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Global warming and green architecture

Tri Harso Karyono

The success of the green movement in architecture is now begining to look questionable. A number of green building standards may be unable to significantly reduce carbon dioxide (CO2) emissions as had been expected before.

Buildings which received the highest green marks, such as “Platinum”, from American green building standards of LEED (Leadership in Energy and Environmental Design), do not necessarily succeed in reducing CO2 emissions. Green building standards tend to put CO2 reductions as a lower criteria.

Approximately 77 percent of greenhouse gas (GHG) emissions in the atmosphere are in the form of CO2. The rest are methane, nitrous oxide, water vapor and ozone.

The latest data of 2009 showed that approximately 30.4 million tons of carbon was released into the atmosphere, down by 0.3 percent from the previous year. Buildings account for about 15 percent, while transportation and industry account for 14 percent and 21 percent respectively, while the rest is emitted by other
activities.

China ranked first as the world’s largest carbon emitter with 7.7 billion tons in 2009. Indonesia placed 16th with 413.3 million tons per year, up by 2.4 percent from the previous year. The carbon emission per capita in Indonesia was relatively low — about 1.7 tons per year compared to Singapore’s 34.6 tons per capita. However, with a population of nearly 240 million, Indonesia is still a high carbon emitter.

The Kyoto Protocol (1997) suggests a reduction of carbon emissions of 5 percent from 1990 levels between the years of 2008 and 2012. This target now seems rather impossible to be achieved. Green architecture movements are expected to reduce carbon emissions from the building sector.

A constraint that exists is that the percentage of new buildings designed with a green approach is still too small compared to the number of old model buildings that are already designed without this approach.

Even if all the new buildings are designed according to green building standard checklists, there is no guarantee that the buildings would significantly reduce CO2 emission because the standards tend to place little emphasis on cutting carbon emissions.

Learning from developed countries, government initiative is needed to drive the movement to cutting energy use in building, which eventually leads to the reduction of national carbon emissions. Without such initiative, it would be difficult for a nation with a population such as Indonesia to considerably cut carbon emissions.

The British government launched a program to cut carbon emissions in the residential sector by 80 percent by 2050, with a medium-term target of 34 percent by 2020. The implications of this program are that all the houses must be designed and modified to curb energy use or even use no fossil energy at all.

Previously the British government had conducted an energy efficient housing program using BREDEM (Building Research Establishment Domestic Energy Model) resulting in an increase of average indoor air temperatures in houses from 13 to 17 degrees Celsius without increasing energy consumption.

This means that an increase of occupants’ thermal comfort were not followed by an increase of building energy consumption.

Lifestyles affect energy consumption in the residential sector. With relatively similar climatic conditions, the New Zealand residential sector consumes less than half of energy consumed in the UK, and only a quarter of that used in Canada.

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Only 5 percent of housing in New Zealand uses central heating and residents tend to enjoy a cool house without heaters.

The issue of global warming has been shaking the architectural paradigm in western countries, especially in the US. A number of great buildings considered “masterpieces” are now coming under question.

Many great buildings in the US release enormous amounts of CO2 because they were designed without energy considerations. The design followed international style approaches, which implemented universal solutions but neglected local climates.

A study several years ago found that the total energy used by US high-rise buildings exceeded the total energy used in buildings in all poor Third World countries combined.

Modern architects tend to design buildings with modern technology in mind. They think that technology solves everything.

Using modern technology such as air-conditioning, heaters and elevators, high-rise buildings completely ignored energy efficiency. Architectural works emphasized aesthetic values and “monumentalism” in a bid to win entry to architectural history books.

The emerging issues of global warming have proved they are all wrong. Inappropriate use of modern technology in buildings is identical to wasting energy in large quantities. The energy used today largely comes from fossil fuels that emit CO2.

Tall buildings emit huge amounts of carbon and slowly but surely, the great works of modern architecture need to be revised, renovated and modified to reduce their contribution to global warming.

Since these buildings are completely sealed by glass, modification of the building envelope is an effective way to reduce the heating load in winter and the cooling load in summer. Sears Tower in Chicago and the Empire State Building in New York are two examples of great works of modern architecture which should be renovated, as they require tremendous energy.

The Sears Tower in Chicago, with 108 floors, is the tallest building in America and needed US$350 million for renovation to reduce its energy consumption. It is expected that energy use can drop by 68 gigawatts per year or equivalent to 596 million liters of crude oil.

The renovation involves upgrading window glass to be more energy efficient and the installation of a number of renewable energy sources such as photovoltaics and wind generators, as well as greening the roof.

The Empire State Building, the tallest building in New York with 102 floors, spent more than $500 million on green renovations. The largest portion of the renovation cost has been committed to improving the performance of windows glass. All glass is improved from single layer to three layers (triple-glazed).

Renovation of this building does not follow the US Green Building Standards checklist, LEED, because the building will not be registered for LEED certification.

Renovation is intended to cut its energy consumption without sacrificing comfort.

Renovation is expected to cut energy consumption by up to 40 percent in buildings, which equals $4.4 million annually and reduce carbon emissions of more than 100,000 tons within 15 years, equivalent to removing 20,000 cars from the highway. Jakarta can follow suit.

The writer is a professor of architecture and visiting academic at the School of Architecture and Design, Victoria University of Wellington, New Zealand.