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The Existing Building Sustainable Retrofit in China-A Review and Case Study

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Abstract

With China's urbanization rate reaches 56.1% in 2015, the limitation of the city scale and retrofitting the existing building became the social consensus. According to incomplete survey, there are 400~600 billion m² existing buildings in China and only less than 10% can be rated as the energy efficiency building, with considerable interest and activity in green retrofit design and construction. We review briefly the context of existing building retrofit design and construction in China. Next we look at a specific project as an example of a high performance, sustainable retrofit design, the Green E-Park, in the typical old downtown area of Shanghai China. Based on the climate condition, cultural characteristics and old industrial features, the retrofit of Green E-Park improves the quality of the indoor environment, building performance and utilization of the renewable energy source. And most importantly, the retrofit of the Green E-Park is not only limited in the building, but also takes the community retrofit into the consideration which includes a series of community sustainable retrofit planning technology. We also comment on the unique planning and design process, which incorporated passive strategies throughout the building, and has led to high occupant satisfaction and remarkably low retrofit cost. Lastly we present thoughts on how the retrofit philosophy of the Green E-Park can be a guide for sustainable retrofit in different climate regions throughout China and elsewhere

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1. Status of existing building retrofit in china

China has more than 50 billion square meters existing building, and most of the existing building, about 30-50%, reaches the function failure or degradation period because of the technical level and economic limitations of the

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built time. The existing building retrofitting is an effective way to make full use of these resources, in terms of economic benefits, the protection of historical and cultural and sustainable development. Together with the city scale expansion, sustainable retrofit will undoubtedly create another important development driving force and more substantial benefits to China's green building industry.

The retrofitting of the existing building starts with the energy efficiency retrofitting of the residential building in the northern part of China. Those residential buildings built in the 80's of last century which cannot meet the current energy efficiency standard are retrofitted with better exterior insulation and window glazing. With the national and local governments attach great importance to the building energy efficiency, the energy efficiency retrofitting extend to the other climate zone and more kinds of building types. The retrofitting technologies are also extended from simply the building envelope insulation to the high efficiency electrical appliances, better air conditioning, optimized system control and M&V etc.

As the existing building retrofitting got the attention of the Chinese central government, many green building and building energy efficiency related laws, regulations and policy documents have been released. The "Energy Conservation Law of People's Republic of China" has some contents directly related to the existing building retrofit. The national "Civil Construction Management Regulations" and other regulations include related contents. In addition, the "Green Building Action Plan", "12th Five-Year Green Building" and "Green City Development Plan", "National New Urbanization Plan (2014-2020)" and other policy documents proposed energy efficiency construction planning and requirements.

In recent years, the concept of the existing building retrofitting extended from energy efficiency to the comprehensive improvement of the building performance which aims to provide a sustainable built environment. The scope is also stretched from individual building to the building complex and community. In 2015, the national standard "Assessment Standard for Green Retrofitting of Existing Building" was put into action. The standard regulates the planning and construction, structure and materials, HVAC, water supply and drainage, electrical construction, construction management and operations management of the existing building retrofit. The assessment indicator is not only limited to the energy performance, but also include the social benefits, environmental benefits and economic benefits of the sustainable retrofit building.

It is not difficult to see that sustainable retrofit will become an important way and the key solution to the environment and resources problems that China is currently facing, which will greatly accelerate the potential of energy saving and emission reduction in China's dwindling predicament. However, compared to the energy efficiency retrofit, the sustainable retrofit of existing buildings is more complicate and the targets of the retrofit are more diverse. Besides technical aspects, it should fully consider the history and local ethnic habits, the community function positioning, the government regulations towards land use and protection of the historical building and other factors. Other barriers include the lack of related standards, technologies, products, and the related policies, mechanisms are yet to be further improved.

2. Designing the green e-park

2.1. Project overview

The Green E-Park is located in the Yangpu District, a typical old industrial area of Shanghai, where Chinese national industry started. With the economic growth, the old industrial area faces the restriction of both environment and land resources. How to retrofit the old industrial factory to improve the city function, stimulate urban vitality and improve the living environment is a critical problem for the sustainable development of the city. The Green retrofit of the Green E-Park is one of the explorations.

The Green E-Park was the factory of the Shanghai Piano Company. It was built in 20s of last century and it is the birthplace of China's first piano and was abandoned in the 2005. The total floor area of the Green E-Park is 13126.83m², with 12324.26 m² ground floor area and 802.57 m² basements. The building site is surrounded by the high density residential and administration buildings with narrow streets and very limited open spaces. The sustainable retrofit aims to change the function of building from the industrial factory to the office building for the design and research team. The retrofit is not only makes the building green, but also improves the vitality and environment of the community.

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