STATUS OF SUSTAINABLE BUILDING IN SOUTH-EAST ASIA

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1. Report on the state of sustainable building in South-East Asia

This report summarises *the current state of sustainable building construction in South-East Asia.* It covers the :

(i) Status of national or regional development of performance targets for SB;

(ii) Status of adoption of policies (tax, programs, regulations etc) that will further SB;

(iii) Status of adoption of SB by the investor community;

(iv) Status of education and training in SB;

(v) Status of adoption of new SB technologies and techniques;

(vi) Status of adoption of SB whole-building performance rating systems.

The report was based on information gathered for SB07SEA Conference, discussions during the conference and further research in some areas with existing limited information for producing a comprehensive report.

1.1 Brief Profile of South-East Asia

South-East Asia is a region covering 4.875.068 sq km which consist of 3,209.506 sq km of land and 1,665,562 sq km of water. South-East Asia comprise ten member countries; Brunei, Cambodia, Indonesia, Lao PDR, Malaysia, Myanmar, Philippines, Singapore, Thailand, and Vietnam, with a combined total population of around 540 million. The population varies from the fourth world populous country like Indonesia with 238 million people to the least populace country of Brunei (365,251, July 2004). The member countries are different not only in terms of population but also in terms of geography, culture, and level of socio-economic development (Shafii et al, 2005, Shafii et.al 2007)

2. Status of SB Performance Targets for South-East Asia

Energy , Water and Waste remain critical issues for environmental sustainability in South-East Asia. The foregoing paragraphs describe existing issues and targets and those planned for the future.

2.1 Energy

Economic development remained the priority of most South-East Asian (SEA) governments for the past few decades. The major objective of these economies' energy policy was to provide enough energy to fuel their growth. Under such a strategy, development in the region has been accompanied by a high growth rate of energy consumption and therefore, heavy pollution. The South-East Asian economies began to make strategic changes in their energy policies only after 1990. An extensive review of energy policies in Indonesia, Malaysia, the Philippines, Singapore, and Thailand shows greater balance between security and

sustainability concerns, and increased focus on wise consumption of energy along with an emphasis on adequate supply (Asia Business Council). The drivers for such change include:

• Concerns over resource depletion and energy security. As energy consumption rise rapidly, SEA governments are increasingly considering the possibility of energy shortages with the realization that increasing dependency on imported oil could hinder economic growth and threatening national security. Sky-rocketing energy prices and occasional disruptions to energy supplies by some producing countries in the past few years have strengthened the arguments for examining the way energy is used in their economies. Therefore, improving the productivity of energy consumption is quickly becoming an unavoidable necessity.

• Concerns over pollution and environmental damage. Heavy pollution and environmental damage have spurred concerns about its impacts on the quality of air. The consumption of energy is the biggest contributor to air pollution, and has become an urgent matter in which governments can no longer ignore.

• Recognition of the major contribution energy efficiency could make in addressing energy security and environmental challenges. Energy efficiency is one of the quickest, cheapest, cleanest ways to address energy and environmental challenges, and is one well-proven strategy practiced worldwide.

In the light of recent hikes in energy prices and tight energy supply-demand conditions, energy security has returned to the top of all country economies energy agenda including South-East Asia. The problem of global warming has been addressed in their energy policies, as the energy sector is the main source of greenhouse gas emissions. One of the major strategic responses of South-East Asia economies is placing greater emphasis on energy conservation and efficiency and renewable energy sources, in order to secure energy as well as to reduce emissions.

In Malaysia the industrial sector has always been the biggest user of electricity consuming about 54% of the overall electricity generated in 2001. The residential and commercial sector consumed 46% (18% Residential and 28% Commercial), while public lighting, mining and other sectors consumed about 1%.

Currently, there is not much published data available on the Energy Performance or actual annual energy consumption of buildings. However, the energy index (total energy used in a building for one year divided by the gross floor area of building) of typical office buildings is between 250-300 kWh/m2/year depending on the type and function of buildings. The breakdown of average energy consumption in an office building is 52% for air conditioning, 20% for lighting and 28% for general equipment *(Kristensen,2003).*

The shift of economy towards energy–intensive industries is a major reason behind the increased in energy demand in Malaysia, however, inefficient energy consumption by the public also added to this higher energy demands. The cost implication and continuous upward trend in energy consumption is a serious concern to the Malaysian government, and this is reflected in the development of the new energy policy and targets , described later in this report.

The revised Malaysian Standard MS1525:2001 for non-residential buildings sets an inferred building energy index standard of 130 kWh/m2/year, in comparison to the typical consumption of 250-300 kWh/m2/year.

The energy consumption in Singapore average around 220 kWh/m2/year and only a handful of them below 140 kWh/m2/yr , despite Singapore's mandatory overall thermal transfer value (OTTV) standards since 1978 (Kristensen 2003). OTTV is the amount of heat a building fabric can transmit.

2.2 Renewable Energy

In the 9th Malaysia Plan, the Government continues to promote renewable energy and energy efficiency as part of the sustainable development agenda.

Malaysia is well-known among the ASEAN countries that has been actively promoting the use of renewable energy in the national energy mix. Malaysia's Five Fuel Diversification Policy provides the renewable energy policy guidance while the current grid-based small renewable energy programmes or SREP, embodies national renewable energy strategy. To accelerate investments in the palm-oil industry for power generation and demonstrate the feasibility of renewable energy power project the government has launched the Biomass-Based Power Generation and Cogeneration (BioGen) Programme (Abdul Wahab et al, 2005)

Malaysia also promoted *building integrated photovoltaic (BIPV)* technologies through the Malaysian Building Integrated Photovoltaic (MBIPV) project. The objectives of this project are to improve significantly the overall technical and non-technical capabilities of the government and private sectors to design, develop and fully utilize the BIPV technology, as well as to develop local BIPV services and manufacturing industries. Cost reduction of BIPV technology would be achieved through sustainable and widespread BIPV market, and the improved local BIPV industries.

The Thailand Government has also been trying to promote the utilization of renewable energy as another means to diversify energy sources. The aim of this plan is to increase the renewable energy share of commercial primary energy to 8% by 2011. However, widespread diffusion of renewable resources has been hampered by their high cost relative to other energy sources, high initial capital costs, and the limitation of available renewable resources, especially biomass. If successful, the plan will deliver a production equivalent 5068 ktoe per year. Solar, wind, biomass, biogas, hydro, biofuels, geothermal and fuel cells are included in the Strategic Plan, as well as energy efficiency (Australian Business Council for Sustainable Energy, 2005).

STRATEGIES TO IMPROVE ENERGY EFFICIENCY IN THE INDUSTRIAL, COMMERCIAL, AND RESIDENTIAL SECTORS

Strategy	Actions
	• Analysis of barriers preventing cogeneration investments in Thailand • Policy research and study on economic impacts for a fuel subsidy scheme for gas-fired CHP
Building Energy Rating and Labeling	• Identification of energy consultant training needs • Compilation and verification of existing building data to establish a benchmark • Development of routines for compiling and processing building data
Energy Audit and Management Scheme	• Improved segmentation and prioritization for the targeting of measures • International review of best practices and recommendations for policy and programmatic approaches • Establishment of innovative incentive mechanisms for both designated and non-designated facilities • Establishment of effective institutional, financial and human resource frameworks to support scaling-up of the value engineering concept
Loan Funds	• Investigation of the implementation of a guarantee fund in Thailand to solve the collateral issue • Study on what type of contract(s) are best suited for Thai customs and business relationships
Energy and CO2 Taxes	• Rationalization of energy taxes • Sensitivity analysis of levee rates for energy and CO_2 taxes • Determination of the impact of energy and CO_2 taxes
Demand Response (DR) and Direct Load Control	• Behavior and perception of electricity end-users and customers in different end-use sectors • International review of DR best practices, with recommendations on applicable DR measures for Thailand • Technical studies on how different DR measures applicable for Thailand would contribute to energy conservation and grid reliability

STRATEGIES TO PROMOTE THE USE OF RENEWABLE ENERGY FOR ELECTRICITY, HEAT, AND POWER GENERATION	
Strategies	**Actions**
Interconnection Agreements	• Independent assessment of bottlenecks in current SPP and VSPP programs and their resolution • Survey of international best practices in interconnection arrangements • Analysis of strategies to provide incentives to utilities to encourage more evenly distributed generation
Power Purchase Agreements	• Study on the impact of changing tariff structure on basis on "time of generation" rather than "firm/non-firm" contracts for all new renewable energy generators. • Study impact on Thai economy and renewable energy generators of shifting from natural-gas price indexing to another index for renewable energy tariffs (e.g., biomass-indexed, flat-rate).
Feed-in Tariffs	• Study to cross-check feed-in values proposed by other studies against estimates from industry in Thailand and internationally • Study to draft feed-in tariff legislation • Study on externality costs of different power resources in Thailand
Externality Adders under IRP	• Integrated Resource Plan for Thailand, including consideration of risks (especially fuel price volatility risk), as well as social and environmental costs
Renewable Portfolio Standard (RPS)	• Study to determine whether it is possible to modify Thai RPS to ensure that EGAT's RPS obligations are met cost-effectively • Study to review policy options under consideration by the Thai government in light of international experience and Thailand's industrial structure and regulatory environment

However, there appears to be barriers for Implementing Renewable Energy Projects in Vietnam (Quyen et al., 1999), as the current policy and regulatory framework for encouraging the use of renewable energy is inadequate to provide the necessary drivers to accelerate the development of the Vietnamese renewable energy industry.

The following are some of the technical key barriers being identified by the REAP workshops:

- insufficient awareness of the available technologies, their costs and performances
- a lack of reliable data on biomass energy sources
- a shortage of high quality technology at affordable prices
- the high cost of biomass conversion technologies that are imported and therefore expensive.

The Financial and Infrastructural barriers include:

- a lack of commercial businesses and infrastructure to provide renewable electricity equipment and services
- the continuing high costs of biomass conversion technologies and therefore of energy generated from biomass
- limited access to finance for consumers, businesses and project developers.

The World Bank is has also given support to the energy sector in Vietnam for:
i. improving energy access to the rural areas
ii. helping the country to mobilise finance for meeting the rapidly growing demand
iii. improving the technical, commercial and financial efficiency of the energy system
iv. initiating a reform of the sector, including market restructuring, sector and corporate governance.
Since the start of its operations in Vietnam, the World Bank has approved over $1 billion in credits

2.3 Water

Water management in Malaysia is largely the purview of MEWC, and has many important roles to play, notably the provision of scientific information and knowledge on the nature and extent of the resource.

The public and industrial sectors use large quantities of freshwater in their operations and wastewater management is an on-going challenge.

The growth in population and GDP over the last three decades has resulted in heavy demand for water. The problem of population growth is particularly felt in the urban areas, due to rural-urban migration and growing urbanization. The domestic and industrial water demand in Malaysia is expected to triple over the next 50 years. Estimation based on doubling the per capita water consumption by 2020, predicts that water shortages will occur within the next 5 years.

In general, the efficiency of water consumption in Malaysia is low. The amount of water consumed by the agriculture, industrial and domestic sector are approximately 62%, 21 % and 17% of the total water resources, respectively.

In Malaysia, there is also a high proportion of unaccounted water in urban water supply systems, as one quarter to one third of the domestic and industrial water is lost before it reaches the consumers. These losses are the result of leaks in the distribution systems and illegal connections. With increased demand from population growth and industrialization as well as competing for diminishing water availability, the optimization of water utilization must be dealt by the government urgently, in order to move towards efficiency, effectiveness of use, conservation and sustainability.

The Malaysian Water Industry Guide 2004 indicates that in year 2002, 67% of water consumption is for the domestic usage. Per capita consumption rate of the domestic water usage varies from one state to another. The highest is about 476 liters per capita per day and the lowest is about 90 liters per capita per day. Water conservation at domestic level is not limited to using less water; it is also about channeling the kitchen wastewater in a proper manner as well as reusing water whenever possible. It is noticeable that there are factors contributing towards the high water consumption and pollution patterns such as the tariff rates, the sanitation and disposal facility, drainage system and the availability of water. The per capita consumption also varies significantly between the urban and suburban areas.
Issues on the governance as well as methods of managing water resources are being studied and looked into in Malaysia following the amendment of the Federal Constitution to transfer the jurisdictions of law under a concurrent list which was previously under the state purview.

Ministry of Energy, Water, and Communication (MEWC) and Federation of Malaysian Consumers Association (FOMCA) organised the National Water Conservation Awareness Campaign from July 2006 – Jun 2008. The campaign is targeted to conserve 10% of water consumption by valuing it in reduction of domestic water usage by 10% (FOMCA, 2005).

The campaign highlight the pivotal role of government, industries and community participation in consumer education on water conservation in addressing the increasing demand problems.

2.4 Waste

2.4.1 Municipal Solid Waste

Due to growing population and increasing consumption, Malaysia generates waste at 19,100 tons per day. In Kuala Lumpur waste generation is about 3,000 tons a day and forecasts shows that this will increase each year. In 2007, about 7.34 million tonnes of solid wastes were generated in Malaysia, enough to fill up 42 buildings of the same size as the world-renowned Petronas Twin Towers (Bernama, 2006). Whilst recycling has almost drawn universal acceptance as a means of waste disposal, Malaysia's domestic recycling rate still hovers at a mere five per cent.

The disposal of solid waste has been solely through open landfills. At this rate, more sanitary landfills and incinerator plants are needed in the future to prevent water contamination and

environmental pollution. Although land in Malaysia is seemingly abundant, taking more and more land to be used as landfills is simply not a sustainable solution to this growing problem.

Waste Water

Wastewater management is an increasingly serious issue, demanding attention in both developing and fully industrialised nations worldwide. It is one of the associated problems that developing countries like Malaysia experiences due its rapid development and urbanisation. In Malaysia, about six million tons of wastewater is generated annually by its 26 million inhabitants (Asian Development Bank 2006). The wastewater is treated to varying levels and discharged into the rivers, from which most of Malaysia's fresh water supply comes from. This is certainly unhealthy and an unsustainable means of disposing wastewater. A more effective and sustainable wastewater management would be required.

In Malaysia about 90 to 95 per cent of the total volume of industrial wastewater originates from food and beverage processing, industrial chemicals and products, and textile plants or dye mills. The major polluters are small to medium scale industries (SMIs).

The SMIs have been encouraged to adopt cleaner technologies in their production processes. To increase the general environmental awareness among the SMIs, SIRIM Berhad intends to intensify efforts to collect and disseminate information on cleaner technologies. Training programs such as environmental costing, auditing, reporting and lifecycle assessments and ISO 14001 will be conducted to encourage firms to adopt company-wide environmental management practices.

In addressing waste issues, the governments in SEA has focussed on the 3 R's principles - reuse, reduction and recycling of materials and promoting companies that undertake these activities. Meanwhile, the housing and local government is also drafting a master plan on solid waste management, which includes recycling campaigns, landfills and installation of incinerators. Eventually, waste reduction and recycling is no longer an option in Malaysia, but a necessity to protect both the environment and quality of life.

Solid Waste

The volume of solid waste generated in Malaysia is estimated to exceed 15,000 tonnes daily. The current system of manual labour, waste collection trucks and open dumps for disposal suffers from a lack of modern equipment and environmental controls (www.idf.com.my/pro/environment/media/waste.pdf)

The housing and local government is drafting a master plan on solid waste management, which includes recycling campaigns, landfills and installation of incinerators. By just recycling 22 per cent of the five million tonnes of waste, it is expected to help save the government RM88 million a year.

2.4.2 Construction and Demolition Waste

The construction industry has been regarded as one of the major contributors of negative impact to the environment, due to the high amount of waste generated from construction, demolition, renovation and activities associated with construction. The construction industry plays a significant role in Malaysia's development both in the infrastructure and economic sectors. After some decades of extensive "use and throw away" philosophy, it has now been recognized that this uninhibited use of natural resources and pollution of the world is unsustainable (Chong, Tang & Larsen 2001).

Construction waste generally refers to waste resulting from construction, demolition, renovation, real estate development, infrastructure development, earthworks and land clearing operation (US EPA 1998, Tang, Soon & Larsen 2003). The growing construction,

renovation, and demolition activities of this built environment cause Construction and Demolition (C & D) waste; this contributes to one of the major environmental burdens to cities in Southeast Asian sub-region. In Malaysia, the source of construction waste at the project site includes materials such as soil and sand, brick and blocks, concrete and aggregate, wood, metal products, roofing materials, plastic materials and packaging of products. Concrete and aggregate is the largest component with 65.8% followed by soil and sand (27%), 5% from wood based materials such as timber, lumber, etc., 1.6% from brick and block, 1% from metal products, 0.2% from roofing materials and 0.05% from plastic and packaging products such as papers, cardboards, etc (Begum et al., 2005).

Southeast Asian countries have their own definition of C & D waste in terms of the components of C & D waste in the construction industry. In some countries particularly in urban centres, the 3R (reduce, reuse and recycle) principles have already been practiced in most C&D waste management. Also, awareness raising on C & D waste management is practiced in some C & D industries of these countries.

The current status of C & D waste management in some SEA countries - relative to 3R practices are discussed by Nitivattananon & Borongan. The practices focus on technology, management and key partners involved in the C & D waste management. In terms of technology on C & D waste, SEA countries are still in the process of development.

In terms of management aspects, most of the construction and demolition activities in Singapore and Malaysia have demonstrated good practices on 3Rs. Thailand, Indonesia, Vietnam and Philippines are in the process of formulating guidelines and procedures to apply appropriate management measures on C & D waste management. Singapore is encouraging most of the construction industry to obtain EMS using ISO 14000 series. Currently, 25 constructors obtained ISO certification and some of the others are in the process of certification approval. 52% of construction industry in Indonesia have complied ISO 9000. Further, NEA Singapore and Vietnam implemented regulatory measures on C & D waste management and other initiatives which are effectively enforced and implemented such as awareness raising and campaign, among others. Partnerships on C & D waste management initiated in SEA countries like Singapore, Malaysia, Indonesia and Thailand.

3. Status of Adoption of policies (tax, programs, regulations etc) that will further SB;

3.1 Energy

3.1.1 New trends

The trend toward energy-efficient buildings has gained momentum in SEA over the past decade, with substantial government initiatives promoting building energy efficiency launched since 2000. For example, building energy standards were (or are being) reviewed and upgraded in most of the other surveyed economies: Singapore 1999, Malaysia 2001, Thailand 2001-2005, and the Philippines 2005 (Asia Business Council 2006).

In addition to standards, Asian governments have been strengthening their regulatory and non-regulatory policies to promote higher efficiency buildings in recent years. More regulations in this region are expected in the coming years.

Besides the clear trend of increased regulation, Asian governments are constructing demonstration and model buildings to raise awareness and showcase best practices.

Although energy efficiency is one of the quickest, cheapest, cleanest ways to address energy and environmental challenges, yet the great potential for efficiency improvement is largely untapped in Asia. The initiatives in energy efficiency measures in South-East Asia are largely government driven as described earlier in section 3, unlike in the U.S. and Europe where industry initiatives are one of the driving forces behind a market-led transformation toward greater efficiency and sustainability in the built environment.

South-East Asian countries are making strategic changes to their national energy policy in response to the rising risk in energy security and environment challenges. Review of these developments showed two trends: (i) Energy Security vs. Environmental Sustainability and (ii) Energy Security vs. Energy Efficiency

Energy Security vs. Environmental Sustainability
Before the 1990s, the objective of South-East Asian countries' energy policy was mainly to enhance national energy security by securing adequate energy supply to meet the needs of economic and social development. In the past two decades, in the wake of heightened concern about global warning, countries sought to strike a balance between national energy security and environmental sustainability, and environmental issues moved to the forefront of national energy policy.

However, in light of recent hikes in energy prices, tight energy supply-demand conditions and geopolitical confrontation in Middle East, energy security has returned to the top of most countries' energy agenda.

Energy Security vs. Energy Efficiency
Before the 1990s, the South-East Asian energy policies have focused on the supply side. However, in the last decade countries have begun to stress the demand side of the energy sector, trying to achieve greater balance between stable energy supply and rational utilization of energy. It has been recognized that increasing energy efficiency before increasing supply is a more economically efficient national strategy; energy efficiency is increasingly seen as an alternative source of energy supply and an important tool to achieve energy security and reduce reliance on energy imports.

While the South-East Asian energy efficiency policies have largely focused on the industry sector , there is increasing attention in the building sector over the last decade because of astonishing growth in energy consumption in this sector. Typically, the building sector accounts for about 20 to –30 percent of Asia's energy consumption.

3.1.2 Policy Tools
A variety of policy tools are being utilized in the SEA countries to improve building energy efficiency. Among these policy tools, building energy codes/standards and appliance/equipment standards and labeling are the essential elements of Asian government's policies, and have been adopted on mandatory or voluntary basis in all 11 countries reviewed in this study. While setting the minimum performance standard, SEA governments are trying to stimulate market transformation and encourage efforts that go beyond the minimum, by raising awareness and creating financial incentives. In particular Singapore are using financial incentives extensively, and these are being applied on a smaller scale in Malaysia and Thailand.

A government-led approach is common like Singapore, Malaysia and the Philippines where energy efficiency programs / requirements targeted specifically at government buildings have been designed to make government buildings the role model and showcases of energy efficiency technologies and practices to the private sector. Facilitating market transformation through demonstration projects is also common Malaysia, Singapore and Thailand.

The rating and labeling of building in term of energy/environmental performance is a newly rising trend in SEA, and is gaining momentum in countries such as Singapore and Malaysia.

3.1.3 Building Energy Codes/Standards
Singapore were the first SEA countries to develop and implement building energy codes in the 1970s after the oil crises, followed by Thailand, Malaysia, Indonesia, and the Philippines Asia Business Council).

As energy efficiency opportunities are more widespread and cost-effective in the design stage, policies and standards in most countries currently focus on new buildings (the design stage of building). However, more and more countries are trying to establish programs that cover other stages of buildings' life cycle. Mandatory code are also on the increase : Philippines, Singapore and Thailand have mandatory building energy efficiency codes/standards.

There is also a general trend of upgrading and strengthening building energy codes/standards among these countries. In terms of differentiation in comprehensiveness and depth of the building energy codes, the following observation are made:

- Malaysia and Singapore are the leading countries where the standards are now well-accepted as basic building requirements
- Thailand, the standards are being implemented, but efforts to go beyond them are still weak.
- In the Philippines and Indonesia, standards have been developed, but implementation plans are still underway.

3.1.4 Summary of Energy Policies in South-East Asia

Indonesia
The five objectives of its national energy policy include: (1) Energy diversification; (2) Intensification in energy exploration; (3) Energy conservation; (4) Energy price based on market mechanism; and (5) Promotion of environmental protection.

Malaysia
Three principal objectives of the national energy policy are (1) To ensure the provision of adequate, secure and cost-effective energy supplies; (2) To promote the efficient utilization of energy; and (3) To minimize the negative impacts of energy production, transportation, conversion, utilization and consumption on the environment.

Philippines
The goals include: (1) Supply security and reliability; (2) Energy affordability and accessibility; (3) Environmental quality; and (4) Consumer protection

Singapore
The national energy policy stresses six key strategies: (1) Focus on conservation and efficiency to reduce the increasing rate of energy consumption, enhance sustainable development, and mitigate greenhouse gas emissions; (2) Enhance the role as a regional petroleum refining and trading center; (3) Promote the country as a regional hub for an integrated gas pipeline network; (4) Restructure and privatize the power sector; (5) Energy reservation; and (6) Participation in overseas exploration, and production.

Thailand
The national energy policy emphasizes: (1) National energy security and reducing dependency on energy sources from foreign countries; and (2) Promoting efficient and economical use of energy and the use of renewable energy sources to reduce total energy demand and protect the environment.

3.1.5 Malaysia's Renewable Energy policy

Malaysia adopted the "Five-Fuel-Policy" with Renewable Energy as the 5th Fuel for Power generation in 2000 to promote renewable energy**.** Malaysia's Five Fuel Diversification Policy provides the renewable energy policy guidance while the current grid-based small renewable

energy programmes or SREP, embodies national renewable energy strategy. The objectives of this project are to improve significantly the overall technical and non-technical capabilities of the government and private sectors to design, develop and fully utilize the BIPV technology, as well as to develop local BIPV services and manufacturing industries. Cost reduction of BIPV technology would be achieved through sustainable and widespread BIPV market, and the improved local BIPV industries.

In terms of policy instrument, Malaysia have relied mainly on *investment incentives and tax Measures*. Income tax exemption of 70 percent on statuary income for 5 years or an Investment Tax Allowance of 60 percent of capital expenditure incurred within a period of 5 years and to be utilized against 70 percent of the statuary income.

There are also import duty and sales tax exemption on machinery and equipment which are not produced locally. Sales tax exemptions are given for machinery and equipment that are produced locally.

In Malaysia, the Clean Development Mechanism mechanism is seen as one of the promising drivers of the surge of renewable energy investments. The *Clean Development Mechanism,* a project-based mechanism where Annex 1 countries can purchase or claim the certified emission reduction (CERs) from projects implemented in developing countries (non Annex 1 countries) to be used for meeting their emissions reduction targets. The Clean Development Mechanism (CDM) assists industrialized countries in meeting their emissions reduction obligations at lower cost and at the same time promotes investments on sustainable development in developing countries.

To date, two renewable energy projects have been approved by the Designated National Authority (DNA) and several more projects in the pipeline for approval. Despite these initiatives the current utilization of renewable energy resources in Malaysia is far below its market potential. Efforts must be strengthened to develop a comprehensive approach in renewable energy development by formulating and implementing a coherent national renewable energy policy framework, policy instruments as well as financial tools and mechanisms.

3.2 Water

3.2.1 Rainwater Harvesting

In today's urban concrete jungle, rainwater harvesting can reduce a building impact on the environment and guarantees a more sustainable development. The increasing numbers of new buildings, especially in cities, creates pressure over existing provision of water supply.

Rain water harvesting policy was introduced in Malaysia in 1999 through the "Guidelines for Installing a Rainwater Collection and Utilization System" . Introduced by the Ministry of Housing and Local Government after the 1998 drought, it aims at reducing the dependence on treated water and provides a convenient buffer in times of emergency or a shortfall in the water supply. The guideline is only intended to be a reference for those who want to install the system. Although rainwater utilization is encouraged, it is not mandatory in all federal and state government buildings. As rainwater harvesting was then alien to many Malaysians then, as well as the fact that most of the system was not available locally, the implementation of this new policy has not been successful (Shahwahid M. et al. NAHRIM).

As far as the Malaysian legal framework is concerned there is no single provision pertaining to rainwater harvesting being stated under local laws. Voluntary rainwater harvesting would not lead to a significant progress to the number of installation. As mentioned earlier only few agencies have adopted the system. Hence the move by the government to make rainwater harvesting compulsory is a welcomed effort.

Steps have to be taken in order to encourage the use and practice of rain water harvesting. By looking at what has been implemented by other countries, it is clear that without certain measures, this practice will not be accepted by members of the public. Learning from other countries, the economic instruments to encourage water harvesting may include:
(i) provision of subsidies
(ii) tax and cost rebates
(iii) rebates
(iv) education and raising awareness
(v) guidelines
(vi) restriction in usage of piped water

Campaigns by various related Government Agencies and mass media conducted to promote benefit and importance of rain water harvesting and utilization are important to encourage the public to uptake rain water harvesting. The incorporation of rain water harvesting into school education curriculum is probably another effective steps to mainstreaming water harvesting.

3.3 Waste

3.3.1 Construction and Demolition Waste

Construction and demolition (C & D) waste is a major component of the solid waste stream (UNFCCC 2007), which should be recognized as a valuable resource as large quantities of it could either be reused or recycled. C&D waste has been overlooked in the efforts to reduce waste sent to landfill, with the emphasis being placed on domestic reuse and recycling.

In this respect, SEA countries have a problem of disposal sites of which C & D waste largely account to it. Environmental issues such as increase in volume and type of waste, resource depletion, shortage of landfill and illegal dumping, among others are evident in countries in this region. Additionally, SEA countries have limited or no available data on C & D waste and the management aspects of it, particularly with regards to their C & D waste generation and composition; practices and policy, stakeholders' participation and available technology related to reduce, reuse and recycling (3R) (Nitivattananon & Borongan, 2007).

3.3.1. 1 Reuse and recycle of concrete and aggregate and construction wood waste in Malaysia

Malaysian construction industry generates a lot of construction waste which cause significant impacts on the environment and increasing public concern in the local community. Extra construction materials are usually planned due to the lack of considerations given to waste reduction during planning and design stage to minimize the generation of waste (Begum 2005). The excessive wastage of raw materials, improper waste management and low awareness of the need for waste reduction are common in the local construction sites. The 3R principles have been promoted and encouraged in the construction industry due to the most significant wastes generated in terms of volume. A study of the project sites in Malaysia, construction waste materials contain a large percentage of reusable and recyclables (Begum et al 2002). An estimated 73% of the waste materials in the project site is reused and recycled The highest amount of reused and recycled materials is concrete and aggregate, comprising 67.64% of the total reused and recycled material, followed by soil and sand, wood, brick and block, metal products and roofing materials (Nitivattananon & Borongan, 2007)

3.3.1.2 Waste management guidelines and regulation for construction sector in Vietnam

Existing legislation on waste management in Vietnam include waste from the construction sector. The guidelines include regulations and environmental protection applied for the space planning of the siting, construction, and operation of landfills (Inter-ministerial circular of 2001); preparation of Environmental Impact Assessment reports for the planning of construction projects, including solid waste management during and after construction (Inter-ministerial circular of 2000); and regulation on environmental protection in the construction sector which establishes the requirements for environmental management (Inter-ministerial circular of 1999)(VEM, 2004).

In 2005, a degree was passed by the Hanoi's People Committee requiring individuals and organizations involved in construction and waste disposal activities to ensure that the waste handling and transport of construction materials does not cause dust pollution. Disincentives e.g. charge or fine was introduced to reduce waste from construction industry directly for waste handling or disposal (ADB, 2006).

3.3.1.3 Initiatives on 3Rs for C & D Waste in Singapore

Construction site waste is a major problem owing to the scarcity of land. Ministry of the Environment put only "construction debris" in a separate category, and shows that 5% of the total amount of waste. The Ministry of Environment encourages more responsible practices and disposal charges have been raised. Further, Environmental Public Health (Amendment) Act 1999 has tightened its legislation, with stiffer penalties, to discourage illegal dumping of wastes (Ofori 2000).

The National Environmental Agency (NEA) of Singapore has been actively promoting the recycling of the waste outputs. Waste concrete is the principal component of C&D waste and is typically recycled by crushing and sieving it for reuse as aggregate material in concrete products. Recycling centers like Tri-Mix has invested in a concrete waste recycling plant that sifts through leftover concrete waste brought back by concrete trucks. The separated components of sand, coarse aggregates as well as the filtered water can be reused (NEA, 2002).

3.3.1.4 Partnerships on 3Rs for C & D Waste

Public Private Partnerships and awareness raising on waste minimization and recycling were among the initiatives undertaken by the authority in Singapore with the participation from multi-national organisations.

In Indonesia, a project on Demonstrating Environmentally Sound Technologies for Building waste Reduction in Indonesia (DEBRI): demonstrate a waste management mechanism where partners involve Ministry of Environment, International Solid Waste Association – Denmark and UNEP. Moreover, Thailand has built partnership between GTZ (Deutsche Gesellschaft für Technische Zusammenarbeit) and the Pollution Control Department for the development of technical guidelines on C & D waste program for recycling and reuse.

4. Status of adoption of SB by the investor community

Three years ago, whilst some producers of buildings have recognised awareness of issues pertaining to sustainable construction, there is little evidence that corporate investors in buildings (e.g. financial institutions) have a similar desire to own sustainable buildings. Recent environmental concerns and hikes on energy prices seem to change these views.

Now, investors are increasingly seeing socially responsible investment as a priority and developed countries are increasingly recognising carbon emissions as a real cost. The importance and awareness of such non traditional costs is growing, with many companies and individuals concerned about greenhouse gas emissions and climate change. Building owners and tenants are also making these concerns their priorities in the buildings they owned and occupied, as highlighted below:

"The environment is creeping onto the agenda for property investment funds in Asia, thanks to pressure from tenants and investors, but also because turning buildings more energy efficient can lift profits.(Whiting, 2007).

"Studies show going greener can pay off quickly".

"In the battle for high-paying tenants, landlords are touting their green building features to multinational firms keen to tick off "corporate social responsibility" check boxes

On the demand side, driven by increased concern over environmental degradation and rising energy prices, sophisticated tenants, investors and home buyers are increasingly showing a preference for buildings that incorporate environmentally friendly features. Property investors and fund managers want better environmental performance as energy efficiency has been introduced into building codes and Asian economies are establishing energy performance rating systems that show product differentiation (Asia Business Council, 2007).

Tenants are increasingly recognizing that environmental performance has a direct impact on their corporate image and energy efficiency creates direct financial benefits. And for home buyers, high-efficiency building means lower electricity bill and healthier indoor environment. Slowly "green" is becoming one of the elements of building features used to lure consumers. Taken together, these factors are likely to have far-reaching effects in the way buildings are designed, constructed, and used in Asia (Asia Business Council, 2007).

In Singapore, there is a growing trend for property developers and owners to have sustainable buildings, and this is mainly due to some help from the government. In 2005, the Building and Construction Authority (BCA) launched the Green Mark Scheme to promote green buildings which incorporate best practices in energy and water efficiency, site and project management, indoor environmental quality, and environmental innovations. The Green Mark rates the buildings and gives them ratings such as Platinum, Gold Plus, Gold and Certified. The incentives and recognition have thus encouraged the development of more sustainable buildings.

Although, in the early stage there was a lack of expertise to develop the entire building development process such as building design, material use, green installations, and life cycle analyses, local players in the property sector have played bigger roles and set a trend for sustainable buildings green buildings by providing complete and holistic services.

Currently, in Singapore, close to 100 environmentally-friendly buildings have been certified, with another 200 projects awaiting assessment.

Even now, investors are concerned about green building developers, and how good they are in delivering projects. This means cascading down to the types of contractors been used, i.e. green developers.

On one hand, industry players believed there are still challenges ahead. A change of mindset is still needed to increase the acceptance level in Singapore and the buy-in process is important. Besides incentives, there is suggestion for educating consumers, and bringing households on board (BCA, 2007).

Currently, the BCA also gives out the Green Mark Awards to building projects which are environmentally friendly. And going forward, more new awards will be presented to developers, consultants and contractors who are supportive of the green building movement. And more incentives could be offered to get the building industry to go green.

In Malaysia and other SEA countries, there has been a surge in interest in sustainable buildings amongst developers and investors , especially after the hike in energy prices. Research organisations and governmental bodies have played significant roles in broadening the investors' awareness of sustainable buildings in relevant issues. However, as property investors rush into SEA, they can ill afford to be choosy because energy efficient buildings are not common. Many investors try to bring in simple energy saving measures, which can deliver big cost savings. As demand in sustainable buildings are picking up steadily, practitioners have the tasks to be able to meet demand more efficiently. Some SEA countries, besides Singapore, are trying to introduce sustainable building ratings system similar to other established international systems, but they are catching on slowly.

Singapore and some other SEA countries are considering imposing carbon tax as it is a 'behaviour-shifting' idea and strives to make the construction industry more sustainable. Sustainable development requires the integration of environmental considerations into all development decisions, including investment decisions, so it is unsatisfactory when the law encourages investment in real estate which has the potential to cause environmental harm, but without simultaneously providing for compensating measures to avoid or mitigate the harm. However, to implement carbon taxes, some problems need to be ironed out first, for example, the price of carbon credits has to be worked out as the price varies greatly from region to region.

In contrast to the Australian commercial real estate which has seen a paradigm shift towards sustainable buildings, SEA is still seeing sustainable certified buildings being developed in dribs and drabs, and hopefully, this would eventually lead to a transformation in the way real estate is developed, managed and perceived.

5. Status of Education and Training in Sustainable Building

5.1 Education

The shift towards more sustainable development is happening rapidly and requires continual learning and change. Learning and change are now particularly important drivers for the property industry, as it becomes clear that the way forward is anything but 'business as usual'. The current mainstream approach to designing, constructing and managing buildings is now recognised as a significant contributor to a host of environmental and social problems.

Many of the barriers to sustainable outcomes in the property sector are related to learning - some directly, some indirectly. Direct barriers include lack of awareness, lack of skills (crucial to translating awareness into action), and the time and cost of pioneering new approaches.

5.1.1 Engineering education

The success of sustainability in design and in the built environment relies on how institutions of higher learning respond to the ideas generated as a result of widespread interest in sustainable development. If sustainability is to become an essential aspect of society and economical development then it has to become an essential part of education.

Studies showed that a complete integration of sustainable development across the curriculum, i.e. in all modules and parts of relevant subjects and activities through all phases is needed in encouraging sustainable practices in civil engineering fields (Shafii, 2007). The fundamental idea is that when sustainability is to become essential for all activities within society and all sectors of economy, it cannot remain as an isolated field of expertise but must form mindset for everyone. However, these are not happening in engineering education in SEA countries (Shafii, 2007).

Sustainable building is a challenge for the engineering community, as it is multi-disciplinary. Ideally, all of engineering graduates working towards careers such as designers, managers or researchers, should be prepared for the challenge of sustainable development and as such, they should leave university able to make sustainable development operational in their designs and daily practices.

The construction industry is fragmented where designers, engineers, and contractors perform their respective tasks without regard to the project whole. Similarly, most existing construction programs use the modular approach to education that provides well-conceived individual classes however fail to provide students with a complete understanding of how building systems are integrated.

The development of a whole building approach to design and construction education that will allow students to understand not only the parts of a building, but also whole building operations are vital. New curricula and techniques are needed for whole building education emphasising on how buildings are developed and designed, and how interdisciplinary teams can be used to maximize energy efficiency, reduce resource waste, and improve the environmental quality of the buildings being constructed.

5.1.2 Architectural education

In Malaysia, the Board of Architects approved sustainability as part of the knowledge to be acquired throughout the five years architecture education however, sustainable issues and development has not coordinated in the curriculum in a systematic way (Samad et. al. 2007). Although there were some inputs integrating sustainable issues and development but these are piecemeal and do not give exposure to the students in broader perspectives. The education is only limited to single discipline with isolated topics based on the knowledge and interests of the teachers.

A typical five or six years architectural training focused on the required range of skills and creativity in design, managerial, media, and technical expertise with core subjects or courses ranging from design, technology, history, theory, practice and environmental behaviour. There appears to be little or no training on how buildings relate to physical, cultural and social contexts, architectural heritage and energy and resource-efficient.
In most cases, the inclusion of sustainable design in the existing curriculum in Malaysia are seen as an extra syllabus which tend to over burden an already outstretch credit hours of an architecture education.

Similar observations are made for other countries in SEA. There is real need of reorienting architectural education towards sustainability so that architects are trained to have a clear understanding of how their role interacts with others to bring about good buildings and designs in many contexts (Architecture Committee, 2005).

Sustainability along with whole building thinking should be considered across the construction and design education curriculum to lead future building designers into a rapidly changing design and construction industry. The reform in architectural/ engineering/design education to incorporate collaborative learning and lateral thinking is essential to respond to the increasing demands from the building industry for a more integrated approach to education and, a means of securing closer and more effective collaboration among building design professionals.

Industrial education is equally important to increase awareness in stakeholders and professionals on current design practices to encourage implementations of sustainable buildings designs which are economical, social and environmental friendly.

5.2 Awareness

5.2.1 Schools, Adults, Community Programmes

In general, as far as sustainability is concerned, there has been a shift from the 'tree hugging hippy' (Green peace) image to a mainstream awareness of environmental issues which has now permeated into almost every level. In SEA awareness is being raised amongst children who are taught about the need to conserve water and instilling the next generation with an environmental consciousness at a very early age. This awareness raising is also observed to permeates into the workplace. Employees are seeing the advantages of working in improved environments which in equates to working in a sustainable building. Employers

recognised the effects of working conditions as it will have a trickle down effect within the workplace, e,g. productivity of staff.

As highlighted by UNEP, the print, broadcast, and Internet media can be a powerful ally in educating the public on environmental matters. The Malaysian Government has work with the media to broaden the environmental interests amongst the public.

The involvement and participation of Celebrities in Media Campaigns has been found to be an effective way of increasing understanding of the importance of environmental issues and enforcement.

5.2.2 Environmental Awareness Campaigns for Specific Sectors

Awareness raising campaigns are found to be successful when they are targeted at specific groups because information can be tailored to the activities, needs and challenges of the group. Additionally, involving organisations and communities in environmental protection and enforcement can create a sense of stewardship towards the environment, ease hardship through the collaboration and provide a forum for new ideas and greater participation.
For example, Malaysia undertook the initiatives to publicise its water conservation campaign to increase consumers' awareness on the rational usage of water and to promote water conservation by:

- Providing consumers with information, educate and build their capacity on different issues related to water conservation such as pollution reduction, grey water pollution and rainwater harvesting.

- Conducting a research on the domestic water consumption in Malaysia to understand the limitations and problems in domestic water conservation, as to take action on the most water wasteful activities.

- Gauging the performance of rain water harvesting in terms of quality and economy to further reinstate and reaffirm the benefits of rain water harvesting in Malaysia.

The campaign is targeted to conserve water consumption by valuing it in reduction of domestic water usage by 10%.

Consumer education and awareness has to be harnessed in promoting conservation and achieving sustainability (FOMCA, 2005). Being a good consumer means being able to understand and value what one's needs and wants are. It involves thinking and utilizing resources intelligently so that conscious decision-making takes place during consumption. They need information on the linkages between their attitudes and practices as consumers, and the degradation of the environment. It will help them to practice better use of resources for their daily needs. They will also be able to understand the cumulative effect of consumer decisions on the community, economy and the environment. Failure to move in this direction will impose disastrous implications to the environment and its finite resources.

5.2.3 Environmental Awareness in Teaching Programmes

In SEA countries environmental awareness is not always a prominent feature of education programmes in institutions of primary or higher learning. However, its presence helps to mainstream environmental education programmes into schools as a regular part of the curriculum, increase public environmental awareness and demonstrates a commitment to environmental protection. Environmental education integrated into existing disciplines or it can be taught as a subject as early as primary school as well as in adult education programmes will foster the environmental responsibilities amongst students.

5.3 Training

5.3.1 Professional, technical, vocational

Industry education and Professional development
The lack of knowledge in sustainable building amongst professionals in SEA demand for industry education in order to increase the awareness of stakeholders and professionals on current design practices and to facilitate mainstreaming of sustainable building design and construction. Current barriers to implementations of sustainable/high performance buildings include the lack of knowledge about the economic and environmental benefits of such buildings, as well as a dearth of familiarity with sustainable building concepts and practices. Continuous professional development courses organized by higher institutions catered to the needs of the industry are common in the SEA region.

5.3.2 Educating Community and Leaders

Leaders can play an influential or even decisive role in how people act. Education of leaders can assist in facilitating the implementation of sustainable buildings.

6. Status of Adoption of New SB technologies and techniques

6.1 Energy

As mentioned in earlier sections, the complementary trends for sustainable building has led to more construction taking place in SEA.

In SEA the development of building design is in the tropical context, i.e. making it climatic responsive and energy efficient. Designing for hot and humid climates takes advantage of local climates to deflect solar heat while assisting natural ventilation into buildings.

Passive solar design are used for achieving energy efficiency in buildings as it can dramatically affect building energy performance.

An integrated approach is used in designing sustainable office buildings to produce with an optimal solution that balances all the important issues that have to be addressed. Various strategies have been identified for office buildings in the tropics. For example, daylighting has been identified as a potential source of energy efficiency measure because daylight is abundant in the tropics for most of the hours (Ng, 2007).

In the tropics, designing office buildings for energy efficiency is less complicated than that for buildings in the temperate climate. In the tropical climate, only cooling and dehumidification are required but not heating. Air-conditioning takes up about 60% of the total building energy consumption. In order to improve the energy efficiency of the building, the first and foremost task is to reduce the cooling load and this is done by keeping the heat out and reducing the internal heat gain.

The low energy approach and zero-energy approach are promoted as potential solutions to a range of issues, including reducing carbon emissions, and reducing dependence on fossil fuels. The adoption of low energy design approaches are demonstrated in government buildings such as the LEO building (HQ of The Ministry of Energy , Water and Communication, Malaysia) and others in SEA.

Currently, the Zero Energy Office in Bangi (HQ of Malaysia Energy Centre) is the only zero energy building in SEA. A zero energy building is currently being designed in Singapore for construction soon.

The zero energy building is a progressive evolution of the low-energy building design and built with significant energy-saving features. The heating and cooling loads are often drastically lowered by using high-efficiency equipment, added insulation, high-efficiency windows and passive solar techniques (Kristensen, 2007).

The development of modern zero energy buildings became possible through the progress made in new construction technologies and techniques. These include:

- Photovoltaic integrated building elements – strategies to improve EE (harnessing renewable energy)
- BIPV components – integral part of the building.
- Integrating modules into the building envelopes (roof and façade).

On the other hand, it also argued that although zero energy buildings significantly reduce energy use and greenhouse gas emissions, they are not necessarily green, because in order to achieve net zero energy use or carbon emissions, buildings do not require other green building practices such as reducing waste, using recycled building materials, and others.

SEA governments and companies are also are also retrofitting existing buildings to improve their efficiency. Energy auditing and retrofitting design techniques for energy efficiency are currently in demand in this region. The Sultanah Zanariah Library of Universiti Teknologi Malaysia and the 35-year-old Makati Stock Exchange Building of Ayala Land Inc. in Philippines had undergone continuous energy-efficiency upgrading (Asia Business Council, 2007).

6.2 Water

Singapore treats its water as a precious commodity. The city state of 4.4 million has no major water catchments. Their water comes from three major sources: water imported from Malaysia, desalinated water from the sea and recycled wastewater.

NEWater is a new state facility where used water from residential and office buildings is treated with state-of-the-art technology. Most of the treated water is brought back for industrial use, but an increasing amount is put in a raw-water reservoir for domestic consumption. Water from all sources, including kitchens and bathrooms are processed and recycled. With a 100-per-cent sewer connection, all wastewater is collected and treated. According to Singapore's Public Utilities Board, recycling is cheaper than desalination and more secure than importing.

A waterless future ultimately means cost increases: desalination, recycled water, third pipes, grey water, black water, water tanks, etc. Irrespective of the chosen solution to Malaysia's / SEA growing 'water crisis' the fact remains that water is going to get more expensive. Water falling out of the sky is cheap. Considerably cheaper than, for example, water falling from the sky into the sea, harvested and desalinated.

In SEA countries , apart from installation of water efficiency/conserving features in buildings, recycling water for toilet flushing or recovery of non-potable water for site irrigation, rain harvesting has been the new topic in water conservation agenda. Rain water harvesting could play important roles in reducing water demands and averting water wastages

In Malaysia, although a guideline on rainwater harvesting was introduced in 1999, very few government buildings have implemented this water conservation technique. Despite several installations, it was an unsuccessful due to design related problems, including breeding grounds for mosquitoes. With such statistics of the level of installation in Malaysia, one may wonder why nobody cares to use this alternative and conventional water supply of rainwater. Is it because of the unfriendly design which had taken too much space in the backyard?

Not until recently, Malaysia plans to make compulsory the installation of rooftop rainwater-collection systems on large buildings as part of efforts to reduce water wastage. The new ruling would see the installation of gutters and drains that would lead collected rainwater to designated ponds and tanks. The rainwater would then be distributed to wash cars, flush toilets and for other general cleaning purposes . However, this will only affect buildings with a considerable size of roof so that adequate rainwater can be collected for the consumption of the buildings.

Hence, despite many years of introduction, rainwater harvesting is still considered as a new phenomenon in Malaysia. In order to make rainwater harvesting effectively functional and successful architects and engineers should produce an environmentally and space-friendly design and one that allows inspection and detection of mosquitoes.

6.3 Waste

In addressing waste issues, the governments in SEA has focussed on the 3 R's principles - reuse, reduction and recycling of materials.

Most SEA countries are now concentrating on the improvements of wastewater treatment systems, monitoring equipment, recycling equipment and industrial purification systems.

There are also plans for upgrading waste water treatment technologies, waste minimisation technologies, hazardous waste (toxic metal and low radioactive sludge, medical waste, etc.) recycling technologies.

Leading edge technologies for waste management like waste incinerators, waste recycling and composting, landfill design and landfill leachate treatment services are also being developed in SEA countries to overcome mounting waste problems.

The use of 3R principles for construction and demolition waste also led to the need of technologies in processing waste as recycled materials.

Table 1: Current Status of C & D waste practices in SEA relative to 3R principle

Country	Annual C & D waste	Technology
Indonesia (Alwi et al., 2002)	No Data Available	Adopt Dry-Masonry Brick House System an environmentally-friendly cycle that covers 3R scheme (Khamidi et al., 2004)
Malaysia (Begum et al., 2006)	28.34% (including industrial waste)	- Reuse and recycle of concrete and aggregates - Recycled Construction Wood Waste Products Developed by FRIM
Singapore (NEA, 2005)	422,900 tons (as of 2003)	- recycle concrete waste from concrete batching plants - use recycled aggregates for non-structural pre-cast concrete products

Thailand (Carden, 2005)	No Data Available	- Immediate reuse of undamaged construction elements for building temporary shelters - Recycling as aggregate for structural concrete
Vietnam (VEM 2002, cited in Vietnam Environment: Monitor, 2004)	Proportion of Construction waste is about 9% of municipal waste	- Monitoring Mobile station for TSP used on large construction projects - Reuse of C & D waste

6.4 Indoor Air Quality

Good indoor air quality (IAQ) is a key aspect of sustainable design - maximizing the well being of all occupants through minimizing airborne contaminants.

The Green Mark for Buildings Scheme by the Building and Construction Authority (BCA) of Singapore has included Indoor Environment Quality embracing IAQ as one of the key criteria in the assessment score to encourage building owners, facility/managers and green professionals to adopt healthier and less polluting practices in the built environment.

Design techniques for providing adequate ventilation and a high-efficiency, in-duct filtration system are required in producing a healthy building. Heating and cooling systems that ensure adequate ventilation and proper filtration can have a dramatic and positive impact on indoor air quality. These technologies are increasingly been used in modern buildings to achieve the standard IAQ.

Other measures to ensure the appropriate IAQ including prevention of indoor microbial contamination through selection of materials resistant to microbial growth, provide effective drainage from the roof and surrounding landscape, install adequate ventilation in bathrooms, allow proper drainage of air-conditioning coils, and design other building systems to control humidity. Special buildings like hospital have to undertake these measures to ensure a safe and healthy building.

7. Status of adoption of SB whole-building performance rating systems.

There is still very little development on local SB rating system in SEA except Singapore. Malaysia is on its way to formailise its own SB rating system within 2008. Currently, most of the international projects developed in SEA countries are using LEED as it is internationally recognised, and because of its adaptability to local requirements.

7.1 Singapore

The Green Mark Scheme by the Building and Construction Authority (BCA) was launched in January 2005 as an initiative to move Singapore's construction industry towards more environment-friendly buildings. It is intended to promote sustainability in the built

environment and raise environmental awareness among developers, designers and builders when they start project conceptualisation and design, as well as during construction.

BCA Green Mark is a green building rating system to evaluate a building for its environmental impact and performance. It is endorsed and supported by the National Environment Agency. It provides a comprehensive framework for assessing building performance and environmental friendliness. Buildings are awarded the BCA Green Mark based on five key criteria:-

- Energy Efficiency
- Water Efficiency
- Site/Project Development & Management (Building Management & Operation for existing buildings)
- Good Indoor Environmental Quality & Environmental Protection
- Innovation

Under the Green Mark assessment system, points are awarded for incorporating environment-friendly features which are better than normal practice. The assessment identifies designs where specific targets are met. Meeting one or more indicates that the building is likely to be more environmental friendly than buildings where the issues have not been addressed. The total number of points obtained provides an indication of the environmental friendliness of the building design.

The assessment process consists of an initial assessment leading to the award of the Green Mark. Subsequently, buildings are required to have triennial assessment. This is to ensure that the Green Mark building continues to be well-maintained. Buildings are awarded **Platinum, Gold^{PLUS}, Gold or Certified rating** depending on the points scored. Apart from achieving the minimum points in each rating scale, the project has to meet all pre-requisite requirements, and score a minimum of 50% of the points in each category, except the Innovation category.

BCA Green Mark has assessment criteria for two main categories: **New Buildings** and **Existing Buildings**. The scheme for new building will provide the opportunity for developers to design and construct green, sustainable buildings which can promote energy savings, water savings, healthier indoor environments and adoption of greenery for their projects. The scheme for existing building will enable building owners and operators to meet their sustainable operations goals and to reduce adverse impacts of their buildings on the environment and occupant health over their entire life cycle.

New buildings assessed under the Green Mark will require triennial assessment to maintain their Green Mark status. They will be assessed under the existing buildings criteria during the triennial assessment. For existing buildings, they will be assessed under the existing buildings criteria unless they are undergoing a major refurbishment programme.

7.2 Malaysia

Currently Malaysia is developing its SB rating system for new office building. The green buildings in Malaysia so far, only address energy efficiency measures, which is only one part of the entire sustainable building assessment criteria. This industry driven initiative was the result of the much publicised promotions on sustainable buildings at the regional conference in Kuala Lumpur (SB07 South-East Asia) and support from construction stakeholders. Various aspects appropriate to the needs and its pertinence were considered when developing the rating system. The SB rating is an adaptation of LEED, modified to Malaysian construction requirements.

7.3 Philippines

Philippines, through its Green Building Council is in the midst of establishing its own SB rating system. This is an initiative of the both the public and private sector.

Thailand ,Indonesia , Vietnam has no whole SB rating yet, except for the Energy Labels already established.

CONCLUSIONS

Energy
Arguably, many of the energy consumption issues faced today have come about as a result of cheap energy**.** The initiatives for energy efficiency in SEA are being left largely to government. This trend differs from the U.S. and Europe where industry initiatives are one of the driving forces behind a market-led transformation toward greater efficiency and sustainability in the built environment. With overall social and economic trends that signal continued strong economic growth, ongoing population explosion, increasing urbanization, living standard gains, and changing lifestyles, SEA will require a dynamic construction market and more energy to meet its needs for space and water/heating cooling, lighting, operating appliances and other equipment.

As SEA move forward the impact of energy cost increase will start to make a significant impact on alternative energy. The rush is already on to find a sustainable large scale alternative to coal. Globally, alternative power options are being utilised to varying degrees, from wind to hydrogen, solar, clean coal and nuclear. Even geothermal power – generating superheated steam from deep beneath the earth's surface - may become an option in the near future.

Achieving SB rating also acts as a safeguard to minimise the effects of future energy price increases – the impact of which should not be underestimated.

Investors are increasingly seeing socially responsible investment as a priority and recognising carbon emissions as a real cost. The importance and awareness of such non traditional costs is growing, with many companies and individuals concerned about greenhouse gas emissions and climate change.

If, in the future, a tax is imposed on energy consumption, a more energy efficient building will incur a lesser impact. Government decisions on carbon trading and tax implications will have a significant impact, looking ahead, however, policies are yet to be formed in most parts of SEA. As public knowledge of the impacts of climate change is gathering momentum, this shift in public opinion will be the driving force of future policy.

In whatever form a new tax is imposed, a more energy efficient building will incur a lesser impact – acting as a safeguard to minimise the effects of future energy price increases.

The need for sustainable and energy efficient buildings in times of climate change cannot be further emphasized. Successful market development include:

- Setting mandatory renewable energy targets
- Giving grid access priority to renewable energy
- Removing administrative barriers
- Ensuring technological diversity (e.g. with research & demonstration support programmes)

Despite current initiatives the current utilization of renewable energy resources in Malaysia and other SEA countries is far below its market potential. Efforts must be strengthened to develop a comprehensive approach in renewable energy development by formulating and

implementing a coherent national renewable energy policy framework, policy instruments as well as financial tools and mechanisms.

Waste

Most of the countries in Southeast Asia address more on municipal solid waste management, and do not recognize C & D waste as a pressing issue. Programs and initiatives on C & D waste management have not been a focus of the sub-region. Such initiatives should be addressed and practiced in the C & D sector, particularly in SEA urban areas, for better management of C & D waste. Also, no available or limited data exist in this sector, particularly related to the practices of the 3R principle in the waste management. C & D waste management practices are evident in countries of Singapore, Malaysia and Indonesia, while some SEA countries where C & D waste data and information are still developing and emerging are found. .

Access and availability of having baseline data and information on C & D waste generation and waste management in SEA countries should be studied and explored. Also, as most of the SEA countries have poor data availability, compilation of C & D waste and waste management in this sector should be strengthened. Key stakeholders in this sector specifically, the national government in different SEA countries should look for an opportunity to formulate strategies and policy measures to mitigate the environmental impact and burden of C & D waste. Awareness raising and capacity building in construction industry should be developed and effectively enforced. Partnerships and cooperation of various stakeholders in C & D sector should be enhanced for the provision of resources for an effective implementation of the 3Rs.

Opportunities of SEA member countries that could be considered include: strengthen information exchange in C & D waste management, usage of 3R principle, enhance Public-Private Partnerships, formulation, development and implementation of 3R policies, develop institutional arrangement and improve participation and cooperation among key stakeholders relative to the practice of 3R principle on C & D waste management.

Education and Awareness

Sustainability along with whole building thinking should be considered across the construction and design education curriculum to lead future building designers into a rapidly changing design and construction industry. The reform in engineering/design education to incorporate collaborative learning and lateral thinking is essential to respond to the increasing demands from the building industry for a more integrated approach to education and, a means of securing closer and more effective collaboration among building design professionals.

Since building systems are inter-related and that many design solutions may lead to other design problems therefore the design concept advocates to the use of inter-disciplinary teams that focus on systems approach to building design and construction. In order to create a successful performance building, an interactive approach to the design process is required. It is necessary for the people responsible for the building design to interact closely throughout the design process and that everyone involved in the use, operation, construction and design of the facility must fully understand the issues and concerns of all the other parties.

Many improvements are necessary in the orchestration of the complicated process, in order to take benefit of available technologies and products. A collaborative learning approach introduced to students will expose them to real problems of building design. The recommendations for cross-disciplines seemed the best solutions for effective designs and therefore should be addressed accordingly by educational institutions so that future designers are able to respond to the industry needs.

Environmental education and awareness raising can include any of the following types of activities:

- Reorienting current education and awareness programs to include environmental dimensions;
- Basic education and awareness programmes (e.g., in schools);
- Adult and community education and awareness programmes; and
- Education, training, and awareness programmes for professional, technical, and vocational personnel.

The revamping of the tertiary level curriculum is vital in changing the mindset of budding building professionals. The process of transformation from conventional to sustainable building design is the underpinning factor in future architecture education, a process which would lead to a redefinition of the tropical architecture in this region.

There has been a diametric shift from the 'tree hugging hippy' greenie image to a mainstream awareness of environmental issues which has permeated into almost every home. Awareness is also being raised amongst children who are taught about the need to conserve water and instilling the next generation with an environmental consciousness at a very early age.

The property industry has reached a stage where most of its members are aware of the concept of sustainability and a significant proportion of them agree that it is important and want to know more. However, sustainability has not yet become a mainstream practice, despite the existence of many 'early adopters' leading the way. This widespread change in practice is the next step in the diffusion of innovation. The property industry is on the cusp of this change, and education is an important catalyst. Much knowledge and information already exists, and the key is arranging it into useful learning processes that engender motivation, skills development and behaviour change.

Industrial education is equally important to increase awareness in stakeholders and professionals on current design practices to encourage implementations of sustainable buildings designs which are economical, social and environmental friendly.

The combined use of 'sticks' and 'carrots' plays an important role in driving the uptake of sustainability by the property sector, through building regulations and incentives. This 'sticks and carrots' approach also applies to an organisation's internal structures and processes. It is important that individuals and teams are accountable for achieving agreed sustainability outcomes, and that they are rewarded for good performance.

Building in accountability and incentives builds motivation, which is an essential driver for effective learning and behaviour change. Accountability mechanisms encourage employees to view sustainability as integral to what they do, instead of an optional 'add-on'. It also makes clear to employees, collaborators, partners and other stakeholders of the issue of their contribution to a sustainable built environment.

Water

A waterless future ultimately means cost increases: desalination, recycled water, third pipes, grey water, black water, water tanks, etc. Irrespective of the chosen solution to Malaysia's / SEA growing 'water crisis' the fact remains that water is going to get more expensive. Water falling out of the sky is cheap. Considerably cheaper than, for example, water falling from the sky into the sea, harvested and desalinated.

Steps have to be taken in order to encourage the use and practice of rain water harvesting. It is clear that without certain measures, this practice will not be accepted by members of the public. With this in mind, it is proposed that certain economic instruments should be introduced.
A review of the literature on economic instruments to encourage rainwater harvesting in the rest of the world can be classified into:

(i) provision of subsidies
(ii) tax and cost rebates
(iii) rebates
(iv) education and raising awareness
(v)guidelines
(vi) restriction in usage of piped water

SB Rating System

Energy. Water and Waste will profoundly affect SB rating performance system in most SEA countries. Achieving high SB ratings acts as a safeguard to minimise the effects of future energy and water price increases – the impact of which should not be underestimated. Most SEA countries do not have SB rating system to measure the performance of building, but the recent hike in energy prices has already set governments to look at new policies and alternative solutions to overcome these problems. SB rating is one way to transform the construction market towards a resource efficient industry.

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Appendix

1.1 About the Conference

The Conference on Sustainable Building South-East Asia (SB07SEA) is part of the regional conference series on Sustainable Buildings co-sponsored by the International Council on Research and Innovation in Building and Construction (CIB), The United Nations Sustainable Building and Construction Initiatives (SBCI), and the International Initiative for a Sustainable Built Environment (iiSBE). SB07SEA conference was in Kuala Lumpur from 5-7 November 2007, and back-to-back with the United Nations SBCI annual meeting.

The Conference was hosted by the Ministry of Energy, Water and Communications, Malaysia and organised by Institute Sultan Iskandar of Urban Habitat and Highrise , Universiti Teknologi Malaysia. The conference was sponsored by Roxul Asia, Ajiya Berhad, Philips Lighting Malaysia and Bovis Lend Lease. Supporting organisations include The Public Works Department Malaysia, Construction Industry Development Board, Institution of Engineers Malaysia, the Malaysian Institute of Architects, Malaysia Energy Centre and The World Green Building Council.

The objectives of the Conference were to:

- To enhance the awareness of sustainable building issues with major stakeholders in South-East Asia with a special focus on sustainable buildings in tropical context.
- To provide an opportunity for South-East Asian experts to share local and regional knowledge with one another and with the broader international community.
- To enhance the network of South-East Asian experts on sustainable buildings and construction for future co-operation.
- To achieve a balance between research and practice in sustainable buildings, as well as, commercial and non-commercial interests.
- To provide regional input on SBC into the next World Conference on Sustainable buildings, SB08 Melbourne, Australia.

1.1.1 General Facts of SB07SEA Conference

Dates: 5-7 November 2007

Venue:
Kuala Lumpur Convention Centre, Kuala Lumpur
Hosted by: Ministry of Energy, Water and Communications, Malaysia

Co-host:
The International Council for Research and Innovation in Building and Construction (CIB),
International Initiative for Sustainable Built Environment (iiSBE)
The United Nations Sustainable Building and Construction Initiatives (SBCI)

Organiser:
Institute Sultan Iskandar, Universiti Teknologi Malaysia

Co-Organiser:
IEN Consultants

Sponsors:
Roxul Asia, Ajiya Berhad, Philips Lighting Malaysia and Bovis Lend Lease.

Supporting organisations:
The Public Works Department Malaysia
Construction Industry Development Board
Institution of Engineers Malaysia
The Malaysian Institute of Architects
Malaysia Energy Centre
The World Green Building Council

Attendance:
400 participants

Participating Countries
Australia, Turkey, Malaysia, Taiwan, USA, UK, Egypt, Hong Kong, New Zealand, South Africa, Singapore, Italy, Brazil, Spain, The Netherlands, Indonesia, Philippines, Denmark, Sweden, Bahrain, Kuwait, France

Programmes
Keynotes : 10
Technical Session : 15 (Papers : 64)
Business Forum
Technical Visits – Zero Energy Office & Tanarimba

Official language: English

1.1.2 TOPICS AND ISSUES

In view of the variations in interests amongst the South-East Asian countries, a broad range of issues on SBC were initially offered for discussions at the Conference (Call for Papers). The final presentation themes are indicated below:

1A - Case Studies of Sustainable Buildings
1B- Sustainable Hosing Development
1C- Benchmarking and Assessment

2A- Renewable Energy & Climatic Design For Energy Efficiency
2B - Sustainability of Public Buildings
2C - Energy Efficiency & Sustainable Buildings in ASEAN Countries

3A – Sustainable Cities
3B- Energy Efficiency Solutions & Building Performance

4A- Urban planning & Regeneration
4B- Construction Materials and Waste

5A- Sustainable Development & Environmental Performance
5B- Sustainable Construction & Safety

6A – Education for Sustainable Development
6B – Sustainable Building Design
6C- Sustainable Community & Infrastructure