LETTER TO THE EDITOR

Ecological Model Optimizing the Sustainable Development of Low-carbon and Energy-Saving Buildings

Jiawei Wu[1, 2], Meixia Che[3*]

1 School of Art and Design, Guangdong University of Petrochemical Technology, MaoMing 525000, China

2 Faculty of Innovation and Design, City University of Macau, Macau 999078, China

3 School of Foreign Studies, Guangdong University of Petrochemical Technology, Maoming 525000, China

*Email: maggie_cheche@126.com

With the increasing threat of global climate change to mankind, it has become a global consensus to reduce carbon emissions. Low-carbon energy-saving buildings are energy-saving, environmentally friendly cities and towns marked by low energy consumption, low pollution and low emissions. It is a model that conforms to the development of urbanization with Chinese characteristics under the constraints of ecological environment. Based on the analysis of the development path of low-carbon energy-saving buildings, this paper proposes that low-carbon energy-saving buildings are a process of integrated development from "building energy conservation and green buildings" to "energy conservation and emission reduction" to "low-carbon energy-saving buildings". The ecological model is an effective method to optimize the scientific development of low-carbon energy-saving buildings. Then the definition, classification, function and construction of ecological models are described. Then, the role of ecological model in the development of low-carbon energy-saving buildings in China is discussed.

Ecological models; green buildings; energy conservation and emission reduction; low-carbon, energy-efficient buildings

1 Introduction

Energy conservation in buildings is mainly an energy-saving transformation of existing buildings, and it is a solution to the problem of excessive energy consumption in existing buildings left over from history. In addition to energy conservation, green buildings pay more attention to the quality of life of people and the impact on the natural environment. Green building is the development of energy conservation for buildings. At the same time, various energy conservation technologies can be used as the basis for the planning, design, construction, and operation of green buildings.

Mu and Kang 2019) published an article in the 2019 Issue 107 of the journal Ekoloji entitled: "The Feasibleness Analysis of Reform". "The Ilities", this document proposed that the ability of deep convolution neural networks(CNN) to learn to distinguish spectral time patterns made them very suitable for environmental sound classification.With the rapid growth of the Chinese economy, the improvement of people's living standards and the aging of the population, the population problem has become increasingly prominent. The total number of pension facilities on the market in our country is very scarce, indicating a trend of "more monks and less porridge".At the same time, due to the adjustment of the National economic structure, some old factories and office buildings in some

cities face idleness. Under the influence of these two factors, more and more existing buildings have been reconstructed into pension facilities on the market, and win-win results have been achieved through the replacement of functions. Based on the convolution neural network algorithm, this paper establishes the feasibility analysis model of the existing building old-age facilities renovation, which is of guiding significance for guiding the existing building renovation and the practical application of old-age facilities. This method is applied to the sustainable development field of eco-model optimization of low-carbon energy-saving buildings, and the effect is also very good.

Atam (2017) studied the model of ecological footprint, and took Guangdong Environmental Protection Engineering Vocational College as an example to measure its daily ecological footprints such as energy consumption, transportation, food, and paper.The results showed that the ecological footprint of Guangdong Environmental Protection Engineering Vocational College was 4200.51 hm and the ecological efficiency was 1.61 persons/hm. The largest proportion of the ecological footprint was food, accounting for about 2/3.The comparison and analysis between the measured results and domestic universities showed that the ecological footprint and ecological efficiency of Guangdong Environmental Protection Engineering Vocational College were centered.From the perspective of ecological footprint, planning and construction of a low-carbon campus should start with reducing food consumption and energy consumption (Lam et al., 2010; Lam et al., 2016). The method was less efficient.

Therefore, we can know that how to produce sufficient data to optimize the scientific sustainable development of low-carbon energy-saving buildings, “ecological model” will be a relatively good construction technology.By collecting data on sample buildings and sample functional areas in different climatic zones and geographical environments throughout the country, a sample database has been established to model models at different levels and levels. Using visualization technology, the results of statistics and analysis can be provided to industry authorities, scientific research institutions, or owners, etc, to provide supporting decision-making data for the sustainable development of low-carbon energy-saving buildings (Wei et al. 2018).

2 Idea description

2.1Definition of ecological models

The ecological model is to support the establishment, management and application of the model through the establishment of a platform system. The ecological model mainly consists of a model, a model database, and a business application system.

A simulation or abstraction made by a model based on certain characteristics and intrinsic connections of objective things.In order to study a process or thing, it can be described or represented by a “model” similar to it in terms of certain features(shape or structure, etc.).The model can be a physical model of the object studied, such as a building model, a teaching model, a toy, etc; It can also be a mathematical model of an object, such as a formula or a graph.It can reflect the relationship between the relevant factors.The model is a digital expression of real things after being refined and summed up. It can describe the laws of things and the correlation between things in detail and accurately, and react to changes in external conditions, and has a high degree of similarity with the performance of real things. It also supports quantitative analysis and research.

The “model database” is a collection of various models, including basic databases, general-purpose model libraries, dedicated model libraries, and intelligent model libraries. The model database mainly realizes the storage, classification and management of model data.The basic database stores the basic data of the ecological model, such as the parameters of the model call, the environmental variables, the basic information of the object, and the basic information of the industry; The general model library mainly provides a general problem solving method and is a general algorithm library;The dedicated model library is mainly a model library designed for certain applications and is linked to specific applications. Different applications will form different dedicated model libraries;The

intelligent model library is a kind of business model of the general model library and the special model library. It is an advanced and adaptive model formed by the pattern recognition method (Salacinska et al. 2017).

"Business application system" is a system that centrally manages the establishment, simulation, and application of models. It usually includes model access management, operation management, modeling management, and model computing.The main functions are: building and maintaining model modules; Provide access, assembly, and operation of model language tools and execution modules;The input, output and intermediate result access of the model are automated by connecting with the database. Connected with Fangfaku to achieve target search, sensitivity analysis and simulation operation automation.

2.2 Classification and function of the model

The model system usually includes three levels: data model, analysis model and business model. The data model is an abstract simulation of the relational entities, the analysis model is an abstract simulation of the laws, and the business model is an abstract simulation of business elements and processes.

(1) Data model:Through the analysis and abstraction of the main features of things and things in the real world, the data structure of data access and corresponding constraints are provided for the implementation of ecological models.The elements of the data model are operation, data structure, and constraints.In general, when we design data models, we consider the data structure most and ignore the other two elements. According to the application level of the data model, it can be divided into a conceptual data model (conceptual model), a logical data model (logical model), and a physical data model (physical model). Conceptual model: From a business point of view, it is mainly used to describe the conceptual structure of things and things. Its purpose is to unify business concepts and serve as a bridge between business personnel and technicians. The description methods are ER maps, Merise maps, and Barker maps.In the process of building a conceptual model, the main consideration is the things and things in the real world and the relationship between them without paying attention to the specific attributes of things and things.Logical model: Consider the problem from the perspective of the database. Based on the conceptual model, the refinement of things and objects properties and the integration of objects are described in the ER diagram.At this level, the data model can be divided into layers, networks, and relational models. Physical model: refers to the specific physical computing environment.

(2) Analysis model: It is an abstract simulation of laws. It is mainly used to support statistical analysis, prediction decision-making, etc, such as regression analysis model, timing analysis model, statistical decision model, prediction evaluation model, etc.The main law of the subject object can be obtained intuitively by using the analysis model. The analysis model is a conclusive model.

(3) Business model: It is an abstract simulation of the static and dynamic characteristics of the business organization.Static features include: business objectives, business organization structure, business roles, business results, etc. Dynamic characteristics mainly refer to: business processes. The business model is mainly used to plan business processes and business structures of business organizations, identify business bottlenecks and problems, improve business processes, improve business organization operational efficiency, and achieve business goals. In many organizations, business models have gradually become a powerful means of management planning.

The following is an example to describe the three levels of the ecological model. The entire ecological model of the energy-saving regulatory platform for compact campus buildings includes a multi-level energy consumption model (data model), an energy consumption analysis database(analysis model), and an energy conservation regulatory model (business model).

2.3 Energy consumption control concept

(1) Multi-level energy consumption model

By establishing a sub-metering model for building energy consumption, the building electricity will be

classified into first-class items such as electricity, air-conditioning, power, and special electricity.The secondary structure of refrigeration pump, cooling pump, room lighting, emergency lighting, and information center power is used to construct the data structure of building energy consumption monitoring.By using this model, the detailed monitoring of building energy consumption and the accumulation of energy consumption data are directly realized.

(2) Energy consumption analysis database

The energy consumption analysis database includes three kinds of analytical models: the same architectural analysis model, the architectural anomaly diagnosis analysis model, and the campus pipe network analysis model. All kinds of analysis models are abstracted and simulated on the law of campus energy use. Using the model, we can intuitively find the main energy contradictions of various types of energy use subjects.For example, by comparing and analyzing the energy consumption of similar buildings, it is possible to arbitrarily compare the use of energy in the same electric sub-items in the same buildings, the proportion of energy used in different sub-items in the same building, and the comparison of energy used in the same period of time in the same sub-history. Support quantitative analysis and diagnosis of campus energy use.

(3) Energy Conservation Regulatory Model

The energy conservation supervision model mainly includes the construction energy audit model, the construction energy settlement model, and the construction energy use evaluation index system. Using the energy conservation supervision business model, the business unit and process of campus energy conservation supervision can be modeled (Loewenstein et al. 2018).For example, the building energy audit model simulates the entire process of building energy audit, collects relevant audit data, and generates building energy audit reports.

2.4 Idea of Ecological Model Construction

The construction of ecological model mainly includes three aspects: model construction (modeling), data platform construction, and application platform construction. From the government industry management function, it mainly includes three aspects: policies, regulations, standards, and evaluation management.The construction of the model is a cyclic optimization process. From the establishment of the model, simulation to correction, it constitutes a feedback closed-loop process. The data platform provides storage space for basic data, model data, and business data. The data platform is built according to open and extensible ideas. As the number of basic data, models, and business data increase, the scale will continue to grow. The database will continue to increase.The construction of the application platform also adopts the modular construction idea. With the increase of the model and the increase of database data, and the continuous development of the ecological model, the corresponding business application module is added. The ecological model can not play its real role simply by realizing the ecological model technically and not by combining the social management service functions of the government functional departments.The functions of the service government departments need to be the starting point for the construction of ecological models. Policies and regulations are the guiding directions and rigid guarantees for the construction of ecological models. Standards and norms are necessary measures to ensure the implementation of ecological models. Evaluation management is an important means to effectively monitor the implementation of ecological models and correct errors.

Therefore, the idea of constructing the ecological model as a whole is to apply the mechanism of sustainable optimization to realize the circular incremental construction of the whole and the unit.The following describes the construction idea of sustainable optimization from the perspective of model construction. A model mechanism for sustainable operation generally includes:based on the actual situation, modeling tools and methods are used to build models; Based on the actual data, the model is modified by comparing the difference between the simulation results and the actual values. The development of things can be predicted and analyzed through a calibrated and optimized model.

2.5 Conservation of Service Buildings and Development of Green Construction Technology

The ecological model of building energy conservation and green building is positioned as integrating energy conservation and green building data, building a model system of building energy conservation and green building, and completing the construction of modeling and simulation platforms (Sustainability et al. 2017).We will guide the design and construction of green energy-efficient buildings and the continuous optimization of energy use management during their operation, and build energy conservation and green building databases and public information platforms. It provides monitoring and management, supervision and inspection, scientific research, and engineering design services for government management departments, construction research institutions, and architectural design institutes.

3 DISCUSSION

The eco-model of energy-saving emission reduction serves the development of low-carbon energy-saving buildings by establishing a set of standardization, evaluation, accumulation and promotion mechanisms of energy-saving emission reduction technologies.The ecological model of energy conservation and emission reduction includes an evaluation system, standards and databases for energy conservation and emission reduction technologies, a platform for modeling and simulating energy conservation and emission reduction, and an information platform for energy conservation and emission reduction management. In order to serve the needs of the National energy conservation and emission reduction work, according to the requirements of the National energy conservation and emission reduction standards, the energy conservation and emission reduction ecological model needs to meet the following requirements:

(1) Based on various energy-saving and emission reduction technologies, ecological models can form a quantitative energy efficiency evaluation indicator system. With the development of urbanization, databases are used to accumulate experience in energy conservation and emission reduction, and the indexation weights of various energy-saving and emission reduction technologies are dynamically adjusted. Form a continuously improved energy saving and emission reduction mechanism.

(2) The simulation platform for energy conservation and emission reduction can support the evolution of the ecological environment of low-carbon energy-saving buildings by establishing data models, analysis models, business models, etc.According to the current industrial structure, economic model, population ratio, and ecological environment of the city, the trajectory of the urban ecological environment under a certain energy conservation and emission reduction index is simulated.

(3) Provide business management functions such as energy conservation optimization, sewage treatment, garbage collection, and tail gas recovery.Establish an energy-saving and emission-reduction management information system for energy-saving management departments, environmental protection departments, and owners.

(4) On the basis of ecological models, a set of technology requirements for energy-saving and emission-reduction projects should be explored, constructed, operated and cooperated.Guide key energy conservation and emission reduction projects and urban environmental infrastructure projects.

(5) Coordinate and guide the internal energy-saving and emission reduction of urban energy-using units, move toward multi-unit, cross-industry, and inter-regional circular economy, broadly and comprehensively improve the effectiveness of energy conservation and emission reduction.

4 CONCLUSION

China is in the historical stage of rapid urbanization. According to the current rate of urbanization, it is expected to increase to about 75 % by 2050. Therefore, China faces great pressure on the intensive use of energy in the process of rapid urbanization.Therefore, the construction of low-carbon energy-saving construction market is not only a direct requirement to relieve energy pressure and curb climate warming, but also a concrete theoretical

practice to adhere to the scientific concept of development and build a harmonious society.Through ecological models, we have accumulated and digested experience in planning and constructing demonstration areas for building energy conservation and green buildings and low-carbon energy-saving buildings, and we have constantly revised, enriched and upgraded the construction of more and more demonstration areas. The emergence of truly low-carbon and energy-efficient buildings in China will not be far off.

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