

Palm Oil Based Diesel: An Inconvenient Opportune?

The spiraling price fury of crude oil has lost its steam, lately; it may not be for long, though. It settled at a tolerable level of USD90 per barrel in October 2008 after hitting the high mark of USD133 per barrel in July 2008. With global warming lurking, the cry for greenhouse gas (GHG) reduction by the Kyoto Protocol and the awakening of the China and Indian economies and their lusty consumption of energy, have all added up to the call for biofuel (ethanol and biodiesel). Biodiesel is supposedly a greener and cheaper alternative for vehicles and generators. Our golden crop, palm oil, happens to be the most efficient feedstock for biodiesel production. Is this an opportune arrival?

The Call for Biodiesel

On the surface, the justifications for biofuels appear defensible. It is when one probes deeper into the food-fuel dilemma, one sees a paradox in the making. Let's list down the calls for biodiesel.

The first in the list is the energy security argument. This stems from the continuous upheavals and uncertainties in the fossil-based fuel market in the face of growing world demand for energy which calls for alternative energies such as bio-based fuel, which includes bioethanol and biodiesel. Bioethanol is produced from crops such as sugarcane, corn, beet, wheat and sorghum. Biodiesel is made from seeds such as rapeseed, sunflower, soy, palm, coconut or jatropha.

Why biofuel? Biofuel seems more appealing simply because it is renewable. It can be grown over and over again in the same plot of land, suggesting that it is a 'cheaper' alternative.

The Kyoto Protocol is another push-factor towards biofuel demand. The Protocol sets targets for industrialised countries and the European Community to reduce GHG emissions. One of the mechanisms to achieve this objective is, of course, replacing fossil with bio-based fuel.

And there is the economic argument that biofuel can create employment and income opportunities for local farmers. Africa has been identified as the biofuel production zone under the guise of addressing global warming and providing many poverty stricken African nations with sustainable development. Malaysia and Indonesia, by default as the world's largest producers of palm oil, will also be suppliers of feedstock for biodiesel.

With these justifications, the demand for biofuel was 'politically created' worldwide. That is, the demand curve was drawn



through mandate and subsidies. The European Union (EU) Biofuels Directive has set targets rising from 2% in 2005 to 5.75% by 2010. By 2020, 20% of conventional motor fuels will be replaced with alternate fuels (e.g. biofuels, natural gas, and hydrogen fuels). With these targets, the EU hopes to drastically reduce their greenhouse gas emissions and their reliance on imported crude oil. The US is targeting 20% by 2030.

The other ASEAN countries are also pushing the demand curve further through mandatory requirements on biofuels. Thailand, eager to reduce the cost of oil imports while supporting domestic sugar and cassava growers, has mandated an ambitious 10% ethanol mix in gasoline starting in 2007. For similar reasons, the Philippines mandated 2% biodiesel to support coconut growers, and 5% ethanol in 2007. Indonesia set a target of 10% biofuels by 2009. In Malaysia, a policy has been made to ensure the use of B5 blend of palm olein-based biodiesel into diesel oil, both in the transportation and industrial sectors in 2007.

The mandates were supported further with massive subsidies and non-tariff protection by the US and EU. The US spent about USD5.5 billion to USD7.3 billion a year to support biofuel production. The EU subsidies on biofuel production are equally stunning; to the tune of USD4.6 billion.

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From the desk of the Director General

Moving the Environmental Agenda



News and views emerging on the global environment are frightening. It is increasingly difficult not to paint a bleak picture even if we tried. In the midst of this climate of despair comes the spectre of a severe global economic recession. We are told the likes of this recession are a 'once in a lifetime' event. Even this fearsome development is met by environmental quarters with the stoic view that an economic slowdown will at least slow down the rate of environmental and ecological degradation, giving Mother Earth, breathing space. Somehow the picture in the mind of seeing people poor on a rich Earth seems more appealing than seeing rich people on a poor Earth. It seems a little heartless but we all know that humanity can eventually get out of an economic downturn. Getting out of an environmental downturn past the tipping point may not be easy or possible. We have to take action and fast.

Both the people and government of Malaysia will not and must not allow the economic agenda to derail the environmental agenda. It is crucial that the environmental agenda is moved forward. The environmental agenda has to be moved to the very top of our priorities and it must be done now! The dynamic imperative of sustainable development is a real issue, not a rhetorical one. We must review and reassess the condition of both our frontyard and our backyard. Picture our frontyard as all that is pretty and nice about economic development. And the backyard...all that is ugly about the lack of sustainable development. So where do we start this clean up?

We can start by seeking the common thread that unites and sustains the various sectoral policies, laws and regulations regarding the environment that were made over the years. This is important because there is the ever present danger of 'loosing the environmental plot' or to use a greenish metaphor, "we may end up not seeing the forest for the trees". We think the issue of climate change can be the unifying thread that we seek. It is the plot of our existence on Earth. It is the metaphorical forest that encompasses all the trees. We should view the thrust of our past, present and future environmental efforts through the prism of climate change. For clearly, climate change will have a profound impact on all of us. It will undoubtedly affect our economy, our social structures and relationships, and our environment. It will challenge natural and man-made systems that make up the global ecological system. The IPCC has identified two broad strategies for addressing issues of climate change. They are first, to mitigate or reduce greenhouse gas emissions; second to adapt to environmental changes attributable to global warming.

There are, in our minds, some major environmental issues on the table for Malaysians to consider. A few are discussed in this issue: possible use of nuclear energy? Promotion of biofuels including biodiesel from oil palm, air pollution, waste management, marine pollution and the pervasive use of Environmental Impact Assessments (EIA). When viewed through the prism of climate change, close scrutiny will slowly reveal the common thread that runs through all these issues. Policies, laws and regulations can be built around this central spine called climate change. Ideas, discussions and initiatives will surely be able to coalesce and gel onto this central framework. Slowly and surely humanity can find common cause and build a framework of shared ideas and solutions to deal with climate change. In doing so, we can move from a sectoral view of the 'particular' to the unifying principle of 'universality'.

Take the use of nuclear energy for instance. Leaders across the globe are now acknowledging that the use of nuclear energy is a potential solution to reducing carbon emissions. Currently, electricity production is responsible for an estimated one-third of all greenhouse gas emissions. Modern nuclear energy generation plants do not emit carbon dioxide. The world's 439 operating nuclear reactors reduce carbon dioxide emissions by 2.5 billion tonnes a year. But all are aware that the issues related to the use of nuclear energy like safety, security of supply of fissionable materials, waste management and cost effectiveness have to be carefully handled. We are not advocating the use of nuclear energy in this country but expressing how nuclear energy, promotion of biofuels, better systems of waste management and pollution monitoring and a more pervasive use of the EIA in project design, raw material use and energy consumption can all contribute towards alleviating global warming and climate change.

In a similar manner the various environmental issues need to be considered against a background of environmental conservation and sustainable development. If more and more countries make policy decisions on this basis we will increase our chances of avoiding an environmental catastrophe. This focus on sustainability rather than development per se can bring about change we can all believe in!

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The Biodiesel Market

The next relevant question is how big is the biofuel market? The answer is 'not big at all'. The share of biofuel in the world's energy stands at a meagre 1%, though it is accelerating rapidly (Shapouri, 2006). The two most common biofuels are ethanol and biodiesel. Production of biofuels in 2005 equalled nearly 2% of world gasoline use. From 2000–2005, ethanol production worldwide nearly tripled, from 4.6 billion to 12.2 billion gallons. Biodiesel was an estimated 790 million gallons in 2005 (Brown, 2006). In 2002, crude palm oil's (CPO's) consumption share in the global biofuel market was only 1% of that of soybean oil. Rapeseed oil accounted for 84% of biodiesel feedstock followed by sunflower oil at 13%.

Brazil and US together account for 90% of the world's fuel ethanol production. In Brazil, ethanol derived from sugar cane claims 41% of its automotive fuel needs. In the US, ethanol, mainly derived from corn, now makes up 2% of its high automotive fuel use. Europe ranks third in fuel ethanol output, with a significant share from France, the United Kingdom and Spain.

In the biodiesel sector, the EU which imports 75% of its fossil fuel requirements, dominates. As a result of its aggressive renewable fuels policy, the EU's total biodiesel production capacity was almost 2.4 million tonnes in 2004 (European Biodiesel Board, 2006). Currently, 90% of Europe's biodiesel is produced from rapeseed oil, because of its availability and quality. Biodiesel consumed about 45% of Europe's rapeseed oil. With the expected increase in demand for biofuel, the supply of rapeseed as feedstock may run out of demand, hence the need to look for alternative feedstocks. Palm and soybean oil provide viable alternatives as they are on average 25% cheaper than rapeseed oil. In 2005, 1.5 million tonnes of palm oil were used as fuels in European power plants.

Malaysia's Response

Looking at the demand side, there is substantial case for palm oil as the feedstock for biodiesel in EU. Malaysia and Indonesia account for 85% of the world's production of palm oil and between them, they have the potential to capture 20% of the biofuels market share in Europe. Malaysia and Indonesia are setting aside 40% or 6 million tonnes of their CPO for biofuel production. Though both countries continue to increase their palm oil output, they differ in their ratio of usage. Malaysia cultivates 70% of its crop for industrial uses, including household products as well as fuel, while the remainder goes into food products. As for Indonesia, 30% is used for fuels and other industrial products.

Clearly, Malaysia has responded to the call for biofuel with eagerness. In line with the existing

'Five-fuel Diversification Policy', the Malaysian Government launched the National Biofuel Policy in August 2005. The National Biofuel Policy consists of three important strategies: (1) production and utilisation of biofuel for transportation, (2) production of biofuel for export, especially to the European market, and (3) commercialisation of biofuel technology as a local technology.

Malaysia is one of the signatories to the Kyoto Protocol to reduce greenhouse gas emissions. The use of palm biodiesel is expected to help reduce the use of fossil fuel and indirectly reduce the emissions of greenhouse gases. Additionally, the move to produce palm biodiesel is assumed to promote rural development through creating more employment opportunities.

Despite concerns developing in the palm oil industry that the biodiesel business may lose its viability if crude oil prices fall below the USD50 per barrel level, interest in the biodiesel business has been growing. Globally, 600,000 tonnes of crude palm oil were used for biodiesel production in 2005 and this was estimated to grow to one million tonnes in 2007 (Chowdhury, 2007). Exporting biodiesel is a major thrust for the biodiesel industry in Malaysia and in 2007 the volume of exports was 95,000 tonnes (MPOB, 2008), mainly imported by USA (58%) and Europe (28%).

The Economics of Biodiesel

The economics of palm oil biodiesel appears good too. Palm oil's fuel yield per hectare is the highest among crops, that is, 3000 litres/ha compared to soybean (524 litres/ha), rapeseed (638 litres/ha), corn (172 litres/ha) and rice (828 litres/ha) (Phillipe, 2005). The cost of raw materials [crude palm oil (CPO)] is relatively cheap as CPO is being traded, on average, at USD99 per tonne discount to soybean and USD83 per tonne discount to rapeseed oil (Table 1). Besides, supply is consistent and available all year round. In terms of cost competitiveness, palm oil is relatively competitive. In the absence of subsidies, palm

oil is the most competitive vegetable oil for the production of biodiesel.

Beyond Economics

The worth of a project goes beyond economic reasons. Biodiesel may have its economic justifications, but the trade-offs may prove otherwise. Let us look at the intricate relationship between economics and non-economic implications of biodiesel production.

One of the major economic impacts of the biofuel surge in demand was an increase in the price of feedstocks including palm oil. It was good for the country's coffers and the industry participants at large. However, food takes the heaviest toll in the form of higher prices, unprecedented in history. Malaysia has always been a net importer of food, recording a whopping RM9.7 billion deficit in 2007 which is expected to grow bigger in view of the food price hikes. Hence, for a net food importer like Malaysia, food security may override the concern for biofuel production in the long term.

The diversion of food commodities to biofuel has merely increased food prices, the extent of which was not foreseen by many. As indicated in Figure 1, in nominal terms, the price of rice has increased 221% between January 2007 and April 2008 reaching a peak at USD1015 per tonne. Meanwhile, the price of wheat increased by 84% and maize by 39% during the same period. The International Monetary Fund (IMF) has estimated that 20 to 30% of the food price increases in the past two years are accounted for by biofuels, and that last year they accounted for about half the increase in demand for principal food crops. According to the Organisation for Economic Cooperation and Development (OECD), biofuels explained nearly 60% of the increase in usage of cereals (principally in the US) and vegetable oils (mainly in Europe) between 2005 and 2007.

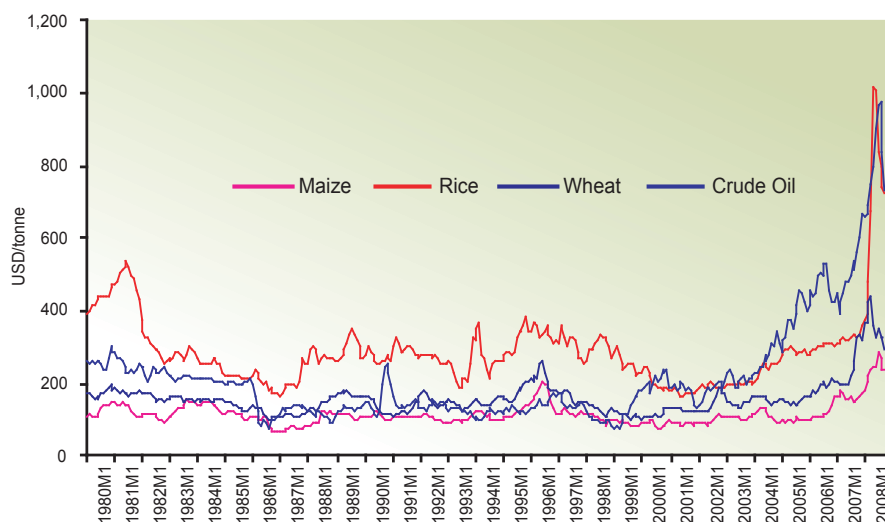
The increase in food prices reduces the welfare of many, particularly the poor. In Malaysia, the

Table 1: Estimated biodiesel production cost comparisons (USD)

Cost Component (USD/tonne)	Palm Oil	Rapeseed Oil	Soybean Oil
Feedstock (FOB at producing country)	547	800	601
Bio-diesel production cost:			
Solvents, acids and chemicals	47		
Other costs	35		
Adjustment for Energy Parity with petroleum diesel (based on 90% of kj/kg of energy of petro-diesel)	55		
Total	137	196	150
Cost of palm oil bio-diesel (FOB Malaysia)	684	996	751
Est. freight & insurance cost to Rotterdam	70		
Total landed cost in EU	754	996	801
Local distribution	~30-50	~30-50	~30-50
Total cost EU (at petrol kiosk)	784-804	1,029-1,046	831-851
Price of retail biodiesel (Germany)		1,332	

Notes: Assuming production plant with capacity>100,000tonnes/annu; other figures based on pricing as at March 2007
Source: Rabobank analysis

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Source: International Monetary Fund (2008)

Figure 1: Crude Oil and Selected Cereal Prices, Jan. 1980 – Sept. 2008 (USD/tonne)

Consumer Price Index has increased by 4.8% between January and August 2008 at 110.4 compared to 105.3 in August in the year before. The real income of the poor has declined and food security has become a major concern of the country. A national food security plan was announced to boost local food production and to ensure food security in the future.

Biofuel crops are land intensive. The US and Canada would have to utilise one-third of their land areas to achieve 10% renewable energy mandate, while in EU, it would be two-thirds of their agriculture land (Blumenthal, 2006). Besides, biofuel crops need agricultural inputs such as industrial fertilisers which require fossil energy for their production and transportation. This would negatively affect the contribution of biofuels to reducing atmospheric carbon dioxide. Moreover, the use of so much land to meet a relatively small share of transportation fuel demand just does not make sense.

The conventional use of land – food-feed-fibre – has a new dimension. There is now fuel creating competition that pushes the prices higher. Producers may enjoy higher prices, but the majority of consumers who happen to fall under the category of 'low income' may suffer real income decline. Food politics should not be underrated as proven in the past. High food prices are fertile seeds for social unrest.

The environmental impact of palm oil mono cropping in large scale plantations has not received due consideration. A century ago, 80-90% of Indonesia was covered with tropical rain forest with the richest plants and animal species in the world. In 1997, this was reduced by half. At this rate, it is estimated that all Indonesian lowland tropical forests will be wiped out by 2010. Malaysia may suffer the same fate if we lack the compassion and understanding of the

role of biodiversity to human life. The clearing up land for expanding palm oil plantations will pose a major threat to plant and animal diversity.

Biofuel production may have other environmental consequences, including soil erosion. Land clearing causes considerable increases in topsoil run-off, disturbs stream-flow and increases sediment loads in rivers and streams. The intensive use of agro-chemicals in the oil palm plantation sector (around 25 different pesticides may be used) is a serious hazard to mankind, particularly when there is loose monitoring of workers in the plantations.

The perception that palm-based fuels would be much better for the planet than fossil fuels is being questioned. This is based on the assumption that while they grow, they absorb as much carbon as they later produce when being burned. As a result they offer a great reduction in carbon emissions. However, this notion no longer holds. Cropland does not absorb anything close to the rainforest that it replaces.

The Morale of the Story

Biofuel has been perceived as one of the solutions for global problems such as GHG emissions and fossil fuel energy independence. Clearly there is a big mismatch here, where the global carbon problem created mercilessly by many developed countries over the past 100 years is left to be shouldered upon nature's green plants which are not only delicate and highly vulnerable but are food necessities to mankind. This is not a fair equation. Besides, morally it is questionable when large amount of crops and land and other resources are diverted to produce fuel for vehicles in the developed and fast moving economies when food is in demand worldwide, climate continues to change extremely, land and water resources continue to dwindle and nature's biodiversity is about to become extinct.

That statement summarises the premise to evaluate the future of biodiesel development in Malaysia. It calls for the realisation that the environmental, economic and social benefits of biodiesel are not straightforward. The trade-offs need to become clearer to all stakeholders. A number of policy options have to be explored in order to strike a balance between the economic benefit and cost to the environment and resources. First in the list is the priority of resource use that has to be right. The major determining factor is 'sustainability of resource' in every sense of the word. The tangible economic contribution of the biodiesel industry has been identified and policy instruments to spearhead the development have been deliberated (Basiron, 2008). While economic justifications are important for growth, conservation of resources (including Malaysia's richness in plants and animals diversity) and environment is the key to long term sustainable development of this industry.

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Source

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The Global Resurgence of Nuclear Energy

Global energy security and climate change concerns sparked by escalating oil prices, high population growth and the rapid pace of industrialisation are fueling the current interest and investments in nuclear power. Globally, policy makers and energy industry leaders, are evaluating either a new or an expanded role for nuclear power.

The resurgence of nuclear energy is thus inevitable, shifting it from obscurity, in particular after the Three Mile Island accident and Chernobyl disaster, into the spotlight once again.

Presently only 31 countries or 16 % of the 192 United Nations Member States operate nuclear power plants. The European Nuclear Society (ENS) highlighted that as of end 2007, there were 439 nuclear power units with 372 gigawatt-electric GW(e) of installed electricity generating capacity in 31 countries. The World Nuclear Association (WNA) had reported that these provided 2608 billion kWh, supplying about 15% of the world's electricity (Table 1). In the lead for advanced nations include France (77 %) followed by Belgium (54%) and Sweden (46%). Large developing countries such as Brazil, India and China have about only 2-3 % of their electricity generated from nuclear power.

Recent Global Scenario

Global leaders are presently under immense pressure to meet growing energy demands while trying to fulfill international obligations to curb carbon emissions. Many are now acknowledging that nuclear energy is a potential, attractive and cost-effective solution.

Subsequently a growing number of countries and government have expressed interest in nuclear power programmes and this has put nuclear power back on the agenda for many nations.

Table 1: Worldwide number of nuclear reactors and nuclear power capacity as of end 2007 and October 2008.

Countries	Nuclear Electricity supplied in 2007		Reactors in Operation, (As end 2007)		Reactors under Construction, October 2008 (IAEA 2008)		Reactors on Order or Planned October 2008		Reactors Proposed October 2008	
	or TWh	%	No of Units	MW(e)	No of Units	MW(e)	No of Units	MW(e)	No of Units	MW(e)
1 Argentina	6.7	6.2	2	935	1	692	1	740	1	740
2 Armenia	2.35	43.5	1	376	-	-	0	0	1	1000
3 Bangladesh	0	0	0	0	-	-	0	0	2	2000
4 Belarus	0	0	0	0	-	-	2	2000	0	0
5 Belgium	46	54	7	5,824	-	-	0	0	0	0
6 Brazil	11.7	2.8	2	1,795	-	-	1	1245	4	4000
7 Bulgaria	13.7	32	2	1,906	2	1906	2	1900	0	0
8 Canada	88.2	14.7	18	12,621	-	-	3	3300	4	4400
9 China	59.3	1.9	11	8,438	6	5,220	26	27620	76	62600
10 Czech Republic	24.6	30.3	6	3,619	-	-	0	0	2	3400
11 Egypt	0	0	0	0	-	-	0	0	1	1000
12 Finland	22.5	29	4	2,696	1	1600	0	0	1	1000
13 France	420.1	77	59	63,260	1	1600	0	0	1	1600
14 Germany	133.2	26	17	20,470	-	-	0	0	0	0
15 Hungary	13.9	37	4	1,829	-	-	0	0	2	2000
16 India	15.8	2.5	17	3,782	6	2,910	10	9760	15	11200
17 Indonesia	0	0	0	0	-	-	2	2000	2	2000
18 Iran	0	0	0	0	1	915	2	1900	1	300
19 Israel	0	0	0	0	-	-	0	0	1	1200
20 Japan	267	27.5	55	47,587	1	866	11	14945	1	1100
21 Kazakhstan	0	0	0	0	-	-	0	0	2	600
22 Korea DPR (North)	0	0	0	0	-	-	1	950	0	0
23 Korea RO (South)	136.6	35.3	20	17,451	4	3,840	5	6600	2	2700
24 Lithuania	9.1	64.4	1	1,185	-	-	0	0	2	3400
25 Mexico	9.95	4.6	2	1,360	-	-	0	0	2	2000
26 Netherlands	4.0	4.1	1	482	-	-	0	0	0	0
27 Pakistan	2.3	2.34	2	425	1	300	2	600	2	2000
28 Romania	7.1	13	2	1,310	-	-	2	1310	1	655
29 Russian Federation	148	16	31	21,743	8	5,809	12	14340	25	22280
30 Slovakian Republic	14.2	54	5	2,034	-	-	0	0	1	1200
31 Slovenia	5.4	42	1	666	-	-	0	0	1	1000
32 South Africa	12.6	5.5	2	1,800	-	-	1	165	24	4000
33 Spain	52.7	17.4	8	7,450	-	-	0	0	0	0
34 Sweden	64.3	46	10	9,014	-	-	0	0	0	0
35 Switzerland	26.5	43	5	3,220	-	-	0	0	3	4000
36 Taiwan	38.4	19.3	6	4,921	2	2,600	-	-	-	-
37 Thailand	0	0	0	0	-	-	0	0	4	4000
38 Turkey	0	0	0	0	-	-	2	2400	1	1200
39 Ukraine	87.2	48	15	13,107	2 (0)	1,900 (0)	2	1900	20	27000
40 United Kingdom	57.5	15	19	10,222	-	-	0	0	6	9600
41 United States	806.6	19.4	104	100,582	1 (0)	1,165 (0)	12	15000	20	26000
42 Vietnam	0	0	0	0	-	-	0	0	2	2000
TOTAL for WORLD	2608	15%	439	372,100 = 372 GW(e)	38	32,648 = 32.6 GW(e)	99	108,675	233	211575

Source : 1. Power Reactor Information Systems, IAEA-<http://www.iaea.org/programmes/a2/index.html>
2. IAEA - for nuclear electricity production & percentage of electricity (%) 5/08.
3. European Nuclear Society
4. Reactor data: World Nuclear Association (WNA) up to 30 September 2008

In the US, although its nuclear industry was dormant for nearly three decades as it had not received an application for a new nuclear plant since 1973, a changing landscape is observed. The US Nuclear Regulatory Commission (NRC) has received 17 licence applications to build 26 new nuclear reactors since mid-2007.

Europe is also poised to witness a renaissance in nuclear power. Sweden has announced a new nuclear policy to reverse the decision of a 1980 referendum to phase out nuclear reactors by 2010 whilst a referendum in Switzerland has rejected a nuclear moratorium on new nuclear plants. Belgium has extended its phase-out period for at least another 20 years.

China, India and Brazil are embarking on ambitious plans to add more nuclear capacity over the next decade. China plans to add as many as 63 nuclear reactors, nearly quadrupling its current fleet of 16. India is building 7 reactors. Vietnam intends to begin construction of its first nuclear power plant in 2015. Indonesia plans to build two 1000MW reactors in central Java, while Thailand's Energy Generating Authority announced plans to build two large nuclear plants, with construction to begin in 2015. Singapore may consider using nuclear power and could even look into building an underground plant because of its limited space. Gulf countries such as Qatar and Abu Dhabi have signed agreements with French companies to build third-generation nuclear reactors.

So far, 38 new nuclear power plants with an installed capacity of 32.6 GWe are being constructed in 14 countries and well over 100 more nuclear power plants have been written into the development plans of governments for the next three decades (Table 1 on page 5).

Advantages of Nuclear Energy

This global resurgence of an optimism as well as enthusiasm regarding nuclear energy is

attributed to several key factors. These include global competition for energy resources, proven performance and safety of current nuclear reactors and plants, advanced technologies and designs to further enhance safety and efficiency, the best capacity factor of any electricity generating technology in the country, the need for more reliable continuous power, sufficient fuel supply, favourable economics, and increasingly tight restrictions on emissions of carbon dioxide plus opinion shift of and growing support from public and policy makers.

1. Safety

The main aim of reactor safety is to ensure that the radioactive fission products generated in the reactor are contained under all circumstances and no harm is caused to plant personnel and the public. Enhanced safety and security measures of the current nuclear reactors worldwide, with no incidences, are now presenting a good economic and business case for countries and businesses to consider nuclear energy (Ball *et al.*, 1994; Paul Scherrer Institute, 2001).

2. Security of Supply

Unlike other sources of energy, which are estimated to be depleted within a period of time frame, uranium, the natural material for fuelling nuclear power plants, is plentiful, relatively affordable and well distributed across the planet and will thus be available for a much longer term.

3. Reduction in Carbon Emission

Electricity production currently is responsible for an estimated one-third of all greenhouse gas (GHG) emissions, largely emitted by fossil fuels. In contrast to fossil fuels, nuclear power plants which generate heat from fission rather than by burning fuel, do not emit carbon dioxide. (Fig. 1) Presently, on a global scale, the world's

439 operating nuclear reactors reduce carbon dioxide emissions and save the planet from some 2.5 billion tonnes per year, which would have been emitted had coal been used instead.

4. Cost-effectiveness

As the technology has matured, nuclear power has also proven to be both reliable and economically competitive. The World Nuclear Association (WNA) further reported that its August 2003 figures put nuclear costs at EUR 2.37 c/kWh, coal 2.81 c/kWh and natural gas at 3.23 c/kWh (on the basis of 91% capacity factor, 5% interest rate, 40-year plant life). Hence, as our economic growth is inextricably linked to affordable abundant electricity, the relatively cheaper cost of generating nuclear energy is another plus factor for policy and decision makers to consider and chose nuclear.

How Does Resurgence in Nuclear Energy Impact Malaysia?

The recent challenges confronting the global community relating to energy security and global warming have caused policy makers in Malaysia to re-examine the role of nuclear power in Malaysia.

Consensus has started to emerge amongst policy and decision makers on the relevance of considering nuclear energy:

"Ministry of Energy, Water and Communications and Ministry of Science, Technology and Innovation (MOSTI) are jointly preparing a Paper on the proposed use of Nuclear Energy to the Cabinet"

Source: Bernama, 27 June 2008

Budget 2009 marks an important milestone for the nation and energy sector as, YAB Datuk Seri Abdullah Hj Ahmad Badawi, the Prime Minister of Malaysia had announced that it is imperative for Malaysia to look for new, long-term solutions for its energy needs, to ensure energy security, including developing viable alternative energy sources, such as solar, wind, and biofuels, apart from exploring nuclear energy.

For Malaysia to shift from previously according nuclear as the last option to incorporating nuclear as a component in the nation's energy policy requires us to embrace change. And a critical solution would encompass a definitive political/ leadership decision, shift in public opinion and acceptance accompanied by a significant increase in investments and human capital.

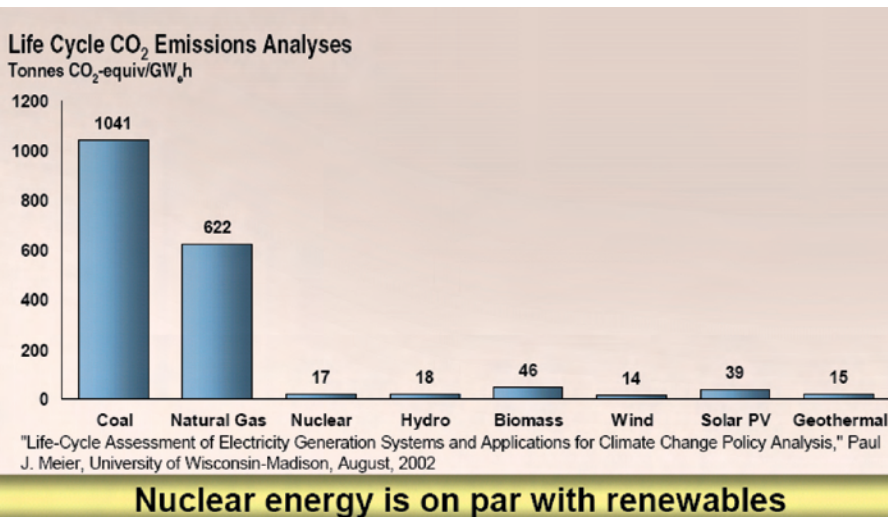


Figure 1: Nuclear: Toward a lower carbon energy future

Thereafter, there is an urgent need to fast-forward an actionable agenda for Malaysia, in the form of a national nuclear power plan and policy or national nuclear energy strategy that must fundamentally also include a communications and financing strategy primarily to enhance public and investor awareness and acceptance to transform nuclear energy from a plan into reality.

“This nuclear energy is vital following the increase in world fuel price and our limited oil reserves. Moreover, nuclear energy is cheap and clean”

YB Datuk Dr Maximus Ongkili
Minister of Science, Technology and Innovation

Source: Bernama, 19 August 2008

“Nuclear Energy is the most attractive option as the alternative source of power for Malaysia if it wants to be competitive beyond 2020”

YB Datuk Shaziman Mansor
Minister Energy, Water and Communications

Source: Biz News, page 28 *New Straits Times*, 13 November 2008.

Issues and Challenges and Proposed Action Agenda

A checklist, though not exhaustive, may be used as reference in charting the new developments that are taking place and those that are further required to be executed for successful introduction and implementation of a Nuclear Power Programme (NPP) in Malaysia. These are:

1. Public announcement and news stories regarding nuclear energy in the media – Ongoing
2. Seek and Maintain Public Approval
A comprehensive Public Awareness Programme and Communications Strategy to explain all aspects of nuclear technology particularly to remove fears related to nuclear radiation, waste management and safety issues, must strive to reach a target audience or group covering policy and decision-makers, investment target groups, businesses and industries, students and teachers, media representatives and the general public.
3. Nuclear Power Option included within the National Energy Strategy/policy
4. Conduct Feasibility Study including selection of sites

5. Enabling legislation
6. Seek and secure funds for NPP investment.
For countries just starting to embark on a NPP, the construction of the first new nuclear power plant is always regarded as a relatively high-risk undertaking by the electric utilities and the financial community. Hence engaging several potential investors including the electric utilities, Government-Linked Companies (GLCs), and the Finance and Banking sector would be a crucial first step to share with these investors the benefits and potential of nuclear power.
7. Successful research and development (R&D) and demonstration of advanced technologies
Nuclear R&D agencies may need to relook and review their past R&D strategic plans with a view to aligning them to present and future demands. Discussions and engagement with all relevant stakeholders need to be undertaken to enable a Technology and Human Capital Roadmap to be formulated so as to identify new research areas to be embarked upon as well as required human and financial resources.
8. Nuclear Engineering Enrolment and Staffing
There is an immediate need to elevate the image and to increase career awareness in the nuclear energy sector through outreach efforts with industries, professional societies, in schools and universities through the Internet and other media. In terms of current and future staffing, it is pertinent to ensure availability of qualified manpower for all activities which are required (e.g. nuclear power planning, project management, operations, maintenance and regulation etc)
9. Ready to invite bids for the first Nuclear Power Plant
10. Construct, license and operate nuclear power plant / successful completion of the first nuclear power plant. Ready to commission and operate first nuclear power plant.
11. Nuclear Safety, Security and Safeguards (3S)
It is fundamental that the power plant be closely supervised and scrutinised by national regulatory bodies to ensure safety at every phase including design, construction, commissioning, trial operation, commercial operation, repair and maintenance, plant upgrades, radiation doses to workers, radioactive waste management and ultimately, plant decommissioning.

12. Safe, transparent and economical waste disposal.
Plans for waste disposal in almost all countries with commercial nuclear power plants are based on the placement of the waste in deep geological repositories. Spent reactor fuel is currently stored on-site in the U.S. at power plants until it can be shipped to a centralised site for storage. Sweden stores its used nuclear fuel in a geological stable repository. In other nations, including France, spent fuel is shipped to commercial reprocessing plants, recycling the extracted uranium and plutonium, vitrifying and storing the highly radioactive wastes. Hence these options of storing spent nuclear fuel in a geological stable repository or reprocessing them can be considered.



Conclusion

Lastly, apart from enhancing energy security for Malaysia, nuclear power plants also provide thousands of highly paid construction jobs and long-term employment for hundreds of engineers, scientists and skilled technicians – just the kind of new economy jobs that Malaysia would benefit from.

The availability of clean, reliable and affordable energy will not only benefit consumers but also businesses and investors as this will enable Malaysia to offer a competitive cost of doing business which would ultimately designate Malaysia as a preferred location for business and investment.

In the long term, investment in nuclear power would position Malaysia as a center of nuclear energy production, research and education in addition to a hotspot for business and investment.

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A New Era of Solid Waste Management Where Are We Heading?

Solid waste is a persistent but unnoticed part of our lives. Today, many countries are facing a looming solid waste management crisis as their disposal sites reach capacity and continue to degrade the environment. However, new and innovative waste collection and management systems can help to reduce solid waste disposal and subsequently minimise environmental and health impacts.

Malaysia should be prepared and able to create a solid waste management plan that suites the local demands and expectations. The question is: Should we duplicate existing practices that have already been implemented elsewhere? Or should we institute a new and innovative system based on local conditions? This paper elaborates some common practices in developed countries, which will provide some insights on the possible future direction of solid waste management in Malaysia.

Solid Waste Management in Malaysia – a New Era

Solid waste management in Malaysia has entered a new era with the enactment of the new Solid Waste and Public Cleansing Management Act (Act 627) in August 2007. This Act was enacted to allow for centralised and coordinated management of solid waste by the Federal Government of Malaysia. In other words, the power of managing the solid waste including the public cleansing (road sweeping, drain cleaning and grass cutting etc.) will be federalised or taken over by the Federal Government from the Local Authorities.

While many countries in the world are moving towards 'decentralisation' of solid waste management, Malaysia is moving in the opposite direction. Certainly Malaysia needs to find its own unique formula to ensure successful enforcement of the Act, to achieve an effective solid waste management that is of high quality and fulfill the needs and expectations of Malaysians as a whole. The establishment of the new National Solid Waste Management Department (JPSPN) and Solid Waste and Public Cleansing Corporation (PPSPPA), as well as the privatisation plan to divide the country into three concessionaire zones constitute a part of the strategies tailored under the new Act. However, other approaches are needed particularly at micro scale to create a mechanism that is able to steer our path in this new era of solid waste management in Malaysia.

Act 627 – Where are we heading?

Act 627 empowers the Minister to publish matters which promote reduction, reuse and recycling of controlled solid waste, including possible mandatory source separation of recyclable materials. In addition, it also empowers the Minister to establish a possible take back system and deposit refund system for certain specific products or goods. However, there is no clear indication as to which system should be implemented in Malaysia, given local needs and most importantly, one that is acceptable by Malaysians. Some examples of common practices implemented in developed countries are described below.

Kyoto, Japan – “Pay as You Throw”

In communities with “Pay as You Throw” (PAYT) system, residents are charged for the collection of solid waste, based on the amount they throw away. This creates a direct economic incentive to recycle more and to generate less waste.

Traditionally, residents pay for waste collection through property taxes or a fixed fee, regardless of the quantity of waste they generate. “Pay as You Throw” idea breaks the tradition by treating waste collection services in a similar manner to electricity, water and other utilities.

Most communities with PAYT charge residents a fee for each bag or bin of waste they generate. In some communities, residents are billed based on the weight of their waste. Either way, these systems are simple and fair. The less you throw away, the less you pay.



The PAYT system was introduced in Kyoto, Japan in October 2006, in which household waste is collected for 1 yen (about RM0.035) per litre and recyclables such as cans, glass bottles, and PET bottles are collected for half that price. For example, a 120-litre waste bag of household waste, not including recyclable materials, would cost 120 yen for collection (about RM4.20).

It was reported that about 9 months after the fee-based waste collection system was introduced in Kyoto, the volume of household waste generated had dropped by 17%. Over 50% of people who responded to a public survey conducted by the city in February 2007 said that they had significantly changed their waste handling habits as a result of the PAYT system.

The PAYT system also comes in several other varieties. For example, some cities in the Netherlands have a similar system but based on waste weight, which is tracked by a computer chip embedded in the waste bins. In the United States, there are now more than 7,000 communities managing their solid waste following the PAYT system. The PAYT programmes have been shown to reduce waste generation in the United States by 4.6 to 8.3 million tonnes annually.

North Sydney, Australia – “Throw More, Pay More”

The “Throw More, Pay More” (TMPM) system is implemented by North Sydney City Council, Australia. The difference between TMPM and PAYT system is that the PAYT system implies direct payment for each bag of waste discarded by volume or weight, while TMPM system implies payment only if the waste discarded exceeds a standard waste collection service limit, which is covered under property taxes or a fixed fee.

In North Sydney City, the collection service provided is only to collect one waste bin of 60 litre per week for each residential house. There is a strict limit to the number of waste bins that each property is entitled to be collected:

- Cardboard boxes, rubbish bags or any other receptacles used for waste other than the approved bin will not be collected.
- Bins that are overloaded or exceed the size limit of one 60 litre bin per house or 240

litre bin per four units, will not be collected unless appropriate excess arrangements have been made.

Excess waste stickers are available from the Council at a cost of A\$5 (About RM12) per 60 litre bin. These stickers must be attached to the extra bin or it will not be collected. Flat or unit dwellers sharing a 240 litre bin are required to buy four stickers totaling A\$16 (About RM38) per extra 240 litre mobile bin service.



Christchurch, New Zealand – “26 bags System”

The system implemented in Christchurch, New Zealand, is also a TPM system, but the Council implies standard collection service based on a fixed number of waste bags provided instead of size limit to the waste bin.

The assessment tax paid by the residents covers the supply, collection and disposal of 26 black waste bags a year. Only official Council waste bags which can be identified by the Council logo printed on the bag will be collected. The bags must be securely tied and weigh no more than 15kg each.

In May each year, waste bag coupons are delivered to the household owners. These coupons can be redeemed for 26 waste bags at most supermarkets and also at Council service centres. The residents are required to redeem all their 26 waste bags by 31 July each year.

The residents can decide to use as many waste bags as they wish on collection day. However, each household in Christchurch is entitled to only 26 waste bags each year, or in other words, once the 26 waste bags provided by the Council are used, the residents have to purchase additional waste bags, which can be purchased from the Council service centres and most supermarkets in Christchurch. Currently, the purchase price for additional bags is NZ\$8 (About RM17) for 5 bags at the Council service centres, or at a slightly higher price at the supermarkets.

Nova Scotia, Canada – “Deposit Refund System”

The deposit-refund system (DRS) is a system that requires consumers to pay a deposit when purchasing a product, which is subsequently refunded when consumers return the reusable part of the product.

DRS in Nova Scotia Province of Canada has been in place since 1996. The system is part of the Province's Solid Waste Resource Management Strategy, which sets out a plan to help Nova Scotians divert 50% of the waste going into landfills.

The DRS covers all beverage containers of less than 5 litres sold in the province, which is legislated under the Solid Waste Resource Management Regulations except milk, milk products, soya milk or concentrates. The regulations require that all beverage containers sold in the province are subject to the DRS and shall be either refillable or recyclable.



Consumers pay a deposit on all regulated beverage containers sold in the province based on container type and size. The Resource Recovery Fund Board (RRFB) that operates the system in Nova Scotia has a network of 83 ENVIRO-DEPOT locations throughout the Province. Consumers will bring their redeemable beverage containers directly to these depots for the refund. The price for deposits in Nova Scotia is C\$0.10 to C\$0.20 (about RM0.30 to RM0.60) depending on the container volume.

However, only half of the deposit money is redeemed once the container is returned. The halfback revenue, in addition to unredeemed deposit amounts plus the revenue generated from the sale of container materials, support the operation of the entire system. This arrangement, allows for very minimal cost on the part of the government since the system is able to self-finance RRFB to operate the system.



As a result of Nova Scotia's DRS, fewer beverage containers of all types are being sent for disposal or end up as litter on the road. According to the RRFB, the overall recovery rate in Nova Scotia for redeemable beverage containers in fiscal 2005 was 79.3%. As of March 2005, over 1.7 billion beverage containers had been recycled through the system. This has reduced the costs for taxpayers, and the DRS has created approximately 300 jobs through the province's ENVIRO-DEPOT network.

Conclusion

Mismanagement of solid waste can have harmful impacts on the environment as well as human health. Experiences from developed countries show that extensive recycling efforts, coupled with an innovative waste management system will be able to reduce the overall quantity of solid waste that needs to be disposed.

We could learn from the different experiences of other countries. However, there is a big difference between the direction of Malaysia and most other countries since we are moving towards federalisation of solid waste management, while other countries are mostly implementing solid waste management at local level. It is no doubt a big challenge to change a solid waste management system which is already deep-rooted in the country for decades. We probably have a long way to go, but the relevant stakeholders and players in solid waste management and public cleansing in Malaysia are ready to accept the new move of the Government towards federalisation. It is certainly a great challenge. It is hoped that federalisation will achieve its goal of ensuring that all Malaysians are able to enjoy a high quality and cost effective solid waste management and public cleansing service in the long run.

Source

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Air Quality and Likely Health Effects

Air pollution in Malaysia caused mainly by domestic sources and from transboundary movement of pollution particularly in July - October each year from Indonesia. Currently the main domestic sources include vehicular emissions (89%) especially in commercial areas, power plants (9.2%), industrial processes such as cement plants, iron and steel mills from industrial zones (1.5%) and open burning at solid waste dumpsites (0.3%). The large increase in the number of motor vehicles in Malaysia, from 5.7 million (1993) to more than 12.8 million in 2003 (MOT, 2006) is the main contributor of nitrogen oxides (70%) and carbon monoxide (98%) as well as particulate matter (8%).

Transboundary pollutants in the form of fine particulate matter from forest fires during the dry seasons (July-October) are also transported to Malaysia almost every year. The worst of these recurring haze episodes was the one which prevailed over much of South-east Asia in 1997. Widespread forest fires in Kalimantan and Sumatra were triggered by extremely dry weather brought about by the El Nino phenomenon. The Klang Valley and Kuching in Sarawak were among the worst hit areas in Malaysia and the health consequences have been well documented by various authors (Jamal *et al.* 1998; Jamal *et al.* 2004). On several occasions during the dry months, the transboundary air pollution could have been further aggravated by peat soil burning especially within and around the Klang Valley (Mahmud 2007; Sharifah Mastura Abdullah *et al.* 2007).

Since the 1997 haze episode, there have been two other severe haze occurrences experienced in Malaysia, one in 2005 and the other in 2006. The haze episode in 2005 started at the beginning of August and became worse round about 12 August. At its worst, some parts in Selangor (Port Klang and Kuala Selangor) were declared as haze emergency zones with API rising above 500.

The Department of Environment (DOE) monitors the status of air quality throughout the country. Currently there are 50 National Air Quality Monitoring Stations maintained by the DOE, which take real-time measurement of pollutants in the ambient air (DOE, 2006).

Health Effects of Air Pollutants

Air pollution affects three major systems of the body namely, the respiratory, circulatory and the olfactory systems. Of the three, the respiratory system is the principal route of entry of air pollutants and is the most affected.

In some cases, air pollutants can even alter the function of the lungs. The health effects attributed to air pollutants range from mild eye irritation to mortality.

It can be observed from Table 1 that while specific air pollutants are associated with certain health effects, in reality all of the pollutants recognised in the Table act together to affect human health and hence the net consequences could be even more complex. NO_x as well as sulphur dioxide, SO₂, for example, will react with water vapour in the atmosphere to form a weak acid. Together with PM₁₀ and the other smaller size particulates, it can cause severe health effects. Indeed, at high concentrations and for an extended period, it can cause death particularly among the elderly and infants.

Nitric acid and related particles formed when NO_x reacts with ammonia, moisture, and other compounds, have implications on human health which include effects on the respiratory system, damage to lung tissues, and premature death. Fine particles penetrate deeply into the deeper reaches of the lungs. These can cause

or worsen respiratory diseases like chronic obstructive pulmonary diseases (COPD).

Increases in ambient PM₁₀ concentration can also lead to significant impacts on the respiratory health of children, the elderly and susceptible individuals e.g. reduced lung function, asthma, pneumonia, bronchitis and emphysema (Juliana 1998; Zailina *et al.* 1996; 1997; Shamsul 2002).

The MAAQG and API

Currently Malaysia has no ambient air quality standards to speak of. However, we do have the Malaysian Ambient Air Quality Guidelines (MAAQG) which is based on WHO Guidelines and standards from elsewhere such as the United States, Japan and Europe, and the Air Pollutant Index (API) as a measure of outdoor air quality.

The MAAQG prescribes ambient guidelines for 7 air pollutants (Table 2). Five of these 7 pollutants (ozone, carbon monoxide, nitrogen dioxide, sulphur dioxide and PM₁₀) have the greatest impacts on human health, especially on respiratory and cardiovascular morbidity and mortality (Jamal

Table 1: Selected air pollutants and associated health effects.

Pollutant	Health effects
CO	<ul style="list-style-type: none">Reduction in the ability of the circulatory system to transport O₂Impairment of performance of tasks requiring vigilanceAggravation of cardiovascular disease
NO _x / NO ₂	<ul style="list-style-type: none">Increased susceptibility to respiratory pathogensNitric acid and related particles formed when NO_x reacts with ammonia, moisture and other compounds, have human health implications which include effects on the respiratory system, damage to lung tissues, and premature death. These can cause or worsen respiratory diseases like chronic obstructive pulmonary diseases (COPD) which include emphysema and chronic bronchitis, as well as aggravate existing heart disease.
O ₃	<ul style="list-style-type: none">Decrement in pulmonary functionCoughing, chest discomfortIncreased asthma attacksEven at low levels, ground level ozone can trigger a variety of health problems including aggravated asthma, reduced lung capacity, and increased susceptibility to respiratory illness like pneumonia and bronchitis. Ozone can irritate lung airways and cause inflammation (Burnett <i>et al.</i> 1998; Dockery <i>et al.</i> 1993). Other symptoms include wheezing, coughing, pain when taking a deep breath, and breathing difficulties during exercise or outdoor activities (Dockery <i>et al.</i> 1993)
SO ₂ / particulates	<ul style="list-style-type: none">Increased prevalence of chronic respiratory diseasesIncreased risk of acute respiratory diseasesPM₁₀ associated with increased cardio-pulmonary mortality (WHO 2003)Reduction in lung function growth in children in areas with high PM₁₀ (Ganderman <i>et al.</i> 2000)Increase in ambient PM₁₀ concentration can lead to significant impacts on the respiratory health of children, the elderly, and susceptible individuals e.g. reduced lung function, asthma, pneumonia, bronchitis and emphysema (Juliana 1998; Zailina <i>et al.</i> 1997; Shamsul 2002)
Peroxyacetyl nitrate, aldehydes	<ul style="list-style-type: none">Eye irritation

Source: Stern *et al.* 1984; Jamal *et al.* 2004; Ganderman *et al.* 2000

et al. 2004). The same 5 pollutants are also used as criteria in the computation of the API.

Table 2: Malaysian Ambient Air Quality Guidelines

Pollutant	Averaging Time	Malaysian Guideline ppm	µg/ m ³
Ozone (O ₃)	1 hour 8 hour	0.10 0.36	200 120**
Carbon monoxide* (CO)	1 hour 8 hour	30.0 9.0	35 10**
Nitrogen dioxide (NO ₂)	1 hour 24 hour	0.17 0.04	320 10**
Sulphur dioxide (SO ₂)	1 hour 24 hour	0.13 0.04	350 105**
Particulate Matter (PM ₁₀)	24 hour 1 year		150** 50
Total suspended particulate (TSP)	24 hour 1 year		260 90
Lead (Pb)	3 month		1.5

* mg/ m ; ** API = 100

API values range from 0 to 500, with higher numbers indicating more air pollution and more potential risk to public health. The API scale is divided into 5 categories as follows:

0 - 50	Good
51 - 100	Moderate
101 - 200	Unhealthy
201 - 300	Very unhealthy
301 - 500	Hazardous
> 500	Very hazardous/ dangerous

The highest API value for an individual pollutant becomes the AQI value for that area for that particular day. For example, if on a day, a certain area had API values of 150 for the pollutant ozone and 120 for PM₁₀, the AQI value would be 150 for pollutant ozone on that day. In Malaysia, ozone and PM₁₀ levels most often drive the API (Jamal et al. 2004).

API as a measure of outdoor air quality has come under severe criticism for various reasons. Firstly, the composite API indicator is too general and does not identify the pollutants of concern, that is, it does not show which pollutant(s) are causing the days with an API of more than 100, or which ones have decreased and are responsible for an improvement in the API. Secondly, the composite API indicator does not show which areas, or how many areas, have problems – a specific number of days could reflect a few areas with persistent problems or many areas with occasional problems.

General Air Quality Status 1999 – 2006

In so far as air quality is concerned, the DOE divides the country into three major regions that is, the West Coast and the East Coast of Peninsular Malaysia and Sabah, Labuan and Sarawak. The West Coast of Peninsular Malaysia is further subdivided into 3: the Klang Valley Region, the Northern Region and the Southern Region.

Table 3 shows the annual mean number of days with API greater than 100 in Malaysia during

2004 - 2006. The West Coast Region obviously stands out as an area with the highest number of unhealthy days, while Sabah and the East Coast have the least. This is despite the fact that 2005 and 2006 had relatively bad 'haze' episodes. Of the sub-regions in the West Coast, the Klang Valley appears to be the most prone to air pollution followed by the Southern Region. Comparatively, the Northern Region has the least number of unhealthy days.

Table 3: Annual mean number of days with API greater than 100 in Malaysia, 2004 - 2006.

Region	2004	2005	2006
West Coast			
1. Klang Valley	31	36	34
2. Northern Region	2	5	3
3. Southern Region	4	9	12
East Coast	1	1	1
Sabah	Neg.	Neg.	Neg.
Sarawak	2	Neg.	13

Note: Neg. = negligible
(Calculated based on DOE 2005, 2006, 2007)

The Klang Valley

The Klang Valley is more prone to air pollution than any other part of the country largely due to the high concentration of population, large-scale industrial and commercial activities and high traffic volume. Being in the valley with the foothills of the Main Range in the east and the Straits of Melaka in the west, the winds are generally weak which cause pollutants in the air to stagnate. In addition, its geographical position also makes it an excellent target for transboundary pollution from across Sumatra to be transported in via the South-west Monsoon during June - October/ November.

Concluding Remarks

The paper has provided an assessment of air quality using API greater than 100 and the MAAQG as indicators of 'unhealthy' air. Though the API as a measure of air quality has several shortcomings, it is nevertheless a useful first estimate of air quality in an area. On the basis of frequency of days with API greater than 100, it was found that (1) the West Coast of Peninsular Malaysia, especially the Klang Valley Region experienced the greatest number of 'unhealthy' days followed by the Southern Region. The rest appear to be relatively good except during severe haze episodes when API values can be excessive; (2) if 'business as usual' prevails, there is a tendency for the number of days greater than API 100 to increase as it was during the 1999 - 2006 period; and (3) the transboundary air pollution from across Sumatra during the South-west Monsoon during July - October/ November is still an important pollution source which affects air quality particularly in the Klang Valley.

In the meantime, Malaysia should be sensitive about the associated health effects of air pollution and take the necessary precautions. We all need to be reminded that for the unusually sensitive individuals especially children and people with respiratory diseases like asthma, health effects may be experienced even when API values are between 51 - 100.

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Source

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Is the EIA an Adequate Approach to Address Climate Change?

Climate change is a significant global challenge requiring a strategic approach by governments and the private sector today and into the future. Essentially, the ultimate impact of climate change will affect us, economically, socially, and environmentally and challenge natural and man-made systems that make up the global ecological system in which we live.

The Inter Governmental Panel on Climate Change (IPCC) has concluded two broad strategies for addressing issues of climate change, which are:

- Mitigation or reducing greenhouse gas emissions
- Adapting to environmental changes attributable to global warming

In Malaysia, climate change concerns have been addressed and incorporated in some of the sectoral policies such as the National Biodiversity Policy, National Energy Policy and Forestry Policy, etc. However, there is still a lack of active climate change abatement action being implemented in Malaysia. Climate change abatement actions are primarily restricted to the Clean Development Mechanism (CDM) programme where motivating forces are mainly economically orientated towards Certified Emission Reductions (CER) credits and reductions in operation costs through resource (waste) recovery activities.

The Current Role of the EIA

Consensus is beginning to emerge that environmental impact documents should consider climate change in some manner. There is some development and discussion on the strength and weakness of EIA in addressing climate change. However, several countries have widely incorporated climate change in the EIA process and support the consideration of CO₂ emissions in the environmental impact assessment process.

Can EIA address climate change? It should be noted that the creative flexibility inherent within the EIA process demonstrates that EIA can be readily used to analyse, explore and discuss climate change issues in a wide variety of projects. For example, an EIA project can often easily quantify the expected amount of specific greenhouse gases associated with a particular project.

EIA is also used to evaluate (and sometimes implement) the means of mitigating or minimising

significant environmental impacts. As such it is also possible to address the qualitative impacts of increased greenhouse gases to climate change although the significance of the impact may be difficult to quantify.

Although EIA is capable of addressing climate change issues at the project level, it should be noted that EIA should not be considered as the primary means to manage global climate change. EIA is not intended, and could not be used, as a comprehensive regulatory or market strategy in reducing global greenhouse gases emissions, but it provides a secondary path towards greenhouse gas emission reduction goals with the following advantages:

1. EIA is already a unilateral global custom, therefore it could immediately be brought into force using existing laws. The use of EIA will complement any range of existing or future regulatory schemes specifically addressing climate change;
2. The inherent creativity and deference provided to government agencies in carrying out EIA allows approaches to EIA to integrate climate change into decision making;
3. EIA could be an effective means of linking global goals with municipal action where

EIA provides the opportunity to creatively integrate lofty environmental goals into a very specific level of decision-making and design at the local level.

Climate Change Assessment Procedure in EIA

Generally the addition of climate change to the EIA process will not change the fundamental structure of a normal impact assessment process. However, it will necessitate systematic consideration of the following:

- 1 Changes that may occur to primary and secondary climate parameters (temperature, wind characteristics, precipitation and sea states) and also to relevant tertiary parameters over the life span of the project and its impacts (ecological conditions, growing season, groundwater elevation, etc) on the environmental components/ receptors within the EIA boundaries;
- 2 Changes to the project itself because of climate change over the project's life, which may significantly alter key characteristics of the project.

The suggested procedures of climate change assessment in the EIA process is illustrated in Figure 1.

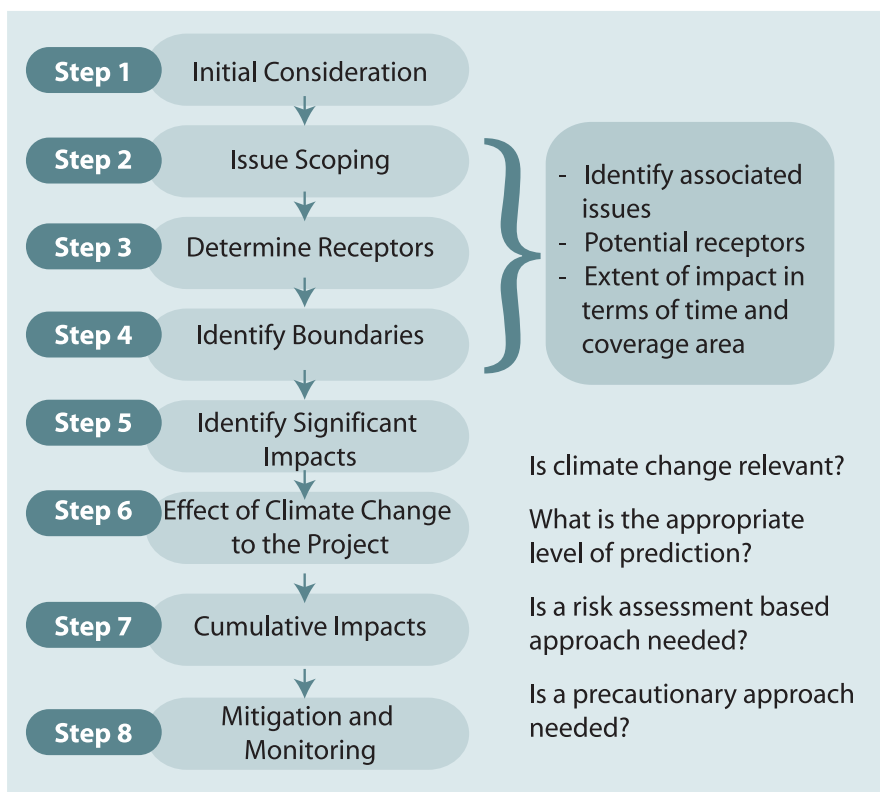


Figure 1: Suggested climate change assessment procedures in the EIA process

Step 1 Initial Consideration of Climate Change in EIA

The initial step is to determine if climate change is likely to be a potential consideration in the EIA process for the particular project. The following assessment approaches could be adopted in the decision making process to identify the need for climate change assessment in the project: -

- Risk Assessment Based approach as a screening tool to assess the risk of potential climate change impacts and its implications and the confidence in the predictions that includes the availability and reliability of relevant data for assessment exercises (e.g. regional climate change projections, relevant country reports, modeling tools, etc);
- Adoption of precautionary principle approach which recognises the absence of full scientific certainty in the impact assessment exercise; and
- Stakeholder consultation for determination of tangible values for appropriate climate-change parameters and the appropriate level of assessment.

Step 2 Issues Scoping

Scoping is a critical early step in the preparation of an EIA. The scoping process identifies the issues that are likely to be of most importance during the EIA and eliminates those that are of little concern. In climate change, scoping how climate change has been, or may need to be incorporated into design criteria, ecological, socio-economic and physical factors, cumulative impacts and the definition of uncertainty of predictions should be considered. The scoping exercise could be carried out based on public opinion, applicable legislation, regulation and professional judgment.

Step 3 Determination of Potential Receptors

Receptors associated with climate change impacts may be of broad categories or specific species of concern (people, species, infrastructure, property) that are linked to a project through specific pathways or potential interaction with project activities within the design, construction, operation and abandonment stages. Analysis of climate change impacts needs to be based on specific parameters or species (receptor) selected for their importance or as an indicator of impacts.

Step 4 Determination of Boundaries

This involves identification and establishment of boundaries in terms of timeframes and areas that the receptors are likely to interact with or be influenced by the project.

The relevance of climate change must be analysed within spatial, temporal, ecological,

administrative and technical boundaries with reference to each receptor being assessed. The analysis must identify any effects of the project beyond its lifespan.

Step 5 Identifying Significant Impacts

In identifying the significance of impacts, the following criteria are commonly used in the impact assessment exercises and similarly it should be applied in the identification of the significance of the impacts on, or from, climate change.

Key terms	Criteria
Significant	Magnitude Geographic extent Duration and frequency Irreversibility
Likelihood	Probability of occurrence Scientific uncertainty

Changes to receptors resulting from specific predicted climate changes must be determined with appropriate input from specialists knowledgeable in the specific receptor and in climate change implications. In this context, it is important that a balance be achieved in the accuracy of predictions for changes to both climate change and receptors.

Step 6 Effects of the Environment on the Project

Incorporation of the climate change issues in the EIA process could essentially affect the proposed operation and productivity of the project through increased project costs, alteration of project design, increased maintenance frequency, installation of additional emission control equipment, potential project modifications, etc. In this instance, the source of climate change predictions and their specific magnitude must be described with rational design criteria.

Step 7 Cumulative Impacts

Cumulative impacts are an important consideration in the integration of climate change into the EIA process. Climate change can either create direct impacts over time, or can modify other non-climate change related impacts and thus compound the effects of a project. Cumulative effect assessment should be carried out whenever climate change proves to be an important element in EIA. Cumulative effects associated with climate change could include:

- Increased transport of physical or chemical constituents beyond the spatial boundaries under consideration, by factors such as increased storm intensity and frequency;
- Increase or decrease in habitat area for a species or species group that is already affected by the project; and

- Secondary effects related to climate change modification to the environment or its effects on the project.

Step 8 Mitigation and Monitoring

Specific mitigation measures to address climate change impacts, including any appropriate adaptation measures, should be recommended. When a project is predicted to be sensitive to climate change, a monitoring programme should also include periodic assessment of climate change impacts based on reviewing new information and/or monitoring of specific climate elements identified in the EIA. The review should focus on validating whether the mitigation measures are performing as designed or to identify changes needed to bring the project in line with predictions made in the EIA.

Conclusion

Similar to all environmental issues, climate change is not the sole responsibility of an activity, government or party. The effort in combating climate change requires co-operation and action from various levels of government, individuals and corporations, regardless of the size and boundary of the activities that have potential to contribute to increased greenhouse gas emissions. EIA, which has been embedded in legislation by many governments, has the potential to be a useful tool as a secondary approach in addressing climate change.

Early planning in the EIA process regarding climate change initiatives may also result in project cost savings when compared with remedial works undertaken at a later date to address issues of climate change. Overall, increases in greenhouse gas emissions are inherent in various project activities. Climate change consideration in the EIA process is appropriate in reducing the potential of greenhouse gases emission in various project activities either from project design, raw material usage or energy consumption.

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Source

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Air Pollution in Malaysia: Moving Towards a New Agenda



Until recently, air pollution from ships went largely unregulated, with regulatory and advocacy focus on more visible land-based sources.

Air pollution can be defined as 'human introduction into the atmosphere of chemicals, particulate matter, or biological materials that cause discomfort to humans or other living organisms, or damages the environment'. Some of the more significant gaseous air pollutants include carbon monoxide, sulfur dioxide, nitrogen oxides, and particulate matter. In addition, carbon dioxide while vital for plant photosynthesis, is now also categorised as a potential form of air pollution due to the raised levels of this gas in the atmosphere causing the greenhouse effect. In the past, there was greater emphasis on land-based sources of air pollution such as from motor vehicles, chemical plants, coal-fired plants, petrochemical plants, oil refineries, incinerators, plastic factories, and others. However, emissions from ships have now been recognised as one of the important sources of air pollution as well.

Despite the fact that ships are more energy efficient than all other forms of commercial transportation, marine engines operate on extremely dirty fuels. Known as bunker oil, this fuel is the collection of residues from the production of higher grade fuels and contains significant concentrations of toxic compounds. Moreover, diesel engines are widely used as the main power source for vessels, and the gaseous and solid substances exhausted from the engines during the combustion process is also a cause of air pollution. This

eventually affects human health, especially the coastal communities, besides harming the environment. Nevertheless, until recently, air pollution from ships went largely unregulated, with regulatory and advocacy focusing on more visible land-based sources. Moreover, several recent studies had showed that most shipping emissions occur near the coast where they can be transported over land, therefore dismissing the notion that because shipping emissions originate at sea, their impact on human health and the environment is minimal.

In addition, global change in temperature and climate is currently one of the more complex and challenging issues facing the world at large. Ships burning diesel, bunker oil and other fuels have also been categorised as pollution sources of greenhouse gases mainly from the combustion of fossil fuels, such as diesel and residual fuels burned in marine engines. Although shipping activities contribute to a very modest amount of carbon dioxide compared to land-based activities, it could get more significant if not regulated. As such, shipping is expected to contribute, however modestly, to the wider efforts being made to arrest global warming.¹

The principle means of regulating air emission from ships is the Annex VI on 'Regulations for the Prevention of Air Pollution from Ships' of the International Maritime Organisation (IMO) International Convention for the Prevention of

Pollution from Ships (MARPOL 73/78). The Annex entered into force in May 2005 with an adequate number of countries ratifying it (15 nations representing 50% of world merchant shipping fleet). Annex VI covers a number of pollutants and shipboard operations that affect air quality, which include nitrogen oxide, sulphur oxide, quality of the fuel oil used, incinerators, ozone depleting substances, volatile organic compounds, as well as vapour emissions. To date, there are 53 contracting countries to the MARPOL convention, representing 81.8% of the world's merchant shipping fleet. The level of ratification has been commendable and is in itself proof that serious attention is being placed and progress is being made on the matter globally.² The requirements of the Annex apply both to ships registered in those countries that are a party to the convention as well as other States while operating within the waters under the control of the contracting States. In the case of States ratifying the MARPOL Annex VI after the entry into force date, the specific requirements will take effect three months from the date of their signing.

Situation in Malaysia

Part VI on Prohibition and Control of Pollution (Section 22) of the Malaysian Environmental Quality Act 1974 (Act 127) stipulates 'Restrictions on pollution of the atmosphere', specifying the type of pollution and fines that are likely to be imposed on polluters.

In line with this, the Department of Environment (DOE) Malaysia monitors the country's ambient air quality through a network of 51 stations. Among the main sources of pollution taken into consideration include that from industrial and commercial activities, residential areas, and vehicular traffic. The six pollutants taken into consideration include carbon monoxide, nitrogen oxide, ozone, sulfur dioxide, particulate matter and lead. The government has also imposed various measures to address the emission levels. For example, a notable drop of 72% in sulfur dioxide levels was recorded in year 2006 compared to year 1998. This was mainly attributed to measures taken to promote the use of cleaner fuel such as natural gas for industrial combustion processes and vehicles.

Harmful Air Emissions from Ships

As one of the world's top twenty trading nations, the importance of the maritime sector to Malaysia cannot be underestimated. Besides housing some of the world's major ports, about 95% of the country's goods traded are also transported by sea.³ Malaysia is also strategically located along the Straits of Malacca, where more than 60,000 ships pass through annually, making it one of the busiest shipping lanes in the world (Figure 1). However, ships are currently not required to meet air pollution controls as other land-based transportation is required to do so in Malaysia.

Several studies yield results that emissions from ships are affecting areas with dense shipping activities, including this region. For example, the study by Corbett *et al.* (2007) was carried out using modelling methodology on the ambient particulate matter concentrations from ocean-going emissions. The global and

regional mortalities were estimated by applying the ambient particulate matter increases due to ships contributing to cardiopulmonary and lung cancer risks. The results indicate that shipping-related particulate matter emissions are responsible for approximately 60,000 cardiopulmonary and lung cancer deaths annually, with most deaths occurring near coastlines in Europe, East Asia, and South Asia. Under current regulations and with the expected growth in shipping activity, it was estimated that annual mortalities could increase by 40% by 2012.

Another study carried by Streets *et al.* (1997) have estimated the emissions of sulfur dioxide from international shipping in Asian waters using information on shipping parameters and quantities of goods shipped to and from the major ports. The findings were that shipping emissions were found to be the dominant source of sulfur deposition in large areas of the Indian Ocean, the western Pacific Ocean, and the South China Sea. Land areas most heavily threatened include those bordering the Straits of Malacca, where portions of Sumatra, Peninsular Malaysia, and Singapore have contributions from shipping in excess of 10% of total sulfur deposition. It has been suggested in the study that emissions from shipping may be contributing to ecological damage in areas surrounding the Strait of Malacca. The study suggests a need to introduce policies to reduce the sulfur content of marine fuels or otherwise reduce emissions of sulfur dioxide from ships in the Asian waters.

Moving Towards a New Agenda

It is apparent that air pollution from shipping activities is a growing problem that is drawing increased attention around the

world. Furthermore, emissions from shipping activities are projected to continue to grow in tandem with the increasing shipping activities worldwide. However, this has been backed up with remarkable actions towards establishing global standards to mitigate air quality concerns related to shipping, especially through the IMO. As such, all the relevant stakeholders especially the ship-owners/operators need to be aware of the developments taking place on the matter. Further study is also required to determine the actual contributions and related impacts of shipping activities to air pollution in Malaysia so that the government could come up with necessary policy options to mitigate the effects.

Footnotes

- 1 The First Intersessional Meeting of IMO's Working Group on Greenhouse Gas Emissions from Ships was held in Oslo in June 2008. The main task was to discuss the technical basis for reduction mechanisms that may form part of a future IMO regime to control greenhouse gas emissions from international shipping, and to prepare a draft of the actual reduction mechanisms, for further consideration by the IMO's Marine Environment Committee (MEPC).
- 2 Air emission from ships remained high on agenda at the 58th Session of the MEPC at the IMO, held in October 2008 at the IMO's London headquarters and the developments have been momentous towards reducing harmful emissions from ships with more stringent standards.
- 3 Some of the major ports in Malaysia include the Port Klang, Westport, Penang Port, Port of Tanjung Pelepas, and Bintulu Port.

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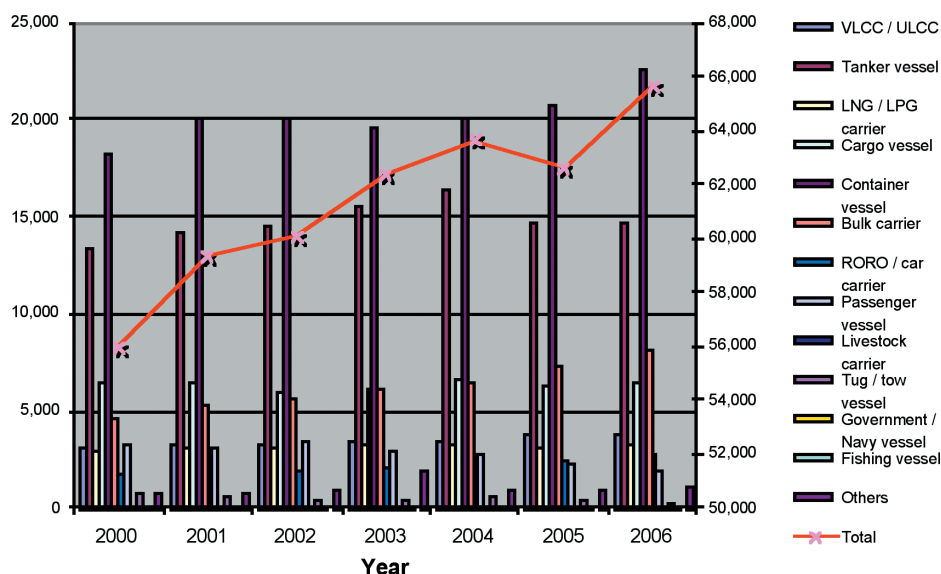


Figure 1: Total number and type of ships traversing the Straits of Malacca
Source: Department of Marine Malaysia

Event Highlights

Department of Environment, Malaysia



October 2008

2008 Malaysia Environment Week (MASM 2008)

The 17th Malaysia Environment Week, with the theme 'Environmental Conservation, Our Shared Responsibility' was launched on 20 October 2008 at Paya Indah Wetlands (PIW), Dengkil, Selangor. This event coincided with the re-opening of Paya Indah Wetlands and the launch of the Environment Awareness Campaign.

YB Datuk Douglas Uggah Embas, Minister of Natural Resources and Environment officiated the reopening of Paya Indah Wetlands by releasing 53 water birds. Meanwhile, tree-planting, a major event of the day saw the participation of 500 guests from different sectors and 920 schoolchildren from 21 schools in Bangi, Banting, Cyberjaya, Dengkil, Kajang, Putrajaya and Sepang. During the event, recyclable shopping bags were also distributed to guests to encourage the public to use these bags and refrain from using plastic bags.

Commercials, jingle and print advertisements on air, water and marine pollution appeared in the mass media through television, radio and newspaper on the same day to launch the Environment Awareness Campaign. This campaign not only aimed at encouraging public and community involvement but also people's commitment to protect and preserve the environment.



December 2008

HCFC Phase-out Management Plan (HPMP) Inception Workshop

More than 300 participants from Government agencies, industries, importers and suppliers, Institutes of High Learning, Associations and NGOs attended the HPMP Inception Workshop from 2- 3 December 2008. Organised by the Department of Environment in collaboration with the United Nations Development Programme (UNDP), the workshop was officiated by Minister of Natural Resources and Environment, YB Datuk Douglas Uggah Embas. Also present were Y Bhg Dato' Rosnani Ibarahim, Director General of Environment, Dr Suely Cavalho, the Chief of Chemical and Montreal Protocol, UNDP New York, Ms Cecilia Mercado from the Multilateral Fund, Mr



Kamal Malhotra, Resident Representative of UNDP in Malaysia, Mr Nandan Chimulay, UNDP Regional Coordinator, international consultants as well as experts on HCFC alternatives. In his Keynote Address, YB Datuk Douglas Uggah Embas urged participants to extend full co-operation by providing relevant data and information on the consumption of HCFCs to ensure the drawing up of a comprehensive HPMP. The plan is important for two major reasons: (i) the plan will determine the amount of financial assistance received from the Multilateral Fund and (ii) the plan will ensure that no stakeholders are omitted and that we meet our obligations to phase out HCFC.



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