

Exploration of Cost Management and Implementation Key Points for Green and Energy-saving Buildings

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Abstract: Currently, people are paying increasing attention to resource-saving and environment-friendly building work, as well as to green development, energy conservation and emission reduction. They are promoting the concept of green and energy-saving buildings to the field of building technology, in order to better implement the concept of sustainable development. It should be pointed out that in the process of building green and energy-saving buildings, more attention should be paid to cost management, and relevant entry points should be grasped to comprehensively ensure that the overall green and energy-saving building can bring better benefits.

Keywords: Green and energy-saving buildings; Cost management; Implementation key points

1. Introduction

With the continuous deepening of China's socio-economic construction and development, people's impact on the environment is also increasing. Environmental pollution seriously affects human physical and mental health. Due to the impact of climate change, serious natural disasters have occurred in many places, bringing enormous economic losses to the people, which is very unfavorable for building a harmonious society. In construction engineering projects, there is significant energy loss and potential for energy conservation. In recent years, the Chinese government has advocated the creation of "green buildings" to achieve the restoration and improvement of the natural environment, thereby optimizing people's quality of life. This article discusses the application of cost management in green and energy-saving building construction from the concept of the green and energy-saving buildings.

2. The Definition of Green and Energy-saving Buildings

The term "green" refers to buildings that are "energy-efficient and environment-friendly". In building planning, both green design and energy conservation should be considered. Green and energy-saving buildings refer to the use of natural resources to build buildings that conform to the concept of sustainable development, reduce energy consumption, reduce environmental pollution, thus making building projects more energy-efficient and environment-friendly, and have been widely used by the general public. Green and energy-efficient buildings reflect the essence of building energy-efficient, and their internal design also has its own characteristics and scientificity. During the design process, designers should minimize the consumption of indoor building materials, and reduce additional decorations to existing buildings to fully utilize natural energy sources such as lighting and ventilation. Designers can design indoor spaces that are warm in winter and cool in summer within the building based on factors such as wind direction and climate, thereby achieving the goal of reducing air conditioning usage. Although air conditioning can make people feel comfortable, long-term use can also cause diseases, pollution, and waste of energy. Therefore, when designing buildings, natural and pollution-free materials such as stone, wood, sand, etc. should be used as much as possible. Although the cost of using environment-friendly building materials is relatively high, psychologically speaking, environment-friendly building materials can shorten the distance between residents and nature, save energy, and maintain people's physical and mental health. People are increasingly paying attention to the concept of energy conservation and realizing the need to achieve sustainable development and harmonious development of the ecological environment. In various industries, energy conservation and emission reduction work is gradually being carried out. Human behavior is determined by ideas, and only after emphasizing the concepts of "green" and "energy conservation" can people take corresponding measures.^[1] In the process of engineering construction, the concepts of "green" and

“energy-saving” should always be strengthened. All kinds of industrial development should be based on the protection of the ecological environment. Without natural energy, human productivity will decrease. So, people not only need to learn how to obtain scientific and reasonable resources from nature, but also learn how to effectively protect natural resources, maintain a balance between nature and human society in the process of social development, thereby achieving harmonious development of the ecological environment and social economy. After the introduction of the national “Green and Energy-saving Plan”, Chinese construction enterprises have responded positively to this, continuously innovating the design of green and energy-saving buildings, thereby promoting the development of China’s green and energy-saving building industry. The development of this emerging industry organically combines green and energy-saving buildings with building technology planning, continuously innovating green building technology, and laying a solid foundation for building a green and energy-saving society. With the introduction of national policies on energy-efficient and environment-friendly, as well as the active participation of local governments, China’s construction industry will usher in a bright future. As shown in Figure 1.



Figure 1: Green and Energy-saving Buildings.

3. Importance of Cost Management for Green and Energy-saving Buildings

3.1. Improving the Precision of Budget Evaluation in Engineering Cost Management

In engineering projects, operational risk is a crucial issue that directly affects the business performance of the enterprise. The main reason for this phenomenon is that after implementing full project cost management, construction managers overly focus on the effectiveness of full project cost control, while failing to effectively manage and analyze project funding elements. For example, changes in bank interest rates, changes in market conditions, and so on. Therefore, in engineering construction, in order to ensure the successful implementation of the project, a large amount of investment must be made according to the specific economic situation of the project. In order to effectively manage the cost of construction projects, modern green construction management need to be implemented successfully.

3.2. Reducing the Risks of Economic Management

The scale of green building projects is large, the environment is complicated, and there are many risk factors, which have a significant impact on the economic benefits of the project, so it is very important to prevent and control risks. When conducting cost management, it is necessary to strengthen cost control throughout the entire project process and identify potential risk factors, then evaluating the economic risks present in each link, and taking targeted prevention measures to effectively avoid and reduce risks in economic management. Some enterprises, in order to obtain high operating profits, may falsely declare the progress of the project after completing it, resulting in huge losses for the owners. In this case, by implementing a full process engineering cost, the main body of the buildings can strictly follow the original design drawings for construction, ensuring construction quality, and thereby reducing the phenomenon of arbitrary construction caused by its own reasons. At the same time, it is necessary to strengthen on-site verification of visa documents and research on the accuracy of design drawings.^[2]

4. The Relationship between Green and Energy-saving Buildings and Engineering Costs

4.1. Whole-process Energy-saving Building Cost Management Theory

Cost management is the effective cost control throughout the entire cycle of a project during project execution. Currently, China's construction industry is developing towards a "green" direction, with an increasing demand for energy conservation and environmental protection. Therefore, construction enterprises should also focus on how to improve the energy efficiency of the project in the process of building. With the continuous development of green and energy-saving buildings, higher requirements have been put forward for their economic benefits. If green and energy-efficient buildings only focus on energy conservation and environmental protection, while neglecting cost management, it will result in high engineering costs, it will have a significant impact on the economic benefits of the project. Therefore, it is imperative to promote the implementation of full process cost management in construction projects.

4.2. Economic Benefits of Energy-saving Buildings

Most people believe that the use of new energy-efficient materials and techniques in the implementation of green and energy-efficient buildings will inevitably result in higher overall costs. However, from the perspective of practical engineering practice, the six-floor steel frame structure is the boundary between traditional buildings and green and energy-saving buildings. Therefore, if a green and energy-saving building with six or more floors is built, its cost will be significantly lower than the cost of traditional buildings. The result is that although from the perspective of energy conservation, this will bring more costs, it only accounts for a small portion of the entire project cost.

4.2.1. Building Enclosure System

In terms of green and energy-saving buildings, the enclosure structure is a key link. Clay bricks and insulating mortar with good breathability are the exterior wall structures of many buildings. Through such design and construction, it can save 15 yuan per square meter. If the housing system uses cement polystyrene board, its cost will increase by 60 yuan per square meter, and the cost of energy conservation can be saved accounts for 8.7-10% of the total cost. If this material is used, it can increase the engineering cost by about 50 yuan per square meter.^[3] However, in practical applications, the investment in energy conservation only accounts for 7.4-9.6% of the construction cost.

4.2.2. Wall Engineering Projects

Walls are also an important part of energy conservation, therefore, when building green and energy-saving buildings, attention should be paid to them. The use of breathable concrete block walls can significantly reduce the weight of the wall, reduce the cross-sectional area of components, and reduce reinforcement. The groove depth of the wall panel built using this method is much smaller than that of traditional wall panels, which can reduce the thickness of the plaster on the wall panel. On this basis, the construction cost of building exterior walls has been significantly reduced, and the economic benefits of the project have also been achieved.

5. Current Situation and Shortcomings of Cost Management for Green and Energy-saving Buildings

Although more and more construction units are realizing the importance of strengthening cost management in the construction process of green and energy-saving buildings, there are still certain shortcomings in the actual implementation process, mainly including the following points:

One is that the selection of construction materials has a certain degree of randomness: in the stage of project cost management, due to inadequate supervision by the construction unit, construction personnel often experience the phenomenon of "taking shortcuts". Many projects, due to improper utilization during construction, result in a large amount of material waste.^[4] According to data, during the construction phase of green and energy-saving buildings, the cost of raw materials accounts for over 60% of the total project cost, and waste of materials will inevitably lead to waste of funds.

Secondly, there is a lack of suitable cost management system: compared to the international advanced level, China's green and energy-saving buildings started relatively late, and a corresponding cost management system has not yet been established, making it difficult to scientifically evaluate the

early, mid-term, and later costs, thus unable to effectively control project costs. Some units have not combined reality and learned foreign green building cost management methods and experiences, making it difficult to provide high-quality services for improving the efficiency of green and energy-saving building cost management in China.

Thirdly, there are deficiencies in the standardization of cost management: in the cost management of green and energy-saving buildings, it is necessary to minimize material consumption and reduce engineering costs as much as possible. However, some staff members have not fulfilled their duties in this regard, which can easily lead to other problems due to simple cost savings, and can affect the smooth progress of green and energy-saving buildings. In the actual operation process of cost management, relevant personnel need to complete the work of saving materials and costs in accordance with the principle of standardization. However, most staff only use the pretext of saving materials and costs, while the entire green and energy-saving building cost management work has not been standardized, which will inevitably affect the effectiveness of cost management work.

6. Exploration of Key Points for Implementing Green and Energy Efficient Building Costs

6.1. Decision Stage

The correctness of early engineering decisions is directly related to the quality, progress, and cost of green and energy-saving building projects. When making decisions, it is necessary to scientifically evaluate the operability of the green energy-saving part, whether its cost meets the best standards, and the feasibility of investment. After finding investment opportunities, construction enterprises should do the following work well:

(1) Building standardized design planning: Conducting in-depth research on green building design specifications and standards, and integrate the ideas of “green” and “energy-saving” into cost management, so that all measures in cost management can be carried out in accordance with the specifications. Therefore, various problems that arise in engineering must be taken seriously by various design units and must be dealt with seriously.

(2) Design standards: In the cost management stage, conducting in-depth analysis of engineering design standards to enhance the understanding of green and energy-saving cost principles and content among all accounting personnel, in order to make them more in line with the core requirements of green building cost management.^[4]

(3) Based on the environmental conditions in which the project is located, a preliminary assessment is made of the cooling and heating, insulation, and sound insulation effects inside the building. During the implementation of the project, the best energy-saving plan should be formulated based on the energy conditions required for the project. After determining the project implementation plan, the feasibility of project implementation was evaluated using methods such as income analysis, value analysis, and system analysis. An investment budget was created to calculate the energy-saving plan, providing a reliable reference for selecting the best energy-saving plan.

6.2. Bidding Stage

The contract conditions are an important component of the bidding documents. Therefore, in order to effectively control the construction cost, it is necessary to sign a formal contract with legal effect, which further stipulates the settlement methods, technical changes, and contract terms involved in the contract to reduce potential disputes in the future. At the same time, the contract also clearly states that in order to achieve the goal of refinement, strict regulations must be made on the relevant elements of the project dispute resolution plan, and it must be effectively simplified and executed to make the project dispute resolution plan more comprehensive and avoid increasing financial costs.

6.3. Cost Management During the Design Stage

In the daily work of engineering planning cost and financial management, to achieve the basic standards of green and energy-saving building design, it is necessary to clarify the labor cost table prepared by relevant cost personnel and calculate the project cost appropriately, in order to meet the basic requirements of engineering project cost in engineering planning. Similarly, the concept of full life cycle cost management can also be introduced into architectural design, and traditional engineering

operation modes can be transformed to become natural energy in green and energy-saving buildings. The full process management of construction projects mainly includes: One is to conduct bidding management for the project: for bidding companies, they should combine architectural design, cost control, and the characteristics of green and low-carbon building projects, always adhere to the principles of fairness and impartiality in cost project construction, ensure the smooth progress of green and energy-saving buildings, and optimize architectural design and engineering cost control.^[5] Secondly, in construction supervision, it is necessary to be aware of the reasons why building losses cannot be changed, in order to ensure the rationality of design and construction. By selecting building elements, environmental elements, and resources reasonably, the damage of buildings to the environment can be reduced.

6.4. Cost Management During the Construction Stage

In green and energy-saving building projects, the construction cycle is relatively long. There are many links involved in engineering construction, which can easily cause waste. Therefore, the importance of engineering cost management in engineering construction cannot be neglected. The content of construction project cost management mainly includes two parts:

One is to supervise the construction process of construction projects. Managers and technical personnel should have a comprehensive understanding of the project, establish a grid chart of project progress, and clearly explain the various processes and overall project progress to ensure that the project can be completed on schedule.

The second is cost management during the project construction process. There are many connections between construction enterprises, and the cost waste of construction enterprises is also very serious. Management personnel are responsible for controlling the use of materials and allocating them. When there are insufficient building materials, an application must be made.

7. Suggestions for Cost Control of Green Building Projects

7.1. Full Life Cycle

In the construction stage of green and energy-saving buildings, project cost management should be an indispensable part of the entire construction process, and must be carried out by suitable staff under the guidance of life cycle thinking. In the early stages of engineering construction, cost management is used to assist in the formulation and approval of engineering planning schemes, make scientific predictions of the initial cost of the project, provide an important foundation for engineering decision-making, and help investors make rational investments. After the project is approved, full life cycle cost management is carried out, aiming to strengthen the coordination between design and cost through more scientific cost information, and promote the continuous improvement of engineering design and construction. Minimize the impact of technological changes on cost composition and ensure that technical design can proceed as planned. After the completion of the project, the cost management department shall conduct a comprehensive review of all investments during the construction process and assist in completing relevant work such as completion acceptance. In short, in the construction process of green and energy-saving buildings, the concept of full life cycle can be used as a support to continuously strengthen the connection between cost management work and various links, which has played a positive role in improving the quality of cost management work and providing better services for the development of green building construction.^[6]

7.2. Emphasis on Comprehensiveness

In the entire process of green and energy-saving building construction, cost management should be integrated, and resources in each construction stage should be reasonably allocated and comprehensively controlled. In the preparation, construction, and completion stages of the project, scientific analysis of the project cost should be carried out, striving to achieve global and closing stage control. On the premise of ensuring comprehensiveness, construction units can know which process and process can reduce material input, save resources, improve energy efficiency in engineering construction, and promote the harmonious development of the construction industry and the ecological environment while ensuring the quality of building construction.

7.3. Strengthening the Control of Cost Management During the Implementation Stage

Firstly, it is necessary to mobilize the work enthusiasm of construction workers, establish a “green”, “standardized”, “economic”, and “efficient” architectural ideology, create an environment that satisfies all workers, and enable them to participate in project cost management, thereby saving manpower and resources to a greater extent. Secondly, it is necessary to improve the professional quality of relevant personnel: As a new type of construction project, green and energy-saving buildings should fully utilize advanced construction technology to ensure construction quality during their construction process. Therefore, it is necessary to strengthen the training of engineering cost management personnel to enable more scientific and rapid analysis and control of engineering costs. Finally, in the procurement of green building materials, it is necessary to establish specialized personnel in the procurement process, strengthen cost management, and fundamentally promote the construction of green and energy-saving buildings.

7.4. Utilizing Modern Technology to Assist in Innovative Development of Engineering Cost Management

Construction enterprises must rely on modern technological means to innovate project cost management models in order to systematically improve the effectiveness of cost management. For example, construction enterprises can use Building Information Modeling (BIM) technology to construct virtual building information models, and fully utilize the virtualization features of BIM technology to showcase the overall structure of green buildings from multiple perspectives, thus pointing the way for innovation in engineering cost management models. In addition, construction enterprises should also make appropriate use of information technologies such as ERP (Enterprise Resource Planning), cloud computing, and big data to establish an information-based engineering cost management system, adhere to the basic concepts of green environmental protection, low-carbon energy conservation, and promote the timely transmission of engineering cost information. On this basis, it is necessary to strengthen business collaboration between enterprises, strengthen information sharing between enterprises, and provide a good environment for enterprises to carry out technical cost management.

8. Conclusion

In summary, in modern society, green and energy-saving buildings is the development direction of architecture. When conducting cost management for such buildings, it is necessary to have a full understanding of their current situation, conduct in-depth analysis of their causes, adopt appropriate cost management strategies and footholds, and adopt more scientific and practical cost management methods to ensure that such buildings can generate greater economic benefits, integrate the concept of green and energy-saving development, and significantly improve environmental benefits.

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