



# IMPAAK

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Energy, Water and Environmental Resources

## Rio+20 - The Future We Want? Back to Rio: 1992-2012

With more than 190 heads of government attending, this was indeed the ultimate event to determine the future and survival of our planet. And what did we get out of this event? A high series of 'R' words document called, 'The Future We Want' – Recognise (the word appeared 148 times in this 253 paragraphs of affirmations and entreaties), 'Reaffirm' (59 times), 'Resolve' (16 times) and 'Renew' (10 times). The document is just full of 'RhetoRics'! Indeed the *United Nations Conference on Sustainable Development* also known as the Rio Earth Summit, was doomed to fail long before all the world leaders gathered and restated to save planet Earth. Europe is in deep economic crisis, USA, who is not a signatory of the Kyoto Protocol (or other such agreements) is in election fever, China (the largest greenhouse gas emitter) is still hiding behind the garb of 'we are a developing nation and are victims of policies of developed countries' rhetoric, and India is still sticking to the "common but differentiated responsibility" clause of Rio 1992, whereby developed countries are to cut back on emissions and transfer funds/technology to developing countries to check the problem. On the whole, leaders of all (most) are embroiled in their own domestic issues and are fighting for their own political survival. What more the survival of the planet!

UN Secretary-General Ban Ki-moon stressed that, "At Rio, we must begin to create a new one (model) - a model for a 21<sup>st</sup> century economy that rejects the myth that there must be a zero sum trade-off between growth and the environment."

In reality, is this conceivable? Before the Rio Earth Summit planet commenced, the list of priorities for the ailing planet was determined for debate. Looking at the list, can growth and the environment co-exist? The top 10 issues that was in the priority list included the following:

- |                       |                     |
|-----------------------|---------------------|
| 1. Deforestation      | 6. Water Scarcity   |
| 2. Overpopulation     | 7. Global Poverty   |
| 3. Endangered Species | 8. Renewable Energy |
| 4. Climate Change     | 9. Oceans           |
| 5. World Hunger       | 10. Air Pollution   |

Nonetheless, a more disturbing aspect of all these mega summits is the derailment of any commitments by the developing countries. Shifting the blame to the developing countries without actually looking at the per capita impact seem the easy way out for these rich developed nations while boosting the growth of their economies at the cost of nature and its resources.

Hence, 'Green Economy' is the buzz word. The concept of green economy has been put forward to bring growth and development in a sustainable manner, bringing social

equity and well-being without affecting the balance in the environment and ecology. But is this going to be another pipe dream if maximising profits at the cost of anything seems to be the agenda for all private corporates. Can the Heads of Government play a more effective role to abate the problem we are all facing as inhabitants of this planet?



As Malaysia accelerates to become a fully developed nation by 2020, guided by the Economic Transformation Programme (ETP), the impact that the nation may be creating on the carbon footprint is intense although it may not be as impactful as compared to the other more developed and developing nations especially when compared with the per capita income (see Table 1) in page 3.

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From the desk of the Director General

# Energy, Water and Environmental Resources



In this edition of IMPAK, we turn once again to three fundamental issues that govern our lives on Planet Earth: Energy, Water and Environmental Resources. Often, more heat than light is generated when these issues are discussed and debated. A sober relook is necessary this time around.

First, energy. A growing global population brings about an increase in economic activities. At the very basic level, more houses need to be built, more food needs to be grown and more clothes need to be manufactured. It is an unstoppable imperative. Human existence is as sophisticated as it is complex. Our societies are organised beyond the need for shelter, food and clothing, or for that matter, fresh air and sunshine. A whole panoply of services and products, too numerous to mention, are the fabric of everyday living.

These products and services require that a primary energy source like coal, oil or natural gas be converted into other forms of energy like electricity or steam or heat. The conversion process results in gaseous emissions - carbon dioxide, nitrogen oxides, other gases and particulates. Cleaner and greener technologies are urgently needed to reduce these emissions and impurities from polluting the atmosphere. But what this means is that for the near term, it requires us to manage energy supply and demand efficiently until long term solutions are found. Collectively, this effort is called Energy Efficiency or EE. A key feature of EE is demand side energy management. It focuses on managing energy needs from the consumer side. 'Consumer' here includes all of us, the homes and offices we live and work in and the factories that produce the things we consume. The Malaysian Standard MS 1525: 2007 Code of Practice for Energy Efficiency and use of renewable energy in non-residential buildings (First Revision) provides a good reference point for managing energy efficiently in buildings. Also useful is the ISO 50001 for Energy Management Systems.

Next, water. Our record on this issue is poor if not alarming. Our use and misuse of water is not sustainable in the long term unless corrective actions are taken. Malaysia's non-revenue water or NRW losses are estimated at some 36% as compared to that of only 15% in developed countries. The Association of Water and Energy Research (AWER) estimates that the revenue losses in ringgit terms alone is RM 1.6 billion based on their modelling study. Indeed this can be avoided if concerted efforts are made to reduce such losses of water and money. For a start, we must prepare a detailed NRW Reduction Action Plan. The Plan must identify critical, sub-critical and non-critical areas of NRW losses by monitoring the supply of water to various locations via a network of pipes and pumping stations. The Technical Regulator, Suruhanjaya Perkhidmatan Air Negara (SPAN) must play a more active role by specifying the technicalities involved in the provision of water services. As a further important

measure, all water operators must be licensed and regulated under the Water Services Industry Act 2006 without exception. Sabah and Sarawak must be brought within its ambit. SPAN can and should set and monitor NRW targets for water operators. The public should be informed when they fail to meet them. For the record, of major cities Tokyo has the lowest NRW loss of some 3% and our closest neighbour Singapore is close to 5%. Clearly we have a long way to go on this issue.

Lastly, environmental resources. 'Environment' is one of criteria that defines liveability. In short liveability is about finding the right equilibrium between development and sustaining the environmental resources of a place or city. Of the top ten liveable cities of the world, four are in Australia and three in Canada. The question that must come to mind is: How did they do it? For a start, these cities have critically catalogued both their natural resources and the environment resources in and around them. It includes also evaluating the direct economic value of land and all that is on it at the surface and the near-surface such as climatic, soil and terrain conditions, fresh water, vegetational and animal conditions, biodiversity of animal and plant populations, scenic, educational or research value of landscapes and lastly the occurrence of vectors of human or animal diseases. There is a mix of tangible and intangible components in ascertaining economic value so as to best manage the available environmental resources of a city or area. Leading from this both the carrying capacity and the 'limits of acceptable change' (LAC) can be ascertained for finding the right equilibrium between sustainable tourism and the environment.

There is no better testimony that these three issues of energy, water and environmental resources can be at the centre of human endeavour and be properly managed than the staging of the Olympics which are often billed as the 'The Greatest Show on Earth'. Since 1993, the IOC includes in its charter the concept of sustainable development. And in the recently concluded London Games, the Organising Committee was the first to achieve the Specification for Sustainability Management System for Events, also known as British Standard 8901. Syabas London!

Halimah Hassan  
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Table 1: CO<sub>2</sub> Emissions versus CO<sub>2</sub> emissions per capita

Country	CO <sub>2</sub> emissions (mio. tonnes)	Rank	CO <sub>2</sub> emissions per capita	Rank
China	6538.37	1	4.92	82
United States	6094.39	2	19.74	10
India	1610.00	3	1.38	143
Russian Federation	1579.82	4	11.13	26
Japan	1303.78	5	10.23	34
Germany	841.15	6	10.22	35
Canada	590.2	7	17.91	13
United Kingdom	546.43	8	8.97	45
Korea, Republic of	503.32	9	10.49	31
Iran (Islamic Republic of)	495.99	10	6.85	61
Italy	475.3	11	8.01	52
Mexico	471.46	12	4.39	89
South Africa	433.53	13	8.82	47
Saudi Arabia	402.45	14	16.31	14
France	401.01	15	6.50	63
Indonesia	397	16	1.77	131
Australia	396.28	17	19.00	12
Brazil	368.32	18	1.94	125
Spain	366.00	19	8.32	51
Ukraine	340.15	20	7.35	58
<b>Malaysia</b>	<b>194.48</b>	<b>27</b>	<b>7.32</b>	<b>61</b>

Source: UNSD Millennium Development Goals Indicators database, 2009

Comparing the countries with high CO<sub>2</sub> emission and high CO<sub>2</sub> emission per capita, it is obvious that countries like USA, Russia, Japan, Germany, Canada and UK are creating more damage to the environment, than countries like China, India and Brazil. That explains why the latter countries protested for being unfairly treated by the more developed countries in all the recent environmental summits.

So, what was the agreed outcomes in 'Rio+20'? Only a few significant ones are outlined in Time Inc. (2012), namely:

- AGREED, in principle, that polluters ought to bear the cost of their pollution, that poverty ought to be eradicated and that 'appropriate demographic policies' (i.e., family planning) ought to be promoted.
- ACKNOWLEDGED that developed countries, having put more 'pressure' on the world environment, bear some responsibility for putting it right.
- AGREED to give 'special priority' to the needs of the developing countries - without specifying what those priorities might be.
- CAME up with a 600-plus-page 'agenda' to save the planet, with a price tag of more than USD600 billion a year but have not yet agreed on plans for raising the bulk of the money.
- AGREED to try to roll back emissions of carbon dioxide and other greenhouse gases by the end of the decade, with the understanding that 1990 levels would be a desirable - but not mandatory – just a target.
- EXTRACTED a USD75 million commitment from the U.S. to help developing countries with efforts to combat global warming.

### What they could still do?

- FORGIVE some part of the developing nations' USD1.2 trillion debt if they set up additional nature preserves in ecologically critical areas, like the tropical rain forests.
- GIVE developing nations preferential access to new, environmentally friendly technology.
- EXTRACT a commitment of USD3 to USD6 billion in new funding from developed countries to help pay for the environmental agenda.

### What they should do but would not?

- CONFER tangible value to species in biologically diverse regions by requiring payment of royalties for the use of their genetic materials.
- FIND a way to put the brakes on the world's spiralling population, which will otherwise double by the year 2050.
- PUT an international tax on emissions of carbon dioxide and other greenhouse gases.
- PUT strict limits on the trade of timber from the earth's remaining virgin forests.
- SET up a recycling plan in every major city in the world.
- GIVE the United Nations broad powers to create an environmental police force for the planet.

### What Next?

Generally, the 'Rio+20' is a forum on how to make sustainable development a reality for seven billion people today, and to define the future we want for nine billion by 2050. Hence, a bigger agenda (bigger than the environment) may be needed to get the attention of the whole world. The United Nations has already started laying the foundation for its next big move – the launching of the 'Post 2015' UN Development

Agenda. The post-2015 agenda will reflect new development challenges and be linked to the outcome of 'Rio+20'.

The Millennium Development Goals (MDGs) were targeted to achieve their goals by 2015. Enormous progress has been made towards achieving the MDGs - global poverty continues to decline; more children than ever are attending primary school; child deaths have dropped dramatically; access to safe drinking water has been greatly expanded; and targeted investments have been directed at fighting malaria; and millions have been saved from AIDS and tuberculosis. Hence, a post-2015 development agenda is required to achieve a world of prosperity, equity, freedom, dignity and unabated peace. Environmental sustainability can only be achieved if the other MDGs are targeted concurrently. The goals where environmental sustainability is concerned is shown in Table 2.

In conclusion, tackling environmental issues globally seems impossible (at least for now). So, do we just ignore the fact that we may be reaching the tipping point? We should at least use our resources intelligently by diverting the money that goes to fight climate change (which seem too macro and unconceivable) and instead channel it towards micro issues like environmental threats that are killing people right now – namely, the lack of clean water and sanitation, as well as ordinary air pollution. We need to educate people from all ages on their role (no matter how minor it may seem) to protect the environment. That is where we, as a nation, can make a difference. If there is one lesson we can learn from Rio, it is that top-down problem solving is not an option any longer to resolve mega global issues. The best we can do for now is to attempt solving the small problems that are within our control and hope that the big ones are less big than feared.

### References

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United Nations Development Programme (UNDP) (2012). Accessed on 21 Aug 2012 from <http://www.undp.org/content/undp/en/home/mdgoverview.html>

Table 2: Environmental sustainability goals of the MDG(extracted from the MDG)

Environmental Sustainability	• Integrate the principles of sustainable development into country policies and programs; reverse loss of environmental resources
	• Reduce biodiversity loss, achieving, by 2010, a significant reduction in the rate of loss. Proportion of land area covered by forest
	• Halve, by 2015, the proportion of the population without sustainable access to safe drinking water and basic sanitation (for more information see the entry on water supply). Proportion of population with sustainable access to improved water source, urban and rural
	• By 2020, to have achieved a significant improvement in the lives of at least 100 million slum-dwellers. Proportion of urban population living in slums.

### Source

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# Demand Management and Sustainability of Water Resources Through Reduction in Non-Revenue Water

Malaysia aspires to achieve developed nation status by year 2020. However, our performance in a key resource such as water is sadly lacking sustainability. Our water supply systems simply leak too much. Many of us are still in the dark over this issue, but this is one of the most serious matters in water supply systems for most Asian countries except Japan, South Korea and Singapore.

## What is Non-Revenue Water (NRW)?

Non-revenue water (NRW) is the difference between the volume of water put into a water distribution system and the volume of water that is billed to customers (Figure 1). NRW comprises three components: physical losses, commercial losses and unbilled authorised consumption.

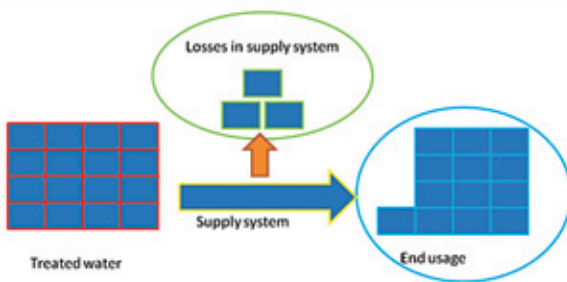


Figure 1: Water Supply System Model

- Physical losses comprise leakages from all parts of the system and overflows at the water operators' storage tanks. They are caused by poor operations and maintenance, the lack of active leakage control and poor quality of underground assets.
- Commercial losses are caused by customer meter under-registration, data handling errors, and theft of water in various forms.
- Unbilled authorised consumption includes water used by water operators for operational purposes, water used for firefighting and water provided for free to certain consumer groups.

Table 1 indicates the NRW values for states in Malaysia. Pahang has the highest NRW percentage for both years. However, Selangor has the highest NRW value in terms of actual volume of treated water wasted. The total NRW for Malaysia in year 2008 was 36.93% reducing slightly to 36.85% in year 2009. Unfortunately, the total of treated water lost has increased by 18,318,000 cubic metres (m<sup>3</sup>).

Table 1: Treated water production and NRW in Malaysia

Water Supply entities	2008			2009		
	Production (m <sup>3</sup> '000)	NRW (m <sup>3</sup> '000)	NRW (%)	Production (m <sup>3</sup> '000)	NRW (m <sup>3</sup> '000)	NRW (%)
Johor	523,424	163,831	31.30	535,012	170,914	31.95
Kedah	423,627	190,581	44.99	428,234	192,586	44.97
Kelantan	124,655	61,568	49.39	125,160	60,479	48.32
Labuan	17,221	5,715	33.19	17,673	4,567	25.85
Melaka	156,753	47,163	30.09	161,755	48,060	29.71
N. Sembilan	243,341	122,900	50.51	240,541	118,248	49.16
Pulau Pinang	327,813	55,387	16.90	333,335	63,585	19.08
Pahang	334,939	177,046	52.86	334,077	200,127	59.90
Perak	371,205	115,785	31.19	379,395	116,389	30.68
Perlis	39,625	16,509	41.66	39,798	17,779	44.67
Sabah	300,282	167,334	55.73	320,176	158,214	49.41
Sarawak	350,028	102,843	29.38	370,275	109,305	29.52
Selangor	1,423,202	483,184	33.95	1,432,901	465,548	32.49
Terengganu	200,049	76,034	38.01	207,122	78,397	37.85
<b>MALAYSIA</b>	<b>4,836,164</b>	<b>1,785,880</b>	<b>36.93</b>	<b>4,925,454</b>	<b>1,804,198</b>	<b>36.85</b>

Source: Malaysia Water Industry Guide 2010

## Estimated Revenue Loss Due to NRW in Malaysia

Knowing that the NRW is water that is lost during a water supply process, the Association of Water and Energy Research Malaysia (AWER) has conducted a modelling study to estimate revenue loss due to NRW. AWER has used average lowest tariff for domestic and commercial sectors, consumption percentage for domestic and commercial sectors as well as total volume of NRW as parameters for the modelling. The study is also taking lower estimates compared to World Bank's NRW modelling study.

Table 2 shows the NRW recorded in each state. A total of more than RM1.6 billion worth of water is actually lost due to NRW.

The World Bank has also published a report comparing NRW between developed and developing nations. In the year 2006 report, the average NRW recorded for developing nations was 35% and for developed nations, it was 15%. Malaysia aspires to be a developed nation by year 2020 and AWER is proposing to keep our national NRW levels at 20%. This is actually higher than the 15% average NRW recorded by developed nations. However, this rate is achievable.

Table 2: Estimated revenue loss using financial modelling derived by AWER by state

No	State	Estimated revenue loss due to NRW (RM)	
		2008	2009
1	Selangor (including Kuala Lumpur & Putrajaya)	582,256,047.36	557,987,210.88
2	Sabah	150,600,600.00	142,392,600.00
3	Labuan	5,143,500.00	4,110,300.00
4	Kelantan	39,960,710.40	39,665,152.15
5	Perak	90,330,825.60	90,442,400.23
6	Perlis	9,914,314.86	11,274,730.64
7	Terengganu	56,300,895.98	58,107,856.40
8	Kedah	116,178,177.60	118,016,700.80
9	Pulau Pinang	23,794,255.20	26,568,356.40
10	Sarawak	79,162,370.82	83,670,791.40
11	Negeri Sembilan	102,226,991.00	108,389,664.24
12	Melaka	36,319,283.04	42,857,985.60
13	Johor	208,723,970.62	220,714,921.32
14	Pahang	120,093,842.72	136,582,674.96
	<b>TOTAL</b>	<b>RM 1,621,005,785.20</b>	<b>RM 1,640,781,345.02</b>

## Developing National NRW Reduction Action Plan

AWER has proposed the formation of a task force to prepare a detailed NRW reduction plan. It is important to plan rather than leaving it to the water operators to decide on the way forward in reducing NRW levels. The plan should contain several steps as follows:

**STEP 1:** Identification of critical, sub-critical and non-critical areas through the NRW monitoring system. The savings from these locations can assist to help to reduce the NRW in the sub-critical and non-critical areas. The classification of 'critical' will be based on results of NRW monitoring in each supply area. Each state will have different targets as the NRW values vary.

**STEP 2:** As a Technical Regulator, Suruhanjaya Perkhidmatan Air Negara (SPAN) is also entitled to determine the types of replacement materials and other technical specifications in water services. Such a move will avoid individual operators from offering their own solutions. A common stand ensures estimation of a proper and equitable cost for NRW reduction.

**STEP 3:** To prevent escalating costs claimed by water operators, all water operators must be licensed and regulated under the Water Services Industry Act 2006 (WSIA, 2006). This further supports the need for Sabah and Sarawak to be regulated under WSIA 2006. This also means that SPAN will regulate the water operators. SPAN needs to audit all Capital Expenditure (CAPEX) and Operational Expenditure (OPEX) of licensed water operators to ensure there is no element of 'bloated cost'. Pengurusan Aset Air Berhad (PAAB) will be financing the development of all water services' infrastructure to minimise impact on tariff. The 'Asset-Light Model' approach is vital to ensuring NRW reduction takes place while ensuring equitable tariff.

**STEP 4:** SPAN should monitor achievements of water operators based on targets set on NRW reduction. SPAN should also constantly publish water operators' achievements to inform the public of the service quality of water operators. This will keep all level of users assured that water quality and services are constantly monitored.

Table 3 outlines NRW achievements by selected Asian cities which record NRW levels below 20% as published in the Asian Green City Index by Siemens.

## Strict Tariff Setting Process Will Boost Efficiency in Water Operators

The Office for Water Services or OFWAT is the regulator of the water industry in the UK. The OFWAT model which is the core of WSIA and

SPAN outlines the transparency of the tariff setting process. Some of the core components that need to be implemented are:

- **Audit of Capital Expenditure (CAPEX) and Operational Expenditure (OPEX)**  
Under the enforcement of SPAN, all water operators must get their CAPEX and OPEX approved. The determination of the costs will be monitored and regulated by SPAN to ensure it does not burden the people.
- **Comparing Operational Costs to fix a Benchmark Value**  
Benchmark value is an important value to be used as a reference value to cross check CAPEX and OPEX. These values are obtained from the daily operations of water operators. These values will be later classified based on different treatment and supply systems.
- **Differentiate the water services related costs and non-water services related cost**  
SPAN will also audit the operators' costs related to water services and non-water services. This means only costs related to water treatment and supply will be allowed to be channelled to tariff.
- **Reinvestment Cost**  
Any water treatment system and supply system need to be maintained and upgraded. Investment in the latest technologies is one of the methods to improve the efficiency of water treatment and supply to reduce cost. Water quality can be improved with enhancement in the technology used.
- **Involvement of the public in the tariff setting process** is an important element in the restructuring of the national water services industry. Through this method, all levels of people can provide their opinion and know the costs of treatment and supply.

Through the strict mechanism for tariff setting implementation, water operators will be forced to implement the National NRW Reduction Action Plan while the regulator is able to monitor and prevent 'bloated cost' activities.

Table 3: NRW achievement by major Asian cities as reported in the Asian Green City Index by Siemens

No.	City	NRW recorded (%)	Year of record
1	Beijing, China	12.5	2008
2	Guangzhou, China	14.8	2007
3	Mumbai, India	13.6	2005
4	Osaka, Japan	6.9	2007
5	Seoul, South Korea	7.0	2009
6	Singapore	4.6	2009
7	Tokyo, Japan	3.1	2008

Source: Malaysia Water Industry Guide 2010

## Importance of Sabah and Sarawak to be Regulated under WSIA 2006

The states of Sabah and Sarawak are currently not governed under the WSIA 2006. This has placed both the states in difficulty to further enhance the water services industry. In addition, the need to develop infrastructure for almost a 40% increase in water services to cater for rural areas will require much investment. The NRW reduction in Sabah and Sarawak will cost more and the need for a viable financial model is very vital.

Some points to ponder by Sabah and Sarawak state governments:

1. The water operators/state government must make every effort to improve the services and quality of water supply in these two states. Therefore, agencies such as SPAN and PAAB can play a vital role to ensure water supply services in Sabah and Sarawak are reliable.
2. The requirement for a 40% increase in water supply coverage in Sabah and Sarawak, will see a tremendous increase in operational and maintenance costs such as pipes. This will also increase the NRW values due to wider coverage areas.
3. The people of Sabah and Sarawak have the right to have continuous, safe and reliable water supply with service quality that is comparable to other states.

## Way Forward

The creation of a National NRW Reduction Action Plan will result in a more efficient and sustainable water services sector. In addition, it will optimise available water resources in our country. Early 2012, the cabinet approved the formation of the task force under SPAN as suggested by AWER and a number of technical meetings are ongoing to streamline work on NRW reduction. The Sabah and Sarawak water services industry must be regulated under WSIA to improve the water services standard.

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Source  
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# Energy Management and Energy Efficient Technologies

The growing population and economic activities have led to increased demand for various manufactured products ranging from basic human needs such as food, clothing and housing to more expensive products and materials to meet and satisfy our needs. This in turn has led to greater demand for more energy resources. Figures 1 and 2 below emphasise this trend of population and energy demand growth globally.

The long term global primary energy source for the next two decades will still be coal, oil and natural gas. These primary energy sources have to be converted into other forms of energy such as electricity, steam and heat. Only then will they be useful for application in manufacturing and transport. The conversion process requires conversion equipment such

as boilers, furnaces, gas turbines and internal combustion engines. The process of burning fuels to produce heat, generation of steam or electricity produces gaseous emissions such as carbon dioxide, nitrogen oxides and other gases and particulates depending on impurities in the fuels and the efficiency of combustion. These emissions can ultimately lead to environmental degradation as well as cause various health hazards and problems.

## Need for Cleaner and Green Technologies

Cleaner and green technologies are needed to reduce combustion related emission. The long term solution is to substitute fossils fuel with other source of energy that have low or zero gas emission in electricity generation, manufacturing and transport sectors. Electricity can be generated from other sources of energy

such as nuclear, hydro, wind and solar which emit zero carbon, but their contributions to the total energy generated is still small due to various factors. Renewable energy such as solar photovoltaic for electricity generation is still very costly and relies heavily on government support. Other mitigating factors are geographical location, current land use and environmental concerns such as the opposition to the development of wind farms by environmentalists.

Managing energy supply and demand efficiently is a near term solution. It is vital for the preservation of natural resources to prolong fuel reserve and protect the environment. Efficient use of energy (Energy Efficiency or EE) or the ability to do more work with less power is essential to ensure continuous production of food, goods and services, as well as protect the environment and ecosystem and achieve green growth. We have to change the way we produce, deliver and consume this energy.

This article will highlight demand side energy management practices and energy efficiency technologies particularly in the building and manufacturing industries in this country.

## Demand Side Energy Management

Demand side energy management means managing energy at the consumer side. That is the process of monitoring, controlling and conserving energy such as in buildings or organisations. Typically, it will involve the following steps:

1. Knowing your energy consumption and cost.
2. Identifying good practices and cost saving opportunities and estimate how much energy could be saved through energy audits.
3. Taking action based on the recommendations and identified opportunities.
4. Tracking your progress by analysing energy data to see how well your energy saving efforts work.

## Energy Management Systems

In order to enhance energy management in organisations, the ISO 50001 standards can be used as a guide. The standards specify the requirements of top management commitment, operational control, monitoring, measuring and

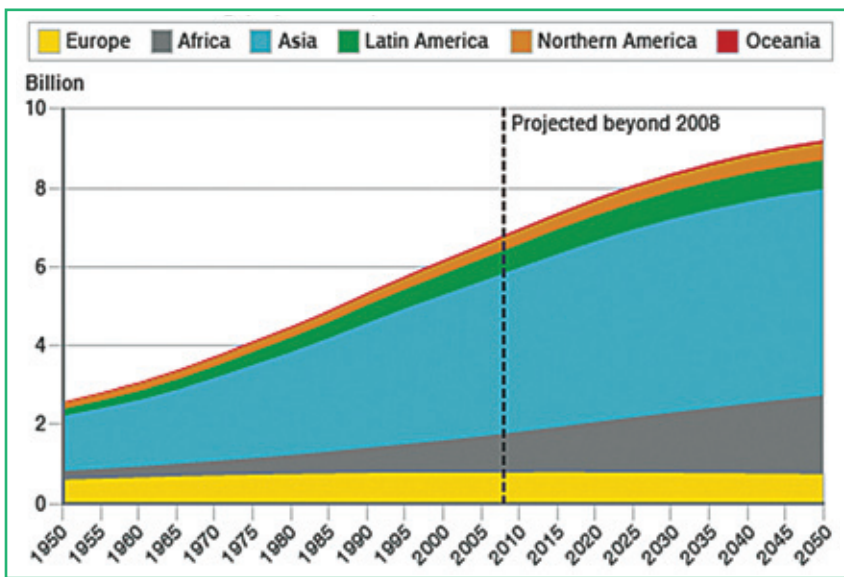


Figure 1. The world's rising population, 1950-2050

SOURCE: UN

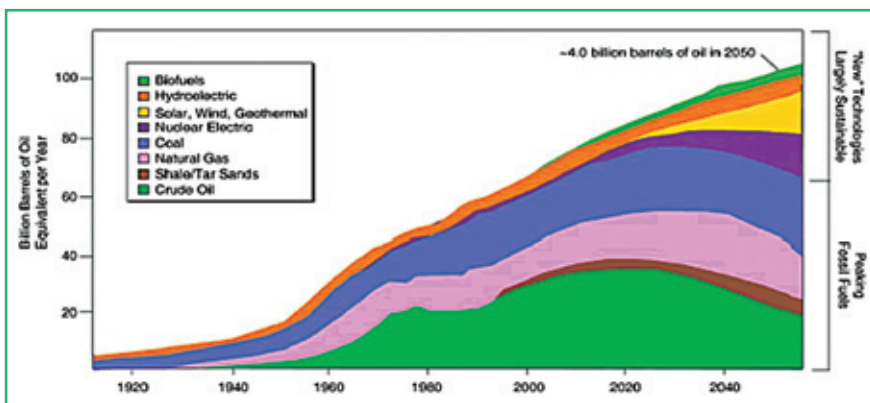


Figure 2. World energy demand - long term energy sources

Sources for Figure: Lynn Orr, Changing the World's Energy Systems, Stanford University Global Climate & Energy Project (after John Edwards, American Association of Petroleum Geologists), SRI Consulting

analysing energy use and conducting energy reviews. The success of energy management certainly needs the commitment and support from the top management and the participation and the contribution of everybody in the particular organisation.

## Managing Home Energy Use

There are a number of ways to improve EE. For home and personal energy use, it can be helpful for a start to analyse our utility bills. Today most homes are connected to a power supply which enable us to use many electrical appliances. The electricity bill will increase as we use more appliances. To keep the bill low, we have to control usage or manage our energy consumption. This can be done through conscious efforts at switching off any appliances such as lighting and the air conditioning system when we are out of the room or house.

Using energy efficient appliances is another way to reduce our electrical consumption and electricity bill. Energy efficient appliances means the appliance gives the same output with less energy consumption. For example, it is logical and worthwhile to choose a light source that gives the same brightness but with less power requirement or energy usage. Currently there are appliances that come with star rating. This star rating provides us with information on the energy consumption and expected saving. Suruhanjaya Tenaga has a website that provides more information on equipment with star rating.

as site planning, sustainable building design, building envelopes which relate to building fabric and the use of active systems inside the buildings such as efficient lighting and lighting control, efficient design of air conditioning system, the controls of electrical equipment and an energy management system. The standard also encourages practitioners to use renewable energy such as the use of daylighting, solar water heating and solar power generation where and when possible.

To save electricity on cooling the building, the standard recommends that room temperature be set at 24-27°C. However, this does not apply to rooms having special requirements such as operating theaters, instrument rooms or laboratories.

## Energy Management in Industries

Managing energy use in a manufacturing set up is a more challenging task due to the fact that we need to understand the manufacturing process and energy requirements for different processes. These include the efficiency of individual energy conversion equipment such as boilers, furnaces, heaters and dryers that provide heat to the process as well as equipment that provide chilled water or cooling to the processes.

To ensure that energy is not wasted due to inefficiency of the equipment, regular inspection and maintenance on major energy consuming equipments and systems must be carried out. Steam distribution systems and pipings, for example, need to be constantly monitored and well maintained to avoid any leakage which can cause an unnecessarily high energy bill. Inefficient combustion of fuel will result in fuel wastage, less heat generated and emission of black smoke. Replacing old inefficient equipment with new and energy efficient ones should be considered not only to save energy and maintenance costs but to improve the working environment and occupational safety and health.

The most simple and often ignored industrial practice is record keeping. Keeping records and tracking energy consumption and cost, operations of equipment, process change and production are important in managing EE in manufacturing. Analysing the data using scatter graphs can relate the production to energy consumption. If it appears that too many readings are off the trendline, it means the production is not energy efficient and the cause of the problems needs to be identified and rectified.

## Energy Efficiency Technologies

Reducing our economic activity to reduce greenhouse gas emission is not an option. Therefore the emphasis must be on technology improvement. It is not enough to make our buildings, appliances, lighting and automobiles etc. more efficient in their use of energy; we must also increase efficiency throughout the delivery chain using new technology. Many companies in the world have invested in the development of energy efficient technologies, systems and processes. Efficient technologies such as infrared drying, energy efficient motors, combined heat and power system, heat recovery system, LED lighting, solar light to name a few are important for low carbon and green growth as well as helping to maintain the competitiveness of our industry.

The following recommendations are proposed to increase implementation of EE for the local industries:

- Market benefits such as cost reduction, energy saving, increased competitiveness and environmental benefits should be highlighted and demonstrated.
- Information needs to be disseminated to the industries on the feasibility of EE.
- Best business practices need to be identified and the associated benefits such as increased profitability, improved market share and preservation of natural resources highlighted.
- Continuous research and development is required to innovate new energy sources and systems to ensure a continuous energy supply such as converting solar energy to affordable electricity.
- Enhanced utilisation of solar heat for drying.

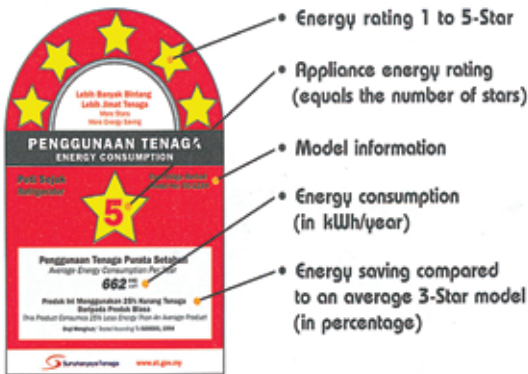
## Conclusion

EE is an important component of the larger solution to our energy future. Our manufacturing and building sectors have immense potential for incorporating EE measures. Combined with other energy technologies, EE measures can ensure that our energy needs are met and our economy continues to grow and prosper in a sustainable way. The challenges and opportunities for EE improvements can make our country more prosperous, more secure and reduce the strain on our energy infrastructure and environment.

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## Energy Management in Buildings

Managing energy use in buildings such as office buildings, shopping complexes, hotels and hospitals is similar to managing energy at home but probably a little more sophisticated due to the size and complexity of some of the buildings. The Malaysian Standard MS 1525: 2007 Code of Practice for Energy Efficiency and use of renewable energy in non-residential Buildings (First Revision) provides a good reference to managing energy in buildings. The standard specifies the requirements for architectural and passive design strategy such

# Environmental Resources: Finding the Right Equilibrium

Post Rio+20 Summit, developing countries like Malaysia needs to understand what makes our country liveable and attracts investors and also tourists. What exactly makes one city more liveable than another?

In the recent announcement of the most liveable cities 2012 (see Table 1), it was interesting to see many of these cities are in Australia. The Economist Intelligence Unit (EIU), an independent forecasting and advisory business within the Economist Group, defines liveability by the following criteria – stability, health care, education, infrastructure, culture and environment. Hence, environment is one of the criteria that is important to rank the liveability of a city. The humidity/temperature rating (adapted from average weather conditions) and the discomfort of climate to travellers (EIU rating) is used to rate the environmental dimensions. In short, the right equilibrium between development and sustaining the environmental resources is critical for a liveable city.

## Getting the Right Equilibrium

But how do we ensure we get the right equilibrium and at the same time ensure sustainable development. According to the Food and Agriculture Organisation (FAO) in their landmark 1995 publication, "Planning for sustainable use of land resources: Towards a new approach", two major aspects are important:

### Natural Resources

In the context of 'land', it is taken to be those components of land units that are of direct economic use for human population groups living in the area, or expected to move into the area. These are near-surface climatic conditions, soil and terrain conditions, freshwater conditions, and vegetational and animal conditions in so far as they provide produce (food). To a large degree, these resources can be quantified in economic terms. This can be done irrespective of their location (intrinsic value) or in relation to their proximity to human settlements (situational value).

### Environmental resources

These are taken to be those components of the land that have an intrinsic value of their own, or are of value for the longer-term sustainability of the use of the land by human populations, either in local or regional and global. They include

Table 1: Global liveable cities 2012 ranking

Top 10 cities				Bottom 10 cities			
Rank	Country	City	Rating	Rank	Country	City	Rating
1	Canada	Vancouver	98.0	130	Senegal	Dakar	48.3
2	Austria	Vienna	97.9	132	Sri Lanka	Colombo	47.3
3	Australia	Melbourne	97.5	133	Nepal	Kathmandu	47.1
4	Canada	Toronto	97.2	134	Cameroon	Douala	43.3
5	Canada	Calgary	96.6	135	Pakistan	Karachi	40.9
6	Finland	Helsinki	96.2	136	Nigeria	Lagos	39.0
7	Australia	Sydney	96.1	137	PNG	Port Moresby	38.9
8=	Australia	Perth	95.9	138	Algeria	Algiers	38.7
8=	Australia	Adelaide	95.9	138	Bangladesh	Dhaka	38.7
10	New Zealand	Auckland	95.7	140	Zimbabwe	Harare	37.5

Source: Economist Intelligence Unit's Liveability Survey (EIU, 2012)

biodiversity of plant and animal populations; scenic, educational or research value of landscapes; protective value of vegetation in relation to soil and water resources either *in loco* or downstream; the functions of the vegetation as a regulator of the local and regional climate and of the composition of the atmosphere; water and soil conditions as regulators of nutrient cycles (C, N, P, K, S), as influencing human health and as a long-term buffer against extreme weather events; occurrence of vectors of human or animal diseases (mosquitoes, tsetse flies, blackflies, etc.). Environmental resources are to a large degree 'non-tangible' in strictly economic terms.

Nonetheless, the distinction between natural resources and environmental resources may not be as important when defining an integrated and holistic land use planning. Environmental resources are normally part of the natural resources. What is more important to understand is how the tangible and intangible components need to be balanced out to enjoy the direct and indirect benefits at the local level.



## Economic Value

That brings us to another important concept of 'economic value' that is critical in managing environmental resources. The economic value expresses the degree to which a good/product or service satisfies individual preferences (Freeman, 1993). In the case of environmental resources, the goods/products are the natural resources – flora, fauna, environment and the people. Services include all those industries that are using the environmental resources i.e. tourism, agriculture, etc.



Thus, the economic value of environmental resources can be measured by the amount of money an individual (tourist/guest) is willing to pay for a good or service or the amount of money an individual is willing to accept as a compensation for forgoing the good or service. Willingness to pay (WTP) and willingness to accept (WTA) are measures that can be revealed in exchange.

## Benchmarking the Threshold of Environmental Resources

Finding the right balance in development that will not totally wipe out your natural resources is critical in Post Rio+20. That is indeed the essence of the 'sustainable development' concept. But realistically finding the 'magic number' for carrying capacity may sometime seem preposterous!



For example, in the field of tourism, the concept of tourism carrying capacity can be used when seeking and selecting 'appropriate' types of tourism developments in these sites. The physical and socio-economic carrying capacity can be determined for environmental resources. Carrying capacity in tourism has a direct relationship to sustainable tourism development. The concept of carrying capacity is one which exemplifies the need to maintain development and activities at a level that is both ecologically and socially sustainable. Primarily it aims to avoid environmental degradation and thus, evade social conflicts. Hence, carrying capacity would define limits on tourism development in a place, such as the maximum number of people that may visit a tourist destination at the same time, without causing environmental destruction and hence resulting in an unacceptable decrease in the quality of visitor satisfaction.

Thus, limiting 120 divers per day at diving destinations like Sipadan Island in Sabah as the carrying capacity point may seem non-scientific. Does that mean if you have 121



divers, you will get environmental degradation or if you have 119 divers, your corals are safe and sustainable? Certainly not! Thus, the weaknesses in finding these magic numbers that do not exist.

Trailing from the idea of carrying capacity is another more acceptable visitor management concept called 'limits of acceptable change' (LAC) that is important in environmental resource management. Determining the threshold number before a destination is destroyed is not as important as having a good management system to determine if the destination is negatively impacted. Hence, the LAC concept describes the level of allowable variations in the quality of the environment before irreversible degradation is likely to occur. Environmental management rather than development control is of much greater importance in managing the finite environmental resources.

The LAC framework to manage the environmental resources is frequently summarised into a nine step process:

1. Identify area concerns and issues.
2. Define and describe wilderness recreation opportunity classes.
3. Select indicators of resource and social conditions.
4. Inventory existing resource and social conditions.
5. Specify standards for resource and social indicators for each opportunity class.
6. Identify alternative opportunity class allocations.
7. Identify management actions for each alternative.
8. Evaluate and select preferred alternatives.
9. Implement actions and monitor conditions.

Hence, for the LAC model to work in environmental resource management, all processes must: (a) contain standards that

express minimally acceptable conditions; (b) require monitoring capable of determining whether standards have been met; and (c) base management prescriptions on evaluations of whether or not standards have been met.

In conclusion, finding the right equilibrium between development and sustaining the environmental resources is critical for the survival of mankind. In years to come, the next World War is not on who controls the fuel (oil) but it will be on who controls the energy, water and environmental resources.



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# Green Olympics – Approaches of Host Cities

## Introduction

The Olympics is a very grand global sporting event that is held once every four years. Many years of preparation are needed for the host city to be ready to host the sporting events as well as the millions of people that visit the host city during the Games. The International Olympics Committee saw the importance of sustainable development, and in 1993, they included the environment in its charter, developed an environment policy and required bidding cities to address the theme of the environment in their bidding documents.

The recent host cities of the Olympic Games are Sydney (2000), Athens (2004), Beijing (2008), and in 2012, it was hosted by London. Each of these cities has their own unique plans for the environment, and sustainable development and the adapter of a green economy have been the important elements in making the Games as eco-friendly as possible. Often, these cities undergo massive infrastructural development and its impact on the environment will be huge.

## Sydney Olympics 2000

The inspiration to organise the green Olympics in Sydney came from the commitment from the government, community and industry towards addressing sustainable development, or ecologically sustainable development (ESD). The United Nations Earth Summit in Rio de Janeiro in 1992 provided the right push for the Sydney Games bidding committee to focus on environmental concerns. The 'green' aspects of the Sydney bid for the 2000 Olympic Games were one of the contributing factors in making them the winner.

Interestingly, the Sydney bid received support from Greenpeace, the vocal advocates for the environment, where they collaborated with the joint winners of the Athletes Village design competition held before the bidding in 1993. This collaboration initiated the formation of an Environment Committee to create the Environmental Guidelines for the Summer Olympic Games. The Environmental Guidelines addressed the major areas of energy conservation, water conservation, waste avoidance and minimisation, pollution avoidance and protection of significant natural and cultural environments. It became part of New South Wales (NSW) legislation once Sydney won the right to host the Games, and ensured that the environment was considered at all stages in the development and organisation of the Games.

Some of the major positive changes happened after Sydney won the bid to host the 2000 Games:

- A coalition of environment groups came together to form Green Games Watch 2000. This independent group became the environmental watchdog for the Games development. It reported on progress of the games in regard to the environment and lobbied for environmental protection.
- The Olympics Coordination Authority (OCA), which was responsible for developing the physical infrastructure for the Games, invited the Earth Council to undertake an independent review of its environmental performance against the aims described in the Environmental Guidelines. Environmental Tender Specifications were set up to monitor tenders so that they followed strict guidelines and practices listed in the Environmental Management Plan and demonstrated how they would address the Guidelines. The OCA used an Environmental Management System, a structured set of procedures, lists and actions, to ensure it achieved its environmental commitments.

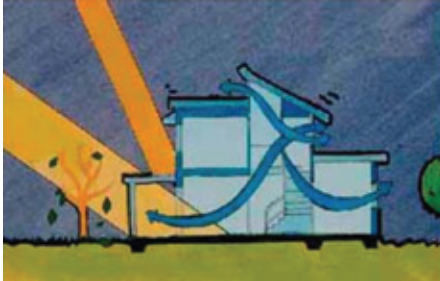
With the strict development guidelines, Sydney has achieved some success in the following aspects of energy efficiency, waste management and public transport.

- The Homebush Olympics site has been successfully remediated, a site which previously contained industrial and toxic waste. The site once housed a brickwork factory, an abattoir and an armaments depot as well as being the site for eight of Sydney's rubbish dumps.
- The Games Athletes Village was the world's largest solar suburb (in terms of the number of houses). The houses were fitted with photovoltaic solar collectors and connected to the electricity grid, as well as solar hot water collectors.
- Sewage and runoff from the Village was captured by the Water Reclamation and Management Scheme (WRAMS) for treatment and reuse on the site. A dual-pipe water system was used to provide the recycled water for toilet flushing and garden use. Gardens were landscaped and designed to use native species and minimise water use.
- Passive solar design was utilised to maintain temperatures and avoid the need



The Sydney Games Village

for air conditioning. The Passive design principles include orienting living areas to prevent the hot summer sun while allowing the mild winter sun into the house. Besides, the clever use of materials for heat dissipation and smart air flow design throughout the building resulted in a 50% reduction in energy demand of homes in the Village compared to normal homes.



Passive Design Principle for the Games Village, Sydney

- Sydney was able to recover 77% of the waste generated by the visitors and 60% of the construction and demolition waste. They put recycling bins and used biodegradable packaging materials during the entire Games. These strategies worked in the sense that they directly involved the people to take 100% responsibility for the waste reduction. The wastes were designated clearly among containers, glass, compostable, etc., with colour coded bins to sort and store them.
- Materials used in the Games were also interesting, as they were all biodegradable. Foodware and packaging were collected with food scraps using biodegradable bin liners. The utensils were made either from cornstarch or wood. Even the furniture, such as tables, chairs and partitions were made from recycled cardboard.

## Beijing Olympics 2008

Beijing, the capital of the People's Republic of China, is the second largest city in terms of population after Shanghai. Beijing is notoriously known for its pollution and much of the pollution actually comes from surrounding cities and provinces such as Shandong and Tianjin.

In preparation for the 2008 Summer Olympics, the city had spent nearly USD17 billion to maintain the air quality by implementing a number of air improvement schemes. Beijing had taken some drastic measures to curb air pollution before the Games. Further deterioration of the air quality threatened the cancellation of some outdoor events, such as marathon, triathlon and open water swimming. They imposed traffic restrictions by only allowing vehicles to be on the road on alternate days according to number plates. This restriction applied for citizens in Beijing, as well as the neighbouring municipal of Tianjin.

Beijing took other positive steps such as upgrading or replacing more than 2,000 buses and 5,000 taxis with cleaner models. Millions of coal-burning homes have been converted to gas and production at the biggest iron company in Beijing was cut by more than 70%. The public transport system was also improved with the addition of five new urban railways.

The United Nations did an assessment on the Games preparation and found that Beijing's efforts in spending huge amounts of money to support environmental enhancements and green projects had borne fruit, with improvements in the air quality. These achievements were considered impressive given that the Games were held in a rapidly developing city in a country facing multiple development challenges in the 21<sup>st</sup> century. The efforts and policies implemented have been seen as a catalyst for permanent improvements for the transportation infrastructure and vehicle emission standards.

There is no doubt that Beijing has reported good marks in fighting air pollution. Some of the results were found by the UNEP assessor to have exceeded expectations.



Newer models of buses & taxis for the Beijing Olympics



The Sydney Olympics mascot, Syd with an environmental message

- On emissions, the organisers had committed to implementing vehicle emission standards equal to Euro II for light vehicles. By upgrading to Euro IV emission standards for cars in time for the Games, Beijing now has one of the most stringent regulations in the world. It helped the cutting of carbon monoxide pollution by 47% and particulate matter levels by 20%. Emissions of nitrogen dioxide and sulfur dioxide, the main sources of acid rain pollution, also fell by 38% and 14%, respectively.
- An improvement can be seen in the number of blue sky days (days with an Air Pollution Index of 100 or below), where it rose from less than 180 days in 2000 to 274 days in 2008.
- The greening of Beijing and the Olympics' venues, with the creation of 720 green spaces in central Beijing. Since winning the bid to host the Olympic Games, approximately 8,800 hectares of green space were developed using more than 30 million trees and rose bushes.
- Waste classification and recycling goals were exceeded by 2% and 5%, respectively.

Furthermore, hazardous and medical waste treatment facilities were expanded and updated with all solid waste being sorted in venues; the recycling rate in the Olympics' venues was 23% higher than the committed level.

- Another major effort was the elimination of the ozone-depleting hydrofluorocarbons (HFC) that contribute to the global greenhouse effect. Though it was planned for a total phase-out of HFC in Beijing by year 2030, they managed to do that as early as 2008, ahead by 22 years.
- The Olympic Games accelerated the introduction of energy-efficient infrastructure in Beijing, where more than 20% of the total electricity consumed in all the venues were supplied by renewable energy.

Continued on page 12

With almost all the sports venues or complexes being newly built for the Games, they were able to implement green elements and practices into the buildings:

**Beijing National Stadium**

Could gather roughly 70% of the water needed to run the facility.



**Beijing National Aquatic Stadium**

Expected to be 30% more energy efficient than a standard building of similar size by using super efficient LED lights.



**Beijing National Indoor Stadium**

Used photovoltaic generators installed under the roof and behind the curtain walls of the structure putting out as much as 100 kilowatts of electricity daily. Attached to the walls and roof of the stadium, the PV system has over 1,100 solar battery components.



**Beijing Olympics Green Convention Centre**

Had very efficient insulation throughout the building. Additional green features include rain water collection on the roof for flushing systems and irrigation of the surrounding landscape, an ice storage cooling system, and a 'free air cooling' ventilation system in the public foyers of the convention centre.

**Beijing Olympics Village:**

Had solar heating, solar hot water, solar thermoelectric cogeneration and intelligent controls. It consumed about one thirtieth of the energy consumed by conventional buildings. Plus, 200 tonnes of water could be recycled every day and used in landscaping. Almost 90% of all the hot water used in the Olympics village was solar heated, and 80-90% of street lights around Olympics' venues were powered by solar.



**Olympics Green Tennis Centre**

Had a zero-discharge sewage treatment system where 100% of sewage was treated through membrane biological reactors before being recycled for watering. It also utilised fully the energy sourced from ground with a geothermal heat pump system for cooling and heating.

**London Olympics 2012**

London was the host for the Summer Olympic Games 2012. The London 2012 Organising Committee (LOCOG) had committed itself to meeting the sustainable event management standard BS8901 in preparation for the Games and they aimed to be the first and truly sustainable Olympic and Paralympic Games host city. The commitment not only covers infrastructural development, but also comprises public transport, meals preparation, waste management, and every aspect of the activities related to preparing and hosting the Games.

Among the six development programmes and sustainability achievement shared by the LOCOG are as follows:

- The Olympics Park: The Olympics Stadium was completed on time and within budget, while meeting high sustainability standards. It sites the largest new parkland in Europe, and the existing river valley on site was cleaned and redeveloped.
- Carbon Management: LOCOG used new carbon footprint methodologies to measure the footprint of this year's games and this will be monitored for the entire term of the project. The LOCOG prepared pre-Games sustainability report that listed in detail the breakdown of the estimated carbon footprint and the measures to reduce and mitigate them. They then worked to achieve direct carbon savings through energy efficient practices

and sourcing local and renewable energy.

- Sustainable Transport: Transport arrangements and preparations were a major challenge for a global city such as London. Hence, the organising committee incorporated walking and cycling schemes for the visitors to the Games. This was less strenuous to the current public transport such as buses and metro. Another novel idea was to utilise the Thames river for low carbon, sustainable water transport, as well as introduction of the Active Travel Program.
- Food Vision: LOCOG provided 14 million sustainably sourced meals over the entire duration of the Games. Its chosen catering partners met the Food Vision standards.
- Waste: LOCOG has committed itself to a 'zero waste to landfill' Olympic Games. According to the report, the committee achieved a 98.5% rate on material re-use and 99% on material recycling in demolition and construction of the Olympics Park, according to the standards of the Olympics Delivery Authority (ODA).
- Standards: In 2011, LOCOG was certified as the first Organising Committee to achieve the Specification for Sustainability Management Systems for Events, also known as the British Standard 8901.



The Olympics Park, London

**Summary**

With such big scale preparations needed for organising the Olympic Games, and also the impact it brings during and after the Games, the IOC has made the right move in requiring the bidding cities to include environmental management and sustainable development plans in the bidding documents. It will also be interesting to see Malaysia's participation in future bidding.

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**Source**

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# International Trade and CO<sub>2</sub> Emissions

The concern with growing greenhouse gas (GHG) emissions, the cause of climate change, has generated many calls for action, particularly to limit emissions. In terms of current global efforts, the only global mandatory mechanism is the Kyoto Protocol whose first commitment period (CP1: 2008-2012) expires this year. The Kyoto Protocol obliged developed/Annex B (A-B) countries, the largest historical emitters, to take emission cuts in CP1 relative to their 1990 emissions in most cases. The aggregate emissions reduction for CP1 was to be at least 5% below 1990 levels (Article 3 (1), Kyoto Protocol) with individual countries or regions (like the EU) taking on differing cuts.

## Moving the Green Economy

The method of calculating these cuts applies territorial emissions accounting as per the Intergovernmental Panel on Climate Change (IPCC) accounting rules. This method creates emissions boundaries according to geographical territories on the rationale that mitigation only applies to GHG emissions within national territories.

Although there has been some progress towards achieving the CP1 target, global emissions, however, have increased considerably recording a 39% growth between 1990 and 2008 (Le Quéré *et al.*, 2009). The aim of this article is to summarise the findings of a recent study published in 2011 as to the reason behind this alarming trend.

Peters *et al.* (2011) consider emissions reduction responsibility from a different perspective, that is consumption. The consumption approach attributes responsibility for emissions related to all consumption in a territory, regardless of where the goods and services were produced. They find that the results are quite different from those using territorial calculations. The latter shows a 0.3 gigatonnes (GT) decrease in CO<sub>2</sub> emissions in A-B countries from 1990-2008 whilst the former shows an additional net emission transfer of 1.2 GT CO<sub>2</sub> from developing/Non-Annex B (N-AB) countries to A-B countries. A conservative estimate of 11% of the growth in global emissions in this time period can be attributed to A-B countries using consumption accounting as opposed to a 3% reduction using territorial accounting. Hence increased consumption in A-B countries has caused an increase in global emissions contrary to the UNFCCC reported statistics based on territorial accounting.

Overall they find that international trade has played a significant role in the growth of emissions as well as the change in emissions in many countries. They note that international trade and financial flows provide a link between production and consumption in different countries which is ignored in territorial accounting of emissions.

## Method

Peters *et al.* (2011) based their calculations on CO<sub>2</sub> emissions from fossil fuel combustion, cement production and gas flaring only. Other

GHGs like methane and nitrous oxide, or CO<sub>2</sub> emissions from other sources like land use change, are not included in the calculations.

They made detailed calculations for three years, 1997, 2001 and 2004 using input-output tables and used this to develop a time series from 1990-2008. The input-output analysis has been disaggregated to 113 regions (including 95 countries) and 57 economic sectors. Details of the method are provided in the paper (*ibid.*).

## Results

Annual percentage growth rate of emissions from the production of exported products was compared to the annual percentage growth rate of other indicators like population, GDP, CO<sub>2</sub> emissions, and trade. The results interestingly showed that except for trade (12%), the growth rate for CO<sub>2</sub> from exported products (4.3%) grew faster than that for population (1.4%), GDP (3.6%) and CO<sub>2</sub> emissions (2%). Furthermore, the net annual average growth rate of emission transfer from N-AB to A-B countries grew at a higher rate of 17%. Figure 1 shows a graph of these results (1990-2008) as an index to 1990 values.

Changes in emissions for A-B countries were calculated comparing net change in territorial emissions and emissions transfers with N-AB countries. Some of the results are shown in Figure 2. The study finds that net emissions transfers via international trade accounts for emissions that exceed the Kyoto Protocol emission reductions. In both the cases of the

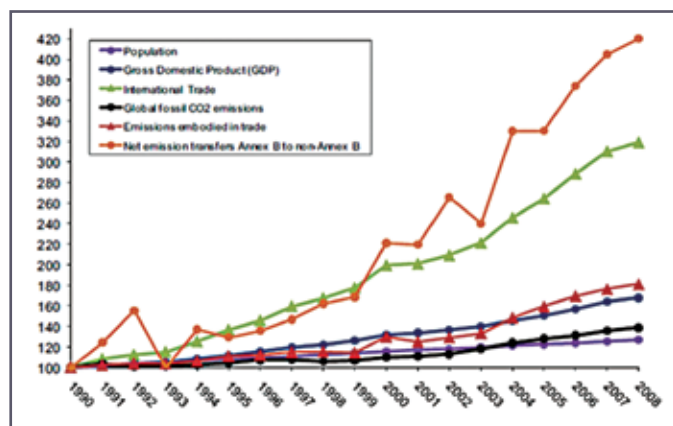


Figure 1. The development of various global macrovariables indexed to 1990 Source of variables: Population- US Census Bureau; GDP - & International Trade- United Nations National Account estimates of Main Aggregates; Fossil Fuels & Process Emissions – Carbon Dioxide Information Analysis Centre; Emissions embodied in global Trade - present study; the Net Emission Transfers between Annex B and Non Annex B Countries - present study. Source: Peters *et al.* 2011

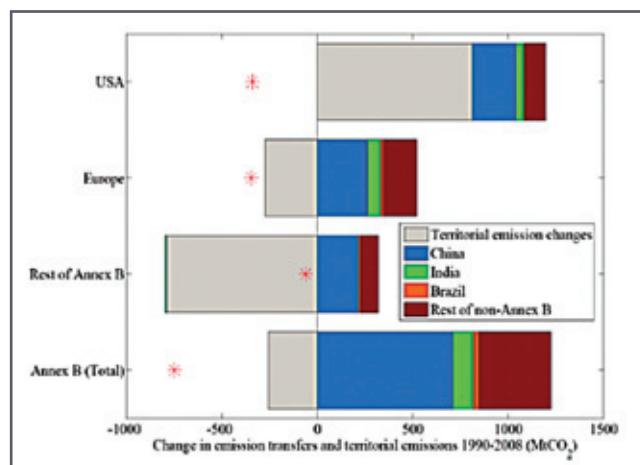


Figure 2. The net change in territorial emissions (1990-2008) together with the change in the net emission transfer between each country and the non-Annex B countries(1990-2008). The red stars represent pledged emission reduction commitment in the Kyoto Protocol. Emission transfers between Annex B EU27 countries plus Croatia, Iceland, Liechtenstein, Norway and Switzerland. Source: Peters *et al.* 2011

Continued on page 14

US and Europe, international trade changed their emissions ranking. Using the consumption approach, the US was the number one emitter rather than China on the territorial accounting basis.<sup>1</sup> Europe, rather than having reduced her emissions and almost achieving her CP1 target, is seen to have in fact increased it on a consumption accounting basis. The UK for example rather than achieving a 19% emissions reduction from 1990-2008 based on the territorial accounting method, had an emissions growth of 20% using the consumption approach (Barrett *et al.*, n/d). The rest of Annex B includes net exporters like Australia, Ukraine and the Russian Federation and net importers like Japan. Although they are the only group that achieved their CP1 target collectively from both a territorial and consumption perspective, their contribution is insufficient to rectify the shortfall from the US and Europe. Hence as noted above, the overall effect is that A-B countries have contributed to the increase in global emissions from a consumption perspective.

If the average growth rate of net emission transfers between A-B and N-AB countries continues at the present rate of 17%, by 2020, it is noted that an estimated 2.3 GT CO<sub>2</sub> will be transferred, comparable to the most optimistic 2020 emissions limitations offered by A-B in the Copenhagen Accord (CA). In other words, all the emissions reductions offered in the CA by A-B countries would be achieved through emissions transfers enabled by international trade.

Several interesting facts emerged from the study on sector contributions to net emission transfers (Figure 3). Firstly, international trade in non-energy intensive manufactured products (textiles, electronics, furniture, cars, etc) dominates net emissions transfers (41% of growth from 1990-2008). Most efforts to reduce emissions, however, are normally focussed on energy intensive manufacturing (cement, steel, pulp and paper, etc), emissions of traded products at the global level which have been stable from 1990-2008. Be that as it may, the study secondly shows that A-B countries moved from being small net exporters of emissions from energy intensive manufacturing in the 1990s to substantial net importers presently (35% of growth in imported emissions).

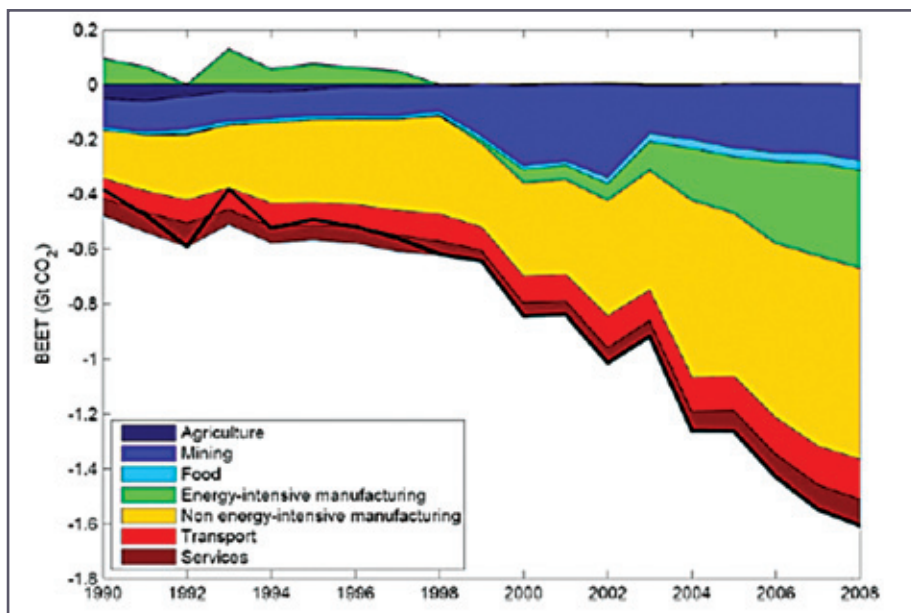


Figure 3. The development of the net emission transfers via international trade between Annex B and non-Annex B countries for seven aggregated sectors from 1990 to 2008 using the Time Series With Trade (TSTRD) method. Net emission transfers represent the emissions from the production of exports minus the emissions in other countries from the production of imports. The solid black line is the net emission transfers for Annex B and non-Annex B countries and the coloured areas are the balance for each sector. Source: Peters *et al.* 2011

The above suggests that policy should also focus on non-energy intensive manufacturing which is taking a growing share of the net emissions transfers. It also highlights the fact that A-B countries have divested themselves of energy intensive or dirty industries from their own territories and instead import the finished products from N-AB countries. The study postulates that this trend is not driven by climate policy, but results from other socio-economic factors.

### Recommendations

The study recommends that consumption emissions of A-B countries should be compiled together with territorial emissions. Consumption emissions should be subjected to regular monitoring, review and verification (MRV). Given the strong role of international trade on the growth of global emissions, it notes that policies that affect international trade should not be separated from climate policy, particularly within the context of a differentiated framework for mitigation like the Kyoto Protocol.

### Conclusion

This article drives home the point that consumption is a fundamental driver of emissions and that international trade has

facilitated increased consumption. Unless measures are taken to address consumption, emissions will continue to rise. A corollary point therefore is whether the notion of continuous economic growth which is dependent on increasing consumption is feasible or whether the time is ripe for some other measure of progress to be adopted.

#### Note

<sup>1</sup> A more recent study, however, suggests that this reversed in 2009 with China being the top emitter on a consumption basis too (Peters *et al.*, 2012).

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#### Annex B countries

Australia	Finland	Latvia	Russian Federation
Austria	France (including Monaco)	Lithuania	Slovakia
Belgium	Germany	Luxembourg	Slovenia
Bulgaria	Greece	Netherlands	Spain
Canada	Hungary	New Zealand	Sweden
Croatia	Iceland	Norway	Switzerland (including Liechtenstein)
Czech Republic	Ireland	Poland	Ukraine
Denmark	Italy (including San Marino)	Portugal	United Kingdom
Estonia	Japan	Romania	United States of America

Box 1: Summary of key points

	Key Points
1	Shows that stabilisation of CO <sub>2</sub> emissions (from fossil fuel combustion, cement production and gas flaring) in developed countries was partly due to growing imports from developing countries.
2	Most developed countries have increased their consumption based emissions faster than their territorial emissions.
3	International trade is a significant factor in explaining change in emissions in many countries from both a production and consumption perspective. This is explained by the change in international trade structure and volume; and differing emission intensities in different regions resulting in regional shifts of the location of emissions from the production of goods and services and the location of its consumption.
4	International trade in non-energy intensive manufactured products dominates the net emissions transfers (41% of growth from 1990-2008).
5	Net emissions transfers via international trade accounts for emissions that exceed the Kyoto Protocol emission reductions.
6	Consumption based emission calculations often change emission ranking of individual countries.
7	International trade and investment flows provide a link between production and consumption in different countries which are not considered in the current territorial based accounting system for emissions.
8	Increase in CO <sub>2</sub> emissions from the production of exported products is similar in magnitude to land-use change emissions.
9	Growth in emissions from the production of exported products is greater than growth in population, CO <sub>2</sub> emissions and GDP but less than growth in dollar value of international trade.
10	The cumulative relocation from A-B to N-AB of emissions resulting from international trade from 1990-2008 is 16 GT CO <sub>2</sub> .
11	Continuation of the historical trend in relocating CO <sub>2</sub> emissions from A-B to N-AB is equivalent to 2.3 GT CO <sub>2</sub> annually in 2020 which is comparable to the most optimistic 2020 emissions limitations offered by A-B in the Copenhagen Accord.
12	The figures presented are conservative and do not take into account emissions relocated by the global supply chain (or emissions-associated imports that are used to produce exports) which consistently attribute more N-AB emissions to A-B.
13	Emission transfers via international trade often exceed emission reductions in developed countries. The net CO <sub>2</sub> emission reduction of 0.3 GT CO <sub>2</sub> (2%), from 1990-2008 in A-B countries is much smaller than the additional net emission transfer of 1.2 GT CO <sub>2</sub> from N-AB to A-B.
14	Increased consumption in A-B countries has caused an increase in global emissions (contrary to territorial emissions statistics reported in UNFCCC).
15	Theory suggests growth and structural changes in international trade, important factors in the rise of emissions, were not driven by climate policy.
16	Policies that affect international trade should be considered together with climate policy.
17	Developed countries should compile their consumption based emissions alongside their territorial emissions and this should be subject to MRV.
18	Uncertainty is higher for consumption based emission calculation compared to the territorial basis.

Compiled from Peters *et al.*, 2011

Box 2: Summary of key data

	Key Data	Data
1.	Growth of global emissions (1990 – 2008)	39%
2.	Developed country territorial emissions (1990-2008)	Stabilised
3.	Developing country territorial emissions (1990-2008)	Doubled
4.	Net emission transfer from N-AB to A-B countries (1990)	0.4 GT CO <sub>2</sub>
5.	Net emission transfer from N-AB to A-B countries (2008)	1.6 GT CO <sub>2</sub>
6.	Net annual average growth rate of emission transfer from NA-B to A-B countries (1990-2008)	17% per year
7.	Global CO <sub>2</sub> emissions from the production of exported products (1990)	4.3 GT (20% of global emissions)
8.	Global CO <sub>2</sub> emissions from the production of exported products (2008)	7.8 GT (26% of global emissions)
9.	Annual growth of CO <sub>2</sub> emissions from the production of exported products (1990-2008)	4.3% per year
10.	Annual growth of population (1990-2008)	1.4% per year
11.	Annual growth of GDP (1990-2008)	3.6% per year
12.	Annual growth of CO <sub>2</sub> emissions (1990-2008)	2% per year
13.	Annual growth of dollar value of international trade (1990-2008)	12% per year
14.	Emissions reduction in A-B from a territorial emissions perspective	3%
15.	A-B share of growth in global emissions on a consumption basis (not including portion of emissions from capital formation for exports)	11%

Compiled from Peters *et al.*, 2011

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# Event Highlights

## Department of Environment, Malaysia

June 2012

### 22<sup>nd</sup> Inter-University Environmental Debate

Organised by the Department of Environment (DOE) in collaboration with the Malaysian Universities Debate Council (MADUM), Ministry of Higher Education and Dewan Bahasa dan Pustaka (DBP), the 22<sup>nd</sup> Inter-University Environmental Debate saw participation from 27 institutions of higher learning in Malaysia. Universiti Malaya hosted the event from 29 June to 2 July 2012. The two teams that made it to the finals of the 2012 Debate held at Auditorium, Kompleks Perdana were Universiti Tun Hussein Onn Malaysia (UTHM) and Universiti Malaya (UM). UTHM emerged the overall winner of the 2012 Debate, receiving the Minister of Natural Resources and Environment Challenge Trophy, a cash prize of RM8,000.00 and a certificate of participation. Mohd Firdaus bin Ahmad of UM emerged as the Best Debater and received the Director General of Environment Trophy, together with a cash prize of RM1,500.00. YBhg. Datuk Dr. Abdul Rahim bin Haji Nik, the Deputy Secretary General (Environment), Ministry of Natural Resources and Environment gave away the prizes. The Department hopes that participation from universities and institutions will increase in the yearly event.



July 2012

### ASEAN Environment Year 2012

Held from 17 to 18 July 2012 in Kuala Lumpur and attended by Environment Ministers and representatives from ASEAN countries as well as China, Japan and South Korea, the launch of the ASEAN Environment Year 2012 was officiated by YB Dato Sri Douglas Uggah Embas, Minister of Natural Resources and Environment. This year's theme, 'Environmental Awareness through Eco-Schools' focused on the role played by schools in improving awareness of their pupils on the importance of protecting the environment and conserving nature.

To highlight the occasion, the inaugural ASEAN Eco-Schools Award 2012 was presented by YB Tan Sri Datuk Seri Panglima Joseph Kurup, Deputy Minister of Natural Resources and Environment to selected primary and secondary eco-schools from ASEAN Member States to recognise their exemplary efforts in inculcating environmental awareness in all aspects of education to their students and the surrounding communities. The selection of the eco-schools was based on national criteria and the ASEAN Guidelines on Eco-schools adopted by the ASEAN Environment Ministers in 2011. The winner received a Labu Sayung Crystal and a certificate of participation signed by YB Minister of Natural Resources and Environment.

Delegates from ASEAN countries were taken to visit the SMART tunnel, Taman Eco Rimba and SJK(C) Tsun Jin which was one of the recipients of the Sustainable School – Environment Award.



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