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Sustainable design for low carbon architecture

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Abstract

Low carbon architecture designed according to sustainable principles is becoming an important part of the journey towards achieving sustainable development of economy, society, natural environment and architecture itself simultaneously. The definition, principles and factors considered in design have been investigated in details in this paper. A Three Rings Models of sustainability proposed by author is useful for understanding mechanism of sustainable design.

Keywords: Low carbon architecture; Sustainability; Sustainable design; Principles of sustainable design; Factors considered in design

1. Introduction

Climate change in characteristic of global warming which may bring serious natural disasters to humans was an indisputable fact upon us. The data studies show the scientific evidence of global warming across a spectrum of indicators. From this evidence it follows that there will be impacts, the severity of which will depend on the level and pace of CO_2 emissions. Following the situation of environment getting to increasingly severe, the whole world initiates to develop low carbon economy, to popularize new life style of low carbon, to reduce the carbon intensity by using the way of decreasing the carbon emission. The essence of low carbon economy is to make energy sources in efficient utilization, to develop clean energy, and to seek green GDP, which gives an influence on the development of architecture directly.

It has long been recognized that architecture in construction and in use contribute significantly to CO_2 emissions, which was estimated more than 50% of total emission. The architecture, including community, building and housing in general , and the activities of humans, such as energy and material consumption and waste minimization, and related them to the continuing support of natural resource, can be produced a large amount of harmful emission. So ,we now need to design and construct sustainable low carbon architecture to meet environmental targets generated by international policy organizations ,such as the Kyoto Protocol ,and to create the user-friendly environment that promote well-being and personal enjoyment. Early definition of low carbon architecture emphasized balance between the need of living organisms, architecture and climate. During recent years, the development of passive low energy architecture has referred low carbon architecture in the context of sustainability. Hence, we may redefine the low carbon architecture as a sustainable architecture base on a human ecology with the sustainable development of economy, society and architecture simultaneously.

Because of the complex relationship and their interactions between the architecture and other three parts, i.e. economy, society

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and natural environment, sustainable design should be holism which relates to the way in which these parts and their associated performance attributes combine to create a whole .To understand the sustainable design process, we just simply use a three rings diagram to illustrate interdependence and connectivity of parts of sustainability (see Figure 1).

In Figure 1, sustainability contains four parts: low carbon economy, society, natural environment and architecture. Each part has subsequent factors shown as below.

- Natural environment: Orientation, Clamite, Infrastructure , Light/ Space/ Ventilation, Energy/ Water.
- Low Carbon economy: Added Value, Flexibility, Commercial Reality, Longevity.
- Society: Culture, Social Benefits, People, Health and Well-being.
- Architecture: Form and Function, Identity, Structure, Materials, Innovation.

We conclude that architecture is not only an exercise judiciously balancing considerations internal to the building. The building itself enters into a complex whole where the successful resolution of the project depends on the achievement of a harmonious dynamic interplay between the architecture and the surroundings that as three rings shown in Figure 1.

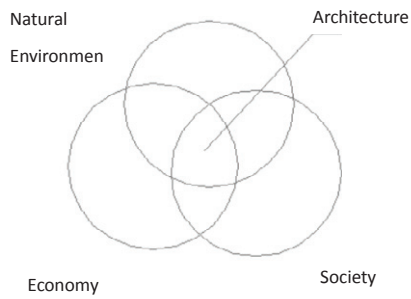

Figure 1 Three rings of sustainability

2. Sustainability in architecture

2.1 Sustainability

Sustainability means continuing, evolving, and adapting to renewable. Usually, sustainability is emerging as a key issue in economy and society. Now, the challenge of climate change leads us to introduce sustainability in architecture. As we know, architecture is about creating a better living space for human life and development, as well as considering the nature and resources of the planet from a global sustainable perspective. Sustainable architecture must not solely become a question of CO_2 emission reducing. It is necessary to consider sustainability from a holistic point of view that considers financial, cultural, and social issues as well as wider ecological and environmental aspirations.

As it is production of conventional energy sources that produces carbon dioxide, the first step will be to find ways in which to reduce the energy consumption of the buildings. This means minimizing the need for everything that requires power, e.g. air conditioning, mechanical ventilation, and artificial light, etc. The second step would be to use sources of renewable energy wherever possible in the planning of the future master plans.

2.2 Factors considered in sustainable design

For us, sustainability is a humanistic issue which has come to mean all things to all people. It is really a system that will continue to evolve for a sustainable architecture with its surroundings. So that, sustainable design based on holistic approach can bring a greater connectivity between people's well-being, environmental considerations, technological possibilities and nature itself which is fundamental to a sustainable future.

It is common to attempt to minimize the environmental impacts of buildings by selecting environmental criteria which are used to inform the design process. BREEAM, a UK Sustainable Building Code issued in 2006, describes the environmental