

# Green Building: The Future of Buildings

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With rising energy costs and increasing awareness on the effects of global warming, the need for sustainable design in building and construction has become increasingly urgent. As the human race strives to leave a minimal ecological impact on the environment, the green building concept should be embraced on a large scale. It is indeed possible to design, construct, and operate buildings that combine environmental responsibility with sound engineering and business practices.

There are many existing definitions of what makes a building green. According to an article by Autodesk Malaysia entitled 'Green Design' published in the press recently, designing a green building goes beyond incorporating elements and practices such as monitoring devices for lighting, heating and cooling. It needs to consider the use of building materials that maximise energy performance and minimise environmental impact; the use of reusable salvaged and recycled building materials; the maximisation of interior solar lighting; and the evaluation of the environmental impact and lifecycle of building materials.

In many developed countries, the adoption of the green building concept is very much accepted and practised by the private and public sector. However, in Malaysia, the adoption rate has been slow. JURUTERA, The IEM Bulletin, sought the views of some experts on the status of green buildings in the country.

## What makes a building sustainable?

A building is sustainable when it does not create a negative impact on its natural environment. The building is in harmony with the environment, where the presence of the building does not impose any strain on the ecosystem. The Malaysia Energy Centre or Pusat Tenaga Malaysia's Zero Energy Office (ZEO Building) has been designed with sustainability as the key element so that the building is carbon neutral.

It achieves that by incorporating energy efficiency technologies so that amount of electricity required for the office operation is very minimal. The building also makes optimum use of natural resources for its daily operations. For instance, office lighting is achieved by maximising daylight as its light source, rain water is harvested for non-consumable use such as watering of plants, and electricity is generated by sunlight by the use of solar photovoltaic.



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Malaysia Energy Centre's Zero Energy Office (ZEO Building), Bangi (June 2007)  
Energy index: 35kWh/m<sup>2</sup> per year

A Zero Energy Office building means that the building must not consume more electricity than what can be produced in the building using renewable energy sources. The ZEO Building aimed to demonstrate that this target in the future can be as low as 50kWh/m<sup>2</sup> per year, and that the use of renewable energies can bring the building to a Zero Energy status.

The design of the building incorporated strategies regarding energy optimisation. To achieve this, integrated whole building design approach and systems are being implemented with the following main strategies:

- Passive building design
- Active design of M&E systems
- Low Energy office equipment
- Renewable Energy supply system

The building also incorporated and demonstrated innovative design solutions with the use of daylight as the prime light source (targeted at 100% use of daylight during daytime) and the use of high efficient artificial intelligent lighting. To reduce the heat gain from outside, the building adopted high insulation in facade and roof and installing spectrally selective glazing or double-glazing on all of the windows.

### What are the challenges of integrating a green building into its environment?

Designing sustainable buildings is still a relatively new concept in Malaysia. As far as technological challenges are concerned, it is the least of all barriers faced as such technologies are already in maturity and proven in developed countries. Technology and knowledge transfer will help to overcome these challenges.

The larger challenge faced is the higher upfront cost of designing and building sustainable buildings. Many people are reluctant to invest in energy efficiency and solar technologies to build sustainable building due to the higher investment cost. However, they do not realise that the operational cost is significantly lower, and, as such, provides better overall value.

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

### What are the environmental and economic benefits of a green building?

Green buildings are designed and built primarily to address environmental issues. This means less CO<sub>2</sub> emission as a result of running the office, and if rain and grey water harvesting is practised, there will be less wastage of treated water from utility.

Generally, the capital cost for a green building will be higher. However, the running cost of the building will be lower as the building has been designed to make the best use of natural resources to address some of the building's operations.

For many companies, the pressure to incorporate Corporate Social Responsibility (CSR) towards society and the environment is mounting. Companies who have sustainable buildings as their offices are seen as being responsible by society. Studies have shown that the majority of companies which practise CSR will not find their profit being compromised.

### How can the public and private sector be encouraged to embrace the adoption of green building?

Firstly, it is important to enhance capacity building especially among building professionals on designing and building sustainable buildings (i.e. concept, technologies and their applications). There is also an urgent need to increase awareness among the people on critical issues such as climate change and the need to live in harmony with nature.

To address the higher capital cost, the Government will need to provide financial incentives to encourage both the public and private sector to adopt the concept of sustainable buildings and homes. This is commonly practised in all countries advancing the use of energy efficiency and renewable energies in buildings. Financial incentives can be offered in several modes such as capital subsidy, tax relief and feed-in tariff (for renewable energies).

Besides providing incentives, the Government may have to come up with a policy which mandates new buildings to meet certain requirements on sustainability issues. CSR reporting was made compulsory in Budget 2006, requiring all public listed companies to report on their environmental and social responsibility performance. Unfortunately, CSR activities in Malaysia are largely confined to donations, philanthropy, sports development or participation in charity events. CSR is only truly meaningful when it is embedded into the corporate culture and business.



*Ministry of Energy, Water and Communications' Low Energy Office (LEO Building), Putrajaya (September 2005) (Winner of the 2006 ASEAN Energy Award under the Category of New and Existing Buildings)*

Energy saving features were to be incorporated at an extra cost of not exceeding 10% of the total base building cost, giving a payback time of less than 10 years. From a building energy index (BEI) target of 100kWh/m<sup>2</sup> per year and energy savings of more than 50%, results from a 12-month post-occupancy monitoring programme indicate that a monitored BEI of 114kWh/m<sup>2</sup> per year has been achieved.

The LEO Building has adopted both passive and active design features. The passive design features include:

- Building orientation – most of the windows face either north or south to minimise heat gain from direct sunlight, thereby reducing cooling load;
- Building envelope – walls have been constructed from 200mm autoclaved light concrete blocks; glazing that allows 65% of the light and only 51% of the heat through;
- Natural ventilation – the atrium is cooled by natural ventilation assisted by a solar chimney, which also provides daylight deep into the building;
- Interior space layout – work areas are designated near the façade to maximise the use of daylighting;

The building is also equipped with a comprehensive Building Energy Management System which monitors the building's energy consumption in terms of cooling, lighting and plug loads on a continuous basis.



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### **What makes a building sustainable?**

Sustainable buildings or sometimes called 'green buildings' are generally buildings built with an awareness to minimise its impact on the environment and the conservation of natural resources and energy without compromising the intended functional requirements and facilities of the buildings. All these require an optimal balance of the environment, human benefits and, ultimately, the cost.

Some of the fundamental principles for a sustainable building are:

- Optimise energy consumption and practise energy efficiency
- Optimise land use, site design and planning
- Enhance building environmental quality with adequate insulation, controlled ventilation, etc.
- Conserve water and recycle water (i.e. where possible) and rainwater harvesting
- Use of environmentally low-impact materials
- Maximise renewable energy such as solar power, natural lighting, etc.
- Optimise operational and maintenance practice

### **What are the environmental and economic benefits of a green building?**

Sustainable buildings will enable the building owners/operators to mitigate the escalating energy costs and realise their economic savings from the lower operating costs of the buildings. A moderate energy efficient office building may have an average energy/electricity saving of 150kWh/m<sup>2</sup> per year and based on the current electricity tariff, the building owner can achieve a payback period within seven to eight years for his investment in the energy efficient features incorporated into his building. With the imminent energy crisis, depletion of natural resources and global warming syndrome, we need to conserve energy and our natural resources, and, ultimately, save our environment for our future generations.

### **What are some of the energy efficient buildings projects that the company has involved in?**

To date, Putra Perdana Construction Sdn Bhd has successfully completed the Low Energy Office (LEO Building) for the Ministry of Energy, Water and Communications and Malaysia Energy Centre's Zero Energy Office (ZEO Building).

Currently, we are building another energy efficient office building i.e. the Energy Commission Diamond Building in Putrajaya as well as constructing some energy efficient building integrated photovoltaics (BIPV) bungalows also in Putrajaya. The group is also in negotiation with a few parties to design and build energy efficient office buildings and retrofitting an existing office building into an energy efficient building.

### **How can the private sector be encouraged to embrace the adoption of green building?**

With the imminent energy crisis and escalating energy costs, we envisage that the public will be compelled to consider sustainable buildings/development. We are anticipating that the updated Malaysian Standard MS 1525:2007 will be incorporated into the Uniform Building By-Law for all the new office building in the near future.



*Energy Commission Diamond Building, Putrajaya (2008)*  
*(Design Target: A sustainable building with an energy index of 77kWh/m<sup>2</sup> per year)*

The eight-storey Corporate Office building is set within lush landscaping. The design of the building is derived from a contemporary interpretation of the distinctive diamond form, which symbolises Value, Transparency and Durability. The building slanted facade, which is self-shading, optimises passive design approach to achieving energy efficiency.

The atrium of the building is exposed to the intense solar radiation throughout the day. It was designed in such a way that the heat gain and thermal impact is kept at a minimum while ensuring sufficient daylight to enter for natural lighting purposes. Rainwater is harvested for the use of toilet flushing and irrigation, which covers more than half of water load required for the building.

The facade is integrated with internal Light Shelves to direct natural daylight deep into the office space whilst the glazing is specially coated with Low-Energy coating to address the heat. To further reduce the latent and sensible load, the building will incorporate floor slab cooling as one of the means to improve the comfort of its office space.

*(Sourced from the websites of the Independent Energy Network Sdn Bhd, the Ministry of Energy, Water and Communications and the Energy Commission)*

### What makes a building sustainable?

Installing a solar panel on the roof or having floating gardens alone does not constitute a green building. According to the United Nation's Brundtland Report entitled 'Our Common Future' published in 1987, 'Sustainability is to meet the needs of the present without compromising the ability of future generations to meet their own needs'.

For a building to be sustainable, it has to have minimal negative impact on the environment. It has to have a holistic approach to its design; taking into consideration the use of materials that can be recycled or that does not drain our natural resources, energy efficiency of the building, water use efficiency, minimal disruption to the natural site, indoor environment (i.e. use of natural light and ventilation) and even the design and construction process.



*Lim Eng Jin, Country Manager  
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### What are the environmental and economic benefits of a green building?

About 40%-70% of all energy is consumed by the construction and operation of a building while 12%-13% of fresh water is consumed during the operations of a building. These buildings also use up 30%-40% of all raw materials and emit up to 30% of all greenhouse gases. Green buildings that can reduce these figures by even a small percentage would contribute positively to the environment.

The economic benefits are huge but not readily seen in today's traditional economic sense. We cannot put a price tag on the environment, but if a building costs 30%-40% more because of the use of a new recyclable material or equipment that generates electricity through alternative green means, most people will not be willing to fork out the extra cash.

On the flipside, there are examples of immediate economic benefits. For example, in today's building and construction process, 30% of the work is 're-work' (variation orders), at least 10% of materials are wasted and a typical RM100 million building project will churn out over 150,000 documents (technical drawings, paper reports, etc). Some building and construction professionals today have successfully reduce these costs by implementing technology and concepts such as the Building Information Modelling (BIM) in the design process.

It's important to note that the initial cost of constructing a building is estimated only at about 10% of its entire cost during the lifecycle of that building. It is important to help the owners and operators of these buildings to understand that this is a step forward and to encourage them to implement sustainable projects and apply financial models that span into the future.

### What is the company's involvement in the green building concept

Autodesk solutions are widely used in the Architectural/-Engineering/Construction (AEC), Manufacturing and Geospatial (GIS) industries. Our solutions are used in the design of alternative energy equipments for homes, buildings and communities (in the manufacturing space); in mapping out geospatially our environment for better environmental analysis (Geospatial/GIS) and in the design process of buildings. The role of technology is central to a sustainable design.

To be cost effective, a sustainable design relies on the creation of an accurate 3D computer model of the design, used for a variety of purposes:

- Rapid prototyping, to get energy-efficient designs to market quickly;
- Simulating energy usage, permitting long term calculations of energy consumption and cost;
- Ease of modifications to optimise energy use;
- Sharing of modelling data throughout the supply chain, to permit the specification of the least wasteful materials.

Specific to the building and construction industry, the widely popular concept of BIM is fast gaining acceptance and adoption. We have many customers who have practically applied the BIM technology to their green designs. Other than that, Autodesk is one of the few vendors that take a leadership role in promoting the awareness of sustainability.

We have participated and sponsored worldwide sustainability forums such as those promoted by the United Nations. We also partnered with many government agencies around the world such as the Building and Construction Authority (BCA) in Singapore and the Green Building Council in the United States to promote standards, create awareness, provide technical papers, etc.

### How can the private sector be encouraged to embrace the adoption of green building?

Although education and awareness are very important, the leadership has to come from the authorities. Governments have a very significant role to drive the adoption of the green building concept through legislature and incentives. Building codes and standards should be updated to reflect sustainable designs. Training incentives should be provided to encourage the adoption of technology (use of new materials, use of design technology, etc).

An authoritative agency or government body should be established to promote the adoption of the green building concept by introducing standards, a proper process for the private sector to emulate, as well as training and incentives. Today, we see governments in the United States, Australia and Singapore taking these initiatives very seriously. The United States have the Leadership in Energy and Environmental Design (LEED®), Australians have the Green Star rating and while the Green Mark which is spearheaded by Singapore. ■