The Green Building Development Status in Guangzhou

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Abstract. The paper mainly introduces the green building development status in Guangzhou. As one of the well developing areas of green building in China, Guangzhou's green building projects are gradually increasing. However, the development is still in its infancy. There are certain problems and limitations of the green building development.

1. Introduction
Since the 18th century, the industrial revolution has opened the era of industrialization of human society, and the impact of human activities on the climate and environment is growing. With the rapid development of economy, energy consumption is also growing rapidly, causing serious problems of resources and environment. At the Copenhagen Conference in 2009, China pledged to significantly reduce carbon intensity and actively develop a green low-carbon economy. In November of the same year, China announced the goal of reducing carbon intensity: by 2020, carbon dioxide emissions per unit GDP of China will be reduced by 40%-45% compared with 2005.[1] With the increasingly prominent issues of the environment, the green low-carbon research has become an important topic at home and abroad. Many places in China have proposed concepts e.g. the carbon emission rights, the carbon benefits, and the green buildings, which helps to seek construction and life style that can reduce the impact to the environmental.

2. The concept of the green building
Architecture is the main place for life, work and entertainment. The whole life of the architecture includes the beginning of planning and design, the construction, the operation, the decoration and the final demolition. Except from the planning and designing, the other stages of an architecture are accompanied by resources utilization, energy input, and discharge of waste water and waste gas. [2] In the 1990s, the concept of green building was introduced to China, which attracted great attention. The relevant departments issued many relevant management methods and normative documents. [3] Green building refers to the maximizing resource conservation during the entire life cycle of the architecture, including energy saving, land saving, water saving, material saving, etc. It can protect the environment and reduce the pollution. Moreover, it provides people with healthy, comfortable and efficient use of space, and the nature harmonious symbiotic buildings. [4]

Due to the difficulty of data acquisition in China and the lack of a unified and standardized database and calculation method, the research on carbon emissions from building life cycle in China is still in its infancy. Although there is a big gap with developed countries, in recent years, Chinese scholars have made some attempts in obtaining basic data of carbon emissions and calculating carbon emissions, which laid a good foundation for the study of carbon emissions in the whole life cycle of buildings.
3. The green building development status in Guangzhou

On July 17, 2015, the Guangdong Provincial Development and Reform Commission officially released the “Guangdong Province Carbon GSP Pilot Work Implementation Plan” and the “Guangdong Province Carbon GSP Pilot Construction Guide”. It encourages different regions to select different industry sectors, explore different construction methods and actively carry out trials. In order to cooperate with the construction of carbon-saving work in Guangzhou, the Guangzhou Municipal People's Government officially released the “Notice of the General Office of the Guangzhou Municipal People's Government on Printing and Distributing the Implementation of the Carbon Trading Mechanism and the Carbon GSP Pilot Project in Guangzhou's Construction and Transportation Sector”. In the notice, it is pointed out that residents can obtain corresponding carbon credits or carbon coins when they purchase (rent) green buildings, which encourages more residents to choose green buildings when they choose to buy or rent houses.

On November 11, 2013, the Guangdong Provincial People's Government officially issued the “Guangdong Province Green Building Action Implementation Plan”. The plan determined that it is in line with the actual green building development technology route in Guangdong Province. Moreover, it pointed out that it is necessary to effectively increase the proportion of green buildings in new buildings in Guangdong Province. The plan emphasizes that the new large-scale public buildings, the government-invested new public buildings, and the new affordable housing in Guangzhou and Shenzhen must fully implement green building standards. Therefore, Guangzhou's work in promoting green buildings needs to play a demonstration role throughout the province. On October 16, 2014, the Guangzhou Municipal People's Government issued the “Guangzhou Green Building Action Implementation Plan”. The plan clarifies that Guangzhou will further increase the proportion of new green buildings in the city. By the end of 2020, green buildings will account for more than 40% of the proportion of new buildings.

As of August 2016, some projects have obtained the green building logo in Guangzhou. In these projects, public buildings and residential buildings accounted for 46.2% and 53.8% of the total construction area respectively. Moreover, there is only one industrial building.

![Fig. 1 Proportion of Different Types of Green Buildings in Guangzhou](image)

There are two main types of green building logo, namely "design evaluation logo" and "operation evaluation logo". Among them, design evaluation marks are the evaluation marks for residential buildings and public buildings in the planning, design and construction stages, which should be carried out after the completion of construction drawings and the validity period of the marks is two years; operation evaluation marks are the evaluation marks for residential buildings and public buildings that have been completed and put into use, and should be put into use. One year later, the validity period of the logo is 3 years. From the type of sign, the building area of the design mark project accounts for 96.0% of the total building area, while the operation mark project is a public building, and its building area accounts for 4.0% of the total building area.
According to GB/T 50378, green buildings are classified into three grades: one star, two star and three star. As of August 2016, the number of green buildings rated as one star of the national standard in Guangzhou was the largest, accounting for 65.3% of the total, followed by two stars of the national standard, 19.3% and three stars of the national standard, 12.4%.

Guangzhou has made great efforts in promoting green building work and actively responded to the requirements of green building development in Guangdong Province. However, as the incentive policy system for the whole process of green building has not been perfected, the construction cost of green buildings is higher than that of conventional buildings. Additionally, the public's awareness of green buildings is not very high, which has caused difficulty for Guangzhou to promote green buildings.

4. Conclusion
Under the background of vigorously promoting sustainable development, Guangzhou's green buildings have achieved great developments[6]. However, due to the fact that Guangzhou's green building development is still in its infancy, there are still some problems and limitations. As one of the well development of green building in China, it is of great significance to carry out research on Guangzhou green buildings as a target. It will greatly promote the development of green buildings in China.
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