

Literature Review on The Whole Life Cycle Assessment of Passive Buildings in The Context of Dual Carbon Emissions

Yuqi Liu, Xinsheng He

School of Civil and Architectural Engineering, North China University of Science and Technology, Tangshan 063210, China

Abstract: With the increasing global demand for sustainable buildings, passive building design has become an area of concern. The design concept of passive buildings is known for its efficient energy use and excellent indoor environmental quality. However, there is a need to delve deeper in order to fully assess the economics and sustainability of passive buildings. The whole life cycle management of passive buildings is a relatively new management concept, and the evaluation research of the whole life cycle of passive buildings under the dual-carbon target is still limited. This paper reviews the evaluation methods and criteria based on the whole life cycle of passive buildings. The literature review includes research conducted over the past two decades and will focus on evaluation indicators for passive buildings. Many reviews present evaluation indicators for low energy design in the full life cycle evaluation of passive buildings and discuss future design directions. This literature review serves as a preliminary step to guide the evaluation criteria of passive buildings in light of China's two-carbon target, which will help to enrich the evaluation indicators of passive buildings and promote the transition to high-quality development of passive buildings.

Keywords: Passive building; carbon emissions; evaluation index.

1. Background

The carbon emissions from the entire life cycle of the construction industry, including the production, transportation, construction, and operation of building materials and equipment, account for more than 51% of total society emissions. Therefore, it is crucial for the construction industry to take action in reducing carbon emissions in order to achieve the national "3060" strategic goal.

On March 11, 2022, the Ministry of Housing and Urban-Rural Development issued the "14th Five-Year Plan for Building Energy Conservation and Green Building Development". The development of building energy efficiency and green buildings faces significant challenges but also presents important opportunities. Accelerating the construction of green buildings, changing construction methods, actively promoting green building materials, promoting efficient and low-carbon building operation and management throughout a building's life cycle will greatly contribute to urban and rural green development.

We will raise building energy efficiency standards, carry out energy-saving renovations on existing buildings, optimize energy use structures within buildings while properly controlling total energy consumption and carbon emissions within the construction sector. We have adopted a "compulsory plus voluntary" model by increasing star-rated green buildings in government-invested public buildings as well as large public buildings and new constructions in key functional areas.

Local governments have been advised to develop policies on green finance, floor area ratio incentives, and priority awards in order to support the advancement of star-rated green buildings. In an effort to enhance the energy efficiency of new constructions, our focus will be on promoting ultra-low energy consumption buildings. Currently, certain regions in China have implemented a construction carbon emission calculation and management system for construction projects.

This system is designed to assist the construction industry and government agencies in effectively managing and reducing carbon footprint.

Engineering projects typically exhibit low-carbon practices in two main areas. Firstly, they leverage the technical advancements of the industrial information revolution by incorporating collaborative design BIM technology. Secondly, they embrace a low-carbon development approach through the utilization of green building planning and design, passive building techniques, assembly design, intelligent control systems, and other low-carbon building technologies to promote sustainable construction actions. Furthermore, an increasing number of industries have participated in carbon trading market management systems, which proves to be an effective strategy for enhancing the environmental friendliness of construction projects within the industry. Notably, managing carbon emissions from passive buildings holds particular significance in this regard.

On September 14, 2023, the China Building Energy Efficiency Association formulated the sixth batch of near-zero energy building evaluation projects for 2023. This project has seen an increasing number of passive building projects being implemented. Passive buildings are gaining more respect in the construction industry due to their ability to rely on the natural environment and local climate conditions. Through the use of heat storage, cold storage, and temperature insulation measures during construction, passive buildings are able to regulate internal temperatures effectively. In order to further develop and promote passive buildings, it is essential to establish a comprehensive evaluation standard that can aid in their widespread adoption and popularization.

2. Research Meaning

The concept of passive building energy efficient design has been widely disseminated worldwide and is considered to be at the forefront of sustainable building. However, it is vital to recognize the economics and long-term sustainability of

passive buildings as they will play a key role in the future development of the construction industry. At present, more and more public buildings and civil buildings are adopting passive building designs, making it gradually become the mainstream trend of green buildings in our country. Considering the advantages and characteristics of passive building, there is still room for growth in the scale of passive building, so this kind of construction may be the main growth point for China's construction industry in the next stage. In general, increasing the growth rate of passive buildings will have a positive effect on both economy and environment. The promotion of passive buildings can help combat climate change, improve indoor and outdoor environmental quality, increase resource efficiency, and promote sustainable urban development.

Passive buildings play a crucial role in achieving the two-carbon goal and make significant contributions to addressing climate change by reducing carbon emissions from the construction sector. The design concepts and technologies of passive buildings help the industry to lower carbon emissions, enhance energy efficiency, improve indoor environments, and actively work towards reaching the two-carbon target. Linking carbon emissions to passive buildings is an important step for the construction industry to move towards sustainability and environmental friendliness in the context of the two-carbon target. This will ultimately help reduce its carbon footprint and address challenges posed by climate change.

A comprehensive life cycle approach to passive buildings can offer a more holistic perspective, not only within the passive building sector but also in the green building sector. Firstly, conducting a whole life cycle assessment allows for comparison of the environmental impact between passive buildings and other buildings, revealing the environmental impact of passive buildings at different stages. This information can then be used to drive technological improvements and innovations at each stage, including the utilization of environmentally friendly building materials and processes. Secondly, based on the results of the whole life cycle assessment, a more comprehensive and sustainable evaluation standard can be developed.

The establishment of evaluation criteria can provide a more systematic and objective approach to evaluating the performance and quality of passive buildings. This can assist construction practitioners in identifying potential improvements in the design, construction, and management processes, as well as enhancing practices in energy efficiency, material selection, and resource conservation. Such criteria are essential for promoting a more rigorous and comprehensive assessment of passive building performance.

Currently, China is actively promoting the research and practical application of green building and low-carbon housing. However, standardized evaluation criteria such as the Green Building Evaluation Standard still lack relevance and in-depth analysis capabilities. For example, it focuses solely on the feasibility of the technology rather than its environmental impact or performance over the life cycle. Similarly, Near-zero Energy Building Inspection and Evaluation Standards primarily focus on evaluating building technology suitability rather than carbon emission management evaluation, and do not consider the value of the whole life cycle from a holistic perspective.

This paper proposes using a comprehensive evaluation system for passive buildings that includes an emerging carbon

emission rights trading mechanism. This will enable a scientific and systematic quantitative evaluation of passive buildings to improve living environments, encourage enterprises to embrace zero carbon concepts, and promote the establishment and improvement of carbon trading markets. It is crucial to implement dual-carbon policies, achieve dual-carbon targets, and realize carbon neutrality throughout the entire life cycle of passive buildings.

3. Search Methods

The literature in this review was gathered from nationally recognized academic research databases. Examples of these databases include Bansal N K, Diaz de Garayo S, Hengfang Zhou et al. The key terms used for the search included passive building, green building evaluation, full life cycle, carbon emission measurement, dual carbon target, and Low carbon building. After identifying articles containing these keywords, their references were reviewed to identify any additional valuable articles for inclusion in this literature review. The information obtained from all of these articles was then analyzed and incorporated into this literature review. The specific findings of these articles have been documented and included in the text descriptions as well as tables of this literature review.

4. Current Reserch

4.1. Current research status of passive building theory

4.1.1. Foreign research status

In his book "Man, Climate and Architecture," Givioni B[1] proposed passive technical design strategies for different climatic conditions with a focus on thermal comfort. This book is widely recognized as a model of architectural climatology.

Brown G Z[2] et al. aimed to maximize the use of natural resources such as sunlight and wind energy by proposing a series of design strategies from both macro planning and micro structure perspectives. These strategies have been applied in practical engineering, providing valuable technical support for the advancement of passive buildings.

In "Passive Building Design: Manual of Natural Climate Control," Bansal N K [3] elaborated on the design concept and basic principles of "passive" houses. He formulated overall layout plans and detailed structural settings based on local environmental conditions and geographical characteristics, while also proposing optimization measures to reduce energy consumption rates.

American environmentalist Daniel. D. H[4] ira specializes in the study of active solar energy. His renowned work, "Solar Buildings -- Passive Heating and Cooling," delves deeply into the utilization of solar energy for achieving energy-efficient heating and cooling methods. It provides a comprehensive guide for designing and evaluating these systems, offering valuable insights for professionals in the field.

American scholar James Marley O 'Connor's book [5]"Passive Energy Saving Building" integrates passive concepts and techniques into all aspects of architectural design, while ensuring the functional and aesthetic properties of buildings. It provides in-depth discussion on design strategies, including building structure layout, green vegetation coverage, and thermal physical characteristics of buildings. Furthermore, it elaborates on the passive design

methods that should be adopted in response to different climatic conditions.

In 2016, Wolfgang Feist [6] The "father of passive house" in Germany, conducted an analysis on the feasibility of developing passive buildings under different climate types and natural characteristics in China. He proposed passive design strategies such as building shading, night air flow, humidity regulation, and heat recovery fresh air system for areas with hot summers and cold winters. This research aims to provide valuable reference for the development of passive buildings in our country.

Dumitra Ja 'cu I [7] et al. take the example of a single-family passive ultra-low energy consumption house in Romania, this study comprehensively considers regional climate characteristics, conducts energy-saving design, simulates indoor comfort, and determines the optimal indoor comfort conditions.

Kang Ye [8] et al. used PHPP simulation tool to monitor the indoor temperature and energy demand of a passive ultra-low energy student dormitory in Australia, and adopted a series of step-by-step renovation measures to further improve the building's energy efficiency and occupant's thermal comfort.

Rose Jørgen [9] et al selected an apartment building in Denmark that underwent energy-saving renovation according to the German passive house standard. Following the renovation, the external windows of the apartment building were replaced with better insulation performance and a fresh air system was installed. After measuring the energy consumption and indoor temperature of the renovated apartment, it was found that heating energy consumption decreased by more than 50%. Additionally, the average indoor temperature rose from 21.7°C to 23.3°C, providing valuable insights for energy-saving renovations of existing buildings.

Diaz de Garayo S [10] et al. proposed an HVAC system based on the combination of air heat pump and heat recovery device for passive houses, providing a new idea for improving indoor comfort and reducing energy consumption.

4.1.2. Domestic research status

According to the climate characteristics of Wuhan, Yin Chaojie [11] planned the layout design and indoor environmental parameters of the buildings. He used phoenics software to simulate the experiment, and compared the results with the real situation, thus confirming the rationality and operability of the scheme.

Liu Jiaping [12] in the book "Energy saving Design in building creation", elaborated the theory and method of building energy saving design, at the same time he advocated that we should maximize the role of natural resources to reduce or avoid the use of non-renewable resources, as little as possible to use or do not use fossil energy new residential design concept. It provides an important theoretical basis for the development of passive building in China.

Based on the principles and concepts of passive low-energy design, Wan Li and Wu Enrong [13] revealed the problems existing in the traditional sustainable development building evaluation system, proposed that the correct idea to reduce building energy consumption is passive low-energy and energy-saving design, and elaborated the design strategy of low-energy design evaluation system, and proposed that the proportion of passive low-energy and energy-saving design should be increased.

Dr. [14] Zhang Xiaoling analyzed the design principle of passive house, proposed the compact passive house type, this model can effectively reduce building energy consumption,

no thermal bridge design can effectively reduce energy loss, try to use natural ventilation to adjust indoor temperature and fresh air system, use natural lighting to adjust indoor light, and realize the accurate construction of building air tightness. This provides a new direction for the research and development and implementation of passive house technology.

Song Angyang, Wu Jianlin [15] et al. applied PHPP software to a high-rise passive residential building, based on the calculation results, found out the design difficulties and carried out sensitivity analysis, comprehensively considered the technical, economic and other factors, optimized the building thermal engineering and equipment selection technology, and controlled the technical requirements that the passive building should meet in the design stage.

Zhou Wenjing [16] proposed a cost evaluation strategy based on the time value of funds, and evaluated the overall benefits of sustainable energy saving buildings through comprehensive consideration of both economic and non-economic benefits. The conclusion shows that when the impact of ecological environment and natural resources is taken into account, the comprehensive benefits of passive buildings are significant, which provides a basis for developers to make investment decisions.

Yin Baogang [17] deeply studied the basic theory and technical requirements of passive buildings, analyzed and calculated the economic, social, ecological and technical benefits of passive buildings, and proposed practical solutions for the current development problems encountered by passive buildings.

Xu Chao and Song Wenbo [18] expounded the shortcomings of the development of passive buildings in China, including insufficient market demand, lack of legal provisions and incentive policies, and insufficient economic development power, and put forward corresponding countermeasures and suggestions.

In order to reduce the carbon emission and energy consumption of the construction industry, CAI Wei [19] constructed an active building economic evaluation system by using the analysis technology of grey classification, and applied the theory to the concrete project of the actual project in Qinhuangdao to test the effectiveness of the evaluation model. The research results show that the development of passive building is of great significance to reduce energy consumption and improve the environment in China's construction industry.

Song Xiaogang [20] et al. used PEST method to analyze the macro development environment of passive ultra-low energy buildings, and then explored the main factors and development strategies restricting the development of passive ultra-low energy buildings according to the diamond model theory.

Shi Yuanyuan [21] et al. set up different incentive models for different development stages of passive ultra-low energy buildings, and put forward incentive countermeasures for promoting passive ultra-low energy buildings at different development stages.

Zhang Zhenyuan[22] analyzed the construction technology and development trend of passive ultra-low energy buildings, and provided direction guidance for the future development of passive ultra-low energy buildings.

Zhang Hetian [23] and others summarized the problems in the development process of passive ultra-low-energy buildings, and put forward six development paths to provide

a basis for the large-scale development of passive ultra-low-energy buildings.

Zhou Hengfang[24] and others comprehensively elaborated the characteristics, technical measures and development status of passive ultra-low energy buildings, and analyzed their construction difficulties in China, and put forward important suggestions for further promoting passive ultra-low energy buildings, which is conducive to helping the construction industry achieve carbon reduction goals.

4.2. Research status of green building evaluation index

4.2.1. Foreign research status

Foreign research on green building evaluation began earlier. So far, many developed countries have formed a more mature and perfect green building evaluation system suitable for their own countries. In 1990, the British Institute of Building Research took "management, energy, water, materials, ecology, land and ecology, traffic, pollution, health" as the evaluation index, for residential, ecological, public, industrial buildings and other new and existing buildings to evaluate, and were updated in 1998, 2008 and 2011.

In 1998, Canada and 14 other countries proposed GBTOOL system for the resource consumption, indoor air quality, environmental load, economy, environmental sustainability, maintainability and operation management of housing, office and school.

In 2003, the Japanese Architectural Council established the CASBEE system for buildings of various uses and scales. The main evaluation indicators focus on the quality of building environmental performance and the load of building environment. In 2008, the German Sustainable Building Council introduced the DGNB system, which is based on environmental quality, economic quality, social and functional evaluation quality, technical quality, and process quality. Other DGNB systems include France's ESCALE system, Sweden's ECO-EFFECT system, the Netherlands' ECO-QUANTUM system, and Norway's ECOPROFILE system. The evaluation systems developed by these countries can quantitatively determine the effects and results of energy conservation and emission reduction in green buildings from an objective perspective. They also provide insights for project stakeholders' management while accelerating the development of green buildings.

The research findings on foreign green building evaluation primarily focus on four key areas: indicators and index weights within the evaluation system, life-cycle assessment, economic benefit analysis, and risk identification and evaluation.

In terms of the evaluation system's index and index weight research, it is important to note that due to varying national conditions, there is no uniform green evaluation system. This leads to differences in indicator selection, construction principles of the index system, as well as methods and principles of empowerment. As a result, these foreign models cannot be directly applied to green building evaluations within our country. However, some scholars have conducted regional adaptation studies by utilizing foreign evaluation frameworks to analyze green building assessments in developing countries.

In the study of life cycle evaluation, Safaei[25] proposed an optimized life cycle model that integrates cogeneration, solar energy, and conventional energy systems to minimize the cost of meeting the building's energy needs throughout its

life cycle.

Rebecca[26] believes that it is difficult for compact cities like Hong Kong to achieve sustainable green building development. However, the overall greenness of buildings can still be evaluated by building life cycle model to provide references for formulating green housing development policies.

TsaiWH[27] conducted research on the relationship between carbon emission-related technologies and building life-cycle costs, and established a 0-1MIP decision-making model that helps management make reasonable allocation of resources under a certain cost, which enriches the research achievements in building operation (OR).

In the research on economic benefit evaluation, a large number of research data show that green buildings perform well in energy consumption, and the energy consumption cost is only 70% of that of non-green buildings. Davis Langdon [28] conducted research on the cost of buildings at various stages, drawing from actual case studies. Through a comparison of the one-time construction cost and operation and maintenance expenses between traditional office buildings and green office buildings, he concluded that the savings in operational and maintenance costs for green office buildings can effectively offset the initial construction expenses.

In the research of risk identification and evaluation, developed countries have carried out research in this area relatively early and achieved a lot of research results. By studying how green building risks affect the business of insurance companies, Tulacz[29] discovered that there are currently no insurance products available to effectively address the unique risks associated with the green building market. The most common risks leading to insurance claims primarily include failure to achieve anticipated green certification, inadequate implementation of green design, and issues related to green products and designs.

Robichaud and Anantatmula [30] discovered that active participation of the green technology team and management team throughout the entire project construction process, starting from the early stages, can optimize the construction process, leading to a reduction in green construction costs. This approach enables the delivery of a green building within an acceptable cost range for the owner.

Edwin and H.W. han[31] took the economically developed cities in Asia as their research objects, interviewed designers with questionnaire survey method to explore the reasons for the hindered development of green buildings in these cities, analyzed the influencing factors of investment in the green building market from the perspective of stakeholders, and put forward relevant suggestions for promoting green buildings.

ZinahYas[32] Questionnaire survey was conducted among professionals and data were collected for the factors affecting the design, construction and operation stages. SPSS was used for analysis and the research results were obtained which could be applied to almost all Middle Eastern countries.

In order to achieve the green goal of the building to the maximum, Yong Han Ahn[33] The model clearly divides the rights and obligations of the three major stakeholders, namely the architect, the contractor and the subcontractor, according to the green construction process one by one, thus promoting the realization of the green goal.

Hansen and Knudstrup [34] studied an integrated design IPD process for green buildings. By integrating engineering data and architectural theories and establishing corresponding

links, the IPD process was helped to realize integrated design evaluation of green buildings. Finally, the interaction and influence between different parameters and designs were verified on a virtual project. And the applicability of this process.

By analyzing the problems existing in the design and construction of traditional buildings in Canada, Pearl[35] puts forward the advantages of integrated design in green buildings, and introduces an application example of a public building in Montreal in the integrated design process to analyze how the characteristics of its IPD process can achieve green goals more efficiently. For example, building design is determined by the demands of developers and the traditional role of designers in the project development process is changed, so that designers as project managers, structural engineers, HVAC engineers and other relevant consulting personnel participate in the design throughout the process to ensure the rationality and operability of green design.

In order to help designers choose independent evaluation criteria to better carry out green design work, Weimin Wang et al. [36]proposed a multi-objective design optimization model based on the multi-objective genetic algorithm. By determining relevant green parameters in the concept stage

and using the whole life cycle analysis method, they selected a design scheme with stronger economy and higher environmental friendliness. The optimal solution obtained through calculation represents the optimal design scheme.

Mohammadi S[37] believes that the current conventional construction management mode of the construction industry and the current government to promote green building policies there is a certain mismatch, resulting in the number of green building related claims has been growing, so the author based on the results of expert interviews with the relative importance index method to explore the construction contract claims factors and give solutions.

4.2.2. Status quo of domestic research

In recent years, China's policy preference in the field of green building has driven the continuous development of relevant research on green building, and the research results are mainly concentrated in four aspects: green transformation of existing buildings, green building risk, green building technology and green building evaluation. China has also promulgated a series of green building evaluation systems according to the national conditions, as shown in Table 1.

Table 1. Green Building Evaluation System in China

Numble	System name	Launch time and unit	Evaluation object	Evaluation index
1	Evaluation manual of ecological housing technology in China	2001 Ministry of Construction of China	Residential	Residential environmental planningEnergy and Environment, indoor environmental quality, residential waterenvironment,materials and resources
2	Technical Guidelines for green building	2005 China Academy of Building Research	Civil architecture	Green building planning, planning technology.construction technology, operationtechnology, intelligent technology
3	Beijing Olympic building evaluation system	2008 Tsinghua University,et al	Sports architecture	Quality of site, services and functions provided,outdoorphysicalenvironment,necessity ofprojectimplementation,impact on surroundingenvironment,energyconsumption, materialsand resources,waterresources
4	Green building evaluation criteria	2019Ministry of Construction	Single-building Housing and Urban or Rural Building	Safe and durable, healthy and comfortable,convenient life, resource saving, livableenvironment

As for the research on the green evaluation system of buildings, Hu Yunliang[38] conducted in-depth research on the green evaluation system of super-large public buildings from four aspects: natural environment, comfort, economy and mechanism.

From the perspective of eco-economic balance, community coordination, operational comfort and institutional greenness, Cheng Kai[39] constructed the evaluation index system of building greenness, and analyzed it through an example of a residential district in Chongqing.

Wang Lijuan et al. developed an evaluation system that considers multiple perspectives, including the environment, economy, and energy, taking into account the unique laws governing construction projects in China. They utilized the gray target model to assess and analyze the sustainability of these projects.

According to the research of evaluation method, Hou Ling [41] incorporated cost-benefit analysis into the evaluation index system, thereby enhancing the rationality and effectiveness of the evaluation. This type of green evaluation system not only demonstrates the environmental protection characteristics of the building plan but also reveals its economic viability.

Zhi Jiaqiang [42] compared the evaluation results of AHP and artificial neural network method, and found that the use of artificial neural network method in green building evaluation can significantly reduce the negative effects of subjective factors, so as to improve the objectivity of evaluation results.

After a comprehensive analysis of the classical ecological building evaluation systems and methods at home and abroad, Fan Yong[43] proposes a new method that can reveal the

interaction and limitations between indicators. This is the discrete Approach to the ideal Solution ranking method (topsis).

According to the study of the evaluation object, Zhao Jingxin et al. [44] selected the green attribute of social security housing as their research focus based on the geographical environment, climate conditions, resource advantages, and economic characteristics of southwest Henan. They proposed a green building evaluation system that is more suitable for the actual needs of the security party in this region and can more accurately reflect its level of sustainability.

Sui Lijun[45] adopted the combination of importance analysis and coefficient of variation analysis to create a comprehensive and iconic aging society environmental protection development level evaluation index system, which provides more substantial content for the green development theory of the aging society.

In view of the severe cold and arid environment in northwest China, Bao Xueying[46] adopted radar analysis method, took the environmental protection characteristics of railway foundation construction as the research theme, and built an evaluation model, which provided a reference for the management to choose a more economical and more appropriate construction plan.

In view of the evaluation of benefits, Chinese scholars focus on three areas of benefit evaluation: environmental benefit, economic benefit and social benefit. By focusing on energy conservation and emission reduction, Sun Mingchun[47] deeply explores the long-term and sustainable economic benefits that green building projects may bring, which is helpful to provide clear path guidance for promoting the development of green building at present.

Ma Rui[48] proposed a method of comprehensive evaluation and quantitative analysis of the environmental effects of green ecological residential buildings from the perspective of incremental cost and economic benefits, which provided basic theoretical support for promoting the popularization of green building evaluation standards.

Dinguli[49] evaluated green residential buildings in terms of economic and social benefits, and put forward suggestions on how the government can play its guiding role in promoting green housing.

On the basis of quantifying incremental costs and incremental benefits, Xu Pei[50] put forward a quantitative model of energy-saving economic evaluation, which can help predict the economic feasibility of green buildings in the investment decision-making stage.

5. Discussion

Based on the aforementioned research, both domestic and foreign scholars have established a solid foundation for passive buildings. In the international context, the theoretical basis, technical support, and method exploration for the design stage of passive buildings are relatively mature. However, due to different national conditions and goals, there are variations in the requirements for green building standards, especially in the construction of passive building evaluation systems.

While domestic green building evaluation standards are relatively mature, research on passive buildings within the field of green building started later and thus has fewer evaluation standards. Most domestic research on evaluating passive low-energy buildings is focused on economic benefit analysis. However, there are existing issues that need to be

addressed.

Firstly, under the backdrop of "dual carbon", comprehensive planning for passive buildings including carbon emission management and performance indicators has not been incorporated into the evaluation system. Additionally, an assessment based on the entire life cycle of passive buildings should also include their performance during operation and maintenance stages in order to accurately reflect their sustainable contribution to the environment.

References

- [1] Givoni B. Man, Climate and Architecture [J]. Elsevier: 1969.
- [2] Brown G Z. Sun, Wind, and Light: Architectural Design Strategies [J]. 1985.
- [3] Bansal N K. Passive Building Design: A Handbook of Natural Climatic Control, Elsevier Science BV, 1994.
- [4] Daniel D. Hira. Solar Buildings ---- Passive Heating and Cooling [M]. Translated by Xue Yibing. Beijing: China Architecture and Construction Press, 2008.
- [5] James Marley O'Connor. Passive Energy Saving Building [M]. Translated by Li Chan. Shenyang: Liaoning Science and Technology Press, 2015.
- [6] Wolfgang Pfister, Guo Ling, Sheng Si Chen, et al. Passive Housing Development in China: Health, Comfort, Economy and Sustainability [J]. Dynamic (Eco-City and Green Building), 2016(03):32-37.
- [7] Dumitra Ja 'cu A I, Corduban C G, Hapurne T M, Bliuc I. Passive House Design in Temperate Continental Climate for Increasing Indoor Comfort Conditions [J]. IOP Conference Series: Earth and Environmental Science ,2022 ,1123(1).
- [8] Kang Ye, Ma Nan, Bunster Victor, et al. Optimizing the Passive House Planning Package Simulation Tool: A Bottom-Up Dynamic Approach to Reduce Building Performance Gap [J]. Energy & Buildings ,2022 ,276.
- [9] Rose Jørgen, Kragh Jesper, Nielsen Kasper Furu. Passive House Renovation of a Block of Flats Measured Performance and Energy Signature Analysis [J]. Energy & Buildings, 2022, 256.
- [10] Diaz de Garayo S., Martinez A., Astrain D. Optimal Combination of an Air-to-Air Thermoelectric Heat Pump with a Heat Recovery System to HVAC a Passive House Dwelling [J]. Applied Energy ,2022, 309.
- [11] Yin Chaojie. Research on Passive Building Design Strategy Application in Hot Summer and Cold Winter Area [D]. Wuhan :Huazhong University of Science and Technology, 2007 .
- [12] Liu Jiaping, Tan Liangbin He Quan. Energy Saving Design in Architectural Creation [M]. Beijing: China Building Industry Press, 2009
- [13] Wan Li, Wu Enrong. Passive Low-Energy Building Design Evaluation in Sustainable Building Evaluation System [J]. Architectural Journal, 2012, (10).
- [14] Zhang Xiaoling. Basic Design Principles of Passive House [J]. Construction Science and Technology, 2013(09): 30-31.
- [15] Song Angyang, Wu Jianlin, Gao Caifeng. The Role of PHPP Software in the Design Optimization of Passive Ultra-Low Energy Green Buildings: A Case Study of the Passive House Project in Sino-Singapore Eco-City in Tianjin [J]. Building Science, 2016, 32(4): 38-43.
- [16] Zhou Wenjing. Life Cycle Evaluation of Sustainable Buildings [D]. Qingdao: Ocean University of China, 2014.

- [17] Yin Baogang. Efficiency Evaluation and Policy Support for Passive Energy-Saving Buildings [D]. Xi'an: Xi'an University of Architecture and Technology, 2014.
- [18] Xu Chao, Song Wenbo. Passive Building Development Status and Countermeasures in China [J]. Journal of Jilin Jianzhu University, 2018, 35(03):82-84+88.
- [19] CAI Wei. Research on Comprehensive Evaluation of Passive Building Engineering based on the Perspective of Whole Life Cycle [D]. Baoding: North China Electric Power University,
- [20] Song Xiaogang, Liu Yao-Hua, Zhang Pei-Xing et al. Research on the Promotion and Development Strategy of Passive Ultra-Low Energy Buildings [J]. Building Economics, 2020, 43(02): 5-10
- [21] Shi Yuanyuan, Fu Sujuan, Hao Yuhang et al. Research on the Development of Passive Ultra-Low Energy Buildings in Hebei Province based on Incentive Strategy Control [J]. Building Techniques, 2023, 54(02): 167-170
- [22] Zhang Zhenyuan. Related Technologies of passive ultra-low energy Buildings and their development trend [C]// Organizing Committee of Building Technology and Management. Proceedings of Academic Exchange Conference on Building Technology and Management in July 2021. [Publisher unknown], 202:49-50.
- [23] Zhang Hetian, Zhang Yuexi, Zhang Xinyu. Discussion on the effective Reduction of carbon Emission in the development of high-quality passive ultra-low Energy consumption buildings [C]// Hebei Provincial Society of Environmental Sciences. Proceedings of the 22nd Annual Conference of Environmental Science Society of Five provinces (districts) in North China. [Publisher unknown], 202:86-89.
- [24] Zhou Hengfang, Song Liwei, Wang Weiling. Development analysis of passive ultra-low energy consumption buildings in China [J]. Henan Science and Technology, 2021, 40(36):83-86.
- [25] A Safaei, F Freire, CH Antunes. A life-cycle cost optimization model with environmental impact assessment for energy management of service buildings [J]. International Symposium on Sustainable Systems & Technology, 2012.
- [26] Chiu R L. Environmental sustainability of Hong Kong's housing system and the housing process model [J]. International Planning Studies, 2000, 5(1): 45-64
- [27] Tsai W H, Yang C H, Chang J C, et al. An Activity-Based Costing decision model for life cycle assessment in green building projects [J]. European Journal of Operational Research, 2014, 238(2):607-619.
- [28] Building T R O. The rise of the green building [J]. Economist, 2004(8404):18.
- [29] Tulacz GJ. Insurers worry about green-building risks [N]. ENR: Engineering News-Record, 2008, 7, 261(1):10-11.
- [30] Robichaud L B, Anantatmula V S. Greening Project Management Practices for Sustainable Construction [J]. Journal of Management in Engineering, 2010, 27(1):48-57.
- [31] Edwin, H. W. Chan. The market for green building in developed Asian cities-the perspectives of building designers [J]. Energy Policy, 2009(9):3061-3070.
- [32] Zinah Yasa, Kamal Jaferb. Factors influencing the spread of green building projects in the UAE [J]. Journal of Building Engineering, 2019(27):312-329.
- [33] Yong Han Ahn, Chan Woo Jung, Min jae Suh, Myung Hwa Jeon. Integrated Construction Process for Green Building [J]. Procedia Engineering, 2016, 145:670-676.
- [34] Hansen, H. and Knudstrup, M. The Integrated Design Process IDP-a more holistic approach to sustainable architecture. The 2005 World Sustainable Building Conference: Tokyo, 2005.
- [35] Pearl, D. An ntergrated Design Process (IDP) The crossover between practice and education breeds a new form of architectural representation [J]. Canadian Architect, 2004:32-35.
- [36] Weimin Wang, Radu Zmeureanu, Hugues Rivard. Applying multi-objective genetical gorithms in green building design optimization [J]. Building and The Environment, 2004, 40(11).
- [37] Mohammadi S, Birgonul MT. Preventing claims in green construction projects through investigating the components of contractual and legal risks [J]. Journal of Cleaner Production, 2016, 139:1078-1084
- [38] Hu Yunliang. Research on Greenness Evaluation of Large Public Buildings [D]. Tianjin University, 2008.
- [39] Cheng Kai. Research on Evaluation index System of building greenness [J]. Cooperative Economy and Science and Technology, 2010, (13):10-11.
- [40] Wang Lijuan, Zhu Wen. Research on Greenness evaluation System of Construction Projects [J]. Project Management Technology, 2014, 12(08):35-
- [41] Hou Ling. Research on Evaluation of Green Building Based on cost-benefit Analysis [D]. Xi'an University of Architecture and Technology, 2006.
- [42] Zhi Jiaqiang, Zhao Jing, Li Nan. Green building evaluation based on artificial neural network method [J]. Urban Environment and Urban Ecology, 2010, 23(04):44-47.]
- [43] Zhao Jingxin, Zhang Xiyu, Liu Conghong. Research on comprehensive evaluation method of Ecological building based on TOPSIS [D]. Shanghai Jiao Tong University, 2007. Research on Evaluation system of affordable housing Green Building design suitable for Southwest Henan [J]. Journal of Architecture, 2015(10):92-95.
- [44] Zhao Jingxin, Zhang Xiyu, Liu Conghong. Research on Evaluation system of green building Design for affordable housing in Southwest Henan [J]. Architectural Journal, 2015(10):92-95.
- [45] Sui Lijun, Wu Chunyou, Lu Xiaoli. A study on the construction of evaluation index system of greenness degree of elderly care community [J]. Value Engineering, 2019, 38(05):1-4.]
- [46] Bao Xueying, Zhang Jian, Wang Qicai. Study on Green Construction Grade Evaluation of Railway in Cold and Drought Area of Northwest China [J]. Journal of Railway Science, 2019, 41(03):33-39.
- [47] Sun Mingchun. Economic Benefit analysis of Green Building under the concept of whole life cycle cost [J]. Urban Development Research, 2015, 22(09):25-28.
- [48] Ma Rui. Environmental Benefit Evaluation of Green Residential District based on incremental cost Benefit [D]. Tianjin University, 2018.
- [49] Ding Guli. Economic and Social Evaluation of Green Housing [D]. East China Jiaotong University, 2011.
- [50] Xu Pei. Evaluation of energy efficiency and economy of Green Building and its sensitivity analysis [D]. Shanghai Jiaotong University, 2017.