

Probing Into Assessment Systems of Energy-Efficient Building and Eco-architecture

Youjun Wang¹, Xiaoyong Peng¹, Qian Wang²

¹Nanhua University Hengyang Hunan PRC

²Xi'an University of Architecture & Technology PRC

Abstract: As a result of analyzing the disadvantages of the current assessment methods and indexes for both energy-efficient building and eco-architecture, I suggest three new concepts respectively named as basal energy efficiency coefficient, environmental energy efficiency coefficient and architectural quality coefficient ($K = \frac{C}{AB^2}$), which are based on finding out the prime and essential contradiction among renewable resources(A), unrennewable resources(B) and mankind demands(C). And then I detailedly discuss the significance of the architectural quality coefficient for assessment of energy-efficient building and Eco-architecture

Keywords: Energy-efficient building, Eco-architecture, Assessment

1. FOREWORD

With the human development, the progress of science and technology, the building, as the external manifestation of the human's survival and development has been an important sign which reflects the human civilization all the time. Revolution in science and technology promotes improvement in thought, architecture thought is evolving constantly too. Before 1950s, because of the swift and violent development of industrial revolution, the modernistic architecture which emphasizes the utilization of new technology was unprecedentedly prosperous. However, serious destruction to nature warns us to keep harmony with nature; Energy crisis has woken people's awareness of saving energy up in the beginning of the seventies. Then, with development of green-campaign, the thought of sustainable development has already been rooted in the hearts of the people, the idea of the ecological building is ripe gradually. The thought of the ecological building is shown as the Eco-architecture mainly now. In 1960s, American Italian architect Paul calls ecology and building jointly as the *ecological building* for the first time, namely *Eco-architecture*. In August of 2004, the Construction Ministry defines *Eco-architecture* clearly as: the building which can offer the healthy, comfortable, safe-living, safe-working and safe-acting space to people, realizes utilization of resource with high efficiency at the same time (energy-conservation, section place, water-conservation, material-saving), and the minimum limit influences upon the environment. Summarizing the architectural thought under the guidance of the sustainable development view in these years both at home and abroad, we can draw the conclusion: Energy-conservation represents the most basic requirement, the ecological building is a kind of higher level construction.

2. THE PROBLEMS EXISTING IN THE ASSESSMENT SYSTEM OF ENERGY-EFFICIENT BUILDING AND ECO-ARCHITECTURE

- They didn't consider the issue from social production on whole. We generally regard construction as a *material object* or a project, only calculate someone's or collective's interests. This starting point has limitation. In essence, the course of the construction is a behavior that society consumes social resources and meets society's needs, which is a economic essence of investment and income. So in the assessment course, we should not only consider energy-conservation and ecology merely, but also should regard saving social total resources such as manpower, material resources and so on as the foundation.

- They didn't well reflect the principal contradiction of the problem, only pursue some one or several kinds of goals. The author thinks: the prime and essential contradictory of construction is the construction among Renewable resource, unrennewable resources and the mankind demands. Now, some assessment thoughts have not well distinguished the significance of renewable resources and unrennewable resources. Renewable resources display in the investment for the first time mainly; unrennewable energy displays in the running progress of building life cycle mainly; The mankind demands are shown as two-parts mainly: one is the demands of the comfort for people, the other is a more high-level ecological requirement. Certainly, renewable energy and unrennewable energy exist in every stage at the same time, which are not a isolated relation. As the different realization of the contradiction, there are a series of following problems in the assessment process.

- There is inorganic combination of the economic assessment, energy assessment and environmental assessment. They are too independent to each other.

- In the assessment process, the whole systematic view isn't embodied very well. A lot of indexes are enumerated inorganically, which can't form a optimum option on the whole; some standards only reflect the problems of HVAC, but they don't give consideration to the influence of specialties such as water supply and drain and environmental engineering and so on ; Generally, they also don't consider the influence such as the surface color of the buildings, the wind environment, the shape of the buildings and the inside be divided, etc upon energy-conservation and ecology.

- In Assessment method and assessment process, the contradiction between all-sideness in theory and convenience in practice is being waited to be solved further.

- The standards are usually be mandated with military-force taste, which can't excite its potential economic motive force. Developers are conscientious to energy-conservation and ecological environment, which also can't appeal to users, it is difficult for users to be interested in them.

3. PROBING INTO THE ASSESSMENT STANDARDS OF ENERGY-EFFICIENT BUILDING AND ECO-ARCHITECTURE

After analyzing the principal contradiction of assessment for energy-efficient building and Eco-architecture, we set out the assessment standards, which is the foundation of the assessment system.

First, Analysis of the contradiction between renewable resource (with A show) and unrenewable resources (with B show). We express it with the following formula:

$$k_1 = A \times B$$

k_1 is basal energy-efficient coefficient, which shows the relation between renewable resources and unrenewable resources. Increasing the investment of renewable resources can impel to reduce the consumption of unrenewable resources. k_1 is smaller, the influence is heavier. we pursue more renewable resources to offset the non-renewable resources, so

$\frac{1}{k_1}$ is the bigger the better.

Then, analysis of the contradiction between non-renewable resources (with B show) and mankind demands (with C show). We express it with the following formula:

$$k_2 B = C$$

k_2 is environmental energy-efficient coefficient, which shows the influence of unrenewable resources upon mankind demands , we try to consume less unrenewable resources and reach higher mankind demands . Obviously, k_2 is the bigger the better.

In order to express the contradiction between these three, we can use $\frac{1}{k_1} \times k_2$ and get the following

formula:

$$K = \frac{k_2}{k_1} = \frac{C}{A \times B^2}$$

K is the architectural quality coefficient, which is the bigger the better.

Now we see the relation of these three clearly. Next, we will analyze and discuss the meaning of this formula.

- The non-renewable resources is more precious than renewable resources, it is not more worthwhile to utilize non-renewable resources to meet the human requirement. this is the meaning of B^2 .

- Renewable resource and non-renewable resources contribute to the mankind requirement at the same time. While saving the non-renewable resources, we should treasure renewable resources too. Because of consuming the non-renewable energy while developing the recycled energy, the behavior of construction consumes two kinds of resources at the same time, which have announced that the meaning of saving the social total resources, we should pay close attention to treasure manpower and material resources.

- According to the different demands of the assessment for energy-efficient building and Eco-architecture, we can extent the meanings of A , B and C in various degree and get the assessment standards of them separately. For example, we will assess a energy-efficient building, A is the value of annual investment in service life; B is the annual energy consumption of the building; C is indoor air quality. When we assess Eco-architecture, The definitions of C can be extended into ecological range, the definition of A and B also can be improved.

- Having only caught the principal contradiction, the secondary contradiction can be neglected. Based on architectural quality coefficient, the assessment of energy-efficient building and Eco-architecture can be simplified in a great extent.

- In the present assessment process, we often classify different buildings and then adopt different standards or different assessment methods. It's more tedious. Architectural quality coefficient reflects the generality of building from the prime and essential contradiction, after the assessment system being optimized, the buildings needn't be classified and the range of architectural assessment can be expanded.

- Following this method that contradiction is reflected by formulas, we can also try to carry on the green-assessment to other projects. For example, B stands for the average production of electricity every year in a thermal power station, A is the average coal consumption per year, C means the influence on the ecological environment. The contradiction between them is expressed with the formula below:

$$k_1 A = B \quad k_2 C = B$$

We pursue consuming less coal to output as much as possible electricity, so k_1 is the bigger the

better. We also pursue the output of electricity as much as possible and smaller destruction to ecological environment. k_2 is also the bigger the better.

Then, we use $k_1 \times k_2$ and have:

$$K = k_1 \times k_2 = \frac{B^2}{A \times C}.$$

K can be as the index of energy-conservation and green-assessment for the thermal power station. It's difficult to know that this thought can reflect the relation and position between the contradictions on the mathematics formula vividly.

• There are a lot of factors which influence the value of the assessment indexes, in order to get the optimum, we can try to set up the function of assessment indexes and influence factors. With the development of computer and development of different software, assessment will be a simple course that the parameters are imported and the results are outputted.

4. CONCLUSION

Certainly, a lot of problems exist yet in the application of architectural quality coefficient in practice. The definitions of A, B and C are waiting for

further probe, the coefficients need scientific definitions, simple and convenient methods are still depended on extensive and profound investigation, trial and test. For the prosperity of our country, the scientist must still make great efforts one after another!

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