said About The Organisation [15]

Averaging The Performance Results

Results from various performance analyses are obtained and averaged to get the overall performance of the organisation (*Chart 1*). As shown in *Chart 1*, the overall performance of Labuan Corporation is calculated as 77.87 %.

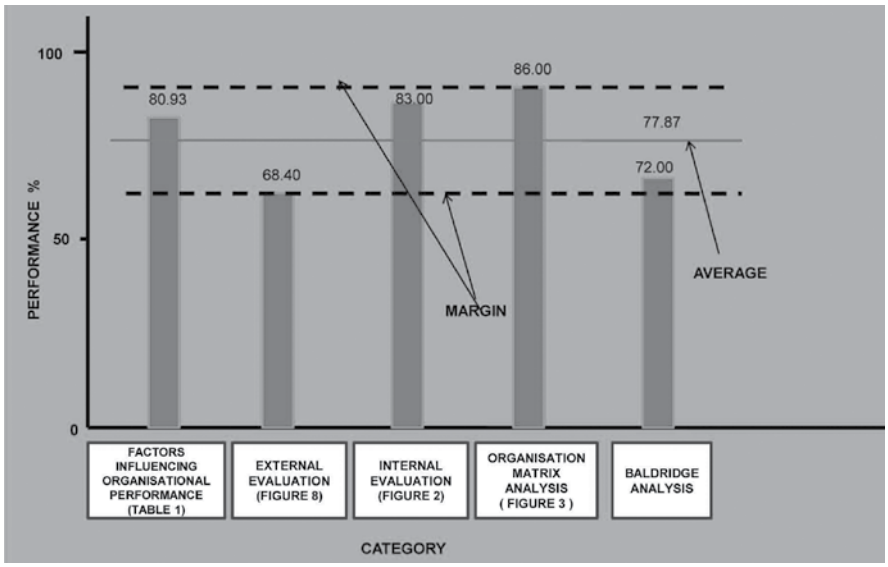


Chart 1: Averaging The Organisational Performance (Labuan Corporation) [17]

Human Capital Modelling

Human capital can be modelled and programmed and a strategic plan is outlined to attain desired organisational performance as shown in *Figure 9*.

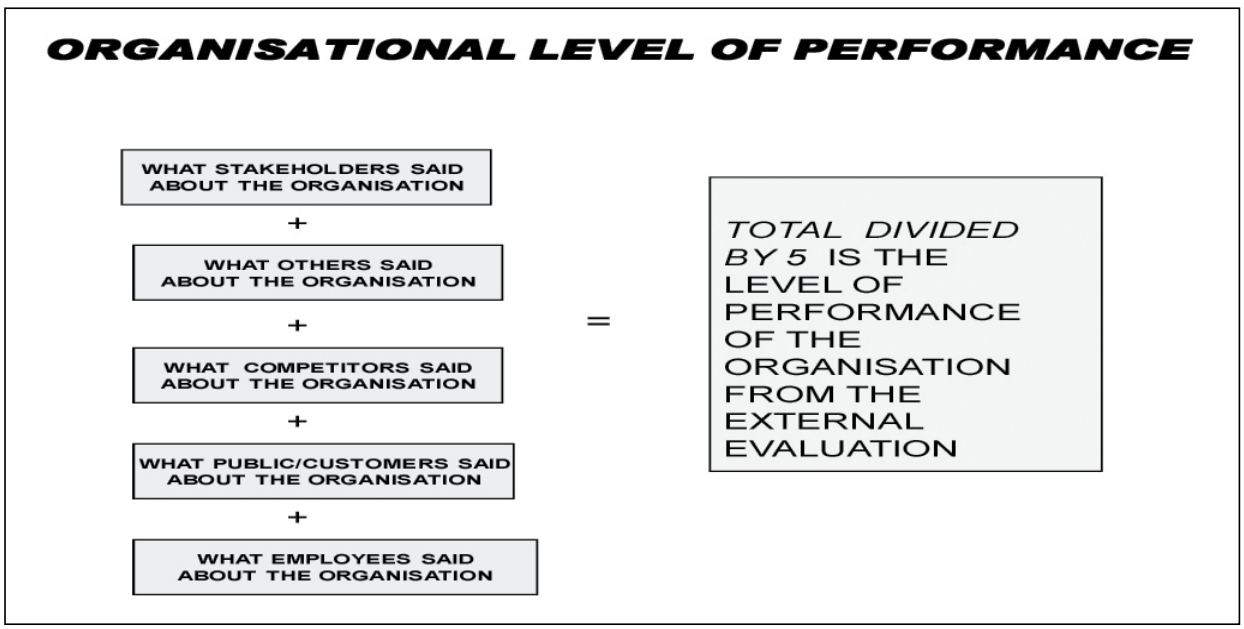


Figure 8: The External Evaluation [16]

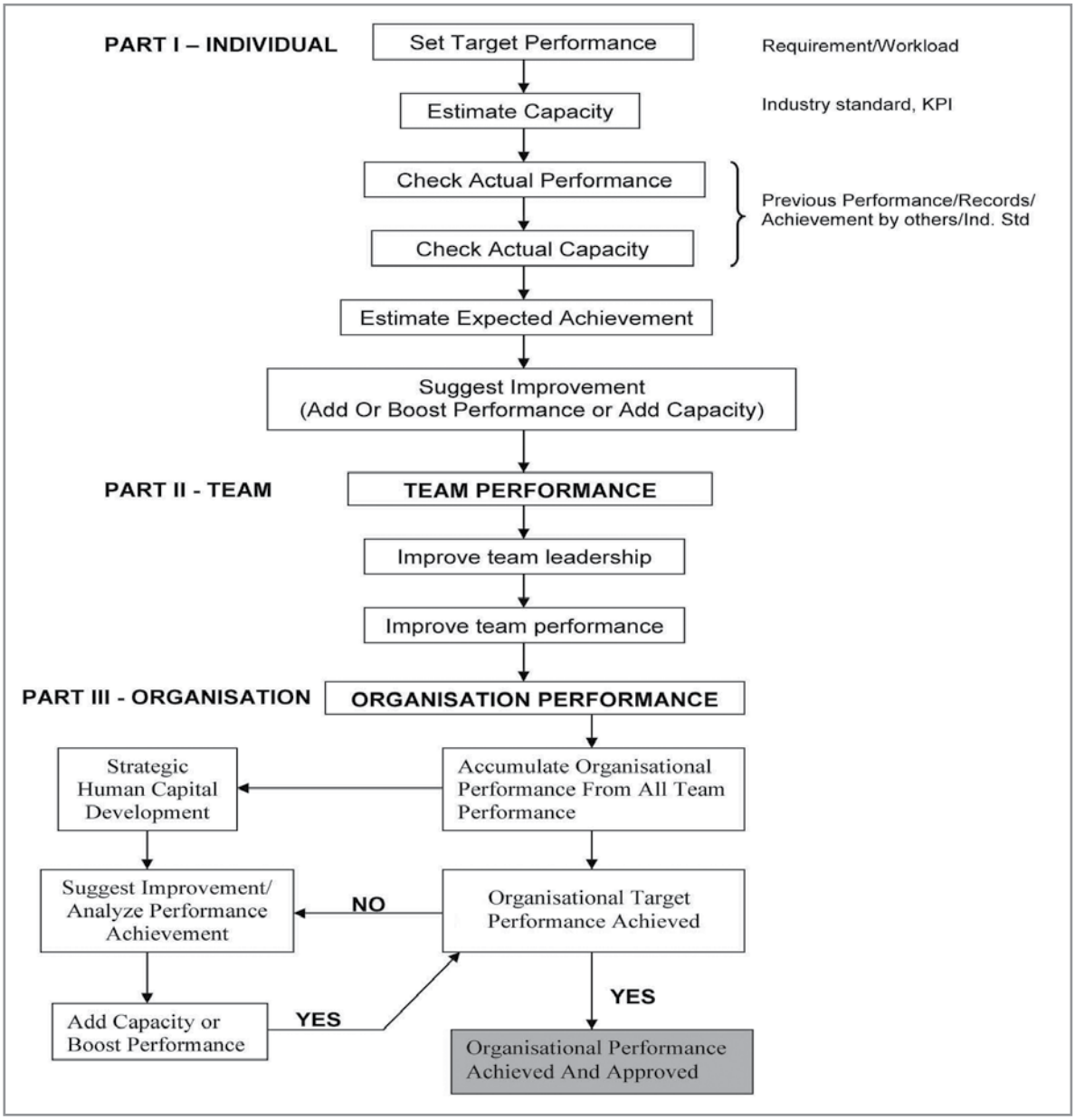


Figure 9: Organisational Performance Improvement Modelling

Modelling for human capital should be based on Organisational Performance Improvement Modelling (*Figure 9*) so that it's correlation and alignment is properly established. *Figure 10* demonstrates Human Capital Modelling showing the relationship between the organisational performance improvement parameters.

Now we can write the equation in the following manner,

Good organisational performance = (*Individual Performance* + *Organisational Performance*) + (*HRM Activities* + *HRM Outcomes*)

Good business result = Good organisational performance + Good business Strategy

Good business strategy = Economic competitive change + (Structural design + Integrated HR strategy) + (Training and development + Work redesign + New work process + Technological change)

Organisational Performance Assessment

The American Quality Award has been devised to award outstanding organisation and business entities. A set of guidelines for performance assessment criteria has been formulated (see Baldridge Quality And Performance Assessment Criteria 2004)[19].

Table 2 shows the performance criteria that should be evaluated in an organisation. Every performance criteria is evaluated and performance scores are given as shown in this case study done on Labuan Corporation (*Table 3*).

From *Table 3*, the percentage of Labuan Corporation performance can be calculated as below:

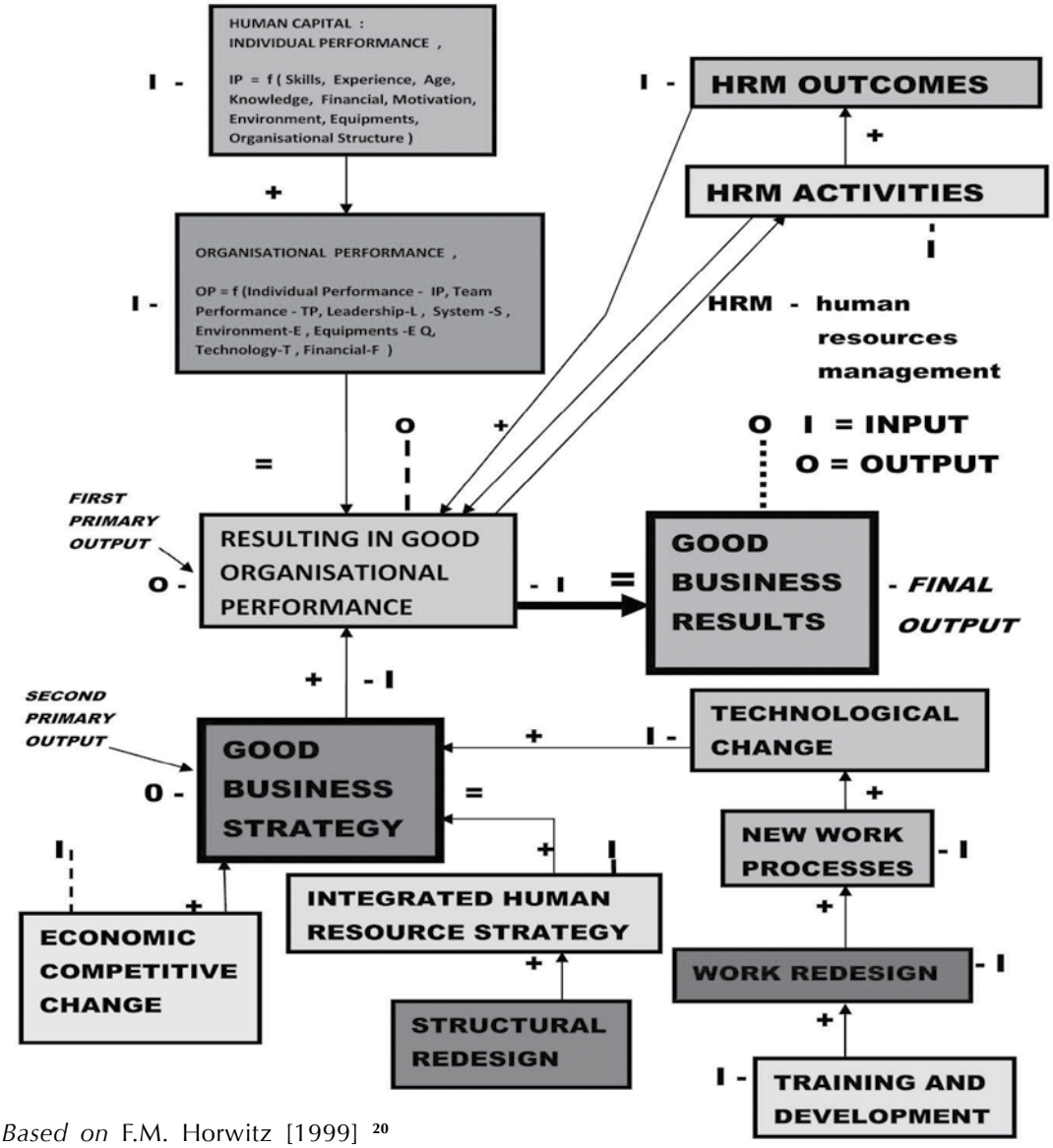
Performance = A_S / A_T x 100%

Where,

A_S = Points scored by the organisation
A_T = Maximum points available to be scored

$$= \frac{718.87}{1000} \times 100\%$$

$$= 71.89\% = \underline{72\%}$$



Based on F.M. Horwitz [1999] [20]
Figure 10: Human Capital Modelling [21]

Table 2: **Baldrige Analysis For Organisational Performance Assessment [22]**

No.	CATEGORIES AND ITEMS	POINT	VALUES
1.	**LEADERSHIP** 1.1 Organisational Leadership 1.2 Social Responsibility	 70 50	120
2.	**STRATEGIC PLANNING** 2.1 Strategic Development 2.2 Strategic Deployment	 40 45	85
3.	**CUSTOMER AND MARKET FOCUS** 3.1 Customer and Market Knowledge 3.2 Customer Relationship and Satisfaction	 40 45	85
4.	**MEASUREMENT ANALYSIS & KNOWLEDGE MANAGEMENT** 4.1 Measurement and analysis of organisational Performance 4.2 Information and Knowledge Management	 45 45	90
5.	**HUMAN RESOURCES FOCUS** 5.1 Work System 5.2 Employee Learning and Motivation 5.3 Employee Well-Being and Satisfaction	 35 25 25	85
6.	**PROCESS MANAGEMENT** 6.1 Value Creation Process 6.2 Support Process	 50 35	85
7.	**BUSINESS RESULTS** 7.1 Customer-Focused Results 7.2 Product and Service Results 7.3 Financial and Market Results 7.4 Human Resource Results 7.5 Organisational Effectiveness Results 7.6 Governance and Social Responsibility Results	 75 75 75 75 75 75	450
	TOTAL POINTS		**1,000**

Table 3: **Baldrige Analysis For Individual [23] Organisational (Labuan Corporation)**

NO	ITEM	POINT	VALUE	LABUAN CORPORATION
1.	 1.1 1.2	 70 50	**120**	**64.3** 22.0 42.3
2.	 2.1 2.2	 40 45	**85**	**69.25** 29.50 39.75
3.	 3.1 3.2	 45 45	**85**	**73.89** 34.29 39.6
4.	 4.1 4.2	 45 45	**90**	**63.14** 35.44 27.7
5.	 5.1 5.2 5.3	 35 25 25	**85**	**62.44** 24.8 18.0 19.64
6.	 6.1 6.2	 50 35	**85**	**61.41** 37.78 23.63
7.	 7.1 7.2 7.3 7.4 7.5 7.6	 75 75 75 75 75 75	**450**	**324.44** 62.5 56.25 60.0 45.0 50.0 50.63
	TOTAL POINTS :		**1,000**	**718.87**

KPI Example

Exhibit 1 shows the KPI example demonstrating the calculation of KPI and performance targets at Labuan Corporation's vehicle maintenance service at its workshop[24].

KPI Success Rate

From the core businesses KPI assessments, every department's success rate is calculated. Hence overall organisational performance is assessed as shown in the following case studies at Labuan Corporation (*Exhibit 2*)[25].

The performance of Labuan Corporation can be calculated as shown below.

(i) seven main processes
(ii) six support process

Exhibit 1: **KPI For Vehicle Maintenance**

Main Process : **MAINTENANCE CONTROL**

Service Delivered : **Vehicle Repair At Labuan Corporation's Workshop**

MAIN PROCESS	SERVICE DELIVERED TO CUSTOMER	KPI	PERFORMANCE TARGET
MAINTENANCE CONTROL i) Periodical Vehicle Maintenance ii) Vehicle Repair at Workshop Labuan Corporation (small repair) iii) Vehicle Repair Outside (Outsource) (Approval process not include the actual time of maintenance work)	**Vehicle Repair At Workshop (Periodical Small Repair)** Members Involved / Workflow / Actual Time (mins) START M Accept complain 5 AA Record into Complaints Form 5 M Inspection for vehicle repair 30 M Prepare mechanical apparatus 5 M Open damaged component 120 AA Preparation of spare part 90 Repair again M Fix new component 120 M Complete and record repair works 5 M Test drive 60 NO Good condition ? 5 YES M Return/handover vehicle and record 10 AA Update record - Management record - Development record 10 M - Mechanic AA - Administrative Assistant END TOTAL 465	1. **Efficiency and Effectiveness of Service Process** a) Period of cycle time for a repair work at internal workshop b) Percentage of error made 2. **Effectiveness** **Productive Time :** **Actual time taken to repair a vehicle** = 465 Minutes (Mins) **One day productive time** 6.5 hr/day x 60 mins = 390 mins/day Number of members involved = 10 persons **Total productive working time per day for all members involved** 390 mins/day x 10 persons = 3900 mins/day 3900 mins/day x 20% = 780 mins/day **Number of vehicle can be repaired per day** 780 mins/day 465 mins/vehicle = 780/465 = 2 vehicles/day	465 minutes 0% 2 vehicles per day

Exhibit 2: **Summary Of The Key Performance Indicators (KPI) Achievement At Labuan Corporation**

ITEM	CORE BUSINESS	DEPARTMENT/UNIT	ACHIEVEMENT
1	PLANNING CONTROL i) Development & Landscape Plan Approval (Govt. & Private) ii) Technical Comments for Division Plan/ Land Combination and Changing Conditions	*One Stop Centre (OSC)*	100 %
2	BUILDING CONTROL i) Building Plan Approval for Housing Projects ,Commercial & Industrial (Private Projects). ii) Building Plan Approval (Govt. Projects) iii) Bldg. Plan Approval for Single House iv) Plan Approval For Amendment/Renovation v) Approval for Certificate of Fitness	*One Stop Centre (OSC)*	90%
3	BUSINESS CONTROL i) Processing of License Applications for Business Premises ii) Processing of License Information Amendments iii) Processing of License Renewal For Business Premises. iv) Processing of Feedbacks For License Appeals v) Processing of Hawkers License Applications. vi) Processing of The Cancellation of Business Premise License	Licensing	60.5 %
4	TAX ASSESSMENT CONTROL i) Property Tax Assessment Evaluation ii) Processing of Bill Production	Property & Evaluation	62.65
5	CLEANLINESS CONTROL & SERVICES i) Rubbish Collections Process	Town Services	91.67
6	ENFORCEMENT CONTROL i) Enforcement (Compound/Reminder Notices) ii) Enforcement Investigation (IP).	Enforcement	87.50
7	HEALTH CONTROL i) Certificate of Health Production	Health	90 %
8	IMPLEMENTATION OF DEVELOPMENT PROJECTS	Development & Engineering	97.00 %
9	FACILITIES BOOKINGS - Halls , Sport complexes , Fields/Courts, Stadium	Services Management	71.19
10	TRAINING & COURSES APPLICATIONS i) National Services Bureau ii) Managing The Preparation of Pension Documents	Human Resources	95.00%
11	FINANCIAL MGMT. & TENDERING i) Account Statement ii) Payment Process	Financial	83.34%
12	COMPUTER MAINTENANCE CONTROL ii) Periodical Computer Maintenance ii) Repair of Computer Equipments (internal) iii) Repair of Computer Equipments (Outsourcing)	Information Technology	67.00 %
13	VEHICLES MAINTENANCE i) Periodical Vehicles Maintenance ii) Vehicles Maintenance At LC Workshop iii) Vehicles Maintenance At External Workshop	Workshop/ Maintenance	66.7%
14	PREPARATION OF ANNUAL REPORT	Public Relation Unit	33.3%
15	LIBRARY i) Membership Applications ii) Book bookings & Return	Library	83.34%

Office workers

Hence, the overall performance of Labuan Corporation can be calculated by averaging all departmental performances as shown beside.

$$\text{Overall Organisational Performance} = \frac{(A_1 + A_2 + \ldots + A_n)}{n}$$

Where,

A_1 = performance percentage of core business 1
A_2 = performance percentage of core business 2
A_n = performance percentage of core business n
n = number of core business

From calculation,

Overall Labuan Corporation performance = **78.60%**

Realtime Organisational Performance

KPI reflects realtime organisational performance, hence it can be used to strategize innovative and corrective improvement to enhance performance.

Thus, from the various measurements and analyses carried out, a sensible and acceptable level of achievement for the performance can be derived.

If the realtime organisational performance can be exactly ascertained and proper strategies and planning can be implemented for future programmes to sustain or improve performance.

CONCLUSION

By using the KPIs in integration with Human Capital Modelling (HCM), a systematic way of assessing and developing the organisational performance can be achieved. Hence, strategic formulations can be implemented to improve performance in the short term and in the long term.

Human Capital Modelling (HCM) enables the programming, planning and modelling of human capital for short and long term needs. Therefore an improvement strategy can be effectively formulated to achieve organisational targets.

Strategic human capital planning will leverage current and future human capital needs of the organisation. This will re-emphasis development of human capital, retention of capable employees, cultivation of corporate culture which fosters creativity, quality, lifelong learning and long-term focus. In addition, a restructuring organisation should carefully plan its allocations for employee development to ensure that their employees are developing skills required for future organisational success. BEM

NOTE: *The Author is the Director of Development And Engineering Department, Labuan Corporation*

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Indoor Air Quality In Malaysia

By Prof. Nor Mariah Adam
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Indoor Air Quality (IAQ) refers to the quality of air inside buildings that has no known contaminants at harmful concentrations and where 80% of building occupants do not express dissatisfaction with the air conditions as defined by the ASHRAE (ASHRAE 1984). It is related to the common air conditioning/mechanical ventilation systems. IAQ is associated with Sick Building Syndrome (SBS), Building Related Illness (BRI), and Multiple Chemical Sensitivity (Legionnaire's disease).

High IAQ environment is desired in buildings to improve worker performance, reduce incidence of chronic diseases, lower medical bills, and create a desirable working environment. The Industry Code of Practice on Indoor Air Quality is applicable to 'Non-industrial place of work'. Examples are

- Offices, educational and training facilities, commercial establishment, and health care facilities
- Cafeterias and restaurants
- Gaming establishment, pubs, bar, karaoke lounges and discotheques
- But does not include premises used primarily as manufacturing and production facilities and vehicles

IAQ is becoming a public concern due to awareness and education. We spend 90% of our time indoors: home, car, office, car, shopping mall, gymnasium, car, swimming pool etc. Failure to respond to IAQ problems increases health problems, reduces productivity and morale of workers and increases rapid deterioration of buildings, furnishings and equipment. Indoor air quality is one of the six factors that affect life of buildings.

Figures 1 and *2* show occurrence of moulds on furniture of an office with poor IAQ. The staff there has serious skin problems, are low in morale and cannot concentrate on their work.

Factors affecting IAQ include:

- Emission from building materials (new or refurbished facilities)
- Permeability of wall structures
- Ventilation practices and ventilation rates
- Building maintenance and cleaning habits
- Emission of products/ equipment
- Body effluents
- Ambient air quality

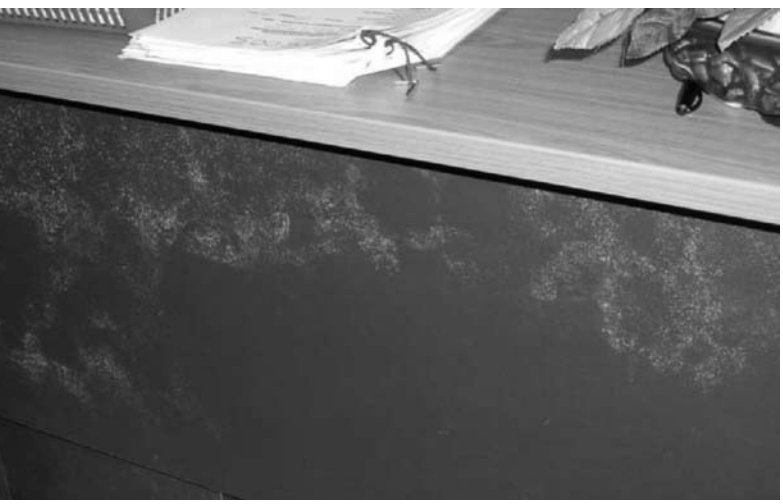

Figure 1: Moulds on office furniture

Figure 2: Poor IAQ

Office environment

Usually the culprit is the location of fresh air supply, which started, as the garden area then later became the car park area or worse, the food court area. Indoor air quality is directly related to HVAC systems. Poor IAQ is the result of the following factors:

- Insufficient air circulation
- Outside contaminant pathway
- Temperature and humidity

Some earlier work on category 'A' discotheques in Peninsular Malaysia showed a carbon monoxide (CO) level of 35 ppm (parts per million or one second in 11.57 days) in some premises because the fresh air intake is from the car park *(Zakaria Abdullah, 2002)*.

Common indoor air pollutants are:

- Particulates: dust and environmental tobacco smoke
- Biological agents: spores, moulds, bacteria, parasite, and bio-effluents from humans
- Hazardous chemical substances: formaldehyde, asbestos, volatile organic compounds (VOCs), pesticide, lead, CO and CO_2

IAQ Legislative Requirements

The related legislative requirements for IAQ are as follows:

- Food Act: Control of Tobacco Product Regulations 2004
- Uniform Building By-Laws 1984
- Occupational Safety and Health Act 1994

The Control of Tobacco Product Regulations 2004 is a regulation made under the Food Act, which is enforced by the Ministry of Health. This Act, entails control of smoking at enclosed public places, and separate smoking area. Exemptions are at casino, pubs, discotheques and nightclubs. The detailed sections of the regulations are:

- Part I: Interpretation
- Part II: Prohibition of Advertisement on Tobacco Products and Sponsorships etc
- Part III: Control on the Sale of Tobacco Products
- Part IV: Prohibition on Smoking
- Part V: Provision Relating to Minors
- Part VI: Labelling and Packaging
- Part VII: Miscellaneous

Uniform Building By-Laws 1984

The Uniform Building By-Laws 1984 was enacted by the Ministry of Housing and Local Government but enforced by Local Authorities. Ventilation requirements during design and commissioning follow the ASHRAE Standards 1984. Under the law, there is no requirement on the inspection and testing of ventilation systems. The major complaints of IAQ are related to ventilation problems (too hot, too cold, stuffy, poor air distribution, insufficient outdoor air etc.).

Occupational Safety and Health Act 1994

The Occupational Safety and Health Act (OSHA) 1994 is enforced by the Department of Occupational Safety and Health under the Ministry of Human Resources. Under this Act, the general duty of the employer is to ensure safety and health of employees and other persons at work. The employer must formulate a written statement on his policy on occupational safety and health (OSH) for his workers, guests, contractors and passers-by within the boundary of his premises. This applies to places of work and the Minister may make requirements pertaining to indoor air quality.

Objects of the Act are as follows:

- To secure the safety, health and welfare of persons at work
- To protect persons (guests, contractors, passers-by) at a place of work against hazard
- To promote the occupational environment adaptable to the person's physiological and psychological needs
- To provide the means towards a legislative system based on regulations and industry code of practice in combination with provisions of the Act.

Under OSHA 1994, Code of Practice on IAQ 2005, Guidelines on Occupational Safety and Health 1996 specifies standards on humidity, temperature, airflow and ozone, which are applicable only to offices.

General practicable duties of employers and self-employed persons are as follows:

- Provide and maintain plant and system of work
- Make arrangements for the safe use, operation, handling, storage and transportation of substances and plant
- Provide information, instruction, training and supervision
- Provide and maintain place of work and means of access to and egress from any place of work
- Provide and maintain working environment that is safe and without health risk and inadequate welfare facilities.

Here practicable relates to severity of the hazard or risk in question; the state of knowledge about the hazard or risk and the way of removing or mitigating the hazard or risk; availability and suitability of ways to remove or mitigate the hazard or risk; and the cost of removing or mitigating the hazard or risk.

A workshop on amendments to the Industry Code of Practice on Indoor Air Quality 2005 was held in April 2009. The purpose of the code is to promote healthy work environment and to ensure that employees and other occupants are protected from indoor air quality that could adversely affect health and well-being and consequently reduce productivity. *Table 1* shows the list of indoor contaminants and the associated maximum limits while *Table 2* shows the acceptable range for specific physical parameters.

Table 1: List of Indoor Air Contaminants and the Maximum Limits

Indoor Air Contaminants	Eight –hour time-weighted average airborne concentration		
	ppm	mg/m³	cfu/m²
Chemical contaminants			
(a) Carbon dioxide	C1000		
(b) Carbon monoxide	10		
(c) Formaldehyde	0.1		
(d) Ozone	0.05		
(e) Respirable particulates		0.15	
(f) Total volatile organic compounds (TVOC)	3		
Biological contaminants			
(a) Total bacterial counts			500
(b) Total fungal counts			500

Note: C is ceiling limit and not to be exceeded at all times

Table 2: Acceptable Range for Specific Physical Parameters

Parameter	Acceptable Range
Air temperature	22.5 – 25.5 °C
Relative Humidity	55-70%
Air Movement	0.15-0.50 m/s

Record Keeping

All records that are generated under this Code of Practice should be kept for a period of not less than five years. Assessment report shall be kept for a period of not less than 30 years.

Records to be kept include:

- Complaint records
- Investigation reports
- Assessment reports including the results of indoor air contaminant measurement and training records.

Conclusion

The indoor air quality requirements in this country are being updated from time to time with cross-referencing to other countries and by notable people in the industry. The present IAQ standard is at par with developed countries and countries in the region. BEM

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Mini Hydro Power Generation As A Renewable Energy Source Under Malaysia's Energy Policy

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In the Eighth Malaysian Plan, renewable energy (RE) was announced as the fifth fuel in the energy supply mix. Efforts are being undertaken to encourage the utilization of renewable resources, such as biomass, biogas, solar and mini-hydro for energy generation. Mini hydro plants were developed mainly in 1980s and early 1990s. Installed capacity is about 42.7 MW in Peninsular Malaysia, 7.3 MW in Sarawak and 5.0 MW in Sabah in year 2001. Mini hydro stations are situated in rural and remote areas of the country. Involvement of private sector in the ownership and operation of mini hydro schemes is encouraged by the Government. This paper aims to provide an overview on the development of mini hydro as RE in Malaysia. Government policies and barriers to development will also be discussed.

Energy has contributed significantly towards the rapid growth of the Malaysian economy. As Malaysia progresses towards becoming a developed country, energy consumption will correspondingly increase. Electricity demand in the country has remained strong and resilient with revenue growth averaging 15% over the past five years and even remained positive after the 1997 slowdown. Peak electricity demand in Malaysia grew at a rate of 5.8% per year and reached 12,637MW in 2003 and is growing at a rate of 7.2% annually, from 12,637 megawatts (MW) to reach 14,531MW in 2005.

Malaysia's energy policy is to ensure secure, diversed and sustainable supplies of energy at competitive prices. Oil and gas continue to provide the energy needed to steer the nation towards higher socio-economic growth and prosperity. Malaysia's National Energy Diversification Policy makes it incumbent to diversify its energy resources to avoid over dependence on any one fuel. This resulted in an expansion of the previous Four-Fuel Diversification Policy of gas, hydro, coal and oil, to incorporate renewable energy, as in the Fifth Fuel under the Eighth Malaysia Plan (2001-2005). Renewable energy is being targeted to be a significant contributor to the country's total electricity supply. With this objective in mind, greater effort is being undertaken to encourage the utilization of renewable resources, such as biomass, biogas, solar and mini-hydro, for energy generation. The Ninth Malaysia Plan (2006-2010) strengthens the initiatives for energy efficiency and renewable energy put forth in the Eighth Malaysia Plan that focused on better utilisation of energy resources. An emphasis to further reduce the dependency on petroleum provides for more efforts to integrate alternative fuels.

Malaysia's technical feasible potential of hydropower is estimated to be around 123,000

GWh/year *(Nathaniel et al., 2002)*. This has made hydro power an attractive option as a renewable energy source in Malaysia. Conventional hydro power plants convert potential energy which is contained in falling water into electricity. They are currently the world's largest renewable source of electricity, accounting for 6% of worldwide energy supply or about 15% of the world's electricity *(Mohibullah et al, 2004)*. However, the majority of these power plants involve large dams which flood big areas of land to provide water storage and therefore a constant supply of electricity. In recent years, the environmental impact of such large hydro projects are being identified as a cause for concern. It is becoming increasingly difficult for developers to build new dams because of opposition from environmentalists and people living on the land to be flooded. Therefore, the need has arisen for small scale hydro electric power plants in the range of mini and micro hydro power plants. There are no Micro Hydro power plants in Malaysia and the smallest category of hydro power plants in Malaysia is small and mini hydro with a capacity less than 1000 kW. The classification of the hydro plant is shown in *Table 1*.

This paper aims to provide an overview of the development of mini hydro as a renewable energy source in Malaysia. Information on installed capacity and power generation will be given. The Governmental effort to promote renewable energy and the barriers to its development in Malaysia will also be discussed.

Table 1. Classification of Hydro Plants (Harvey and Brown, 1993)

Large	All installations with an installed capacity of more than 1000kW
Small	All installation in the range between 500 to 1000kW
Mini	Capacity between 100 to 500kW
Micro	Hydro power installations with a power output less than 100kW

Mini Hydro Sites and Installed Capacity in Malaysia

Mini hydro plants developed mainly in 1980s and early 1990s. These stations in Peninsular Malaysia are owned by Tenaga Nasional (TNB) apart from a few independent power generators. In East Malaysia, the stations are operated by Sarawak Electricity Supply Company (SESCO), and in Sabah by Sabah Electricity Supply Berhad (SESB). Mini hydro stations development intensified in 1980s to promote electrification in the rural area and to promote economic development *(Wallace and Williams, 1997)*.

There are 46 SHP stations which are under TNB with total installed capacity of 42.7 MW (*Figure 1*). About 56% of the mini hydro stations are in the range of 100

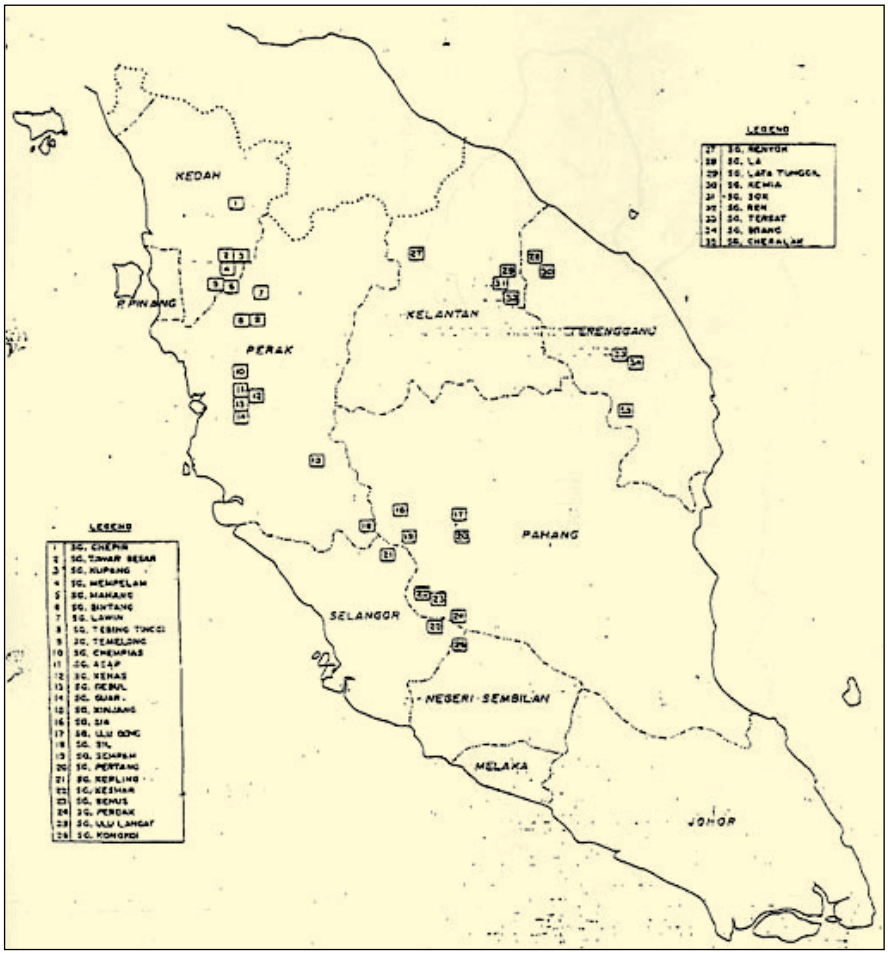

Figure 1. Location of mini hydro stations in Peninsular Malaysia (Source: TNB Hidro, 2002)

MW to 500 MW. There are also three independent power producers (IPPs) of mini hydropower stations in Peninsular Malaysia with total installed capacity of 22500 kW. There are five mini hydro stations in Sabah (*Figure 2*), and total installed capacity is 4.99 MW. In Sarawak, there are seven mini hydro stations with a total installed capacity of 7.297 MW (*Figure 2*).

As of year 2002, total installed capacity in Malaysia was 9,323.8MW. Installed capacity in Peninsular Malaysia under TNB was 8,301MW, Sarawak under SESCO was 544.4 MW and Sabah under SESB was 478.4MW. Power generation in Peninsular Malaysia was 33,241 GWH, Sarawak was 2,781 GWH and Sabah was 1,426 GWH. In Peninsular Malaysia, hydropower ranked second at 1,911 MW (23.02%) after gas 3,002 MW (36.16%) in installed capacity. Out of 23.02%, mini hydro stations installed capacity is 11.9 MW (0.14%). However, the power generation by hydropower is lower. Hydropower ranked third at 11.4% after gas (48.3%) and oil (28.9%) in power generation. Out of 11.4%, mini hydro stations contributed less than 0.2 % (Ministry of Energy, Communications and Multimedia, Malaysia, 2003).

In Sarawak, main installed capacity was by gas with 288.1 MW (52.92%), second was diesel with 168 MW (30.86%) while hydropower ranked third at 88.3 MW (16.22%). Out of 16.22%, mini hydro stations installed capacity was 7.3 MW (1.34%). Hydropower ranked third at 16.3% after gas (50.6%) and coal (17.3%) in power generation. The scenario in Sabah is quite different. Main installed capacity was by diesel powered generation with 302.1MW (63.15%), while hydropower

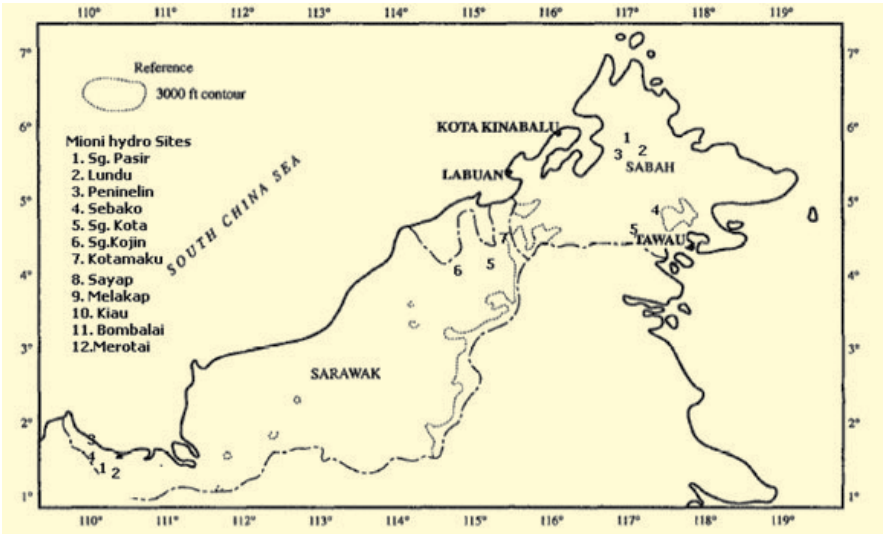

Figure 2. Location of mini hydro stations in Sarawak and Sabah (Source: TNB Hidro, 2002)

Table 2. Installed Power Generation Capacity In Malaysia, 2002

	TNB		SESCO		SESB	
	MW	%	MW	%	MW	%
Hydro	1911	23.02	88.3	16.22	72.3	15.11
Gas	3002	36.16	288.1	52.92	60	12.54
Coal	1600	19.27	0	0	0	0
Oil	1720	20.72	0	0	44	9.20
Diesel	68	0.82	168	30.86	302.1	63.15
TOTAL	8301	100%	544.4	100%	478.4	100%

(Source: Energy Commission, 2002)

Table 3. Power Generation In Malaysia, 2002

	TNB		SESCO		SESB	
	GWH	%	GWH	%	GWH	%
Hydro	3806	11.4	454	16.3	159	11.2
Gas	16064	48.3	1408	50.6	557	39.1
Coal	3655	11.0	480	17.3	0	0.0
Oil	9603	28.9	291	10.5	0	0.0
Distillate	113	0.3	0	0.0	0	0.0
Diesel	0	0.0	148	5.3	710	49.8
Others	0	0.0	0	0.0	0	0.0
TOTAL	33241	100%	2781	100%	1426	100%

(Source: Energy Commission, 2002)

ranked the second at 72.3MW (15.11%). Out of 15.11%, mini hydro stations installed capacity was 5 MW (1.32%). Hydropower ranked third at 11.2% after diesel (49.8%) and gas (39.1%) in power generation *(Ministry of Energy, Communications and Multimedia, Malaysia, 2002)*. The details are shown in *Tables 2* and *3*.

Types of Generator and Turbine and Performance of Mini Hydro in Malaysia

In Peninsular Malaysia, the generators used by TNB on mini hydro are synchronous type (34 units), others are induction types (10 units). Types of turbine consist of Francis, Pelton Impulse, Turgo Impulse, Cross-flows and Reversible Pump, as shown in *Figure 3* and *Table 4*.

Performance of a mini hydro station is measured by plant factor as illustrated in equation (1):

As a rule of thumb, plant factor of 50 to 60% is acceptable for a mini hydro station. The main factor that affects the generation factor in mini hydro is water flow of the river. Other factors are status of equipment, machines and distribution grid.

The plant factors for mini hydro stations in Malaysia range between 0% and 96.4%. For TNB's mini hydro stations, there are 11 stations with plant factor above 50%, this includes eight outstanding stations with plant factor above 60 %. The highest plant factor (96.4%) was recorded by Robinson Falls station followed by Kuala Terla station with 95.6%. There are some stations not generating power due to breakdown of mechanical and electrical components, lack of water due to silt of mud, clogging of intakes, logging activities in water catchment area and others.

$$\text{Plant Factor} = \frac{\text{Power Generation} * 100}{\text{Installed Capacity} * 8760} \quad (1)$$

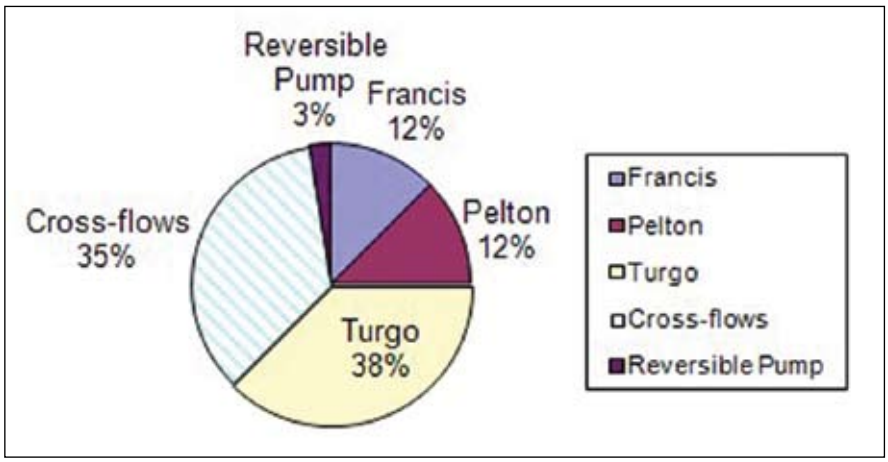

Figure 3. Types of turbines used in TNB's Mini Hydro (Source: TNB Hidro, 2002)

Government Support and Renewable Energy Agencies

Outline Perspective Plan (OPP3)

The Third Outline Perspective Plan (OPP3) and the Eighth Malaysia Plan (2001-2005) are the two main policy references for promoting and developing renewable energy in Malaysia. OPP3 is Malaysia's 10-year development plan (2001 to 2010). Both policies have forecasted that Malaysia may be net oil importer before 2015 (see *Figure 5)*. Under OPP3, the Government will continue to manage both non-renewable and renewable energy resources to meet the demands of the rapidly growing economy. The main thrusts of OPP3 are as follows:

(a) to ensure an adequate, secure, quality and cost-effective supply of energy.
(b) to promote efficient energy utilisation and to minimise negative impact on the environment.
(c) to supplement the conventional supply of energy by encouraging new sources of energy such as renewable energy.

The Fifth Fuel Policy and Eighth Malaysia Plan

In the year 2000, the Government introduced the Fifth Fuel Policy, which identifies renewable energy as Malaysia's 'fifth' major fuel resource. This includes renewable such as biomass, solar, mini hydro and wind. Significant effort is assigned to encourage the utilisation of renewable resources under the Eighth Malaysia Plan (2001–2005) to supplement the supply of energy from conventional energy sources. The Government set a target of 5% of the nation's electricity production (about 600 MW) to come from renewable

Table 4. Mini hydro site in Peninsular Malaysia

No	Site	Nearest Town	Type of Turbine	Type of Generator	Installed Capacity (kW)	Year of Construction
1	Sg. Kongkoi	KL	Francis	Synchronous	84	1982
2	Sg. Ulu Langat	KL	Pelton	Synchronous	2200	N.A.
3	Sg. Benus	Bentong	Cross-flows	Induction	300	N.A.
4	Sg. Perdak	Bentong	Turgo	Synchronous	364	1990
5	Sg. Keshar	Bentong	Turgo	Synchronous	322	N.A.
6	Sg. Sempam(1)	Raub	Francis	Synchronous	800	N.A.
	Sg. Sempam(2)	Raub	Pelton	Synchronous	450	N.A.
7	Sg. Sia	Raub	Cross-flows	Synchronous	548	N.A.
8	Sg. Pertang	Raub	Turgo	Synchronous	492	1986
9	Sg. Ulu Dong	Raub	Francis	Synchronous	550	N.A.
10	Sg. Keneroh	Gua Musang	Turgo	Synchronous	245	N.A.
11	Sg. Rek	K. Krai	Cross-flows	Synchronous	270	N.A.
12	Sg. Sok	K. Krai	Cross-flows	Synchronous	588	N.A.
13	Sg. Lata Tunggil	K. Krai	Turgo	Synchronous	700	1987
14	Sg. Renyok	Jeli	Turgo	Synchronous	1600	1984
15	Sg. La	Jerteh	Cross-flows	Synchronous	225	1986
16	Sg. Kemia	Jerteh	Turgo	Synchronous	526	1990
17	Sg. Berang	Kuala Berang	Cross-flows	Synchronous	422	1984
18	Sg. Tersat	Kuala Berang	Cross-flows	Synchronous	488	1982
19	Sg. Cheralak	Dungun	Cross-flows	Synchronous	500	1986
20	Sg. Kerling	Tg. Malim	Francis	Induction	1180	1987
21	Sg. Bil	Tapah	Cross-flows	Induction	258	1986
22	Sg. Kinjang	K. Kangsar	Turgo	Induction	349	1986
23	Sg. Kenas	K. Kangsar	Turgo	Induction	713	1986
24	Sg. Asap	K. Kangsar	Pelton	Synchronous	124	1983
25	Sg. Guar	K. Kangsar	Turgo	Induction	220	N.A.
26	Sg. Gebul	K. Kangsar	Pelton	Synchronous	120	1980
27	Sg. Chempias	K. Kangsar	Cross-flows	Synchronous	120	N.A.
28	Sg. Lawin	Lenggong	Cross-flows	Synchronous	291	1986
29	Sg. Temelong	Lenggong	Francis	Synchronous	872	1986
30	Sg. Tebing Tinggi	Lenggong	Turgo	Synchronous	178	1986
31	Sg. Tapah Kanan	Selama	Cross-flows	Synchronous	48	N.A.
32	Sg. Bintang	Selama	Turgo	Induction	704	1984
33	Sg. Mahang	Selama	Turgo	Synchronous	483	1986
34	Sg. Lau	Baling	Turgo	Synchronous	223	N.A.
35	Sg. Kupang	Baling	Cross-flows	Synchronous	216	1982
36	Sg. Mempelam	Baling	Turgo	Synchronous	397	1986
37	Sg. Chepir	Baling	Cross-flows	Synchronous	104	1980
38	Sg. Pegang	Baling	Reversible pump	Synchronous	50	N.A.
39	Sg. Tawar Besar	Baling	Pelton	Synchronous	580	1987
40	Sg. Dandang	Beruas	Cross-flows	Synchronous	98	1982
41	Sg Piah	Sg Siput	Pelton	Synchronous	2 x 7300	1987
42	Habu	C. Highland	Francis	N.A.	2 x 2750	1964
43	Odak	C. Highland	Francis	Induction	3 x 1400	1963
44	Kg Raja	C. Highland	Francis	Induction	800	1963
45	Kuala Terla	C. Highland	Francis	Induction	500	1963
46	Robinson Falls	C. Highland	Pelton	N.A.	3 x 300	1959

N.A.: Data not available

energy by 2005 and 10% in year 2010. Fuel mix in 2010 is targeted to 40% gas, 40% coal, and the rest are hydro and other renewable sources of energy *(Australian Business Council for Sustainable Energy, 2005)*.

The strategies adopted to intensify the development of renewable energy have included:

(a) promotion of various renewable energy sources
(b) renewable energy demonstration projects
(c) research commercialisation
(d) extension of financial and fiscal incentives to potential developers.

Mini hydro is one of the renewable energy (RE) sources identified by the Government under The 8th Malaysian Plan (2001-2005) and the Third Outline Perspective Plan (2001-2010). Other RE sources are biomass, biogas, solar and wind. Unlike huge hydro station, mini hydro has minimal environmental impact. The Government is also encouraging more independent power producers (IPPs) participation in RE generation including mini hydro generation under Small Renewable Energy (SREP). The status of SREP projects approved by score as of September 2004 by Malaysia Government is shown in *Table 8*.

Renewable Energy Power Purchase Agreement (REPPA)

REPPA is a legislation issued by the Malaysian Government dealing with the power purchase agreement between power utility TNB and private investors for renewable energy projects. Under REPPA, renewable energy electricity producers are given a

Table 5. List of IPP mini hydro sites in Peninsular Malaysia

	Site	State	IPP	Installed Capacity kW
1	Sg. Ahning	Kedah	Imexa (M) Sdn Bhd	1300
2	Gopeng	Perak	Syarikat Gopeng Perak	1200
3	Sg. Kenerong	Kelantan	Interhydro Corp Sdn Bhd	20000
			TOTAL	22500

(Source: Energy Commission, 2002)

Table 6. Existing mini hydro sites in Sarawak

No.	Site	Region	Installed Capacity (kW)
1	Sg. Pasir	Kuching	760
2	Lundu	Kuching	352
3	Penindin	Kuching	352
4	Sebako	Kuching	333
5	Sg Kota	Limbang	4000
6	Sg Keijin	Miri	500
7	Kalamaku	Limbang	1000
		TOTAL	7297

(Source: Energy Commission, 2002)

Table 7. Existing mini hydro sites in Sabah

No.	Site	Area	Installed Capacity (kW)
1	Sayap	Kota Belud	1000
2	Melakap	Kota Belud	1000
3	Kiau	Kota Belud	350
4	Bombalai	Tawau	1300
5	Merotai	Tawau	1340
		TOTAL	4990

(Source: Energy Commission, Malaysia, 2002)

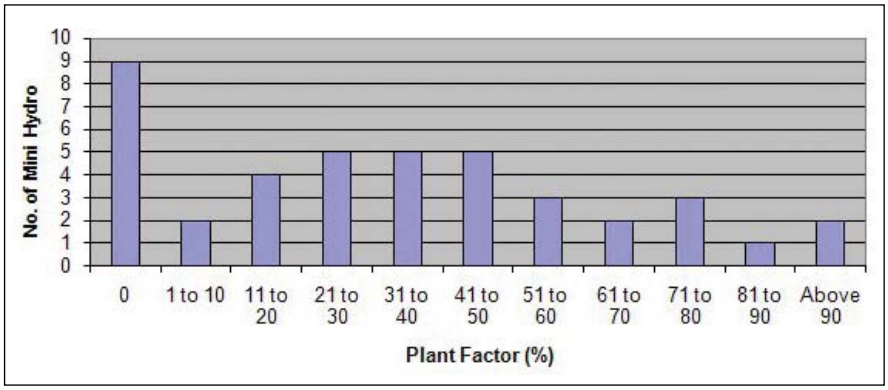

Figure 4: Plant Factor of TNB's Mni Hydro in Year 2001

license for a period of 21 years, which is effective from the date of commissioning of the plant. REPPA allows independent power producers to sell electricity to the grids. The selling price for electricity is capped at a ceiling of RM17 cent/kWh or 4.5 cent US/kWh.

Recently, REPPA became a hindrance to their initiative due to the difficulty in getting financing, as it does not provide a robust cash flow for local bankers to be comfortable with. Furthermore, some of the conditions imposed, such as 'take and pay' payment structure and the non-inflatory fixed tariff for the concession period do not provide the confidence for the financial institutions nor encourage them to make a needed investment. The long negotiation period needed before the sign-up of the agreement is also a major drawback for this programme. Many developers of the RE projects in Malaysia are generally

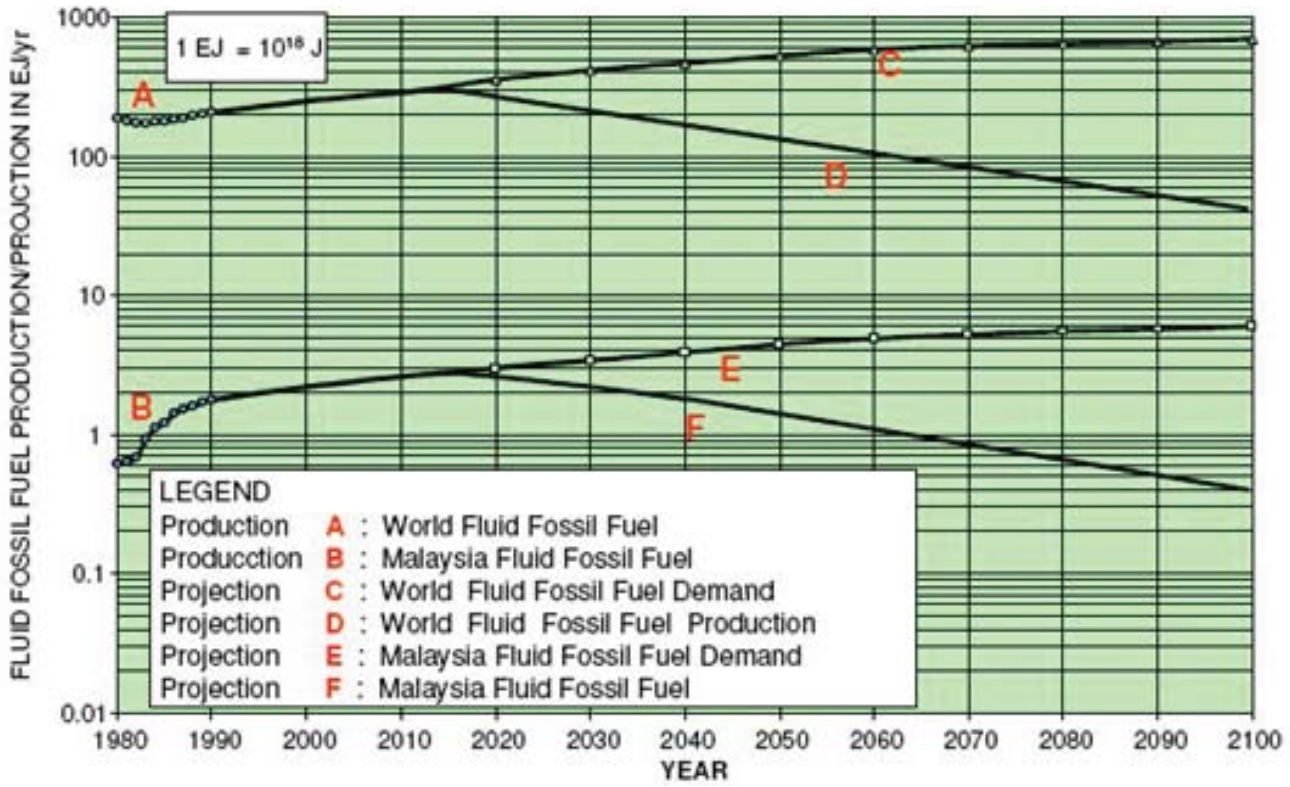

Figure 5. Fluid fossil fuel demand and production (Wan Ramli, 2006)

Table 8. Status of SREP Projects Approved by Score as of September 2004 (Ludin et al, 2004)

No.	Type	Energy Resources	Approved Application	Grid Connected Capacity (MW)	%
1	Biomass	Empty fruit Bunches	25	165.9	52.8
		Wood Residue	1	6.6	2.1
		Rice Husk	2	12	3.8
		Municipal Solid Waste	1	5	1.6
		Mix Fuel	3	19.2	6.1
2	Landfill Gas		5	10	3.2
3	Mini-hydro		25	95.4	30.4
4	Wind and Solar		0	0	0
	Total		62	314.1	100

from small companies with limited resources. Unlike Independent Power Plant (IPP) projects, these developers rely on the capability to fund the development at minimal cost. Therefore, the longer the transaction takes place the more cost the development will incur. Many companies do not have the staying power and will simply abandon their initiative.

To date, more than 60 project proposals have been approved by the Special Committee on Renewable Energy (SCORE) chaired by the Ministry of Energy, Communications and Multimedia. However, only three of these proposals have been awarded power generation licenses.

Tax and Duty Policies

Since the National Budget in 2000, renewable energy technologies have been given additional incentives in the form of tax relief and waivers of import duties. The incentives are part of the package of Government measures designed to encourage the implementation of renewable energy projects as part of the Fifth Fuel Policy. Renewable energy fiscal incentives covers the following areas:

(a) tax allowances
(b) capital allowance
(c) import duties waivers
(d) import tax waivers.

In line with Malaysia's objective to diversify energy resources and develop alternatives, the Government continues to assess and revise incentives for renewable energy projects. To encourage energy generation using biomass, hydropower and solar power, the Government offers several incentives to those that qualify:

- Pioneer status with tax exemption of 70% will be increased to 100% of statutory income and the incentive period is extended from five years to 10 years.
- Investment tax allowance of 60% is to be increased to 100% on qualifying capital expenditures incurred within a five-year period, with the allowance to be set off against 100% of statutory income for each year of assessment.
- The incentive package of pioneer status, investment tax allowance, and import duty and sales tax exemptions will be extended until December 31, 2010.

Small Renewable Energy Power Programme (SREP)

The Small Renewable Energy Power Program (SREP) was launched in May 11, 2001 to enhance the use of renewable energy resources in the power sector. The objective is to facilitate the implementation of small grid-connected renewable power plants. The SREP target is to connect 500 MW of renewable power plants to the national grid within the framework of the Renewable Energy Power Purchase Agreement (REPPA). The SREP allows renewable energy projects up to 10 MW in capacity to sell their electricity output to the state-owned electricity utility, Tenaga Nasional Bhd under 21-year license agreements. Fifty applications for the programme have been received. A total of 18 mini-hydroelectric projects had been approved offering 69.9 MW of total capacity.

Energy Commission (EC) and Malaysian Energy Centre (PTM)

The main institutions in the Malaysian energy sector are the Energy Commission (EC) and the Malaysia Energy Centre (PTM). The Energy Commission (EC) is responsible for creating and enforcing a regulatory framework for the achievement of a reliable, efficient and safe energy supply industry to enhance economic growth and sustainable development. It protects consumers' interests and ensures a competitive and efficient marketplace. Besides advising on energy matters, the EC also promotes the use of renewable energy and the conservation of fossil fuels. EC's commitment is vital to ensure that all energy forms and options are viable in the market.

The rationale behind PTM's establishment is to fulfill the need for a national energy research centre to co-ordinate activities related to energy planning and research, energy efficiency, technological research and development within the energy sector. It has three divisions to assist in energy projects, research and policies: Corporate Affairs and Business Development; Energy Industry and Sustainable Development; and Policy Analysis and Research Management. PTM has taken the lead role in assisting the industry and Government to develop renewable energy in line with national objectives.

Centre for Education and Training in Renewable Energy and Energy Efficiency (CETREE)

The Centre for Education and Training in Renewable Energy and Energy Efficiency (CETREE), together with PTM, are carrying out public awareness activities that enhance communication of the benefits of renewable energy and energy efficiency measures.

CETREE's main objective is to enhance awareness on RE and energy efficiency (EE) in Malaysia by improving and increasing

energy curriculum in primary and secondary schools, universities and among energy professionals as well as information for the general public. Activities are designed and structured in such a way to address each target group since there is an obvious need to increase awareness amongst the public, private sector and Government officials on the applications and benefits of RE and EE.

Barrier to Mini Hydro Development in Malaysia

Environmental perspective

From the environmental perspective, Department of Environment (DOE), Malaysia focuses on the minimisation of the negative impact of energy production, transportation, conversion, utilisation and consumption on the environment. It is obviously seen that till now, the demand-side management initiatives, particularly tariffs, have produced very little positive impact on the utilisation of renewable energies. The energy efficiency regulation is being formulated, focusing on large consumers, appointment of energy managers and equipment labelling. On the other hand, all major energy development projects are subject to the mandatory EIA. There is strong pressure on this environment-related objective from rapid energy demand growth in the country. RE is associated with strong environmental impacts at every level, namely, exploitation of energy resources, energy supply and energy demand. Environmental consequences of hydro station toward the ecosystem are always raised by the non-Governmental organisations and this might prevent further development and investment on hydro power.

Reduction of river water flow rate also affects the power generation capability of mini stations. Major cause of this phenomenon are prolonged draught season due to global warming, logging activities at water catchment area, upstream irrigation activities, competing use of water resources for domestic usage as well as uncontrolled tourism activities.

Financial barriers

RE development in Malaysia is still in its very initial state and has not fully realised the economies of scale with short payback periods for developers to be interested in participating. Whether a proposed RE project is small or big, the initial cost of the project arising from the engagement of consultants can be quite substantial. RE projects are usually capital-intensive, hence financing is often considered the main barrier to their development and implementation. As for mini hydro, the high initial capital cost is one impediment to its development. Capital expenditure (CAPEX) can range between RM5,000 and RM8,000 per kW. Few banks are interested to finance RE projects, as there are no records of experience of RE to rely upon. In Malaysia, only Bank of Development is willing to finance RE projects other than Governmental loan. More often, bank loan officers typically lack the experience necessary to evaluate loans for RE projects even when backed by performance guarantees. The ability of financing institutions to evaluate risk associated with RE projects implementation through non-recourse financing is inadequate. This has further limited financing opportunities for RE projects.

Subsidy for Conventional Energy System

Every type of energy has benefited from assistance in its start-up phase, and renewable energy should be no exception. There is still massive support towards conventional energy sources, such as oil and gas in Malaysia which is in the form of subsidies and export credits. If renewable energy, including mini hydro, is to be competent economically in Malaysia, it is important that it receives the same treatment as fossil fuels. Otherwise, such subsidies for fossil fuel have to be removed or made transparent in order to create a level playing field.

Lack of local equipment suppliers

Malaysia, in general, still relies on foreign equipment suppliers especially from Europe. Existing local equipment suppliers are still unable to fulfill the needs of the RE industry. Most local companies dealing with power projects have joint venture arrangements with their foreign counterparts. Due to the low exchange rate to foreign currency, developers are forced to purchase costly imported spare parts or prolong the service of the components.

Lack of Technical Support

Malaysia still relies on technical support from oversea. Although Malaysia has capabilities in pre-investment studies, construction and operation; engineering design and components including

turbines and generators have to be outsourced from abroad. Importing expertise, components and equipment add cost to the project and further impede the fast development of mini hydro projects. Generally, foreign consultants are considered expensive and they are only affordable when the project is sufficiently large to be able to accommodate the costs.

Lack of Periodic Maintenance

Lacking of periodic maintenance is a major problem faced by the existing mini hydro plants in Malaysia. The failure to adhere to equipment manufacturers' maintenance instruction and maintenance schedule are the main culprits. Remoteness of the station location impedes effective monitoring of the maintenance activities done by maintenance personnel.

In a study on mini hydro station in 2001 it was revealed that 40% of the stations were with major electro-mechanical components defect. A few were in satisfactory condition. Electro-mechanical components such as turbines, generators, transformers and switchboard with technical failure were found in various stations. Civil works damages were also found on the power station buildings and the access road. Some mini hydro stations were facing delay in repairing damages. The delay was caused by among other things, unavailability of spare parts. Some equipment of abandoned stations has been used as parts for other stations.

Conclusion

Mini hydro has a bright prospect in Malaysia. It is not only a RE source but is also a clean and sustainable energy too. Power utility companies should invest in the rehabilitation of the existing mini hydro stations and establish effective monitoring mechanism to ensure each station is properly maintained. Well maintained mini hydro station is vital to ensure better generation factor. Water resources are also crucial for the development of mini hydro. Depleted water source will bring problems into the development of mini hydro. Private sector should be encouraged to take up the opportunity offered by the Malaysian Government since the mini hydro development and resources potentials are high. Power utilities such as TNB, SESCO and SESB are the crucial links in mini hydro development since they are managing the distribution system and are the purchasers of the electricity generated. They should provide technical assistance, advice and better tariff offers. Training and technology transfer must be emphasised by the Government to help Malaysia's power generators develop and advance in mini hydro technologies. BEM

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Mercury Rising

By Ir. Chen Thiam Leong

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The new millennium has certainly made us aware that we have been witnessing the melting of the glaciers with average global temperature rising by one degree Celsius. National Geographic's article, *Six degrees could change the world*, further predicts that when the average global temperature rises by another degree – which we, unfortunately, are on course to reach – will result in destruction of coral reefs.

Up one more degree, to three, the oldest rainforest in the world – the Amazon – will start to dry up. Coastal cities will be flooded with a four-degree rise. Up one more notch, and the world will have to deal with an increase in climate refugees. And most alarmingly, a six-degree rise will equate to a global wipeout.

Climate change is not only impacting the world financially but socially as well. Millions are starving and with the world's population steadily expanding, the situation will only deteriorate further. It will take years, if not decades, to put an end to the emission of greenhouse gases and this can only be achieved through a gradual transition to cleaner energy.

These are not polemics but irrefutable scientific facts. The good news is, we are in a position to prevent this from happening.

Malaysia's population alone has been growing at a rate of 2.8% from 23 million in 2000 to 27 million today. This, coupled with lifestyle changes that come with socio-economic improvements, has accelerated the demand for energy.

This is where green buildings will have a big role to play. A quick fact: Worldwide, buildings consume 40% of our planet's materials and 30% of its energy. Construction uses up to three million tonnes of raw materials a year and generates 20% of the solid waste stream. Malaysia's 2008 electricity use statistics show commercial and residential buildings accounting for over 50% of electricity use.

Therefore, building green is no longer an option but a necessity.

What is a green building? In a nutshell, it is designed to save energy and resources, recycle materials and minimise emission of toxic substances throughout its life cycle. Such buildings also exist in harmony with the local climate, traditions, culture and surrounding environment. A green building is able to sustain and improve the quality of its inhabitants while maintaining ecosystems at local and global levels.

Malaysia's Green Building Index initiative, therefore, is a tool for promoting sustainability in the building environment and raising awareness among all stakeholders – developers, architects, engineers, planners, designers, contractors and the public.

It is a benchmarking rating system that provides a comprehensive framework to evaluate the environmental impact and performance of a building based on six key criteria: energy efficiency; indoor environmental quality; sustainable site planning and management; materials and resources; water efficiency; and innovation.

To quote architecture lecturer and author Peter Graham, 'The skill and vision of those who shape our cities and homes is vital to achieving sustainable solutions to the many environmental, economic and social problems we face on a local, national and global scale.'

And it isn't only the building industry that can play a role. Individuals, too, can be pivotal in combating climate change. First, by reducing energy consumption by simply using less electricity. It is amazing to know that about 11% of electricity is consumed by phantom loads – avoidable electricity consumed by appliances left on standby mode merely to satisfy our convenience.

We're still capable of preventing a global catastrophe. Let's chip in and take care of the only home we've got in the universe, before it is too late.

Overview of MS 2058:2008 Code Of Practice For Good Engineering Maintenance Management Of Active Medical Devices

By Ir. Dr Syed Mustafa Kamal Bin Syed Aman
Senior Biomedical Engineer, Ministry of Health Malaysia, Putrajaya

This Malaysian Standard was developed by the Working Group on Code of Practice of Active Medical Devices under the authority of the Medical Devices and Facilities for Healthcare Industry Standards Committee.

Medical devices include instruments, medical equipment, implants, disposables, and software, used mainly for the purpose of diagnosis, monitoring or treatment of diseases, even replacing physiological functions. New medical devices are developed continuously, so through assessment of needs, verification of safety and efficacy, rational procurement, proper installation, preventive maintenance, rational use and quality assurance, a better use of resources is accomplished.

Biomedical engineers and related professionals play an important role in the proper design, development, selection, management, maintenance and user training of medical devices. Effective engineering management prevents a disproportionate rise in the maintenance costs, and improves the quality and safety of health-care delivery. The selection and use of medical devices has to meet priority needs, be in accordance with the existing infrastructure and services and have a budget for operation and maintenance, in order to prevent misdiagnosis or delays in treatment.

Maintenance of Active Medical Device

A Medical Device is defined as any instrument, apparatus, appliance, material or other article whether used alone or in combination, intended by the manufacturer to be used for human beings for the purpose of control of conception, diagnosis, prevention, monitoring, treatment or alleviation of disease; diagnosis, monitoring, treatment, alleviation of or compensation for an injury or handicap; investigation, replacement or modification of the anatomy or physiological process. Surgical instruments are also medical devices. Medical Devices play an important role in supporting patient care.

This Malaysian Standard applies only to all active medical equipment placed for use in any healthcare facility which requires maintenance. It is also intended to help them set up systems that will minimise risks associated with their use. "Active medical device" means any medical device (medical equipment) relying on a source of electrical energy or any source of power other than that directly generated by the human body or gravity to function.

According to WHO, it is estimated that around 50% of medical equipment in developing countries are not functioning, not used correctly, and invariably

not maintained, with serious consequences for patient care. This may be because the equipment was not needed or not appropriate, and left idle for want of a spare part. It is critical that a medical device management policy exists that includes a financial provision for maintenance, spare parts and training in the initial cost of the equipment.

The main topics covered under MS 2058:2008 are:

CT Scan machine

Responsibilities

Biomedical Engineering services (Section 5); implement and manage the organisation's equipment maintenance programme; obtain required facilities and equipment for the organisation's maintenance programme; ensure equipment is maintained in a serviceable condition at all times; plan for equipment support in the conceptual phase of each new equipment system; develop an equipment management plan; develop and publish local policies and operating instructions (OI) as required; develop references from the maintenance management report to evaluate the effectiveness of the maintenance programmes; establish a work control and priority system to ensure uninterrupted service to supported activities; establish a periodic maintenance and inspection schedule and ensure maintenance personnel perform scheduled maintenance; manage the appropriate use and supply of spare parts; outsource maintenance service of those systems when there are no adequate training, tools, test equipment, and staff.

Biomedical Engineer/technician (Section 5); comply with competency requirements; register with the Board of Engineers as per specified in the Registration Of Engineers Act; attend relevant training and/or continuing professional development (CPD) training with recognised and authorised professional bodies; manage and administer Biomedical Engineering Services.

Medical device user related to maintenance (Section 5); equipment is used only for its intended purpose, operate equipment in accordance with user's manuals and appropriate user maintenance is performed. Home users shall ensure that only competent individuals/ organisations carry out maintenance on their equipment.

Maintenance

Schedule maintenance included planned preventive maintenance PPM, calibration, user maintenance (Section 6); Biomedical Engineering Services shall ensure an optimum performance, safe operation, minimum downtime, and maximum useful life from each equipment system. The scheduled maintenance programme consists of a series of planned maintenance requirements and inspections. The programme is designed to ensure that medical equipment is maintained in the highest possible state of operation throughout its life cycle.

Unscheduled maintenance (Section 7); Unscheduled maintenance involves those actions necessary to restore normal function, safety, performance, and reliability to malfunctioning equipment.

Acceptance tests for newly delivered devices (Section 8); Acceptance testing shall be carried out for all newly introduced equipment before it is placed into clinical service and shall include visual inspection, electrical safety test and performance test.

Management

Mechanisms to avoid failure or breakdown during use (Section 9); Biomedical Engineering Services shall provide mechanisms to avoid failure or breakdown of equipment during patient treatment, diagnosis and therapy. It includes reviewing health alerts, equipment failures, incidence reports, use errors, component failures and carry out corrective action.

Uptime (Section 10); Biomedical Engineering Services shall identify applicable uptime and achieving uptime target for all equipment in service including calculation method on uptime.

Quality assurance program (QAP) (Section 11) for continuous improvement; Biomedical Engineering Services shall provide healthcare facility authority the agreed information and maintain accurate records, procedures and other documents in the QAP. The data collected shall be analysed for further improvement of the structure and processes.

Maintenance management information system - MMIS (Section 12); Maintenance management information system is used to manage all aspects of the Biomedical Engineering maintenance services. The MMIS should consist, but not be limited to, the following modules and be accessible to authorised users: asset register module with links to other modules, work order module, planned preventive maintenance module, maintenance history module and supplier-client register module. Healthcare facilities without Biomedical Engineering Services shall maintain a manual maintenance management system.

Management of warranties (Section 13); to ensure that all faults occurring within the warranty period are detected, reported and repaired under warranty provisions where applicable as well as to ensure that all planned preventive maintenance covered under the warranty provision is carried out within the warranty period as per agreed schedule.

Decommissioned equipment (Section 14); The disposal of potentially hazardous equipment, material or components such as batteries, X-ray tubes, vacuum tubes, pressure vessels, radioactive materials and devices that contain toxic materials such as lead, beryllium, mercury or other heavy metals, polychlorinated biphenyls and asbestos, shall be carried out according to established procedures as laid out in relevant national/international standards or national regulations.

X-Ray machine

Processes for handling hazardous/contaminated equipment (Section 15); Decontamination is the process of handling hazardous/contaminated equipment that may involve cleaning, disinfecting and sterilisation and may vary according to the equipment. Failure to decontaminate equipment properly may lead to post-operative infection and the spread of diseases. Failure to maintain equipment decontamination and sustain proper working practices can raise health and safety issues for staff and patients.

Incidents and hazards (Section 16); Procedures shall be followed in order to carry out investigation and corrective action on incidents and notified hazards. Biomedical Engineering Services shall manage equipment hazard alerts and recall notices provided by equipment suppliers and/or established organisations. In the event of an incident that involve the same model of equipment in any country or location, the manufacturer or supplier shall inform the healthcare facility authority, user and Biomedical Engineering Services and take corrective action to ensure the equipment is safe for use.

User training (Section 17); Users shall be trained on the proper and correct usage and operation of the equipment. When procuring new equipment, healthcare facility authority shall

Operating theatre

include a requirement in the contract that the manufacturer or its representative shall provide training for both Biomedical Engineering Services and users.

Stock of genuine spares parts (Section 18); This is to guarantee the availability of genuine spare parts from the equipment manufacturer to meet uptime target and availability of equipment for minimal interruption of clinical services.

On site library (Section 19); The library should consist of documents such as: operation and maintenance manuals, electronic schematic/circuit drawings, backup software, relevant standards and regulations, training materials; and other related documents.

Workshop setup (Section 20); Setting-up of an adequately equipped workshop facility for maintenance of medical equipment, safe storage for equipment under maintenance and efficient space utilisation.

Advisory service (Section 21); Advice on the following maintenance provisions shall be obtained from the Biomedical Engineering Services: selection of equipment, equipment installation; discontinuation of use of equipment; replacement of equipment; any adverse events; and condition appraisal of equipment.

Procurement of equipment (Section 22); Healthcare facility authority shall ensure local policies for procurement of medical equipment addressing safety, quality, and performance are observed. Policies should include the need to establish advisory groups to ensure the procurement requirements take into account the needs of all parties involved in the use, commissioning, decontamination, maintenance and decommissioning of medical equipment.

Biomedical Engineering

Biomedical Engineering is one of several professional disciplines contributing to safe, effective and economical health care. The role and primary responsibility of a biomedical engineering service is management of medical device technologies, including adherence to recognised safety, quality, cost, and efficiency standards.

Biomedical Engineering is a learned profession that combines expertise and responsibilities in engineering, science, technology, and medicine. Since public health and welfare are paramount considerations in each of these areas, Biomedical Engineers shall uphold an appropriate level of competencies embodied in its professional practice, research, patient care, and training. The level of competencies shall reflect the standards of professional and personal practice for Biomedical Engineers.

Table H1. Competency levels and device specialisation classification matrix
(for more details please refer to MS 2058:2008)

Medical device maintenance specialisation classification		Biomedical maintenance competency levels				
		Level 1	Level 2	Level 3[b]	Level 4[c]	Mgmt[d]
		Junior BMET	Senior BMET	Junior specialist	Specialist	
1	**General / Basic** level medical device (refer to Tables H2-H5)	X	X	X	Optional	X
2	**Intermediate** level medical device (refer to Tables H2-H5)	-	X	X	Optional	Optional
3	**High** level medical device (refer to Tables H2-H5)	-	-	Optional	X [a]	Optional

NOTES:
1. Area of specialisation to be declared based on specific model of medical devices.
2. For Level 3 competency, the Junior Specialist are be given an option to expand their specialisation level based on their training advancement and experiences.
3. For Level 4 competency, the Specialist at vendor and manufacturer are be given an option to exclude the lower specialisation level.
4. For management level, the manager is required to obtain a minimum competency on general/basic level medical device specialisation.
5. The sample of medical device specialisation are given in Tables H2 – H5 and subject to changes based on its complexity and cost of the equipment.

Competency levels of Biomedical Engineering Engineer and Technician

The Biomedical Engineering maintenance competency levels are categorised into four technical levels and one management level. To determine the individual competency levels, the guidelines are cross referred to the medical device maintenance specialisation classification, competency skills, breakdown maintenance level and management skills level of the Biomedical Engineer or technician. The details of the competency levels are as per the relevant matrix in *Table H1*.

Development of Medical Devices Regulation

At present there are no statutory requirements for the registration, control and managing issues associated with medical devices in Malaysia except for equipment that uses ionizing radiation which is governed under the Atomic Energy Licensing Act 1984. In February 2005, the Ministry of Health, Malaysia was given the task to develop the Medical Devices Regulatory System.

In developing the regulation, Malaysia will be guided by the international best practices and international standards as building blocks for harmonised regulatory control of medical devices. The development of the Malaysian Medical Devices Regulatory System is also guided and harmonised with the recommendations and guidelines established by the Global Harmonization Task Force (GHTF).

The aims of the proposed Medical Device Regulations are to ensure public health and safety and to invigorate the medical device industry in Malaysia. Public health and safety are achieved by assurance of device quality, safety and performance through compliance with international quality and safety standards throughout its lifespan. The regulations shall also invigorate the medical devices industry by providing conducive environment for manufacturing, trade and promotion.

The scope of the proposed regulation is based on the World Health Organisation's (WHO) model. The scope encompasses the process from design and development, manufacturing, packaging, labelling, advertisement, sale, usage, maintenance and disposal of the device. These processes are divided into three phases; pre-market, placement-on-market and post market.

The Medical Device Bill 2008 has been finalized and is now with the Attorney General's Chamber to be approved by Parliament hopefully by end of this year. BEM

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Reflection of An Engineer's Unique Experience Working in A 'Black Area' In The 1970s

By Ir. Liaw Yew Peng

Construction of the Temengor main dam in progress. Work was carried out day and night. The surrounding area of the dam site was guarded by a battalion of infantry 24 hours a day.

Transporting part of the Penstock from Butterworth to Temengor Power Station for installation. Note the tight escort provided by using heavy armoured vehicles moving in front and behind the transporter.

Transporting Transformer weighing more than 50 tons from Butterworth to the power station for installation. The item was escorted by the armoured vehicles travelling in front and behind the transporter at all time until it had safely arrived.

Visit to the Project Site by KSU, Ministry of Home Affairs All VIPs came to the project were ferried by Nuri Helicopters. Traveling by road in any vehicles was extremely dangerous from 1972 to1978.

In 1972 the town of Grik was a village and the name is synonym to 'Terrorist Nest' according to my doctor then in Young & Newton in PJ. When my wife saw him for an anti-cholera jab, he quietly told her that the place was infested with terrorists. Yes, it was at that time but not now. Inside the jungle fringe and outside the villages, curfew was inforced during day and night. No one was permitted to enter the site without a security permit jointly signed by the R.E. and the OCPD in Grik Hence the name 'Black Area' was given to such place for more than two decades from 1948. Grik was like a ghost town after 10pm in those days!

We arrived with five small kids in February 1972 and settled down in a small village called Kuala Rui. I assumed the post of Resident Engineer of this mega project and begun the construction of the access road to the dam site, about 30 km away from that small township.

From 1972 till its completion in 1978 the mega project was attacked by terrorists three times. At the height of their anti-development activity, we were protected day and night by three battalions and I was co-opted into both the District and the State Security Council.

As a result of terrorists' threat to stop the project and our security problem and the consequences of three serious attacks and loss of lives, the project had attracted not only the high ranking Government officials but also local and foreign press. The project also attracted a chain of international visitors led by security bosses or accompanied by ministerial VIPs. From 1974 until its completion, the project had been visited by many DYMMs, almost all the ministers of the day and their deputies including both the Deputy PM and Prime Minister, Datuk Hussien Onn.

Their visits were by Nuri helicopters as the access road was unsafe. This indicated the degree of danger under which we worked and the determination of the government to complete the project. We, the site engineers, assistants and workers were like 'a mouse deer' caught between two fighting elephants.

I found a great deal of my time was spent on meetings, briefings and showing visitors to the construction site. In those days we worked till late night in the office or at the site and it was the norm rather than an exception! On retrospect I felt sorry for some of my staff who had to work with me day and night and during odd hours without a cent of reward. Imagine my frustration when my panel doctor prescribed me a tin of Glucerna SA recently. The TNB instructed the pharmacy not to provide it unless the patient wanted to pay for it. This is the shabby treatment or reward an 80 year old retiree gets from the government after sacrificing the best part of his life working in a 'Black Area' for more than 10 years!

It was a big relief and a great joy to these workers and all the technical and administrative staff responsible for the construction and completion of Temengor Project when the completion target date was achieved in 1978 without a day of delay.

One consolation of living in the rural area was that we often met people who were extremely kind and helpful in time of need. They were not so mercenary or greedy. Even the politicians seemed to be exceptionally friendly. Our friendship, with the exception of some politicians, lasts until today!

The Changing Face of Kota Kinabalu (formerly Jesselton)

Old photo by: Paul Wang
New photo by: Ir. Simon Goh Say Keong

Jalan Pantai, KK (Beach Road)

Kota Kinabalu in 1978

Kota Kinabalu in 2009




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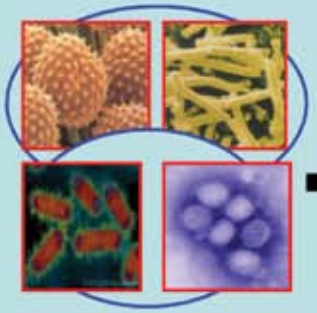

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