RESEARCH ON THE DEVELOPMENT SITUATION OF GREEN INDUSTRIAL BUILDING IN SHANGHAI

[1]ZHANG YINQI, [2]WANG HE, [3]GAO WEIJUN, [4]YING XIAOYU

[1,2,] Doctor student, [3]Professor, [4]Associate professor
E-mail: [1]yinqiz90@gmail.com, [2]344305710@qq.com, [3]weijun@kitakyu-u.ac.jp, [4]evanyxy@qq.com

Abstract - The Evaluation Standard for Green Industrial Building (GB/T50878-2013) has been officially released in 2013. Industrial building has its own evaluation criteria which adapted to its specific characteristic. Since 2012 China launched the first batch of green industrial building evaluation, a total of 30 projects have been certified by Ministry of Housing and Urban-Rural Development of the People's Republic of China (MOHURD) by the end of 2015. Under the development situation of Shanghai which is promoting industrial restructuring and upgrading, the demand of manufacturing and processing industry will decrease, while the amount of buildings mainly for scientific research, including office spaces and industrial production laboratories will grow dramatically. Unfortunately, the current evaluation system of green industrial building cannot completely apply to the latter. In the current 30 certificated green industrial buildings, Shanghai only has one certificated project. This paper analysed green industrial building development situation in Shanghai in detail which will help to develop a standard system that suit for building types of Shanghai industry transformation development characteristic, including for general plant and scientific research and development buildings, so that standardize the green building technology promotion and evaluation on industrial construction.

Index Terms - Green industrial building, Development present situation, Evaluation, Shanghai industry transformation

I. INTRODUCTION

In recent years, the annual newly increased construction area is one billion square metres approximately in China, which including residential buildings by 600 million square metres, public buildings by 300 million square metres and industrial buildings by one million square metres. In terms of project investment, industrial building and civil building account for 53% and 43% respectively. Although the newly increased area proportion of industrial building is not huge, its project investment is larger than that of civil building. Meanwhile, with the rapid development of industrialization in China, the various types of industrial architecture involved in the production process and technical index is uneven. There are high resources consumption (energy, water materials consumption, etc.) and high discharge (waste water, waste gas, solid waste, etc.) existing in the industrial architecture construction and operation process. Therefore, it should be highly valued the greening transformation and integration of industrial architecture and systematic energy-saving emission reduction work.[1]

II. DEVELOPMENT PRESENT SITUATION OF GREEN INDUSTRIAL BUILDING

On August 8th, 2013, Ministry of Housing and Urban-Rural Development of the People's Republic of China (MOHURD) officially issued the Evaluation Standard for Green Industrial Building (GB/T50878-2013). It defines the green industrial building is a kind of industrial building that can maximize resource conservation, including land, energy, water and materials saving, reduce pollution, protect the environment and offer applicable, healthy, safe and efficient use of architectural space in building life circle [2]. The evaluation of this standard sets the integrated energy and water consumption per unit output as the core index. Pollution control and occupational health are the significant content of evaluation as well. The standard features of the industrial architecture and green development requirements.

As the first green building evaluation standard for industrial building specifically in the world, it fill the blank of green industrial building evaluation standards at home and abroad [10]. It achieves the international leading level with its scientificity, advanced and operability [3]-[5].

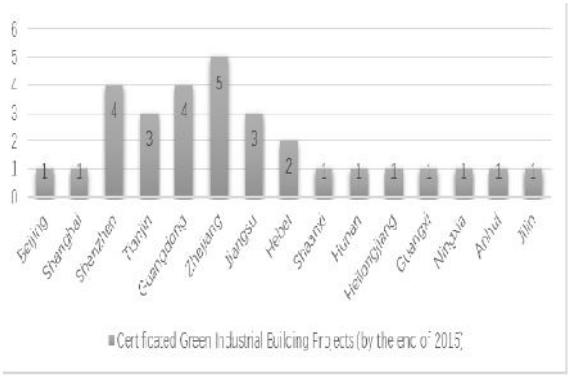

Fig. 2-1 Certificated Green Industrial Building Projects (divided by location, by the end of 2015) [11]

The Evaluation Standard for Green Industrial Building (GB/T50878-2013) was implemented formally since March 1st, 2014, which is the important technical basis for guiding the industrial building greening planning and design, construction and acceptance, operation management, and standardizing the green

industrial building evaluation work [6]. It will lead the industrial construction of China gradually towards a way of greening development. Developing green industrial building is not only the inevitable choice of China for the traditional industrial transformation in the global economic environment, but industrial enterprises in the process of their own development intrinsic demand. Since 2012 China launched the first batch of green industrial building evaluation, a total of 30 projects have been certified by MOHURD by the end of 2015 [7]. According to the location and affiliated industry, the projects are classified statistics are shown in figure 2-1 and 2-2 respectively as follows.



Fig. 2-2 Certificated Green Industrial Building Projects (divided by affiliated industry, by the end of 2015) [11]

Figure 2-1 illustrates that the green industrial buildings distribute mostly in southeast economically developed coastal area of China. Zhejiang stands the largest amount of certificated green industrial building by 5 projects. The certificated projects gives priority to high-tech manufacturing facilities.

III. PROJECTS DEVELOPMENT SITUATION IN SHANGHAI

By the end of 2015, there are 297 certificated green building in Shanghai, with a total construction area of 26.67 million square metres. In the year of 2015, 129 projects were certificated, counting for 43.4% of all certificated projects, increasing 84% than that in 2014. The certificated building area exceed 12.37 million square metres which accounts for 46.6% of the total construction area, up 79% from 2014. The annual new certificated projects include 36 residential buildings, 93 public buildings.

In the total certificated green buildings (2008-2015) in Shanghai, there are 200 public buildings, accounting for 67%. Following 96 residential buildings accounts for 32%. The industrial building is only one projects. Figure 3-2 and 3-3 illustrate that Shanghai has larger proportion of green public buildings and higher classification level projects.

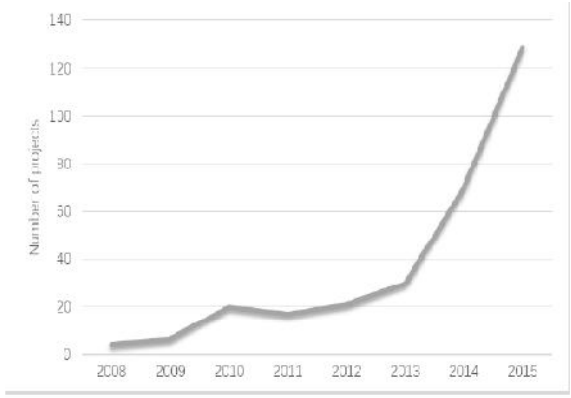

Fig. 3-1 Certificated Green Building Projects of Shanghai

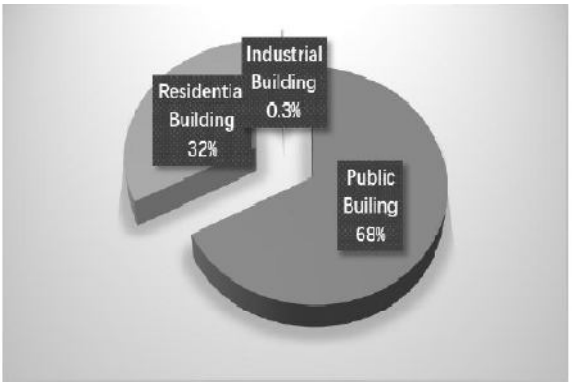

Fig. 3-2 Proportion of different Certificated Green Building types in Shanghai[12]

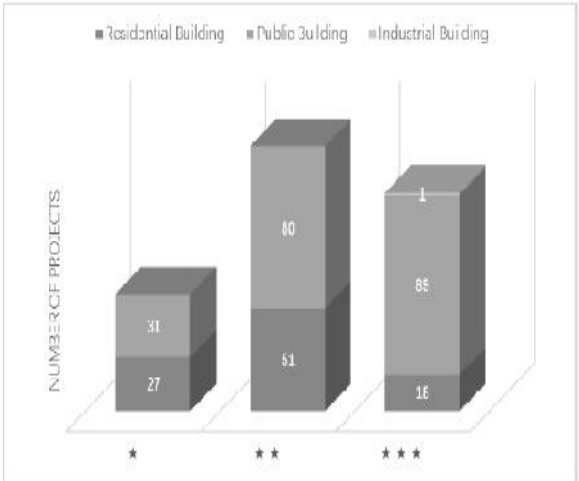

Fig. 3-3 Certificated Green Building classification distribution in Shanghai[12]

IV. INDUSTRIAL BUILDING DEVELOPMENT IN SHANGHAI

A. Changes of industrial land-use

From the beginning of 1990s of last century to 1997, it is a period in which industrial land-use developed in Shanghai. It has launched national industrial zone,

'Nine rural industrial parks' and more than 200 kinds or township and village industrial parks. The basic layout of modern industrial parks in Shanghai was formed with rapid expansion of industrial land-use during this period. In the late 90's to early 21st century, Shanghai industrial suburbanization process was accelerated. At the beginning of the 21st century, Shanghai master plan was approved. 'One City Nine Towns' planning project setup. Industrial suburbanization is the significant driving force for the process of suburbanization in Shanghai. In 2003, the designed industrial park area of three districts, Jiading, Qingpu and Songjiang, was increased from 67km^2 to 173 km^2, namely '173 Plan'. By the end of 2003, there are 17 development zones with 1008 km^2 planning area in Shanghai. In 2006, taking the opportunity of hosting the 2010 World Expo, Shanghai industrial development starts a significant turning point. To the end of the period of '11th Five-year Plan', the second industry declined to 42.3% of GDP. Industrial land growth also changed markedly [9]. In 2009, Shanghai has launched 'Two Plans Integrated' (urban and rural master plans and general plans). The layout of the industrial block adjustment works carried out as one of the special project. Including the 49 industrial block in the national plan announcement, it formed 104 industrial block in Shanghai combining old industrial base, new key industrial base and existing urban industrial blocks. The total area of the 104 industrial block is 764 square kilometres, accounting for about 25% of the construction land in Shanghai. Shanghai developed and published Shanghai Three Years Action Plan (2013-2015) of Industry Transformation and Upgrading, in order to implement the 'Several Suggestion for Systematic Optimize Layout of The Whole City Industrial Block (Shanghai Government Publish [2013] No. 33)', further optimize the structure of industrial layout, promote the construction of resources saving and environment friendly city, promote the development of city industry transformation and upgrading and production integration. It clears that the key point is promoting industrial upgrading, retrofitting, transformation and project linkage. It was asked to respect history, seek truth from facts, combine short-term and long-term, integrate leading and forcing, combine rewards and punishments, carry out responsibility, strengthen the examination, stick the 'Two Plans Integrated', support the development of the real economy and enhance the vitality of innovation. With upgrading-oriented, the planning industrial block focuses on the development of strategic emerging industrial and advanced manufacturing and carries out high-end development. With transformation-oriented, the present industrial land out of the planning industrial block, but within concentrated construction area focuses on developing producer services which is integrated with new town construction and matched the industrial chain. It guides to transform to city life function and carries out transformation of development. With reclamation-oriented, the present industrial land out of the concentrated construction area emphasis the implementation of ecological restoration and reclamation.

B. Appearance of new land-use type

With the development of Shanghai economic transformation, the original land-use classification cannot fully meet the needs of Shanghai economic development. In March 2013, Shanghai Municipal Administration of Planning and Land Resources (SMAPLR) issued 'Guideline Opinions on Adding Research and Development Land-use (SMAPLR (2013) No.153) '. It clears that under the premise of keeping the national land classification standard relatively unchanged, add research and development type of land-use classification combining Shanghai conditions [9]. It corresponds the category of 'Scientific Research Land (C65)' in planning land use classification. The land usage includes scientific research, survey design, observation test, science and technology information, research and development institutes, and all kinds of products and their technology research and development, facilities testing.

For the new, retrofitting, and expansion research and development projects which conform to the planning principles, the planning indicators such as plot ratio and building height will be set based on the actual research. The maximum of plot ratio and building height is controlled by 3.0 and 60m respectively. The specific indicators should be set after planning study based on the overall demand of industrial parks and reginal development, regional overall shape control, as well as industrial specific content.

C. Application of land-use type and green industrial building standard

Based on the current industry transformation and the adjustment of land-use policy in Shanghai, the land-use types can be divided in to four categories:

a) Type 1: Building lot for traditional industrial manufacturing and processing. This type of building contains production process, product output, as well as waste pollution discharge, etc.

b) Type 2: Building lot for transportation and storage. The main function of this type of building is goods storage and transfer. With the rapid development of present electronic commerce, this kind of building type will exist for a long time, and maintain a stable growth momentum.

c) Type 3: Building plot for science, research and development. Generally, it does not contain production process. Whereas there are a large number of laboratories, research and development of science and technology rooms, testing rooms, etc. Lots of scientific and technological product with high added

value, less water and energy consumption and less pollution emissions will be outputted.

d) Type 4: Building plot for the third industry development, such as producer services, research and development head office, etc. There is no production process, product output, and no pollution discharge in this type of building. The major function of this type of building is satisfying the requirement of business office work. The characteristics of the four types of building and the applicability of the green building evaluation standard are corresponded as the following table.

Type	Characteristics	Applicable standard
Type 1	building lot for traditional industrial manufacturing and processing	Evaluation Standard for Green Industrial Building (GB/T50878-2013)
Type 2	building lot for transportation and storage	Evaluation technique rules for green common workshops and warehouses (establishing)
Type 3	building plot for science, research and development	None
Type 4	building plot for the third industry development	Evaluation Standard for Green Building (GB50378-2014)

Table 1 Applicable standard for four types of building

According to the requirement of industry transformation in Shanghai, the type 1 building will be decreased, whereas the type 3 building will be more and more. The main function of this type building is science and research room, laboratories, testing room, office, etc. These kinds of rooms are categorized into auxiliary room in industrial building in accordance with the standards of current evaluation system. They cannot be evaluated as the main body of the building, so there will be a lot of provision inapplicability. This will cause that even the building has been taken some green ecological technologies but cannot get evaluated scores, which will result in failing to achieve green building certification.

CONCLUSION

The Evaluation Standard for Green Industrial Building (GB/T50878-2013) has been officially released in 2013. However, due to the standard applicability, economic development and other limitation factors, green industrial building does not develop rapidly as the green civil building. In the current certificated green industrial buildings, Shanghai only has one certificated project.

The green industrial building standard is used to assess all industrial building types, such as heavy industry, light industry and so on. However, the definition of some indicators is too simple that leads to many problems. Additionally, the applicable scope of the parameters of the production process is not clear, which caused inaccurate calculation and unreliable evaluation. According to the twelfth five-year plan of industrial development in Shanghai, the out-ring area should develop the producer services such as modern logistics, science and technology research, e-commerce, etc. this kind of function of the industrial buildings are mainly logistics buildings, warehouse and science and research offices. In the process of operation, there is no specific production process in these buildings. However, in the green industrial building standard, there are lots of indicators related to parameters of production process. These indicators are not suitable for the industrial building mentioned above. Although there is another method for assessment that comparing with the same industries, the lack of data and the poor comparability of the chosen industries led to unreliable evaluation as well.

It is urgent to develop a standard system that suit for building types of Shanghai industry transformation development characteristic, including for general plant and scientific research and development buildings, so that standardize the green building technology promotion and evaluation on industrial construction.

REFERENCES

[1] J. Chen, “Implementation and Promotion of Green Industrial Building”,Master, South China University of Technology, 2015.
[2] “Evaluation Standard for Green Industrial Building (GB/T50878-2013)”, Ministry of Housing and Urban-Rural Development of the People’s Republic of China, 2013.
[3] F. Hu, “Comparison of Green (Sustainable) Building Evaluation Standard in China, Britain and United States”, Master, Beijing Jiaotong University, 2010.
[4] Y. Wan, R. Xu, T. Huang, “Comparison and Analysis on Chinese Green Building Evaluation Standard and LEED”, Building Science, vol. 25, no. 8 pp. 6-8.2009.
[5] Z. Wang, J. K. Smith, “The development trend of American green building industrialization”, Housing and Real Estate, no. 14, 2016

[6] Z. Wang, M.Itou, S. Yoshida, D, Uebara, "The development trend of Japanese green building industrialization", Housing and Real Estate, no. 14, 2016.
[7] "Evaluation Standard of Green Building Technical Instructions", China Architecture & Building Press, 2015.
[8] "Report on energy conservation and development in China", China Architecture & Building Press, 2016.
[9] "Outline of the 13th Five-year Plan for National Economic and Social Development of the People's Republic of China", Xinhuanet, Beijing, 2016.
[10] "Outline of the 13th Five-year Plan for National Economic and Social Development in Shanghai", 2016.
[11] W. Shi, "Focus on innovative development of green buildings", Urban Development, no. 8, pp. 86, February 2016.
[12] "Evaluation Standard for Green Industrial Building Reference Guide",China Architecture & Building Press, 2015.
[13] "Report of Green Building Development in Shanghai", Shanghai Municipal Commission of Housing and Urban-rural Development, June 2016.

★★★