

# *The Factors Influencing the Saving of Energy and the Reduction of Emissions in the Construction Companies of Prefabricated Buildings*

Hongyu Sun, Qiang Liu, Yafeng Li\*, Ming Liu

*School of Economics and Management, Liaoning University of Technology, Jinzhou, Liaoning, 121001, China*

*\*Corresponding author*

**Keywords:** Assembly building, construction enterprise, energy saving and emission reduction, influencing factors

**Abstract:** This paper analyzes the characteristics of prefabricated houses, proposes the importance of prefabricated houses for saving energy and reducing pollutants, and further analyzes the factors that influence the saving of energy and reducing pollutants of prefabricated houses. It is suggested to realize the organic integration of assembly building and energy conservation and abatement in order to ensure the smooth realization of energy conservation and abatement goals and promote the sustainable development of assembly building enterprises.

## **1. Introduction**

In recent years, China's focus on the development of energy conservation and emission reduction, and the results have been excellent. Local governments and other relevant policies have been released one after another, strict management of related measures, implementing the increasing intensity. We have integrated energy conservation and pollution control into our daily work and every corner of our lives, and we are committed to the long-term development of our companies and people. Resource depletion, environmental protection, economic development, business efficiency and other factors are warning us that we must adhere to the implementation of saving energy and reducing emissions can't be slow. State-owned building construction enterprises, must grasp the energy saving and emission reduction is duty-bound. In the process of the development of China's construction industry, the concept of green and sustainable development has become more and more important, and the construction industry has become more and more concerned about energy conservation. Among them, in the process of building structure development, assembly building structure has been fully embodied. All over the world, the development of urbanization and urban construction together to promote the process, wasting many resources, and the ecological environment of our country has a great destructive effect, and sustainable development strategy does not match. Building assembly construction is able to effectively control construction waste, exhaust gas and other discharges, which has characteristics of energy saving and environmental protection, and is able to promote green construction.

## **2. Connotation and Characteristics of Assembled Building Construction**

### **2.1. Connotation of Assembly Building Construction**

Compared with traditional building construction, the advantages of assembled buildings in terms of carbon emissions and material manufacturing are outstanding. The most important feature of the production method of assembled buildings is the scale of processing in factories, which can reduce the consumption of construction materials and the amount of construction waste to a certain extent and effectively control other energy consumption in construction [1-3]. In the process of producing prefabricated components in the factory, some trimmings and materials of unqualified quality can be recycled and smelted and processed for re-making. In the actual construction of the project, the use of mechanized installation can effectively reduce the emission of noise, waste and wastewater, and at the same time can reduce the carbon emission of the whole building life cycle [4].

### **2.2. Characteristics of Assembly Building Construction**

Most companies have explored new materials and technologies to effectively reduce the resource consumption and pollution rate of construction projects. In the specific implementation process of the assembly building construction project, the construction efficiency can be improved through the reasonable application of assembly construction technology, which can shorten the construction cycle of the whole project. Specifically, it can be divided into the following aspects [5, 6].

#### **2.2.1. Facilitate Easy and Fast Construction**

Construction companies can complete construction work more easily and quickly by using perfect assembly construction technology [7]. The direct installation of building structures not only effectively enhances standardization, but also simplifies the tedious construction process, thus completing the entire construction process quickly and easily [8]. In addition, the main components of the assembled building need to be processed in the factory in order to make the work more convenient and to simplify the whole construction process to the maximum extent in the mass production process.

#### **2.2.2. Facilitate the Application of Green Materials**

The use of green building materials can be reasonably secured in assembly-type construction. Compared with the traditional steel structure construction technology and reinforced concrete structure construction technology, the assembly building construction enterprise can install the prefabricated components on site and play the role of prefabrication [9-11]. In the process of material processing, green construction materials are the first choice [12], for example, steel structures with good performance can make assembly building construction enterprises repeatedly use steel in the construction process to further improve the utilization rate of green resources.

#### **2.2.3. Facilitate the Maintenance and Upgrading of Construction Projects**

The simple installation and disassembly method is fully reflected in the maintenance management of building projects, which can efficiently deal with some quality problems such as water seepage and cracking in the later maintenance management of buildings, and strengthen and replace the components, which not only can simplify the maintenance management of building projects, but also will not have adverse effects on the normal use of building projects [13-17].

### **3. The Importance of Energy Saving and Emission Reduction**

The idea of “pollution before treatment” should be fundamentally abandoned, so that not only can promote the assembly building construction enterprises to enhance the competitiveness in the market can also enhance the ability of the enterprise’s own sustainable development [18]. Enterprises, especially construction enterprises, occupy an important position in society, assembly building construction enterprises to carry out energy saving and emission reduction work, but also for the harmonious development of society, to protect the environment to provide important power, the health of the citizens of society will also be protected [19]. With a high degree of mechanization, the assembled building construction enterprises can greatly reduce the working time in producing prefabricated components and help improve the efficiency [20]. The processing of components at the construction site is relatively rare, and in order to prevent weather changes from affecting the processing process, most enterprises produce components in factories, which can also reduce the construction time and maximize the utilization of personnel.

### **4. Analysis of Influencing Factors**

#### **4.1. Ideological Aspects**

Managers must pay attention to energy conservation and emission abatement, make effective ideological innovations to the construction concept, and properly guide the construction companies' energy conservation and emission abatement development speed. From another point of view, enterprise leaders must also put energy conservation and emission reduction in the first place, and make appropriate plans and proposals for resource conservation and pollutant treatment. The benign development of construction enterprises cannot be separated from the optimisation and upgrading of the enterprise environment. In the entire process of energy conservation and pollutant abatement, the leaders of construction enterprises should take the lead, play the leading role, promote the concept of energy conservation and pollutant abatement vigorously, and make the whole staff of construction enterprises aware of energy conservation and pollutant abatement, and make the effect of energy conservation and pollutant abatement more effective.

#### **4.2. Production Construction Aspect**

The assembled building construction enterprises need to use as many prefabricated components as possible in the actual construction projects, so the assembled building construction enterprises need to unify the management of prefabricated components and make unified planning for prefabricated components in different areas and different construction projects [21]. At the same time, the construction enterprise should also consider the post-construction work and try to take all the uses of prefabricated components into account [22]. In the process of construction of assembly building, many prefabricated components have achieved the role of beautification and decoration while ensuring the utility, killing two birds with one stone and greatly reducing the workload of workers.

#### **4.3. Construction Management Aspects**

The use of building materials should be strictly controlled in the construction of assembly buildings, and the quota distribution system should be implemented according to the basic situation of consumption quota, and the materials received in excess should be strictly approved, and the materials not consumed should be developed through the index control method for the materials

received [23]. The managers should correctly check and strictly measure the specific receipt and issuance of materials and supplies, the input situation, improve the precision of measurement and strictly control the problem of material waste [24]. In the process of building assembled buildings, the application of timber formwork can be reduced and aluminum formwork that can be recycled and recyclable many times can be actively used, thus improving the overall service life and turnover rate. Employees should reasonably arrange construction production practices, do a good job of strengthening the scheduling of machinery and equipment, and improve the utilization rate of on-site equipment.

#### **4.4. Laws and Regulations**

In order to effectively control violations and promote energy conservation and pollution control, it's necessary to make laws and regulations according to specific requirements, to lay the foundation for improving the efficiency of energy conservation and pollution control, and to unify and institutionalize energy conservation and pollution control efforts to promote it [25]. If the laws and regulations are ignored as an influence, pollution, evasion of responsibility, and the conflict between man and the natural environment increases over time, the efficiency of energy conservation and emission reduction decreases. To improve the effectiveness of legislation, we need to actively solicit suggestions from employees of enterprises and local residents, and promptly correct the contents of inappropriate legislation and make appropriate corrections, so as to promote the orderly implementation of energy conservation and emission reduction.

### **5. Recommendations**

#### **5.1. Establish a Sound System for Energy Conservation and Emission Reduction**

The development and progress of any organization is dependent on the existence of certain rules and regulations. The companies involved in building and constructing also need to comply with certain regulations when building. The relevant changes in the market are strictly followed by the relevant departments. To adjust and update the relevant energy-saving and emission-reducing system in a purposeful way, to provide practical and effective system protection and guidance for the relevant companies, including assembly building construction companies, in order to unify the construction companies' operations, improve the efficiency of energy-saving and emission-reducing, and ensure the steady development of operations. First of all, managing can be done according to categories. The category management policy can improve the classification criteria and make the companies' energy saving and emission reduction more efficient, as there are certain differences in the energy consumption and carbon emission of different assembly building construction companies. Second, qualification standards cannot be ignored. Employees of assembly building construction companies must be qualified to meet relevant requirements in order to standardize energy conservation and emission reduction behavior. Finally, real-time monitoring of energy conservation and reduction can raise awareness of the importance of energy conservation and reduction among construction workers.

#### **5.2. Organize Education and Training Activities**

Gathered construction enterprises organize education and training activities for all employees, using multimedia equipment to explain the content of energy-saving and emission-reduction strategies in detail, thereby enriching the theoretical knowledge base and providing theoretical support for improving energy-saving and emission-reduction efficiency. At present, in order to

dynamically update the energy-saving and emission-reducing equipment and to give full play to the application value of the equipment, professional teachers are invited to explain in detail the operation techniques of the energy-saving and emission-reducing equipment, so as to further improve the working skills and achieve the desired effect of saving resources and protecting the environment. During this period, employees at the company have set unified goals and worked together to achieve energy conservation and emission reduction targets. There is an urgent need in the building and construction industry that the awareness and understanding of energy conservation and abatement activities among those in charge of energy conservation and abatement activities is further enhanced. Thus, the level of energy conservation and emission abatement in companies can only be raised by strengthening the training of energy conservation and emission abatement managers at all levels in companies, and by constantly improving the technical level and practical ability of managers.

### **5.3. Improve Management Mechanism**

The internal management mechanism of the integrated building enterprise affects the development of the building enterprise in energy conservation and emission abatement, and the management mechanism will be refined in accordance with the characteristics and changes of the environmental market, so as to promote the economic development of the building enterprise. First, improve the mechanism of paid use of exhaustible resources, which will to a certain extent improve the user's attention to exhaustible resources, and then improve the use rate of resources and reduce the excessive use of resources. Second, improve the ecological compensation mechanism. The efficiency of enterprises in saving energy and reducing emissions has an important impact on maintaining the ecological balance and optimising the ecological environment, so to build a harmonious development relationship between man and nature, we should adjust the interest relationship through ecological compensation so that it's consistent with the "polluter pays" principle, thus playing an economic incentive role. Lastly, to improve the energy pricing mechanism, domestic oil and gas belong to the unbalanced supply and demand, to promote the normal development of the market economy, it is necessary to improve the energy pricing mechanism step by step, according to the law of the market economy to determine the energy price rationally.

## **6. Conclusions**

From a long term perspective, it's appropriate to innovate strategies to improve the efficiency of saving energy and reducing emissions, and to implement environmental protection strategies as much as possible under the premise of ensuring that resources are conserved. Under the influence of the concept of green sustainable development, the construction enterprises of the prefabricated building industry must develop new requirements, strengthen the prefabricated building energy saving and emission reduction, meet the requirements of water saving, energy saving, etc., implement environmental conservation, prevent the phenomenon of environmental degradation, make the recycling of raw materials highly efficient, and inject new vigor and development into the construction industry.

## **Acknowledgements**

This work is supported by 2022 Scientific Research Project of Education Department of Liaoning Province (LJKMR20220986), 2021 Scientific Research Project of Education Department of Liaoning Province (LJKR0224, LJKR0225).

## References

- [1] Fang S.Y. (2017) Analysis of factors influencing energy conservation and emission reduction in enterprises. *Petroleum and Chemical Energy Conservation*, 6, 5-8.
- [2] Zhao H., Chen Y., Yao Q. (2017) Carrying out internal energy conservation and emission reduction in power grid enterprises to alleviate the pressure of corporate carbon emission compliance. *Shandong Industrial Technology*, 19, 180-180.
- [3] Wang X.H., Di P. (2017) Research on the path of energy saving and emission reduction in iron and steel enterprises. *Science and Technology Economic Market*, 7, 90-92.
- [4] Ouyang J.J., Shen H.C., Luo Z.C. (2018) Selection of energy-saving methods for energy-consuming manufacturing enterprises under competitive environment. *Systems Engineering Theory and Practice*, 38, 2564-2577.
- [5] Tang X.L., Gu B.X., Kang Z.Y. (2019) Environmental regulation and total factor productivity of Chinese firms: an examination based on "energy saving and carbon reduction" policy. *Research and Development Management*, 3, 47-58
- [6] Wang P.L. (2019) Analysis of engineering project management and development issues of assembled buildings. *Green Building Materials*, 6, 185-186.
- [7] Zhang X., Kui K.C. (2019) Development prospects of prefabricated assembled buildings and structural design elements. *Green environmental protection building materials*, 6, 68-69.
- [8] Li. Q. (2019) Exploring the problems and countermeasures of developing assembled buildings. *Value Engineering*, 38, 47-50.
- [9] Sun Y. (2019) Research on cost control of production of precast concrete components for assembled buildings. *Northern Construction*, 4, 79-81.
- [10] Ma Y. (2018) Research on the application of assembled residential structure system. *Urban Housing*, 12, 69-72.
- [11] Teng Y. (2018) Reducing building life cycle carbon emissions through prefabrication: evidence from and gaps in empirical studies. *Building and Environment*, 32, 12-18.
- [12] Jaillon L. Chiang Y H. (2009) Quantifying the waste reduction potential of using prefabrication in building construction in Hong Kong. *Waste Management*, 29, 309-320.
- [13] Pon S. (2011) Environmental impacts of prefabricated school buildings in Catalonia. *Habitat International*, 35, 553-563.
- [14] Tavares F. (2019) Embodied energy and greenhouse gas emissions analysis of a prefabricated modular house: the "Moby" case study. *Journal of Cleaner Production*, 212, 1044-1053.
- [15] Lu H. (2013) Investigating waste reduction potential in the upstream processes of offshore prefabrication construction. *Renewable & Sustainable Energy Reviews*, 28, 804- 811.
- [16] Hong L. (2016) Life-cycle energy analysis of prefabricated building components: an input-output-based hybrid model. *Journal of Cleaner Production*, 112, 2198-2207.
- [17] Ji J. (2018) Comparing greenhouse gas emissions of precast in-situ and conventional construction methods. *Cleaner Production*, 173, 24-134.
- [18] Bonamente S. (2014) Environmental Impact of Industrial Prefabricated Buildings: Carbon and Energy Footprint Analysis Based on an LCA Approach. *Energy Procedia*, 61, 2841-2844.
- [19] Loisos G. (2012) Using life cycle assessment methods to guide architectural decision-making for sustainable prefabricated modular *Journal of Green Building: Summer*, 7,151-170.
- [20] Antonucci V. (2018) Life cycle energy performances and environmental impacts of a prefabricated building module. *Renewable & Sustainable Energy Reviews*, 92, 272-283.
- [21] Aye L. (2012) Life cycle greenhouse gas emissions and energy analysis of prefabricated reusable building modules. *Energy and Buildings*, 47, 159-168.
- [22] Wu Z. (2015) Evaluation of energy-saving benefits and carbon emissions of residential industrialized assembly construction methods. *Building Structure*, 45, 71-75.
- [23] Liu S. (2016) Research on comprehensive benefit analysis method of assembled building. *Construction Technology*, 45, 39-43.
- [24] Wang Y. (2016) Research on the whole life cycle carbon emission of industrialized prefabricated and assembled buildings, 43, 112-19.
- [25] Zhang Q. (2017) Research on carbon emission calculation model based on Process-Based LCA method for the materialization stage of assembled houses in China. *Journal of Engineering Management*, 31, 23-28.