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Factors Influencing Carbon Emissions of Assembled Building Construction Enterprises

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Abstract: In the process of national economic development, the pillar position of the construction industry is becoming more and more important, and the development of this green industry, the promotion of energy conservation and emission reduction, and the reduction of energy waste in the construction process are important development goals for the construction industry in the future period, so it is crucial for the assembly building construction enterprises to develop green buildings and optimize the construction capacity. This paper analyzes nine aspects of carbon emission influencing factors of assembly building construction enterprises in the three stages of construction decision, construction design and construction building on the basic theoretical basis, and puts forward corresponding suggestions in order to provide reference and guidance for future energy saving and emission reduction of low carbon buildings.

1. Introduction

While the position of the construction industry is becoming more and more important in its continuous development, some problems that cannot be ignored are gradually emerging. By reviewing the relevant information, it is found that carbon emissions from the construction industry occupy four tenths of the total carbon emissions in China. In terms of global warming and carbon emission reduction, the construction industry needs to make certain actions. The industrialization of construction mainly refers to the replacement of inefficient pure manual production with high efficiency machine production, while standard design, construction oriented parts production, machine based construction process and scientific and reasonable management process. The characteristics of the assembled building coincide with this, the prefabricated components can not only save energy, but also save time, to successfully achieve the environmental protection goal of reducing carbon emissions and carbon pollution should vigorously develop the assembled building. Therefore, it is extremely important to study the influencing factors of carbon emission of assembly building construction enterprises.

2. Related Concepts

2.1. Greenhouse Gas Concepts and Types

The so called greenhouse gases are the accumulation of energy in the Earth's interior through the absorption of solar radiation reflected from the ground. It caused the Earth's temperature to gradually become warmer and the climate to become warmer, further leading to the melting of glaciers and rising sea levels, thus increasing the risk of seawater inundation in the adjacent areas, a situation known as the greenhouse effect[1]. The main greenhouse gases including CO_2, CH_4, N_2O, HFCs, PFCs, SF_6. Among these greenhouse gases, CO_2 as the main greenhouse gas, has a proportion as high as 1/2, and there is a rising trend. The Intergovernmental Panel on Climate Change (IPCC) takes CO_2, CH_4, N_2O and CFCs as the main greenhouse gases to be examined, but since CFCs are completely banned by the Montreal Convention signed in 1971, the greenhouse gases affecting global warming are mainly CO_2, CH_4, and N_2O in a comprehensive view. The above greenhouse gases mainly come from two sources, which are the above greenhouse gases are mainly from two sources, which are considered to be produced and naturally produced [2].

2.2. Carbon Emission Related Factors and Concepts

(1) Carbon emission: Although carbon emission is a general term for all greenhouse gases emitted, it mainly refers to carbon dioxide emission, so "carbon emission" is generally used as the abbreviation for carbon dioxide emission. As a measure of greenhouse gas emissions, carbon emission factor refers to the amount of greenhouse gas caused by one unit of carbon [3-5].

(2) CO_2 Equivalent: CO_2Equivalent (CO_2Equivalent) provides a uniform measure of the extent to which different greenhouse gases contribute to global warming and is usually expressed as the warming potential per unit of CO_2. Specifically, it is the weight of CO_2needed to produce the same warming potential as it does [6]. It can be obtained by multiplying the weight of a greenhouse gas emission, W, by the global warming potential (GWP) of that greenhouse gas in a given time period.

(3) Emissions: The GHG Accounting and Reporting Standard for Enterprises (hereinafter referred to as the GHG accounting standard) published by WRI classifies GHG into direct emissions, which refers to GHG emissions directly generated by enterprise activities, and indirect emissions, which refers to GHG emissions generated by other companies as a result of enterprise activities[7-10].

2.3. Concepts Related to Assembled Buildings

2.3.1. Concept

The assembled building is a type of building in which the components used in the construction work are prefabricated. At the same time, the building has a specific workshop for the production of various parts, which are transported to the construction site and assembled on site [11]. There are six types of assembled buildings, namely block buildings, panel buildings, box buildings, skeleton panel buildings, rising slab and rising floor buildings, all of which can be used in the "product-goods-supplies-waste" cycle.

These types can be used in the cycle of "product-commodity-supply-waste" and also correspond to the design, sales (raw material procurement), construction, use, and end-of-life in the building construction process, respectively. Compared with traditional buildings, assembled buildings have greater advantages, mostly in terms of relatively shorter construction periods, less noise and dust pollution, and less waste of resources [12]. In the process of reducing carbon emissions in the future,

assembled buildings will be the key development object to reduce carbon emissions in the construction industry [13, 14].

2.3.2. Characteristics

The assembled building is considered more comprehensively in comparison with the traditional building, especially the construction techniques and specifications involved in the construction process, including standardized fittings, matching of technology and construction and the integrity of design and links, the specific differences are shown in Table 1.

Table 1: Differences between traditional and assembled buildings

Type	Traditional Architecture		Assembled Building		
Stage	Design	Construction	Design	Production	Construction
Work content and characteristics	Design drawings and plans, as distinguished from construction steps	On site processing and construction of building materials, mostly by hand	Standardized design with attention to technology and scale to match the building	Factory production according to the design plan	Mechanized assembly on site according to the construction plan

(1) Diversified design. The assembled building can reasonably divide the space at the time of design without exceeding the standard requirements, so as to meet the different needs of different occupants; the poured building is mostly limited by the space and pattern of different houses when constructing load-bearing walls [15-17].

(2) Functional modernization. The assembled building can be planned in advance by using prefabricated components for the function of the house. For example, the sound insulation and energy-saving effect of the house can be paid attention to when installing the insulation layer on the external wall. Because more fireproof materials are used to effectively reduce the probability of fire, and lighter materials are used to strengthen the seismic resistance of the house [18].

(3) Integrated parts processing. The parts used by the construction enterprises of assembled buildings are processed centrally in advance in the factory. The reason why the construction companies process and manufacture the parts in advance is that the actual space can be scientifically and rationally divided in conjunction with standard technical means before the actual construction [19].

3. Analysis of Carbon Sources in Assembly Building Construction

The carbon source of assembled building construction, also known as the source of carbon emissions, mainly refers to the source of greenhouse gas production in the construction process of construction enterprises [20]. Carbon emissions of construction enterprises can be divided into direct and indirect emissions, among which greenhouse gas emissions during the construction process belong to direct emissions, while greenhouse gas emissions produced during the preparation of construction process belong to indirect emissions [21]. Through long-term observation and research, it is found that emissions in water, electricity and gas are the main ones, while processing of metals and non-metals, mining and chemicals also occupy apart [22].

4. Analysis of Carbon Emission Impact Factors

4.1. Analysis of the Factors Influencing the Construction Decision Stage

The judgment of the construction decision stage of the assembled building construction enterprise is the basis. Although this stage will not produce the actual greenhouse gases, but if problems arise, the project will not be able to control the actual greenhouse gas emissions in the actual process. After sorting through the data and interviewing experts, it is possible to summarize the factors that influence the construction decision phase on the carbon emissions of poor construction of assembled buildings [23].

(1) The actual level of technology at the disposal of assembly building construction companies. Take into account the geographical environment of China and the level of economic development of the area where the assembly building project is actually located.

(2) The degree of research of the assembly building project. The degree of specific planning of the project and feasibility study of the project directly affects the specific implementation of the assembly building construction enterprise in the construction process. The deeper the research, the more detailed the project will be in the implementation operation, and the more comprehensive the control of carbon emissions will be.

(3) The extent to which construction companies are aware of economic efficiency. The difference or ratio between the results of research and the labor consumed in the process of producing material materials is called economic efficiency. Once this bottom line is broken, it will lead to greenhouse gas emissions far exceeding the actual standard, and the enterprise will pay the corresponding price.

4.2. Analysis of Factors Influencing the Construction Design Phase

The construction design phase is a critical stage in the construction of an assembly building construction company. In this phase, at least four processes are exhausted, namely the design planning of the site, the assessment of the surrounding environment, the assessment of fire safety and the assessment of traffic aspects, all of which will affect carbon emissions. The influencing factors of this phase are summarized below [24].

(1) Determination of building structure. Carbon emissions vary with the building structure. Reasonable planning and design of the building structure and effective use of sunlight and wind power will reduce carbon emissions to some extent.

(2) The selection of construction materials. The assembled building construction enterprises must be thoughtful in the selection of building materials, not only to include the durability of materials and the use of old materials, but also to take into account the recycling of waste materials and energy recycling.

(3) Planning for public services. In the assembly building project, the construction company should also consider the planning of public areas thoroughly. This kind of work seems to be simple, but it requires careful planning of the actual land and traffic.

4.3. Analysis of Factors Influencing the Construction Build Phase

The construction phase of assembled building construction is the process by which the construction company transforms the project blueprint into an actual building, during which a certain amount of material is inevitably consumed and a large amount of greenhouse gases are produced. The main points include the following.

(1) The production process of prefabricated components. This process includes the carbon

emissions caused by the extraction, processing, production and transportation of raw materials to the factory. This process also includes the carbon emissions caused by the operation of resources and equipment used in the actual production of prefabricated components. Therefore, when choosing the location of the factory, we should pay attention to the distance from the extraction site of raw materials to the precast factory, and the actual production level of the factory also affects the final quality of the components.

(2) Prefabricated components transportation process. The process of transporting the completed prefabricated components to the construction site still consumes certain resources and generates certain carbon emissions. Therefore, the choice of the type and quantity of transportation means is particularly important, and the different choices will also cause different carbon emissions.

(3) Assembly process of prefabricated components. After transporting the prefabricated components to the construction site, the assembly of prefabricated components will be carried out. In this process, suitable tools, exquisite technology and precise timing need to be reasonably planned, while the management of site personnel cannot be ignored.

5. Recommendations

5.1. Policy Support from the Government

The government and other relevant departments should increase their support to enterprises in terms of policies, and various policies should jointly promote the development of assembly building construction enterprises, thus helping them to control carbon emissions. In terms of land use for assembly building projects, certain preferential support policies should be provided for projects that meet the relevant policies, so as to guarantee land use for the projects; in terms of finance, government departments can provide technical research funds for assembly building project construction enterprises, and provide certain government subsidies for the corresponding technical talents. This will reduce the carbon emissions of construction companies before construction.

5.2. Optimization of Enterprise Construction and Building Process

The entire construction phase of an assembly building construction enterprise consumes certain resources and produces certain greenhouse gases. Optimizing the design of the construction process makes it possible to minimize the waste of resources at all stages of the process while ensuring the successful completion of the work. For example, recruit experienced personnel to make realistic plans, fully understand the construction site environment and traffic conditions, and effectively use natural resources such as solar and wind energy to control excess greenhouse gas emissions.

5.3. Selection of Green Materials

To minimize the use of fossil fuels, the use of new energy and green materials as well as intelligent manufacturing should be the primary consideration. Open the development of green building materials with high insulation and air tightness and envelope structures with excellent performance, accelerate the development of carbon trading market, improve the quality of carbon services, and promote the green development of assembled buildings.

6. Conclusions

Compared with traditional buildings, assembled buildings can effectively reduce carbon emissions. Finding the factors affecting carbon emissions of assembled building construction

enterprises and taking effective measures will control carbon emissions to a greater extent, and reasonable control of carbon emissions can effectively alleviate the climate and environmental crisis. This paper analyzes the factors influencing carbon emission of assembled building construction enterprises, and thus provides the improvement direction for assembled building construction enterprises, in order to promote the orderly development of assembled building construction enterprises and realize the effective control of carbon emission.

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