Calculation of Carbon Emission Baseline in the Operational Stage of Public Institutions—Summer Heat and Winter Warm Region

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Abstract: Based on the data of carbon emission Statistics Platform of public institutions, the baseline of carbon emission of government agencies, hospitals and schools in the Summer Heat and Winter Warm Region of China is calculated by the method of quartile analysis. The results showed that the carbon emission baseline of three types public institutions are 0.01 tCO₂/m², 0.04 tCO₂/m² and 0.03 tCO₂/m², respectively. The results provide a theoretical basis for public institutions to reduce carbon emissions.

1. Introduction

As early as the end of the 20th century, the "greenhouse effect" has begun to be valued by the international community. In order to minimize the impact of greenhouse gases on the earth, humans began to use the form of regulations to limit the emissions of greenhouse gases in various countries for the first time. Subsequently, countries have successively promulgated standards for the evaluation system of green architecture that are suitable for their own national conditions. At present, the evaluation system of green architecture widely recognized by the world mainly includes the British BREEAM system, the US LEED system, and the Japanese CASBEE system. The above three evaluation systems mainly use qualitative indicators such as ecological environment, energy, and operation management as the evaluation criteria for green buildings, but they are not mentioned in quantitative indicators.

Relevant scholars at home and abroad have conducted relevant research on quantitative analysis of carbon emission evaluation in buildings, from defining the scope of carbon emission accounting in various stages of buildings to the establishment of a system framework for carbon emission evaluation indicators. It can be seen from the current research results that the predecessors defined the boundary range of carbon emissions at each stage in the entire life cycle of the building. The framework of building carbon emission evaluation index system is established; Qualitative part of the quantitative indicators, a total of three different stages of the building carbon emission evaluation indicators were studied. On the basis of previous studies, this paper has obtained data on carbon emissions of three types of public institutions: summer heat and winter heating areas, institutions, hospitals and schools. Using emissions per building area of three public institutions as qualitative indicators to conduct the quartile analysis analysis and research. Thus, the base line of carbon emissions of three types of public...
institutions in the summer heat and winter heating area was determined.

2. The analysis of carbon emissions per unit area
Based on the data from the Energy Conservation Resources Network of public institutions and the carbon emission statistics system of public institutions, 173 data samples were selected from three types of public organizations, including organs, hospitals and schools in the summer heat and winter heating regions, and carbon emissions per unit building area was selected as the measurement index.

The carbon emissions per building area were analyzed by drawing box chart SPSS 22.0.

![Figure 1. Box diagram](image)

In the figure one, NO.1 represents the school, NO.2 represents the hospital, and NO.3 represents the agency. The box diagram can intuitively reflect the average level of data, the degree of fluctuation, and the results of anomalies. Figure 1 shows that the carbon emission level of school public institutions is significantly lower than that of government agencies and hospitals. The carbon emissions per unit area of public institutions in schools are relatively small, and the data on the construction area of public institutions in institutions and hospitals are more volatile than those of public institutions in schools, and the data fluctuations in institutions and hospitals show that the above two types of public institutions have the potential to save energy and reduce emissions in the management of construction operations. Of the 173 data samples, the school is located at No. 4, No. 21; Hospital No. 11, No. 16, No. 30; The No. 22, No. 32 agency, has a total of 7 abnormal points of data; Based on the comparison with other data, we can see that the above-mentioned public institutions with anomalies have shortcomings in building capacity and operating management, and they should strengthen the construction of thrifty public institutions and improve their own management systems. The elimination of old energy equipment, so as to reduce the carbon emissions per building area and achieve energy conservation and emission reduction requirements.

3. Carbon emission baseline measurement
When using the quartile method to measure the baseline of carbon emissions per unit area of public institutions, the first quartile represents the lower level of carbon emissions per unit of construction area of public institutions, and the second quartile represents the average level of carbon emissions per unit of construction area of public institutions. The third quartile represents the higher level of carbon emissions per unit of construction in public institutions. The average levels of carbon emissions were measured by SPSS22.0 in three types of public institutions: organs, hospitals and schools in the summer heat and winter heat regions. The results are shown in the table 1.
Table 1 Carbon emission per unit building area (tCO₂/㎡)

|         | School | Hospital | Government agencies |
|---------|--------|----------|---------------------|
| N       | 52     | 39       | 82                  |
| Effective deficiency | 0      | 0        | 0                   |
| Average | 0.01   | 0.05     | 0.03                |
| Median  | 0.01   | 0.05     | 0.03                |
| 25      | 0.007  | 0.03     | 0.02                |
| Percent | 50     | 0.01     | 0.03                |
| 75      | 0.014  | 0.06     | 0.04                |

From the above table, we can conclude that among the three types of public institutions: schools, hospitals, and institutions, the average baseline of carbon emission per unit building area are 0.01 tCO₂ / m², 0.04 tCO₂ / m², and 0.03 tCO₂ / m².

4. Conclusion

By using carbon emissions per unit of construction area as a measure of carbon emissions, this paper measures the average level of carbon emissions per unit area of three types of public institutions, schools, hospitals, and government agencies. The average level baseline of carbon emissions per unit of construction area are 0.01 tCO₂ / m², 0.04 tCO₂ / m², and 0.03 tCO₂ / m².

The above research and analysis will provide some reference opinions for the selection of quantitative indicators in the theoretical system of building carbon emission evaluation; The determination of the carbon emission baseline can strengthen the construction of economy-saving public institutions in summer heat and winter heating areas, promote the operation and management of public institutions, help some public institutions find their own energy conservation potential, and make a partial contribution to public institutions 'energy conservation and emission reduction.

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