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Current Environmental Concerns

Malaysia's Second National Communication to the UNFCCC

Output from a project undertaken by the Ministry of Natural Resources and Environment enabled by UNDP/GEF

Malaysia is a signatory party of the United Nations Framework Convention on Climate Change (UNFCCC), the international agreement on climate change action, and its Kyoto Protocol. As a developing country, Malaysia has different obligations from developed countries.

A key obligation for all countries is to prepare a document called the National Communication periodically, with developed countries being required to do so more frequently. The National Communications contain the national Greenhouse Gas (GHG) Inventory for a specified year as well as a record of activities undertaken to address the issue of climate change, be it in reducing GHG emissions, or more critically for developing countries, in assessing vulnerabilities to climate change and adapting to these inevitable changes.

Malaysia's first effort in meeting its convention obligations resulted in the document called the Initial National Communication (INC) that was submitted to the UNFCCC in 2000 *(http://nc2.nre.gov.my/)*. Please see Publications/INC.

Malaysia submitted the Second National Communication to the UNFCCC (NC2) in the first quarter of this year *(unfccc.int/national reports/national communications)* culminating 4 years work at the national level undertaken as the NC2 Project by the Ministry of Natural Resources and Environment, supported by UNDP/GEF.[1]

National Communication 2 (NC2)

The NC2 is a comprehensive national document prepared through the involvement of and contributions from a wide pool of stakeholders representing government agencies, research institutions, NGOs, the private sector and academic institutions. It is a collation of information pertaining to key sectors that have a bearing on climate change in the country.

The document is divided into eight chapters that describe the national circumstances; the GHG inventory for the year 2000 along with estimates of emissions for 2005 and 2007; options for reducing GHG emissions; vulnerabilities of key sectors to climate change and options to adapt to ensure resilience against adverse impacts; research, technology transfer and systematic observations related to climate change; initiatives to build capacity, educate and create public awareness as well as share information; existing constraints and needs; and overall measures to address climate change in Malaysia.

The national circumstances chapter opens the document by providing background information on Malaysia in terms of geography, climate, population, energy demand and supply, modes of transportation and key economic activities. The data and information here is applied in analysis in the rest of the document. Table 1 below (Appendix 2 of NC2) provides the key data contained in the document.

Table 1: Key data contained in the document to UNFCCC

	2000	2007
Latitude	99.5°E and 120°E	
Longitude	1°N and 7°N	
Area	329,733 km²	
Coastline	4,800 km	
Mean daily temperature	26-28°C	
Average annual rainfall	2,000-4,000 mm	
Average daily direct sunlight	6 hours	
Forest cover as % of total land area	56%	55%
Population	23.5 million	27.2 million
Population density	71/km²	82/km²
Female life expectancy	74.7	76.4
Male life expectancy	70.0	71.5
GNI/capita (2000 constant prices)	RM 13,939	RM 17,773
GDP (2000 constant prices)	RM 356,401 million	RM 506,341 million
Energy demand	29,699 ktoe	44,268 ktoe
Length of roads (Federal and State)	65,445 km	117,711 km
Motor vehicle registration	10.6 million	16.8 million
Ridership on urban rail network (passenger journeys)	92.1 million	168.6 million
Oil Palm	3,376,700 ha	4,304,900 ha
Rubber	1,344,400 ha	1,247,400 ha
Paddy	698,700 ha	674,400 ha
Cattle	733,892	796,550
Swine	1,807,590	2,027,561
Marine landings	1,271,511 tonnes	1,381,424 tonnes
Aquaculture production	167,894 tonnes	268,514 tonnes
Solid waste (PM*)	16,200 t (2001)	19,100 t (2005)

* Peninsular Malaysia

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[1]United Nations Development Programme/Global Environment Facility

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From the desk of the Director General

Current Environmental Concerns

We end the year on a sober note given the continuing environmental challenges we face, the signs and symptoms of which are all around us. It is therefore most appropriate to highlight in this issue of IMPAK, Malaysia's Second National Communication to the UNFCCC and some of the current environmental issues that have seen much debate among the public.

This document, called NC2 in short, was submitted in the first quarter of this year. It is the culmination of four years of work undertaken at the national level by the Ministry of National Resources and Environment, supported by the UNDP/GEF. The NC2 is a comprehensive national document. For all countries, including us, who are signatories of UNFCCC, the preparation of this document is a key obligation. Its preparation required the contributions of various stakeholders including government agencies, research institutions, NGOs, the private sector and academic institutions. The document is divided into eight chapters that describe the national circumstances in an environmental sense. These chapters cover a diverse range of inter-linked issues that have an impact on the environment and climate change. The issues include: the GHG inventory and estimates for various specified years; the vulnerabilities of key sectors to climate change and the adaptation options and responses; research, technology transfer and systematic observations; initiatives to build capacity, educate and create public awareness; existing constraints and needs; and overall measures to address climate change.

The mitigation analysis component of this document outlines various measures. These include promoting energy efficiency, increasing renewable energy in the energy mix, reducing de-forestration, increasing forest establishment, waste management to reduce the organic waste components that end up in landfills, applying precise water management practices in rice cultivation, replacing nitrogenous fertilisers with natural sources such as bio-fertilisers or soil microbes, managing manure to reduce/reuse methane emissions and production methods that reduce emissions in industries such as the cement industry.

The final chapter ends with proposals to address climate change in Malaysia. The rationale is that if every country does its part, then we can all be saved from the deleterious effects of impending climate change. It therefore has identified focus areas. Attached to each of these ten focus areas are specific proposals to be acted on. In summary, the areas are: information sharing and access to data; managing water resources; coastal areas; public health; development; food security; energy; transportation; industrial processes; and forests/green lungs.

We have to make a start no matter how daunting the tasks ahead for all of us. Indeed, all of this is only the beginning. It will surely require a monumental national effort. We have a long way to go.

This issue of IMPAK also carries articles on themes related to the NC2 - climate change itself. We can see that despite some critics arguing that these extreme weather events are part and parcel of an on-going natural cycle of weather patterns, it is highly improbable that the remarkable extreme weather events of 2010 and 2011 could have all happened in such a short period of time without some powerful climate-altering force at work. The best science we have right now maintains that human-caused emissions of heat-trapping gases like CO_2 are the most likely cause of such a climate-altering force.

As energy efficiency has been identified as a key mitigation issue in the NC2, the need to develop a sustainable electricity industry becomes an imperative. We have an article that proposes how this can be achieved and perhaps it is timely that we have a serious rethink on our energy model.

Other on-going concerns that have seen much public debate are landfills and waste management. Yes we have reached a critical point in waste management and the public have a right to be concerned but we must remember that waste problems that we are currently facing also have much to do with public apathy on managing their own household waste. Continuing on waste management, including hazardous materials, is an article on management and rehabilitation of contaminated land. It is clear that DOE has laid the rules and provided for the guidelines but effective and efficient implementation is the crux of the issue. The final article in this last issue for the year touches on developing an Environmental Sustainability Index (ESI). Perhaps the development of such an index would go a long way in providing a yardstick to measure our efforts towards sustainable development.

On a personal note, as retirement is just round the corner, I would like to thank all staff and each and every one I have had the opportunity of working within a civil service career spanning 34 years. It has been a privilege and a pleasure.

Happy New Year and may we together achieve the goals we have set for ourselves in 2012.

Dato' Hajah Rosnani Ibarahim
Director General
Department of Environment, Malaysia

The Editorial Board wishes to place on record their appreciation and heartfelt thanks to Dato' Hajah Rosnani Ibarahim for her guidance, dedication and efforts towards the publication of IMPAK. Thank you Dato' Hajah Rosnani.

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An important part of the NC2 is the national GHG inventory for the year 2000 calculating emissions/sequestration of the three main GHGs: carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O). The inventory showed that Malaysia was a net sink as the amount of GHGs that were absorbed by our forests more than offset the emissions caused by human activities. However, by 2005, Malaysia was a net emitter as emissions from all sectors, especially the energy sector, had grown. Table 2 below (Table 2.4, NC2) summarises the emissions from the five key sectors considered in preparing the inventory for the years 2000, 2005 and 2007.

Table 2: Five key sectors considered in the preparation of the inventory for years 2000, 2005 and 2007

Sector	Emissions/removal (Mt CO_2 eq)		
	2000 (Actual)	2005 (Estimate)	2007 (Estimate)
Energy	147	204.3	217.0
Industrial Processes	14.1	15.6	17.1
Agriculture	6.0	6.6	7.2
LULUCF	29.6	25.3	19.7
Waste	26.4	27.4	31.9
Total emissions	223.1	279.2	292.9
Total sink	-249.8	-240.5	-247
Net total (after subtracting sink)	**-26.7**	**38.7**	**45.9**

The document also provides a trend analysis from the 1990s showing emission patterns for most of these key sectors. The trend in the energy sector, for example, is closely related to GDP growth underscoring the fact that our growth is linked to energy consumption. GHG emissions against development indices show that in 2000, emissions/GDP was 0.62 tonnes CO_2 equivalent/thousand RM and emissions/capita was 9.5 tonnes CO_2 equivalent.

Overall, the biggest sources of GHG emissions came from the energy sector, with energy industries, transport and manufacturing industries and construction ranking as the three highest. Methane emissions from landfills came next followed by emissions from forest and grassland conversion.

The document then considers options to reduce emissions especially from the largest sources mainly by examining the mitigation potential in existing initiatives or policies guiding Malaysia's development sustainably. This provides added impetus for the successful implementation of these policies and to push for the necessary enablers to do so, be it technology, capacity, knowledge, institutional framework or funding. Hence, the analysis also identifies as far as possible, barriers to implementation and a cost analysis.

In performing the mitigation analysis, the potential avoided emissions are compared to those that would have been released in a "business as usual" state until 2020. Most analysis use projections, for example, in the energy analysis, population and average GDP projections for 2020 of 32.76 million and 4.9 % per annum respectively were applied. The potential contribution from various sectors towards achieving Malaysia's voluntary indicator announced in Copenhagen in 2009 of up to a 40% reduction in GHG emissions intensity of GDP compared to 2005 values by 2020 is also examined. There is expected to be a reduction in emissions intensity from 0.62 to 0.37 tonnes CO_2 equivalent/thousand RM. The measures considered include: promoting energy efficiency; increasing renewable energy in the energy mix; reducing deforestation; increasing forest establishment; waste management to reduce the organic waste components that end up in landfills; applying precise water management practices in rice cultivation; replacing nitrogenous fertilisers with natural sources such as bio-fertilisers or soil microbes; managing manure to reduce/reuse methane emissions; and production methods that reduce emissions in industries such as cement.

In terms of barriers, those identified include pricing and financing, amongst others. For example, in the energy sector, the experience with implementing the Small Renewable Energy Programme (SREP) showed that prices offered by off-takers (utilities) were insufficient to meet the cost incurred by renewable energy generators who have to apply expensive technology to do so, making renewable energy projects economically unviable. Availability of loan financing was also limited and came at high costs given the perception that renewable energy projects are high risk projects. From 2001-2007, only two SREP projects were in operation with a total generation capacity of 12 mega watts.

Furthermore, most mitigation technology also has to be imported, not only raising costs, but requiring modifications to be suitable to Malaysia's climate and other conditions. For example, with solar panels, it was found that Malaysia's high cloud cover with an average duration of direct sunlight of only six hours daily, limited the electricity generation potential. Hence technology suitable to harness solar power more effectively in Malaysia is needed to be developed.

The section on vulnerabilities to climate change starts with an overview of observed changes in temperature, rainfall and sea level. Using downscaled regional climate and hydro-climate models, projections of future climate are made as shown in Table 3 below (Table ES2, NC2).

Table 3: Projections of future climate

	Observed	**Projected (by 2050)**
Temperature	0.6-1.2°C per 50 years (1969-2009)	1.5-2°C increase
Rainfall	No appreciable difference	• (-) 5% to (+) 9% change in regions within PM • (-) 6% to (+) 11% change in regions within Sabah and Sarawak.
Rainfall Intensity	Increased by 17% for 1 hour duration and 29% for 3 hour duration (2000-2007 compared to1971-1980)	• Increase in extremes within wet cycles • Increase in frequency of extreme weather
Sea Level Rise (SLR)	1.3 mm/yr (1986-2006, Tanjung Piai, Johor)	• 0.5m (global high worst case at 10mm/yr)

These changes in climate, especially those anticipated for the future will have an adverse impact on human activities and well being. The NC2 discusses these in relation to water resources, agriculture, forestry, biodiversity, public health, coastal resources and energy. Impacts on water resources due to climate change are expected to have wide ranging effects not only on the quality and quantity of available water, but also on water dependent sectors like agriculture, threatening our food security. Anticipated extremes in rainfall patterns will result in greater flooding incidence, landslides and soil erosion as well as periods of drought. Human health is also expected to be adversely impacted with increased transmission of diseases like dengue, malaria and cholera.

Management of our water resources is critical. Hence measures from early warning systems to strengthening dams have to be undertaken to avert or reduce these impacts. Integrated water resources management (IWRM) and river basin management (IRBM) have to be adopted. The population should also be equipped with the capacity to deal with these adverse impacts. Focus on managing water demand must be enhanced to reduce wastage and per-capita consumption. Maintaining water pipes to reduce non revenue water (NRW) loss, installing rainwater harvesting systems to reduce run-

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offs, and improving irrigation systems are some of the adaptation measures proposed. In terms of strategy, given the uncertainties associated with computer modelling of future climate "No-regrets" options which are options that are relevant even without climate change, have been proposed.

While advances have been made since the INC, in terms of research, technology transfer and systematic observations of the climatic system, as well as capacity building and public awareness, there is still much room for further improvement. In this regard, some of the gaps identified in preparing the NC2, especially in terms of data availability suitable for climate analysis, technical ability and platforms for information sharing highlight the areas where further research and training are required. Greater efforts to reach the public and change behaviours are also necessary. It is however encouraging to see the increase in youth involvement in promoting this, apart from the NGO contribution towards these efforts. Partnerships between the public and private sector have also increased, an example being the Voluntary Carbon Offset Scheme (VCOS), enabling voluntary action to account for individual carbon emissions due to air travel.

The final chapter ends with overall measures to address climate change in Malaysia. These measures are drawn from initiatives already underway from 2007 and those proposed for the future. They include measures to overcome barriers identified earlier in the report. Table 4 on the right summarises these proposals.

The NC2 records many important advances and proposals in addressing climate change in Malaysia. The process of preparing the NC2, whilst admittedly time consuming, allowed for inputs to be obtained from a wide pool of stakeholders and also increased stakeholder knowledge in a more holistic manner given the multi-sectoral nature of the process. As a result, a wider group of locals have hands-on understanding of how climate change can affect their areas of expertise.

Overall therefore, apart from the information contained in the NC2, the process has also developed a network of experts in various sectors, enabling Malaysia to better handle the complexities and challenges of dealing with climate change in the future and also in preparing future national communications.

Table 4: Summary of proposals

Area	Proposal
Information sharing and access to data	Enhance the national climate services. Improve coordination of the national Global Climate Observation Systems.
Managing water resources	Implement IWRM, IRBM, reduce NRW, implement rainwater harvesting, review design specifications of water management infrastructure like drainage and dams.
Coastal areas	Legislation to implement Integrated Shoreline Management Plans (ISMP) nationwide. Extend the National Coastal Vulnerability Index (NCVI) study.
Public health	Apply remote sensing in mapping mosquito vectors, aedes proof buildings and enhance capacity of health workers and researchers.
Development	Develop green and low carbon cities and townships. Develop sustainable regions. Review plans for the nation's economic growth regions incorporating climate change concerns.
Food security	Apply water management such as precision irrigation and drainage to reduce agricultural water consumption and reduce emissions. Revisit traditional cultivation practices. Apply natural fertilisers and reduce reliance on synthetic nitrogeneous fertilisers.
Energy	Feed-in tariff mechanism to promote renewable energy generation. Implement National Energy Efficiency Masterplan, once it is completed. Study the feasibility of other options like nuclear energy.
Transportation	Identification of improving public transportation as a NKRA.
Industrial processes	Prepare a roadmap towards transforming to more sustainable processes in the long run, focusing on high-energy intensive industries.
Forests / Green lungs	Maintaining at least 50% land area as forests as pledged at Rio Earth Summit in 1992 and reiterated at the UNFCCC meeting in Copenhagen in 2009 through sustainable forest management practices, establishing forest plantations on marginal/unproductive land and enrichment and replanting in logged over/poor forests. NRE plans to plant 26 million trees/1 tree per Malaysian by 2015. National Landscape Department plans to plant 20 million trees in urban areas from 1997-2020.
Waste	Implement the Solid Waste Management Act 2007. Recycle organic and green waste. Apply organic compost in the agriculture sector.
R&D and technology transfer	Promote CDM and ensure that the Kyoto Protocol continues. Develop new areas such as biofuels, clean coal, carbon capture and storage as well as solutions like green and white roofs.
Policies and governance	National Policy on Climate Change. National Green Technology Policy. The reduction of emissions intensity of GDP by up to 40% indicator. Recognition of sustainability as one of the three pillars of the New Economic Model. Establishing the Green Technology and Climate Change Council chaired by the PM in 2010.
Public awareness	Apply newer modes of outreach using IT such as blogs and Facebook. Collaborate with the arts community to creatively educate the public using the visual and performing arts to change public perception and act as an effective change catalyst.

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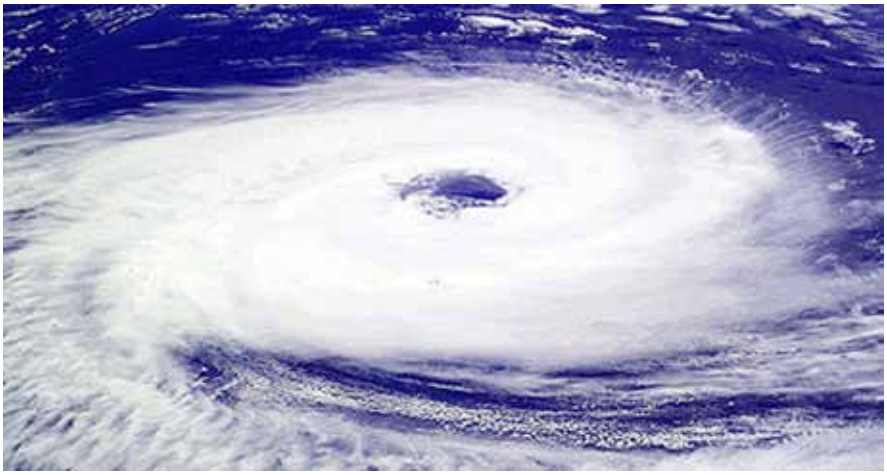
Part 1: A Primer to Climate Change Climate Change and Malaysia

Climate Change, Natural and Human-induced

Climate change is an issue of increasing concern worldwide. In this two-part series, I attempt to provide a lay-person explanation of this complex issue so that non-technical stakeholders can make reasoned and informed decisions and form their own conclusions about how climate change is likely to affect Malaysia in the mid- to long-term.



Climate change is a process that has been occurring naturally on the earth for millions of years. Natural cyclical variations in the earth's distance from the sun, the tilt of the earth's axis, the eccentricity of its orbit, collectively knowns as Milankovitch cycles[1], and even cyclical variations in the energy activity of the sun itself have all contributed to these changes. Natural climate change has been associated with the cyclical glacial periods, alternating with inter-glacial warm periods that have been occurring roughly every 100,000 years.[2,3,4] At the height of the last glacial maximum, around 20,000 years ago, all of Canada and part of the United States were covered by a layer of ice that in places, reached a thickness of up to 3.2km.[5] With a significant proportion of the world's water locked up in terrestrial ice, global sea levels were much lower, some 120 metres or more, lower than they are today. During this period, the larger continental land masses and smaller oceanic water bodies gave rise to a global climate that was significantly cooler and dryer than it is today.[6] At present, we appear to be in a warm and mild inter-glacial period although it has not exceeded the temperatures reported for the last inter-glacial period approximately 120 years ago.[2,3,4]

The Greenhouse Effect

While the scientific community is still seeking a definitive explanation for what causes the onset and cessation of glacial periods, the mechanism by which incoming solar energy in the form of light is trapped and retained within the earth's atmosphere in the form of heat is well understood. To understand how the greenhouse effect works, we need to understand what greenhouse gases are and how they function. Greenhouse gases are gases that are transparent to visible light, that is, they allow visible light to pass through them, yet block the passage of heat [an invisible (infra-red) form of light], by storing it instead. The presence of carbon dioxide and other greenhouse gases such as water vapour, methane, and ozone in the atmosphere makes the atmosphere capable of storing heat and is the reason for the greenhouse effect on earth.[7] Like the glass panes of a greenhouse, greenhouse gases allow the light of the sun to penetrate the earth's atmosphere and warm the earth; however, once that light strikes the earth's surface and is converted to heat, these same greenhouse gases prevent the heat from escaping back to space; so like a greenhouse in winter, the earth remains warm both by day and by night. In fact, we owe our survival on this earth to the greenhouse effect for without it, like the moon and other planets without an atmosphere, the earth would freeze by night. Ultimately, it is the greenhouse effect that makes the climate of the earth mild and habitable.

The Human Effect

Compared to the 4.5 billion-year-old earth, human beings have only been around two hundred thousand years. For thousands of years, we humans were few in number and our energy-based activities, limited. Since the mid-1800s, however, humans have not only increased rapidly in number, but, more significantly, have also discovered how to harness the energy stored in fossil fuels that have been trapped below the earth's surface for millions of years. Statistics for 2009 tell us that each day that year, some 21.260 million tonnes of coal, 17.261 million barrels of crude oil and 13.071 billion cubic metres of gas were freed from their confines deep below the earth, processed, and used for both energy and non-energy needs. When these fossil fuels are burnt, they produce carbon dioxide, the primary anthropogenic greenhouse gas. The International Energy Agency (IEA) reported this to be equivalent to 81.89 million tonnes of CO_2 each day in 2008, an amount that has most certainly increased annually since then. But are these amounts significant in global terms, and is their presence in the atmosphere sufficient to impact the energy balance of the atmosphere, causing it to retain more heat than it otherwise would?

Historic Atmospheric Carbon Dioxide (CO_2) Concentrations

In the earth's very distant past, during the Phanerozoic eon, up to 500 million years ago, the atmosphere was as much as 5,000 parts per million (ppm) CO_2. As microscopic living organisms, molluscs, and later, green plants, began utilising the CO_2 in the atmosphere to manufacture carbonates, carbohydrates, and other stable carbon-containing compounds, CO_2 concentrations in the atmosphere gradually decreased and as recently as the 1960s, it was less than 320 ppm. However, by 2010, the atmospheric CO_2 concentration had exceeded 380 ppm and thus far, shows no signs of slowing. We see that in the last 400,000 years, the concentration of CO_2 in the atmosphere has never exceeded 300 ppm. The work by Dr Eric Wolff and his colleagues with the British Antarctic Survey (BAS) have since shown that this trend has actually persisted for more than 800,000 years.[11]

In fact, to find atmospheric CO_2 concentrations of the level we now have, we would have to go back 15 to 20 million years, according to the research of Dr Aradhna Tripati, Assistant Professor at the University of California[12] at Los Angeles. As things presently stand, we are in territory for which there are no recorded precedents and therefore, there is much uncertainty about how global climate systems

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could change if we persist along these current CO_2 emissions trends.

2010: A Year of Climate Extremes

Although almost every year has a few extreme weather events, a few years are notable in having numerous events of unprecedented extremity. Dr Jeff Masters, co-founder of the world's first internet weather site highlighted the top 20 weather and climate events of 2010 that in his opinion made 2010 a year of climate extremes. These are:

1. **The Hottest Year on Record:** 2010 saw temperature records broken in 19 countries, with temperatures reaching a record 53.5°C.
2. **Most Extreme Winter Arctic Atmospheric Circulation on Record:** The atmospheric circulation in the Arctic took on its most extreme configuration in 145 years of record keeping during the winter of 2009–2010, causing high pressure to replace low pressure over the Arctic, and weakening and even occasionally reversing the polar vortex. This unusual flow pattern allowed cold air to spill southwards and be replaced by warm air moving toward the North Pole. As a result, a series of remarkable snow storms pounded the Eastern US with the 'Snowmageddon' blizzard dumping more than two feet of snow on Baltimore and Philadelphia. Western Europe also experienced unusually cold and snowy conditions, with the UK recording its 8th coldest January. These unusual conditions returned again during November 2010, and lasted into January 2011.
3. **Arctic Sea Ice: Lowest Volume on Record, 3rd Lowest Extent:** Sea ice in the Arctic reached its 3rd lowest areal extent on record in September 2010 with one third of the polar ice cap missing – an area the size of the Mediterranean Sea.
4. **Record Melting in Greenland, and a Massive Calving Event:** Greenland's climate in 2010 was marked by record-setting high air temperatures with the greatest ice loss by melting and the calving of a 100 square-mile ice island – the largest calving event in the Arctic since 1962.
5. **Second Most Extreme Shift from El Niño to La Niña:** The year 2010 opened with a strong El Niño event and exceptionally warm ocean waters in the Eastern Pacific. However, El Niño rapidly waned in the spring, and a moderate to strong La Niña developed by the end of the year, strongly cooling these ocean waters.
6. **Second Worst Coral Bleaching Year:** A near-record warm summer water temperatures over much of Earth's tropical oceans caused the most serious coral bleaching since 1998, when 16 % of the world's reefs were killed off!
7. **Wettest Year over Land:** The difference in precipitation from average in 2010 was about 13% higher than that of the previous recorded wettest year, 1956.
8. **Amazon Rainforest Experiences its 2nd 100-Year Drought in 5 Years:** This rainforest experienced its second 100-year drought in five years during 2010, with the largest northern tributary of the Amazon River–the Rio Negro–dropping to thirteen feet (four metres) below its usual dry season level.
9. **Global Tropical Cyclone Activity Lowest on Record:** The year 2010 was one of the strangest on record for tropical cyclones for in that year, we had just 68 of these storms – the fewest since the dawn of the satellite era in 1970.
10. **Hyperactive Atlantic Hurricane Season:** Third busiest on record: Sea surface temperatures that were the hottest on record for Atlantic hurricanes helped fuel an exceptionally active 2010 Atlantic hurricane season with twelve hurricanes for 2010.
11. **A Rare Tropical Storm in the South Atlantic:** A rare tropical storm formed in the South Atlantic off the coast of Brazil on March 10 – 11, and was named Tropical Storm Anita.
12. **Strongest Storm in Southwestern US History:** The most powerful low pressure system in 140 years of record keeping swept through the Southwest US on 20 – 21 January 2010, bringing deadly flooding, tornadoes, hail, hurricane force winds, and blizzard conditions.
13. **Strongest Non-coastal Storm in US History:** A massive low pressure system intensified to record strength over northern Minnesota on 26 October 2010, resulting in the lowest barometric pressure readings ever recorded in the continental United States.
14. **Weakest and Latest-ending East Asian Monsoon on Record:** The summer monsoon over China's South China Sea was the weakest and latest ending monsoon on record since detailed records began in 1951, according to the Beijing Climate Centre. The monsoon did not end until late October, nearly a month later than usual. The abnormal monsoon helped lead to precipitation 30% to 80% below normal in Northern China and Mongolia, and 30% to 100% above average across a wide swath of Central China. Western China saw summer precipitation more than 200% above average, and torrential monsoon rains triggered catastrophic landslides that killed 2,137 people and caused USD759 million in damage. Monsoon floods in China killed an additional 1,911 people, affected 134 million, and did USD18 billion in damage in 2010, according to the WHO Collaborating Centre for Research on the Epidemiology of Disasters (CRED).
15. **No Monsoon Depressions in India's Southwest Monsoon for Second Time in 134 Years:** The Southwest Monsoon that affects India was fairly normal in 2010, bringing India rains within 2% of average. In 2010, no monsoon depressions formed–the only year besides 2002 (since 1877) that no monsoon depressions have been observed.
16. **The Pakistani flood: most expensive natural disaster in Pakistan's history:** A large monsoon low developed over the Bay of Bengal in late July and moved west towards Pakistan, creating a strong flow of moisture that helped trigger the deadly Pakistan floods of 2010. The Pakistani floods were the most expensive natural disaster in Pakistan's history, killing 1,985 people, affecting 20 million others, and causing USD9.5 billion in damage.
17. **The Russian Heat Wave and Drought: Deadliest Heat Wave in Human History:** A scorching heat wave struck Moscow in late June 2010, and steadily increased in intensity through July as the jet stream remained 'stuck' in an unusual loop that kept cool air and rain-bearing low pressure systems far north of the country. By July 14, the mercury hit 31°C (87°F) in Moscow, the first day of an incredible 33-day stretch with a maximum temperature of 30°C (86°F) or higher. Over a thousand Russians seeking to escape the heat drowned in swimming accidents, and thousands more died from the heat and from inhaling smoke and toxic fumes from massive wild fires. The associated drought cut Russia's wheat crop by 40%, cost the nation USD15 billion, and led to a ban on grain exports and caused a sharp spike in the world's food prices that helped trigger civil unrest across much of northern Africa and the Middle East in 2011. At least 55,000 people died due to the heat wave, making it the deadliest heat wave in human history.
18. **Record Rains Trigger Australia's Most Expensive Natural Disaster in History:** Australia's most expensive natural disaster in history is now the Queensland flood of 2010 – 2011, with a price tag as

high as $30 billion. At least 35 were killed. The Australian Bureau of Meteorology's annual summary reported that sea surface temperatures in the Australian region during 2010 were the warmest value on record for the Australian region and that individual high monthly sea surface temperature records were also set during 2010 in March, April, June, September, October, November and December. In 2010, Australia had its wettest spring (September – November) since records began 111 years ago, with some sections of coastal Queensland receiving over 4 feet (1,200 mm) of rain. Rainfall in Queensland and all of eastern Australia in December was the greatest on record, and the year 2010 was the rainiest year on record for Queensland. Queensland has an area the size of Germany and France combined, and 3/4 of the region was declared a disaster zone.

19 **Colombia's Worst Flooding Disaster in History:** The 2010 rainy-season rains in Colombia led to floods and landslides killing 528, causing USD1 billion in damage, and leaving 2.2 million homeless, making it Colombia's most expensive, most widespread, and second deadliest flooding disaster in history.

20 **Tennessee's 1-in-1000 Year Flood Causes USD2.4 Billion in Damage:** Tennessee's greatest disaster since the Civil War hit on 1 – 2 May 2010, when an epic deluge of rain brought by an 'atmospheric river' of moisture dumped up to 17.73 inches of rain on the state. Nashville had its heaviest 1-day and 2-day rainfall amounts in history, with a remarkable 7.25 inches on 2 May, breaking the record for most rain in a single day.

Co-incidental, or Symptomatic of a Radical Shift in Climate Dynamics?

It is highly improbable that the remarkable extreme weather events of 2010 and 2011 could have all happened in such a short period of time without some powerful climate-altering force at work. The best science we have right now maintains that human-caused emissions of heat-trapping gases like CO_2 are the most likely cause of such a climate-altering force.

In assessing the performance of the global climate models we are relying on as 'our best science', it is always useful to evaluate the performance of the sub-processes that make up our global models to ensure that they are projecting accurately within their respective scopes. We projected that human activities would fundamentally alter the atmosphere by adding more moisture as a consequence of adding more heat. Observations confirm that global atmospheric water vapour has indeed increased by about 4% since 1970, in line with what theory says should have happened given the observed 0.5°C (0.9°F) warming of the planet's oceans during the same period. We also projected that shifts of this magnitude would affect the path and strength of the jet stream, the behaviour of the planet's monsoons, and the paths of rain and snow-bearing weather systems. In line with predictions from climate models, the average position of the jet stream also shifted northward some 270 miles (435 km) during a 22-year period ending in 2001.

While it is generally not likely that years like 2010 and 2011 will become 'the new normal' in the coming decade, nevertheless it is believed that many of the flood disasters in 2010 – 2011 were undoubtedly heavily influenced by the strong El Niño and La Niña events that occurred. Furthermore, the ever-increasing amounts of heat-trapping greenhouse gases that humans are emitting into the air puts tremendous pressure on the climate system to shift to a new, radically different, warmer state, and the extreme weather of 2010 – 2011 suggests that the transition is already well underway. If, as we believe, a warmer planet has more energy to power stronger storms, hotter heat waves, more intense droughts, heavier flooding rains, and record glacier melt that will drive an accelerating sea level rise, then we can expect that in 20 to 30 years from now, extreme weather years like we witnessed in 2010 will become 'the new normal'.

Conclusion

If indeed 'the new normal' is only 20 to 30 years in the future, then the entire Asian continent, the member states of ASEAN, and Malaysia, are all going to have to adapt very quickly to deal with more frequent occurrences of events like those in described in bullets 14, 15, and 16. In the second article of this two-part series, we will examine in more detail, the implications of these shifts in climate patterns for Malaysia and the ASEAN region, and explore potential adaptation measures that may be necessary to ensure that key infrastructure remains undamaged and key economic activities, unaffected.

To close this first article, I would like to recall the importance of using the 'best available science' in our efforts to address the problem of global climate change. In this regard, it is useful to note that scientific skepticism plays an important role in ensuring that all our working models and hypotheses are constantly challenged to ensure they remain robust and relevant. With this firm foundation, developing countries can consolidate the link between the historical emissions of the developed countries and the increase in frequency and intensity of extreme weather events across the globe, and insist that the developed countries take urgent and effective measures to reduce greenhouse gas emissions. In response to those who deny the link between greenhouse gas emissions from the burning of fossil fuels and our current climate predicament, I quote Dr. Ricky Rood, professor at the University of Michigan's Department of Atmospheric, Oceanic and Space Sciences, who writes: *"Given that greenhouse gases are well known to hold energy close to the Earth, those who deny a human-caused impact on weather need to pose a viable mechanism of how the Earth can hold in more energy and the weather not be changed. Think about it."*

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Guidelines for Contaminated Land Management and Control in Malaysia

Industrial activity in Malaysia is relatively young. Beginning from an agricultural economy, it is only over the past 25 years that we are a thriving industrial economy. However, this rapid industrial development has also led to the development of industrial sites in Malaysia that have the potential to be contaminated sites. Contaminated land can be found at places such as motor workshops, petrol stations, fuel oil depots, railway yards, bus depots, landfills, industrial sites, agriculture sites and sites with underground storage tanks. Many contaminated sites remain hidden or unknown, including municipal landfills and refuse dumps that have been abandoned in the past and which now can be potential sources of pollution to the soil and groundwater.

Monitoring Soil Contamination

In Malaysia, soil quality is not monitored for environmental purposes unlike river water quality, groundwater quality, marine water quality, air quality and noise which are monitored on a regular basis. Monitoring soil quality will provide a better understanding of the nature of our soils and also serve to give some baseline values and offer a basis for establishing clean-up goals.

Very little work has been carried out in identifying contaminated sites in Malaysia. Some of the contaminated sites identified by the Department of Environment (DOE) are those that are contaminated as a result of illegal dumping of hazardous and toxic wastes where cleanup is subsequently required. But very little soil and groundwater remediation is carried out in our country with such work being mostly carried out by the oil and gas industries and multi-national companies based on the standards of their home countries.

There is no specific legislation governing soil and groundwater contamination in Malaysia. However, under sections 24 of the Environmental Quality Act 1974, it is stated that:-

1. No person shall, unless licensed, pollute or cause or permit to be polluted any soil or surface of any land in contravention of the acceptable conditions specified under section 21.

2. Notwithstanding the generality of subsection (1), a person shall be deemed to pollute any soil or surface of any land if:

(a) he places in or on any soil or in any place where it may gain access to any soil any matter whether liquid, solid, or gaseous; or

(b) he establishes on any land a refuse dump, garbage tip, soil and rock disposal site, sludge deposit site, waste injection well or otherwise uses land for the disposal of or a repository for solid or liquid wastes so as to be obnoxious or offensive to human beings or interferes with underground water or is detrimental to any beneficial use of the soil or the surface of the land.

3. Any person who contravenes subsection (1) shall be guilty of an offence and shall be liable to a fine not exceeding one hundred thousand ringgit or to imprisonment for a period of not exceeding five years or both and to a further fine not exceeding one thousand ringgit a day for every day that the offence is continued after a notice by the Director General requiring him to cease the act specified therein has been served upon him.

Recognising the importance of contamination to land and the need to formulate specific regulations to control soil pollution, the DOE has published three series of *Contaminated Land Management and Control Guidelines* which lay out a set of site screening levels, assessment and reporting procedures, remediation procedures and a closure plan.

Guidelines

Under the Ninth Malaysia Plan, the DOE initiated a study on the 'Criteria and Standards for Managing and Restoring Contaminated Land' which resulted in the development of three series of guidelines to enable proper assessment and management of contaminated sites in Malaysia. These are:

- Contaminated Land Management and Control Guidelines No. 1: Malaysian Recommended Site Screening Levels for Contaminated Land.
- Contaminated Land Management and Control Guidelines No. 2: Assessing and Reporting Contaminated Sites, and
- Contaminated Land Management and Control Guidelines No. 3: Remediation of Contaminated Sites.

Contaminated Land Management and Control Guidelines No. 1: Malaysian Recommended Site Screening Levels for Contaminated Land

The first in the series, this document defines contaminated land as a site at which substances occur at concentrations above natural occurring metal concentrations and pose or are likely to pose an immediate or long term hazard to human health or the environment, or exceed concentrations specified in the Site Screening Levels (SSLs).

The SSLs of the United States Environmental Protection Agency (USEPA) were referred to in developing the Malaysian Recommended SSLs to determine if subsurface contamination detected has the potential to cause unacceptable human health risk. The SSLs are the criteria to be used to determine if an area of land is contaminated, assess the need for remediation measure and develop remediation targets, that is, target clean-up concentrations of chemicals of potential concerns (COPCs) at contaminated sites.

The contaminated land management framework shall apply to any land that is currently being used or was previously used, to perform polluting activities with the potential to cause soil and groundwater contamination. Polluting activities are defined as any activity involving extracting/mining, manufacture, storage, usage, handling and land disposal of chemicals and hazardous or scheduled waste as part of their operating processes; or any land that will involve a change of land use from polluting activities to non polluting activities or from non polluting activities to polluting activities.

In general, the 'Polluter Pay Principle' and 'Risk-Based Approach' apply for all the three series of guidelines. The 'Polluter Pay Principle' defines the responsibility for performing and paying for site assessments and remediation. A polluter can be the land owner, the property occupant/users and/or chemical/product/waste owner.

Essentially, a risk-based approach highlights potential current and future risks associated with the presence of contaminants in the soil and groundwater matrix and recommends corrective actions to mitigate and/or control incremental risk to the level acceptable from human health and ecological perspectives.

Contaminated Land Management and Control Guidelines No. 2: Assessing and Reporting Contaminated Site

This guideline provides a consistent and uniform approach to site investigation, assessment, risk assessment and reporting of all land properties classified as contaminated land. It also covers the assessment approach, sampling design and techniques, quality assurance and quality control (QA/QC) protocols and report preparation as well as reviewing of such sites and to determine the necessary actions to carry out remediation and rehabilitation measures when required.

The recommended contaminated land assessment procedure follows a tiered approach as not all sites pose the same risk to human health and the environment. Three stages of assessment activities are as follows:

1. Initial Assessment

Also known as Phase I Environmental Site Assessment (ESA), it is a systematic assessment process to identify any potential presence of subsurface environmental impacts based on a defined assessment protocol/procedure. It typically involves a desk top study, interview and a site visit.

2. Detailed Assessment

Also known as Phase II ESA, it is a soil and groundwater investigation process that aims to determine if the subsurface environmental media is impacted.

A detailed assessment would normally be carried out after an initial assessment, should the findings of the initial assessment suggest that the land is potentially impacted by onsite or offsite activities. Typical activities included in a detailed assessment are soil boring, groundwater well installation, and soil and groundwater sampling.

3. Risk Assessment

Risk assessment is a process of estimating the potential impact of a contaminant on an ecosystem or human population under a specific set of conditions. The process can also be used to determine the desired clean up target levels and can be performed in a tiered manner:

- Tier 1 risk assessment is a non site specific risk calculation or a comparison against the SSLs.
- Tier 2 risk assessment is a site specific risk assessment based upon generally acceptable simple fate and transport models for the estimation of contaminant concentrations at the point of exposure.
- Tier 3 risk assessment is a more sophisticated site specific risk assessment that normally would utilise numerical or highly technical fate and transport or exposure modelling for the estimation of contaminant concentrations at the point of exposure.

Depending on the site complexities and project need, Tier 2 or Tier 3 risk assessment would be applied.

Contaminated Land Management and Control Guidelines No. 3: Remediation of Contaminated Sites

This guideline provides the important elements or steps in performing remediation at a contaminated site. It specifies the essential process of contaminated land remediation, that is, (i) Remediation Action Plan; (ii) Remedial Investigation/Feasibility Study; (iii) Remediation Implementation; and (iv) Post Remediation Evaluation.

The guideline sets out the fundamental goals for remediation of contaminated sites which is to select a socially, acceptable and cost effective solution that provides protection for public health and the environment as well as flexibility in the future use of land.

Remediation processes would apply for the site(s) with soil and groundwater concentrations detected by the SSLs; or the site(s) that pose unacceptable risk to human health based on the findings of a human health risk assessment performed in accordance with the *Contaminated Land Management and Control Guidelines No. 2: Assessing and Reporting Contaminated Sites.*

For site(s) that pose other immediate physical threats/risks due to the physico-chemical nature of the released chemicals or sensitivity of the site setting, immediate emergency response action should be devised by the polluter or responsible party to contain the physical threats/risks. These situation(s) include but are not limited to the explosive conditions in underground utilities/structures caused by an accumulation of chemical vapour released from subsurface contamination; or chemical releases that may cause immediate impact on human health or the environment. In other words, this guideline is not applicable and shall not be used as guidance for emergency response of any chemical release into the subsurface environment.

Conclusion

These guidelines provide the details and appropriate criteria and standards for managing and restoring contaminated land. It consists of the framework for the assessment, investigation and remediation of contaminated land in the country. These guidelines should serve as a guide and reference to all the parties involved, including DOE officers, government agencies, consultants and other relevant parties relating to contaminated land management in Malaysia. They will also be a reference for drafting the regulations on contaminated land management in Malaysia to enable the enforcement of Section 24, of the Environmental Quality Act, 1974.

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Do We Need More Landfills?

At present, the issue of municipal solid waste (MSW) is gaining more and more attention, and has become one of the major environmental concerns throughout the world. MSW is defined as household (collected and delivered), commercial (e.g. shops, restaurants, office) and institutional waste (e.g. schools, leisure facilities, hospitals but excluding clinical waste) from daily activities (McDougall *et al.*, 2001)

Worldwide, the most frequent waste disposal method is landfilling, which is recognised as being an important option both now and in the near future – especially in low-and middle-income countries – since it is the easiest and the cheapest technology available. Owing to financial constraints, landfills operating in low-and middle-income countries usually lack environmental abatement measures, such as leachate collection systems and lining materials on the bottom of landfills. As a result, much contamination is inflicted upon the environment and can affect human health.

Overview of Waste Generation and Management

Growing waste amounts are clearly an issue of concern. MSW generation increases rapidly with economic activities and population growth. The rates of waste generation between world regions are notably different. Amongst European countries, Denmark appears to have the highest per capita waste generation (Figure 1). The developed Asian countries (i.e. Japan and Korea), on the other hand, have a similar rate to European countries. In contrast, developing Asian countries (i.e. Malaysia and Indonesia) produce less waste compared with developed Asia and Europe. Notably, although Hong Kong is categorised as being a developed Asian country, it has the highest per capita waste generation rate in the world. This is likely related to the economic growth and population density in this region (McDougall *et al.*, 2001). Furthermore, waste generation globally is expected to double during the next 50 years, as waste production increases from 12.5 billion tonnes in 2000 to over 25 billion tonnes in 2050 (Yoshizawa, 2007).

How is Waste Disposed Off?

Landfilling has become the least preferable option in most European countries. For example, the main waste disposal methods in Germany and Denmark are incineration and recycling (Figure 2), owing to the fact that

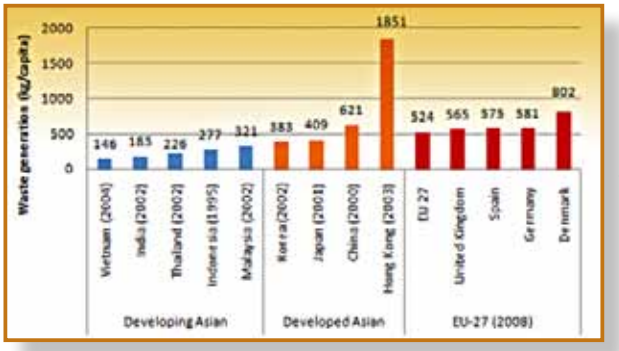

Figure 1: MSW generation in European and Asian countries
(Source: *Terazono et al., 2005; SOER, 2010a*)

these countries have imposed restrictions on the landfills of certain waste streams and have further emphasised policies on recycling and recovery for most of their waste stream. It is reported that only 40% of municipal waste in the EU-27 was landfilled in 2008, while other proportions were recycled (22%), incinerated (20%) and composted (18%)(SOER, 2010a).

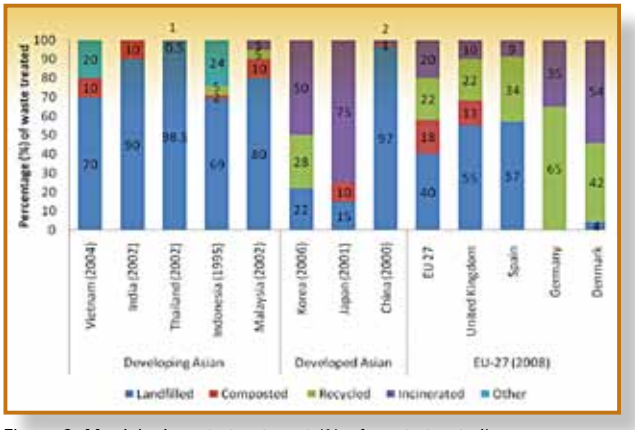

Figure 2: Municipal waste treatment (% of waste treated)
Source: Ryu, 2010; SOER, 2010a

Do We Still Need Landfills?

Importantly, if the question is posed as to whether landfills will continue to be an option for waste disposal globally in the future, the answer is an affirmative. The trend of landfilling amongst Organisation for Economic Co-operation and Development (OECD) countries is still increasing but at a low rate, and by 2020, landfilling is expected to be replaced by incineration and recycling. However, amongst non-OECD countries, the number of landfills are continuing to increase rapidly and are still the most preferred option. Other methods of waste disposal – incineration and recycling – have also increased; however, these have not replaced landfilling.

Health Impacts

In developed countries, public concern surrounding the location of landfills is based largely on the effects on human health of notorious cases of poor management of industrial waste, for example, Love Canal in the USA in the 1970s. Love Canal is a former landfill site in New York State containing large quantities of toxic materials – including residues from pesticides production – deposited in the 1930s and 1940s, followed by the building of houses and a school on and around the landfill in the 1950s. By the mid-1970s, chemicals leaking from the site were detected in local streams, sewers, soil, and the indoor air of houses. This site, and the subsequent studies of the health of the population in the vicinity, raised public concern regarding problems in terms of waste disposal practices.

Waste Management in Malaysia

MSW generation in the country is projected to increase from 292 kg/capita in 2000 to 511 kg/capita in 2025 (Lau, 2004). At present, landfilling is the main waste disposal method (80% usage) and it is still expected to account for 65% of waste in 2020 (Waste Management Policy of 10th Malaysia Plan, 2010 – 2020). By comparison, recycling and intermediate processing are projected to take 20% and 15% of the waste, respectively in 2020.

However, the contention is that most landfills in the country are operated without proper protective measures such as lining systems, leachate treatment and gas venting (Latifah *et al.*, 2009)

Do We Have Sufficient Landfills?

A Case Study of Selangor

Selangor (including Federal Territory of Putrajaya) and Federal Territory of Kuala Lumpur are the major waste producers, responsible for one-third of the total waste of the country (Tarmudi *et al.*, 2009). Selangor is facing a serious crisis of waste disposal as it receives waste from Kuala Lumpur (100% urbanised and high waste) as the city has no landfills owing to limited space. Based on the average waste growth rate of Selangor (3.0%) and Kuala Lumpur (1.1%), the volume of waste in the state is projected to increase from 2.9 million tonnes in 2010 to 3.6 million tonnes in 2020 (Ismail, 2011). It is apparent that the

existing seven landfills (Bukit Tagar, Sedu, Dengkil, Jeram, Sungai Sabai, Bukit Beruntung and Panchang Bedena) in the state could only receive half of this waste per year (1.6 million tonnes per year). The accumulated amount of waste left to be disposed off in the next 15 years (2010 to 2025) in the new landfills is consequently 27.86 million tonnes.

With a waste-specific density of 800 kg/m^3 – which is a common value used for sanitary landfills (Chong *et al.*, 2005) – the use of waste covering materials, e.g. clay soils, adds another 15% to the volume, assuming the sanitary landfill usually has three layers, which, in total gives a height/depth of 15m (Chong *et al.*, 2005). Therefore, the land surface (area) required for new landfills is approximately 267 hectares. It is assumed three landfills with an area of 125 hectares each need to be built to cater to this waste.

Where Are These Landfills to be Located?

Only 7% of Selangor (560 km^2 / 55,953 ha) is suitable for landfill development (Ismail, 2011). These areas are defined by eliminating unsuitable land parcels based on constraint factors such as area with high slope, major transportation routes, urban and populated areas, surface water, protected areas, and airport and excludes land parcels less than 125 hectares (Figure 3). The areas are mainly located on agricultural land and cannot be avoided as it is the only option left. If agricultural land was another of the constraint criteria in the assessment, nowhere in Selangor could be classified as suitable.

The suitability index of these areas were calculated with an integration of GIS and Multi Criteria Decision analysis which divided the value into very low suitability (1 – 50), low suitability (50 – 100), moderate (100 – 150), high suitability (150 – 200) and very high suitability (200 – 255) (Figure 3). Most sites have a value of between 150 and 200 (high suitability), and some parts, i.e. C1, C2, C6, have higher values of between 200 and 255 (very high suitability).

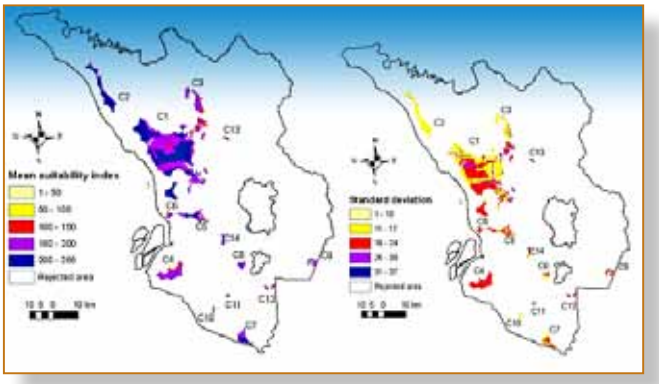

Figure 3: The Suitability Index and standard deviation

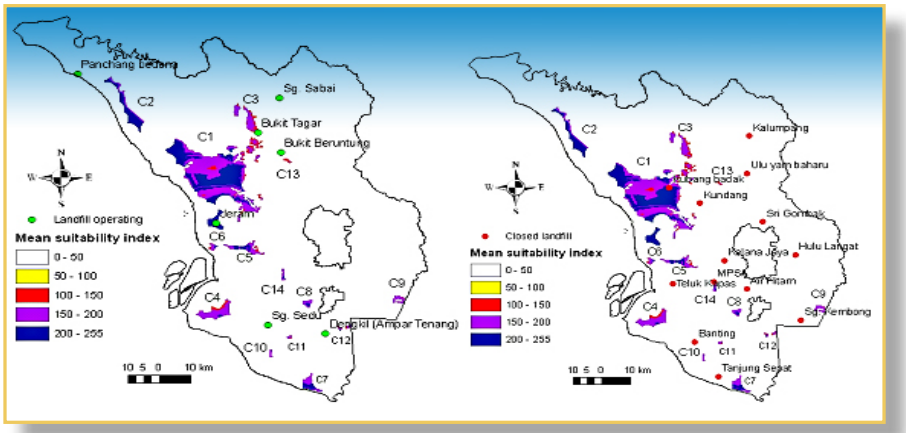

Figure 4: Location of current and closed landfills on the Suitability Index map

A comparison between the location of existing landfills to the suitability map shows that most are located in unsuitable areas (Figure 4) with the exception of Bukit Tagar (C3) and Jeram (C6). This suggests that the current landfill location in Selangor have the potential to harm the environment especially water resources.

Owing to this fact, the conventional landfill is no longer an appropriate practice, not only in Selangor, but possibly in all states in Malaysia due to limited space. Shifting the current waste disposal method to other options should be implemented as soon as possible.

Are These Issues Being Recognised by Current Policy

The answer is yes, but only recently and implementation is still limited. The policy statements of waste management implementation by the government indicates awareness that landfills cannot be the ultimate option any longer, and they have started to adopt new technologies to improve treatment and disposal processes for solid waste. There is also commitment to support environmental friendly activities such as recycling in promoting waste reduction as a key aim in the waste management policy. However, these policies were only promulgated recently, starting in 2006.

Conclusion

In order to reduce the burden of landfills and to increase their lifespan, reduced waste generation should be the overall aim. One way of achieving this is to increase waste recycling, whereby waste can be segregated at the source, with less being dumped in the waste landfill. Recycling is not a new issue in our country. Increased waste recycling and waste segregation should be implemented without any delay.

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A Sustainable Electricity Industry

Energy resources are converted into electricity and connected through a grid system. This grid system is known as transmission and eventually the electricity will reach end users via a distribution system. Conversion of the energy resource into electricity and its usage is a linear process. This means that energy resources are converted and will eventually be used up. This monopoly situation requires an efficient, effective, equitable and secured electricity model to function towards sustainable development and attainment of Vision 2020. Figure 1 shows the simple flow of the electricity industry model in Malaysia.

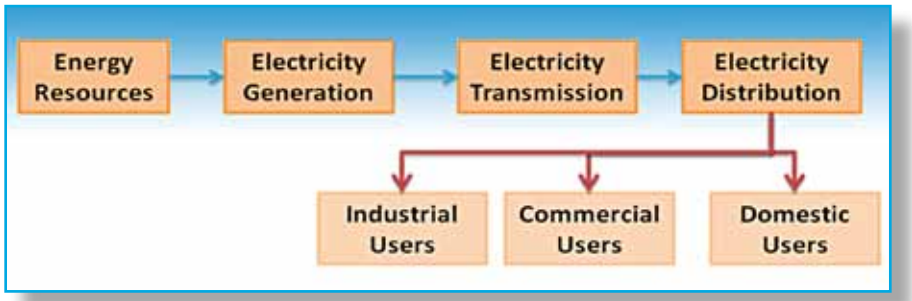

Figure 1: Electricity industry model in Malaysia

The Electricity Industry in the 10th Malaysia Plan

The 10th Malaysia Plan proposes the development of a New Energy Policy that is aimed at securing energy security and economic efficiency, taking into consideration environmental and social impacts. The policy is also said to be based on the following principles:

1. **To secure and manage reliable energy supply:** The importance of securing energy resources that are reliable and environmental friendly is highlighted as well provides for the option of nuclear energy which it adds will be dealt with transparently.

2. **Measures to encourage energy efficiency (EE):** EE will be encouraged through a master plan and standards developed for all level of users. However, the 10th Malaysia Plan does not mention freezing the entrance of energy intensive industries (or industries that use much electricity in their operation) into Malaysia especially smelting industries.

3. **Adoption of market-based energy pricing:** The rationalisation of the subsidy will be done periodically to achieve market pricing. The plan also mentions the gradual removal of the natural gas subsidy through a review at 6-month intervals to achieve the 2015 market pricing target.

4. **Stronger governance:** The industry needs to be disciplined to raise productivity and efficiency. This includes re-negotiation of Power Purchasing Agreements (PPA). However, the plan did not specify the degree of transparency and competitive bidding process for new generation plants.

5. **Managing change:** The plan did not specify the type of structural change that the industry is going to adhere to. Therefore, it is unclear how the change will be managed holistically.

The Energy Commission is now working on an Incentive Based Regulation that is fundamental to achieving all the above principles. However, based on the Association of Water and Energy Research Malaysia's (AWER) study and consultations with the relevant stakeholders, there is still ample room for improvement, enhancement and clarity if the electricity industry is to achieve efficiency.

Regulatory Framework Proposed by AWER

According to AWER, fairness and transparency in governance, regulation, enforcement as well as pricing (through tariff) are the pertinent issues that need to be ironed out. Without proper planning, it will be impossible for Malaysia to achieve energy security. AWER is proposing a regulatory framework for the electricity industry and users. The growth of the electricity industry in Malaysia including that of Sarawak where rural electrification is a core issue must be regulated. Therefore, AWER would like to propose that the Sarawak electricity industry be regulated under the Energy Commission as well.

AWER's proposal is aimed at enhancing the Incentive Based Regulation that is being developed by the Energy Commission currently. The generation sector contributes most cost to tariff. Therefore, it is vital to regulate this sector under a national regulatory framework to ensure the people's well-being is protected (Figure 2).

Regulating Electricity Generation

The major costs that contribute to electricity tariff are fuel cost and generation cost. The current model used for the generation sector is not economically efficient. There are old plants or inefficient plants that need re-investment to improve efficiency or perhaps need to be decommissioned. In addition, as water and energy is a natural monopoly business. 'blind folding' the generation cost and passing it onto tariff is not fair. If generation cost can be capped via effective and transparent regulations, it will bring greater economic efficiency. Increasing operational efficiency will eventually reduce the carbon emission recorded by the electricity industry. At its current rate of efficiency, the Malaysian electricity industry is generating 0.6 kg of CO_2 for every (kWh) kiloWatthour.

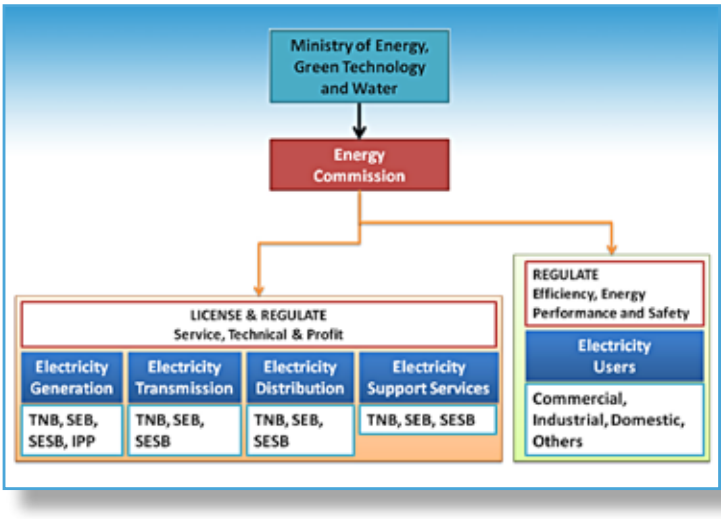

Figure 2. Proposed regulatory framework for the electricity industry by AWER

The bidding process for new power plants need to be more competitive and done in a more transparent manner which can result in an equitable tariff. The competitive bidding should incorporate the following criteria:

1. **Profit that is capped:** It is unfair to pass a higher generation cost to tariff in order to make more profit. The Energy Commission must cap the profit that can be made by the companies.

2 **Best generation efficiency:** The efficiency of technology plays an important role in electricity generation and therefore any increase in efficiency will increase the output of electricity generation with optimum fuel consumption. Therefore, technology with the best efficiency should be given priority.

3 **Equilibrium between Return of Investment (ROI)** and Impact on Tariff (within the operating license period): A typical generation plant can operate beyond 20 years and the electricity industry, like the water industry, gives steady cash flow.

When all of these criteria are implemented fully, we will have a real competitive bidding process in operation that can bring about an equitable tariff.

Currently, coal price is based on market pricing and natural gas is still subsidised by the government. While the government is rationalising the subsidy periodically, the Energy Commission must ensure that only actual fuel cost is passed through to tariff. For example, if a generation plant is inefficient in generating electricity, the fuel cost should not be fully passed on to tariff. With such a mechanism in place, the industry will definitely increase its efficiency in generating electricity. Therefore, generation efficiency together with savings through bulk purchase of fuel will play a vital role in minimising the amount of fuel cost pass-through. Users will then enjoy equitable tariff.

Regulating Electricity Transmission, Distribution and Electricity Support Services

These clusters are pure monopoly businesses. The grid system, distribution system and its components need to be managed, operated and maintained periodically. To ensure grid stability and supply security, planning and extending the grid system needs to be done from time to time. System loss should be monitored and a 'smart grid' system should be implemented.

An Incentive Based Regulation* that is currently being developed by Energy Commission has the following core objectives:

(i) To develop an economic regulatory framework for regulating TNB
(ii) To develop a tariff setting framework and principles for tariff design
(iii) To develop incentive mechanisms to promote efficiency and service standards
(iv) To develop a process for tariff reviews
(v) To develop a format for regulatory accounts and an annual review process.

Note: this Incentive Based Regulation does not cover the generation sector.

Electricity Users

The Energy Efficiency Master Plan will eventually be an Act and it should serve to widen the Energy Commission's power in regulating and improving energy efficiency across many sectors.

Further, the cost of electricity must be shared based on sectoral consumption. Therefore, tariff setting needs to be punitive in all sectors. Such a tariff system will reward sustainable usage and penalise wasteful usage. This element is found in the domestic and commercial sectors. However, in the case of the industrial sector, there is a Special Industry Tariff that gives a tariff discount if a particular industry's electricity cost is 5% or more of its total operational cost. This approach does not make any sense in a subsidised electricity supply system as it is cheaper to waste rather than being energy efficient.

Energy Intensive Industries

Based on the Malaysian Industrial Energy Efficiency Improvement Project (MIEEIP), there are 8 energy intensive industrial sub-sectors namely, iron and steel, cement, wood, food, glass, pulp and paper, ceramics and rubber. The study later introduced three additional sub-sectors which are oleo-chemicals, plastics and textiles.

The MIEEIP study has also concluded that the 48 industries audited during the beginning of the MIEEIP had indicated a potential savings of 2.58 million GJ (Giga Joules) per year and financial savings of RM85 million a year if all of the no-cost, low-cost and high-cost recommendations were to be implemented. This would result in a CO_2 emission reduction of 761,000 tonnes. Over a 10-year period, the amount of CO_2 mitigated would be 7.61 million tonnes.

Managing Energy Intensive Industries

STEP 1: Set Priority in Catering to Energy Demand

Priority must be given to providing energy in any form to the public first and then larger consumers as it will provide basic needs and ensure economic growth. In the case of Bakun and also many other electricity power plants, society and environment were gravely affected. It is only fair to cater to the demand of a larger number of consumers compared to catering to energy intensive industries only.

STEP 2: Categorising Energy Intensive Industries

The government should identify the total number of energy intensive industries in Malaysia and categorise them accordingly. It should also include their energy consumption and their current operational condition status. Energy use per unit product will give an immediate indication of energy consumption. The Energy Commission should take the lead in this step.

STEP 3: Strict Approval Process

The process of enrolling new operations of energy intensive industries is not clear currently. While Foreign Direct Investment (FDI) clouds many decisions, the 10th Malaysia Plan did not specify any solution or concrete steps as well. There should be a 'check and balance' in bringing new industries into the country.

STEP 4: Environmental Tax on Energy Intensive Industries

Increasing the renewable energy content in the overall energy mix will help to reduce the carbon footprint of products and services eventually. This will be attractive to energy intensive industries. As the nature of the industry places a high strain on the environment, the government should impose an environmental tax on such operations. In fact, many countries are already imposing hefty taxes on inefficient energy intensive industries. More organised schemes are observed in Europe but many countries including China have introduced an environmental tax for this group of industries.

STEP 5: Continuous Monitoring and Assessment

The Energy Commission must be given full power to continuously monitor and assess the operations of all energy intensive industries in Malaysia. This will also include an efficiency benchmarking process for each category. A punitive tax system as suggested in Step 4 is vital to ensure efficiency of energy use.

Conclusion

The implementation of a more stringent Incentive Based Regulation for the electricity industry should improve operational efficiency and reduce environmental impact via optimisation of energy resources. The entire usage cycle for the energy industry must be regulated for energy efficiency and carbon emission footprint.

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Development and Implementation of an Enviromental Sustainability Index (ESI)

Since the discovery of the depletion of the ozone layer in the 1970s, the term 'environment' and 'sustainability' have become so closely interwoven in a fabric of symbiotic existence that it would be impossible to separate the two. Despite global efforts to achieve some kind of meaningful environmental sustainability, there is still a lot of misconceptions and perceptions relating to the whole foundation of 'environmental sustainability' from the perspective of measurement of sustainability.

Environmental Sustainability Standards and Indexes (ESI)

On a global platform, the primary challenge is to ascertain the direction, objectives, scope and methodologies employed in the assessment of 'environmental sustainability' standards/indexes. The 1997 Kyoto Protocol (KP) is the founding basis and together with the guiding principles of the UNFCCC[1] seeks to address global concerns relating to climate change[2] phenomenon and eco-economic sustainability issues.[3]

The Kyoto Protocol provides for three mechanisms to achieve this objective:

1. Emissions trading (or also known as 'the carbon market')
2. Clean development mechanisms (CDM)
3. Joint implementation programmes (JI)

Although the *Adaptation Fund* was set up to assist in financing adaptation projects/ programmes in developing countries including ASEAN countries who are Parties to the Kyoto Protocol, the availability of this Fund depends on the actual success of the CDM projects/ programmes. Hence, the non-availability of much-needed funding for local adaptation.

Challenges of Setting an ESI

The Kyoto Protocol compels developed countries (and the EU) to comply with the KP commitment time frames. Despite the reporting and compliance systems under the KP, not all industrialised countries have met all the Kyoto Protocol targets. The grouses, complaints and shifting blames were vehemently played out in the Copenhagen Climate Change Conference 2009 (COP-15)[4] and the Cancun Climate Change Conference 2010 (COP-16)[5] proceedings. During these proceedings, the main issue of environmental sustainability standards and indexes did not reach any real consensus.

Meanwhile the UNFCCC is an international environmental treaty adopted at the Earth Summit in Rio de Janeiro in 1992. Its primary goal is to stabilise, manage and reduce greenhouse gas emission concentrations. But the UNFFC Convention cannot be used to compel developed and developing countries to set definitive commitment time frames to achieve global objectives established under the KP objectives because the standards are now under critical scrutiny.

Malaysia's Perspectives on Environmental Sustainability

Malaysia's position on the issue of environmental sustainability standards is clearly based on her participative role and contribution to global environmental sustainability performance. In 1974, Malaysia enacted the EQA Act 1974 to chart environmental compliance direction for all stakeholders in Malaysia. This was followed by a raft of environmental orders, regulations and rules on numerous private and industrial sectors. The minimum standards have been put in place.

Compliance in this aspect will be based on enforcement performance by environmental agencies and prosecution cases. This is a good methodology in the assessment of legal compliance where environment sustainability is concerned. However, this must be considered in the face of global requirements and protocols in environment sustainability. We do not have environmental sustainability indexes for tracking our environmental sustainability efforts.

Let us take a quick look at ASEAN and see how the bloc has progressed vis-à-vis environmental sustainability tracking. Though ASEAN observation of environment sustainability standards have technically improved over the years in tandem with global environment sustainability protocols, there is no tracking agency to ensure if environmental sustainability indexes have been achieved because there are currently no such environmental sustainability indexes/systems in place. Despite having signed numerous agreements, many of these agreements are not fully performed and utilised due to domestic political turmoil and funding barriers. A good example is the *ASEAN* Agreement on *Transboundary Haze Pollution (2002)* which has not being able to resolve the annual haze problem faced by Malaysia, Singapore and Brunei, etc.

Sustainability Standards in the Government Sector

The various Malaysian Plans, National Development Policy, States' City Council Plans, Energy Policies[6], National Green Technology Policy[7], etc do not encapsulate any clear and significant environment sustainability standards for legal compliance. Environment administration and sustainability management practices tend to follow certain forms of ISO Standard practices which have been adopted without due recognition of local environmental customs and work ethics. This may pose a *conflict situation* in the formation of workable environmental standards and indexes at the workplace.

Sustainability Standards in the Private Sector

The same scenario is encountered in the private sector. Established ISO standards are adhered to. Though legal compliance is adequate evidence of sustainability, it is clearly inadequate in light of global environment sustainability standard requirements. However it must be admitted that many corporations are striving to go beyond that level and that there is some level or degree of sustainability standard observation. But what is clear is the differing and loose manner of observation of some kind of modified standard – *in a rather limited and restricted form.*

There is also no clear environmental sustainability standards/indexes implemented in the private sector. For example there is no environment sustainability standard or even index implemented in the current transportation system in Malaysia. The private sector is not required by law or the EQA Act 1974 to do more than what is presently required. Perhaps a *Green Transportation Unit* needs to be set up to ensure environment sustainability standards in the expanding transportation system in Malaysia.

The construction of the Pusat Tenaga Malaysia's building ('Diamond Building')[8] as the Green Energy Office (GEO) has been acknowledged to be the first Green Building Index (GBI) rated building in Malaysia. However, the cost of building a green home/house remains exorbitant. The cost of construction material remains high and have not come down due to distortions in the demand and supply curve.

As far as the infrastructure construction sector is concerned, the certification standard may be too high and may need to be revised in the light of current construction realities

Recommendations

Recommendation 1

It is believed that environmental sustainability standards are difficult to maintain and achieve based on current administrative constraints under Federal

and State constitutional jurisdictions. There is an urgent need to minimise these barriers by setting up an Independent ***Environment Sustainability Standard Agency*** to ensure Inter-agency and Federal-State cooperation on one hand, and private sector participation on the other hand, in environmental sustainability standards. There is a need to harmonise, standardise and certify the various forms of environmental sustainability standards and – the proposed sustainability indexes – in the global Green Market by domestic benchmarking exercises.

For environmental standards already endorsed by the private sector, there is a need to provide for allowances to tweak, minimise and update sustainability standards which are not realistic in the current economic and financial malaise. But the best method is to establish specific environmental sustainability indexes.

Recommendation 2

Perhaps, there is a need for the Malaysia government to set up an *Environment Sustainability Unit/Agency* to ensure that environmental sustainability indexes are formed, and tracked to ensure sustainability targets are achieved. The unit/agency must establish a uniform environment sustainability index for Malaysia to pioneer the concept of compliance to environmental sustainability standards. Malaysia may then take the lead to push this concept for adoption in the ASEAN region. Besides calling for legal compliance to this Index, Corporate Social Responsibility (CSR)[9] may need to play an important complementary role as well.

The CSR provisions, if any, also do not compel compliance with any specific environmental sustainability issue because CSR itself focuses on the social impact of corporate practice although CSR development now has come to accept the inclusion of the environmental sustainability component as part of a wider holistic socio-corporate governance.

Drafting of an Environmental Sustainability Standard / Index

Environmental and safety standards and index are still in a state of flux, evolving from time to time in tandem with technological advances in environmental sciences and corporate strategies. There are about 8,000 International Standards on numerous subject matters and about 1,000 new ISO standards are developed annually by the International Organization for Standardisation.[10] The scope of coverage encompasses major themes such as environmental and safety practices, agriculture, mechanical engineering, manufacturing, construction, distribution, transportation; medical devices, information and communication technology, good business practices and services, etc.

Guiding Practice

The general guidelines in the drafting of a Standard/Index protocol are provided in the following paragraphs. The short standard precedent provided below should provide for certain guidelines in the drafting, and creation of an environmental sustainability standard. Various factors have been included for illustration purposes. Primary components are highlighted here for observation.

STANDARD AND INDEX DEVELOPMENT CHART GUIDING COMPONENTS/INPUTS			
1. CONCEPTUAL DESIGN BASIS	Cultural Beliefs, Practices, Code of Conduct, Best Practices, etc		
GUIDING PRINCIPLES (parameters)	Dominant thematic principles, rules, ethics,etc		
2. PRIMARY SECTOR	GOVERNMENT SECTOR	PRIVATE SECTOR	OTHER SECTOR
3. SUBJECT MATTER Genre (Scope) industry	Green Water	Heavy/Light Industrial	Halal Industry Standard
	Green Transportation	Green Building /Structures	
	Green Energy / Fuel	Green Transportation	
	Green Environmental Operating Systems (various)	Green IT/IC	
	Green Defence	Green Mining Practice	
	Environment Management	Green Raw Materials	
		Green Procurement / Methods	
		Eco/VBio-Agricultural Activities	
		Marine Fisheries	
Identification of Standard	International ISO/Local		
Certification issue	Scientific techniques involved		
Verification and Reporting Standard	Minimum or maximum guidelines		
Standard Rationalisation	Too cumbersome or too minimalistic		
Standard Revision, Updates and Repealed/ Withdrawn standards	Industrial reality: Economic Impediments/Trade Barriers		
Vision setting			
Objectives Setting			
Scope setting			
Time frame/reporting period	Primary issue		
Other relevant green components	Vital or insignificant		

Conclusion

The observation of environmental sustainability standards in Malaysia is at the cross-roads for both the government and private sector. International environmental standards are being questioned by developing countries as being unsustainable due to the shifting goalpost of standards. Environment-related ISO standards cannot mediate between global environmental protocols and domestic sustainability parameters for both developed and developing countries.

Domestic observation of environmental ISO standards are fragmented. Although there exists some sort of environmental sustainability standards, these standards are not implemented in a cross-sectoral dimension. The main challenges are the defining of proper indicators for the following environmental sustainability imperatives:

- Climate change factor
- Environmental biodiversity
- Air, land, water and marine pollution
- Water use, waste generation
- Sustainable use of natural resources/assets, etc

Environmental certification, compliance and governance of environmental sustainability standards remain controversial as highlighted by the PM of Malaysia.

"…existing systems to address the challenges of environmental sustainability had become too complicated, preventing countries, especially developing ones, from participating effectively. Between 1992 and 2007, the 18 major multilateral environmental agreements alone convened some 540 meetings, which produced more than 5,000 decisions that countries are supposed to act upon through national efforts. "The only countries that can comply with the system are the richest countries, while developing nations have become disenfranchised,". he said at the opening of The First Preparatory Meeting, World Congress on Justice, Governance and Law for Environmental Sustainability."

Perhaps, one way forward is to set up a new World Environmental Organisation (WEO) which could set real Environmental Sustainability Indexes (ESIs) for holistic observation, compliance and governance not just for Malaysia and the ASEAN platform but on a global scale.

Footnotes

1 The UNFCCC is an international environmental treaty adopted at the Earth Summit in Rio de Janeiro in 1992. Its primary goal is to stabilize, manage and reduce greenhouse gas emission concentrations. For details, see United Nations Framework Convention on Climate Change, at *https://unfccc.int/2860.php*

2 See related discussion in "Achievements in Stratospheric Ozone Protection", EPA Publication EPA-430-R-07-001, April 26, 2007, at *http://www.epa.gov/ozone/2007stratozoneprogressreport.html*

3 The main objective of the KP is to see to it the reduction of harmful greenhouse gases(GHG) emissions based on certain agreed commitment time frames. Presently, there are six well known types of greenhouse gases which cause global warming: carbon dioxide, methane, nitrous oxide, sulfur hexafluoride. This includes HFCs and PFCs as well.

4 See statement by the PM at COP15. For other details, see United Nations Framework Convention on Climate Change, at *https://unfccc.int/2860.php*

5 The three Core Consensus adopted therein: 1. A re-confirmation of the UNFCCC; 2. Environment Reporting Standard and 3. the Green Climate Funding. See Summary of GHG Reduction Pledges Put Forward by Developing Countries, See details at *http://pdf.wri.org/summary_of_non_annex1_pledges_2010-06.pdf*

6 See the Fuel Diversification Policy, the Small Renewable Energy Programme and the 2006 National Biofuels Policy.

7 For details, see Malaysia Green Technology Corporation official site at *http://www.greentechmalaysia.my/*

8 Suruhanjaya Tenaga (Energy Commission) No. 12, Jalan Tun Hussein, Precinct 2, 62100, Putrajaya, Malaysia, at *http://www.st.gov.my/*

9 See European Alliance for CSR at *http://www.csreurope.org/pages/en/toolbox.html*

10 For details on this aspect, see ISO Organisation at *http://www.iso.org/iso/search.htm?qt=green+&published=on&active_tab=standards*

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Event Highlights
Department of Environment, Malaysia

September 2011

21st Inter-University Environmental Debate

Organised by the Department of Environment (DOE) in collaboration with the Malaysian Universities Debate Council (MADUM), Dewan Bahasa dan Pustaka (DBP) and the Ministry of Higher Education, the 21st Inter-University Environmental Debate saw participation from 24 institutions of higher learning in Malaysia. Universiti Teknikal Malaysia (UTeM) in Melaka hosted the event from 24-27 September 2011. The two teams that made it to the finals of the 2011 debate held at Dewan Besar of UTeM were Islamic Science University of Malaysia (USIM) and University of Malaya (UM). USIM emerged the overall winner of the 2011 Debate, receiving the Minister of Natural Resources and Environment Challenge Trophy, a cash prize of RM8,000 and a certificate of participation. Mohd Ikhwan bin Rosseli of USIM emerged as the Best Debater and received the Director General of Environment Trophy, together with a cash prize of RM 1,500.00. YBhg. Dr. Abdul Rahim bin Haji Nik, the Deputy Secretary General (Environment), Ministry of Natural Resources and Environment gave away the prizes. The Department hopes for greater participation from universities and institutions in the yearly event.

Assessment on the Effectiveness of Environmental Education and Awareness Program Workshop Series 2/2011

This workshop, held from 27 to 29 September 2011 in Shah Alam, Selangor, was organised by the Department of Environment in collaboration with the Institute for Environment and Development (LESTARI), Universiti Kebangsaan Malaysia. It was attended by 27 participants and included 15 participants from 12 non-government organisations (NGOs) involved in promoting awareness and environmental education programmes.

The objective of this 3-day workshop was to brainstorm on the formation of an Environmental Commitment and Awareness Index. This new Index will be used to evaluate and determine the level of environmental commitment and awareness among citizens in the country.

October 2011

The 20th Malaysia Environment Week

The annual Malaysia Environment Week (MASM) is a premier event organised by the Department of Environment, primarily to inculcate and enhance environmental awareness among Malaysians. This year's MASM, the 20th edition, was held on 18 October 2011 at Taman Tamadun Islam Convention Centre, Kuala Terengganu, Terengganu with the theme "Environmental Conservation, Our Shared Responsibility". YB Dato Sri Douglas Uggah Embas, the Minister of Natural Resources and Environment officiated the launch of MASM 2011. About 1,000 people from different sectors including 360 school children participated in this event. Several activities were organised during the event such as an environmental exhibition and an action song performance by 40 school children.

In conjunction with the launch of the MASM, Langkawi Award 2010/2011 and the Best Project Sustainable School - Environment Award under the Rakan Alam Sekitar Programme were also presented to the winners. This year, the recipient of the Langkawi Award (Organisation/Association Category) was the Frangipani Langkawi Resort & Spa in Langkawi. This award was given to the organisation for practising recycling and conservation of energy activities and contributing significantly to the environment and surrounding communities.

Meanwhile, the Best Project Sustainable School - Environment Award went to SM St. Michael, Penampang, Sabah in the secondary school category, while Sekolah Kebangsaan Ledang, Tangkak, Johor won the award for the Primary School category.

All the awards were presented by the Minister of Natural Resources and Environment. YB Dato' Toh Chin Yaw, Chairman of Industry, Trade and Environment Committee for Terengganu State was also present at the award ceremony.

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