

## The Factors affecting the construction of low-carbon construction and the Countermeasures

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### ABSTRACT

This paper analyzes the influencing factors of carbon emission sources and in the transport stage and construction process of the construction phase, then study the appropriate control measures and energy-saving suggestions for the construction enterprises to achieve low-carbon construction and to provide effective basis of energy conservation and emission reduction.

**Keywords** –Construction of carbon emissions, influencing factors, control measures, energy saving.

### I. Introduction

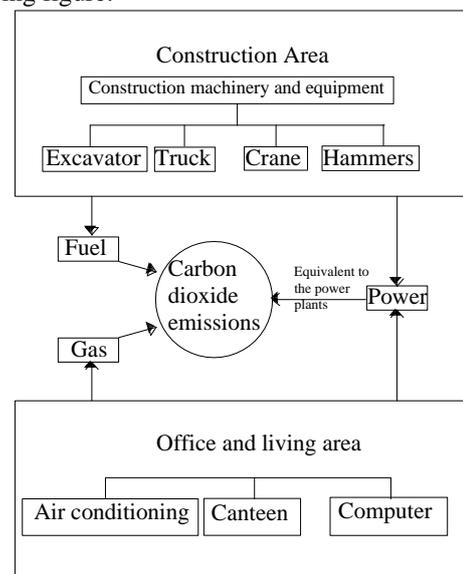
Annual CO<sub>2</sub> emissions of the construction sector accounted for 28% of the total social, reducing carbon emissions has become imperative. After 80 years, global temperatures increased significantly. According to the models predict of IPCC climate, global temperatures will rise by 2 ~ 6 °C within a decade. Greenhouse gases are the most important reason that cause global warming, as a pillar industry the construction industry and its related activities have been generating large amounts of greenhouse gases. In recent years, green ecological building has been brought into the national long-term plan of environment and economic development, and the corresponding research has achieved many results. But most of the research and application focused primarily on the use phase of the building, research on energy saving aspects of the construction phase is still relatively small. Building using phase is the longest of the entire life cycle, while the construction phase time is only 1-2 years or less, So most scholars believe that energy saving measures should focus on building using phase. But it is a short time due to the construction phase, the construction phase of the carbon emissions generated by energy use is concentrated and suddenly, so the carbon emissions per unit of time is higher than the trial stage, the energy saving effect of the construction phase of the more significant. Constraint mechanism of energy saving building construction field has not been established, therefore carbon emissions law of the construction phase and the establishment of energy conservation mechanisms, has important theoretical and practical significance.

### II. Factors of the carbon emissions in construction phase

#### 2.1 Analysis of carbon emission sources Construction

##### (1) The carbon emissions of building construction process

Carbon emissions during construction mainly come from the energy consumption of installation of equipment, living and working. The entire construction jobsite divides into the construction area, living area and office area parts and details of its source of carbon emissions. The sources of carbon emissions in construction phase as shown in the following figure.



As is shown in the figure, by summarize the carbon emissions from the construction phase, we can see that it is made primarily of fossil energy consumption and energy consumption of the composition. So energy consumption will produce carbon dioxide, which mainly include energy

consumption the use of mechanical equipment secondary transport in construction site, as well as the transportation of building garbage and building materials.

## **(2) Carbon emissions generated by the transport of materials and equipment**

The Source of carbon emissions in materials and equipment transport phase mainly is the energy consumption of conveyance. The energy consumption of the phase main related to the weight of equipment and materials, the choose of conveyance, transport distance, the power source (gasoline, diesel, etc.) of conveyance as well as transport energy consumption rate and so on.

## **2.2 Analysis of carbon emission factors during the construction**

### **(1) Factors affecting carbon emissions of the transport**

A lot of building materials in the course of construction will be consumed, the transportation of building materials and equipment will emit large quantities of CO<sub>2</sub> emissions into the atmosphere. The main factors include the mode of transport, transport vehicles selection, transport distance, the number of transport ,efficiency of units materials transportation.

The modes of transport. Transport modes of material generally have road, rail, aviation, shipping and other means. By analyzing and comparing the different modes of transport on energy consumption, We know that sea and rail transport evidently consumes less energy.

The selection of vehicles. According to the survey, the fuel consumption of gasoline truck is 8L for per hundred tons per kilometer and diesel truck is 6L. Our country is more twice the fuel consumption than foreign advanced level when truck with tons running one kilometer, But fuel consumption of trailer vehicle evenly reduced more 30% than a bicycle.

Quantity of transport. The transport quantity directly determine the number of conveyance, and also determines the mechanical energy consumption, thus significantly affect carbon emissions.

The distance of transport. According to statistics, reducing 40.58kg of carbon emissions can be achieved when shorten one hundred kilometers away. Construction units should choose the nearest material suppliers to shorten the distance ,which can significantly reduce carbon dioxide emissions during the transportation.

The efficiency of transportation. Studies have shown that increasing one ton load for vehicle, the energy consumption can be reduced by 6%. Therefore, Sometimes the level of efficiency of transportation decide arriving of building materials and equipment

timely and affect the construction schedule and costs, but also to a large extent impact the carbon emissions.

### **(2) Factors affecting the carbon Emissions of construction process**

Carbon dioxide emissions from the construction site is the main source of carbon emissions during the construction process and the constituent elements may be the most complex. It have many factors, including construction management, worker skills, selection of construction machinery, construction of living and office lighting, energy efficiency, building size, building structure type and so on.

Construction management. The level of construction management often determines construction plan. The project with higher level of construction management the arrangement of process must be reasonable and compact, so slowdown phenomenon and taking maneuvering time may be not easy to happen and the construction of carbon emissions to will be controlled effectively. Therefore, different levels of business management and construction will cause a big difference in the consumption of energy during the construction.

Workers' skills. According to the survey, machine operators of different skill levels may produce the gap by 7% to 25% in fuel consumption. If the quality of workers and their level of technology are low, carbon emissions are higher and vice versa. Therefore, the technical level of workers is one of the factors affecting the energy consumption in building construction.

Construction machinery. Energy Construction of equipment and machinery general construction accounted for more than 90% of the total energy consumption, thus high efficiency and energy-efficiency can consume less energy than the general motors. For example the frequency energy of Liebherr lifts reduce by 25% compared with ordinary lifts in energy consumption.

Lighting of living and office in construction site, Under the same conditions, the statistics have found that carbon emissions caused by the use of energy-saving lamps reduce by 80% compared with the incandescent, accounted for 30% of emissions caused by the use of fluorescent, while the effective planning and management of lighting intensity and time can make the Carbon Emissions of living and office lighting a very significant difference.

Building's size. Building's size has a significant effect on the corresponding emissions. The higher building consume more energy in the construction process, and each additional ten meters of the residential building's height will produce more 0.1kg-0.4kg carbon emissions for square units. When more layers and the greater difficulty of construction, it needs take more construction safety measures, so use more energy and release greater CO<sub>2</sub> gases .

### III. Low carbon construction control measures

To achieve the goal of the low energy consumption, low pollution, low emissions and high-efficiency in the construction phase, we must take effective measures to strengthen the control of carbon emission.

#### (1)Promote low-carbon and advanced technology

To achieve low-carbon construction, we need drawing on international and domestic advanced experience, introducing advanced technology and equipment, optimizing energy structure, promoting solar, wind, geothermal and other clean energy applied actively in the construction process. Meanwhile the national and industry can recommend energy saving products by administrative measures, such as the full use of energy-efficient light, choose efficient machinery and equipment and so on.

#### (2)Establish scientific low-carbon management system of construction

Establish scientific low-carbon management system of construction could help improve management level, make a reasonable construction plan and choose the best construction program, then reduce the increase of energy consumption caused by improper management. While the design units, supervision, owners and other involved parties should actively supervise the implementation of low-carbon construction enterprise in the construction site.

#### (3)Build compensation mechanism of low-carbon construction

The use of advanced equipment to improve production efficiency and reduce carbon emissions may increase the cost of firms. In order to realize the principle of fairness, construction companies should get the appropriate financial compensation. Therefore, the compensation mechanism of low-carbon construction should be established to meet the needs of construction companies and local governments. We can through fund compensate, financial payments, in-kind compensation, compensation tax breaks and so on. In addition, we must also strengthen mutual matching between the various compensation methods and compositions to diversify the compensation.

#### (4)Strengthen the education of low carbon construction

The development of low-carbon construction should strengthen education of low-carbon construction in project department and develop their low-carbon consciousness. Regularly organize staff to exchange the low-carbon construction experience or listen to the lectures of advanced reducing-emission units, then a low-carbon construction atmosphere can be formed, which conducive to create

an advanced low-carbon awareness and ideas for the project department effectively and lasting.

### IV. Conclusion

China has become one of largest carbon-emissions country in the world, the community have called for the development of low-carbon economy and establish a low-carbon society. Through combined with characteristics of construction site, this paper analyzes the carbon-emission sources and the influencing factors in construction phase and proposes countermeasures of low-carbon construction. It has important practical significance for building a more rational system of low-carbon construction index and improving low-carbon architectural theory.

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