Advances in Economics, Business and Management Research, volume 68
International Symposium on Social Science and Management Innovation (SSMI 2018)

Cost Management of Power Engineering Projects based on BIM Life Cycle

Lu Liu [1,*], Liang Shang [2]

[1]Economic Research Institute of State Grid Xinjiang Power Co. Ltd, Urumqi, China;

[2]Construction Branch of State Grid Xinjiang Power Co. Ltd. (Supervision Company), Urumqi, China.

* 609864051@qq.com

Abstract. The whole life cycle cost management of power engineering refers to the enterprise considering the problem from the perspective of cost and cost, and scientifically controlling and controlling the project investment funds. The whole cycle of the project is characterized by a wide range of management and control, and a large time span. Due to the fact that the power engineering has a progress forecast and the cost management is not scientific enough, the system is poor, and the accuracy is low, there is a deviation between the cost management and the various progress control nodes. For this reason, the BIM technology is applied, and the cost simulation is carried out. Demonstrate the feasibility of the construction organization plan and calculate the quantity of the project to show the relationship between the cost and the progress more intuitively and clearly. On this basis, a more scientific, accurate and effective life cycle cost management of power engineering is realized.

Keywords: BIM; Full life cycle; Power engineering; Cost management; Engineering quantity calculation.

1. Introduction

The good realization of power engineering management is determined by three major factors: cost, cost and quality, and balancing the relationship between the three is particularly important. In recent years, with the increasing competition in the domestic power engineering construction market, enterprises have paid more and more attention to cost management. How to reduce costs and improve project efficiency has become a problem that every practitioner needs to consider. Under this background, domestic projects carry out projects with cost management as the focus of "fixed pricing". Under the form of major changes in the industry operation market, the life cycle cost management is also affected, and it is difficult to bring out its own advantages. There are many problems in the cost management of various engineering projects [1]. Even so, the advanced methods and practical significance of this management method have gradually been recognized by power engineering project managers. In this context, it is extremely necessary to actively study the theory of life cycle management and apply it more rationally and efficiently to power engineering cost management.

With the development of computer technology and the popularization of information technology, we can combine it with the power engineering industry to realize the informational of power engineering industry, that is, power engineering information management (BIM). BIM technology makes power engineering products change from two dimensions. In 3D, all participants of the project can also directly observe the construction progress through BIM technology, find unreasonable factors in advance, timely communicate and solve, achieve optimality before construction, and reduce costs.

2. Overview of Related Theory

2.1 Full Life Cycle

Although the academic community has begun to widely use the concept of "full life cycle cost management", the academic community has not given an authoritative and unified definition [2]. By reading and combing the existing literature, it is found that the current academic circles have the following the concept of life cycle cost management:

Life cycle cost management is a tool for mathematically analyzing investment projects.

The life cycle engineering cost management is a means to provide a good design method for power engineering designers. It can calculate the cost of each link in the project through professional channels.

The whole life cycle engineering cost management is a management theory that considers the cost and cost of the project and reduces the total price.

The first two concepts are expressed from the perspective of decision-making and design in the life cycle engineering cost management. They are sufficiently rational, emphasizing the importance of project decision-making and design. The final expression focuses on the cost and the whole life cycle. The connection of cost, that the minimum cost in the entire life cycle is the core element of cost management. We believe that the third concept is more in line with our research strategy, so we use this expression to define the life cycle engineering cost management.

2.2 BIM Technology

BIM technology, also known as power engineering information model, is mainly used in power engineering. It can build power engineering models based on different data and information, and then build information on power engineering through digital information simulation systems. It can also present the engineering construction situation and resource utilization of different power engineering stages, and has certain reference value.

The power engineering industry has always had problems such as loss of information and unclear expression, and the degree of informatization is relatively lower than other industries. The reasons for the inefficiency of the engineering construction industry are many, but if the research has achieved a significant increase in production efficiency in the fields of retail, automotive, electronics and aviation, we find that the overall improvement of the industry and the upgrading of the industry can only come from the application of advanced production processes and technologies. With the widespread application of computer technology in various fields, and the traditional power engineering industry urgently needs to change, the power engineering information model BIM came into being. The BIM concept draws on the manufacturing product model definition (PMD), which is an information model that contains product composition, functionality, and behavioral data that describes the product throughout its lifecycle [3]. BIM is such a technology, method, system and opportunity to provide timely, different stages and different participants in the construction project life cycle by integrating project information collection, management, exchange, update, storage process and project business process. Accurate and sufficient information to support information exchange and sharing between different project phases, between different project participants and between different application software, to achieve project design, construction, operation, maintenance efficiency and quality improvement, and engineering construction the industry continues to increase productivity in the industry. In some developed countries, due to the early research and development of BIM technology, the application has been carried out early, and has already been ahead of China, and verified the application potential of BIM technology. From the application field, BIM technology has been applied in the design stage, construction stage and post-construction maintenance and management stage of power engineering, and the corresponding application software has gradually matured.

3. Application Process of BIM Technology in the Whole Process of Project Cost Management

According to the construction project construction process, the whole process of project cost management includes decision-making, design, bidding, construction and completion acceptance. The whole process of building a project using BIM to carry out the construction process cost management structure is shown in Figure 1.

3.1 Decision Stage

As the initial stage of the whole process of construction, the project proposal and the feasibility study are mainly carried out. In the initial stage, various economic and technological decisions will have a major impact on the overall cost, directly determining the level of project cost. Model data based on BIM can be calculated and calculated, and the number and price of required components can be accurately and quickly calculated. Under the condition of BIM database data sharing, the database is used to query the engineering model with high similarity to the project, and the historical model is used for investment estimation. Moreover, the information update function of BIM technology can be used, so that we can more quickly grasp the market material information, calculate the required material cost more accurately, and lay the foundation for the accuracy of investment estimation.

3.2 Engineering Design Stage

The engineering design stage is an important stage affecting the construction cost management, so it is necessary to pay attention to the value of this stage. First of all, it is necessary to ensure the rationality of the engineering design. If the engineering design is unreasonable, it will lead to deviations in the cost management. Therefore, only when the pre-engineering design has certain rationality, can the cost management objectives be realized. Secondly, it is necessary to use BIM technology, select the characteristics of the project, and use precise calculation to calculate the specific project cost. Finally, the existing design needs to be optimized and adjusted.

3.3 Engineering Construction Stage

In the formal construction of the project, it is necessary to use BIM technology to integrate different professions and simulate the real construction process. Then the test should be carried out. The main purpose is to find out the problems existing in the construction as early as possible, and take effective measures before the problems occur to avoid the problems in this part affecting the construction quality and progress.

3.4 Completion Acceptance Stage

Through the BIM to control the cost control of the construction project investment decision, preparation and implementation stage, the BIM model has a very rich amount of information, which can accurately display the actual workload of the completed project [4]. The accuracy and comprehensiveness of the BIM model information provides reliable information data for the completion of the final accounts, which improves the efficiency of the final accounts, and the cost of the completion and acceptance phase is effectively saved. At the same time, from the point of view of the completion of the construction project, BIM can multi-dimensionally compare, analyze and count the data of the completed projects of the construction project, analyze the construction investment benefits from the perspective of the overall project, and establish relevant databases within the enterprise. To provide effective reference data for subsequent similar construction projects.

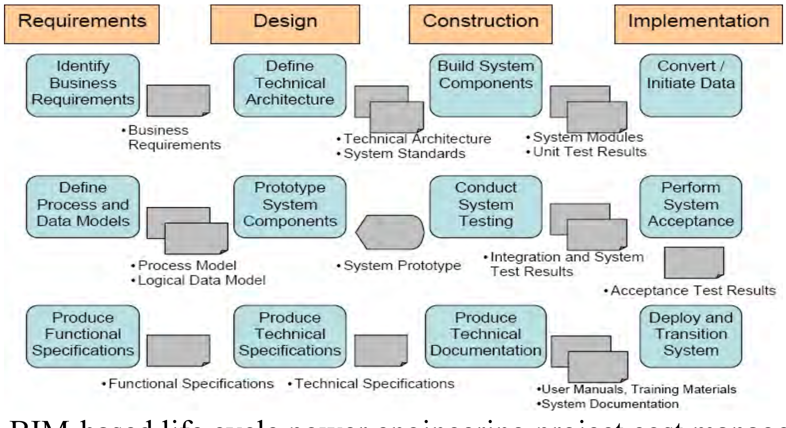

Fig.1 BIM-based life cycle power engineering project cost management

4. Case Analysis

In this paper, a 35kv substation is a typical substation power engineering type, with a power engineering area of more than 700 m2 and a height of 9. 6m, including main transformer power engineering and subsidiary parts: pump house, accident oil pool, fire pool and so on [5]. Our team tried to use the substation model to achieve the purpose of estimating the engineering quantity statistics, compare it with the 2013 version of the new electric power quota measurement rules, find out the difference between Revit embedded measurement rules and electric power measurement rules, find solutions, and software. The company cooperates to import the output results into the pricing software, and finally realize the pricing.

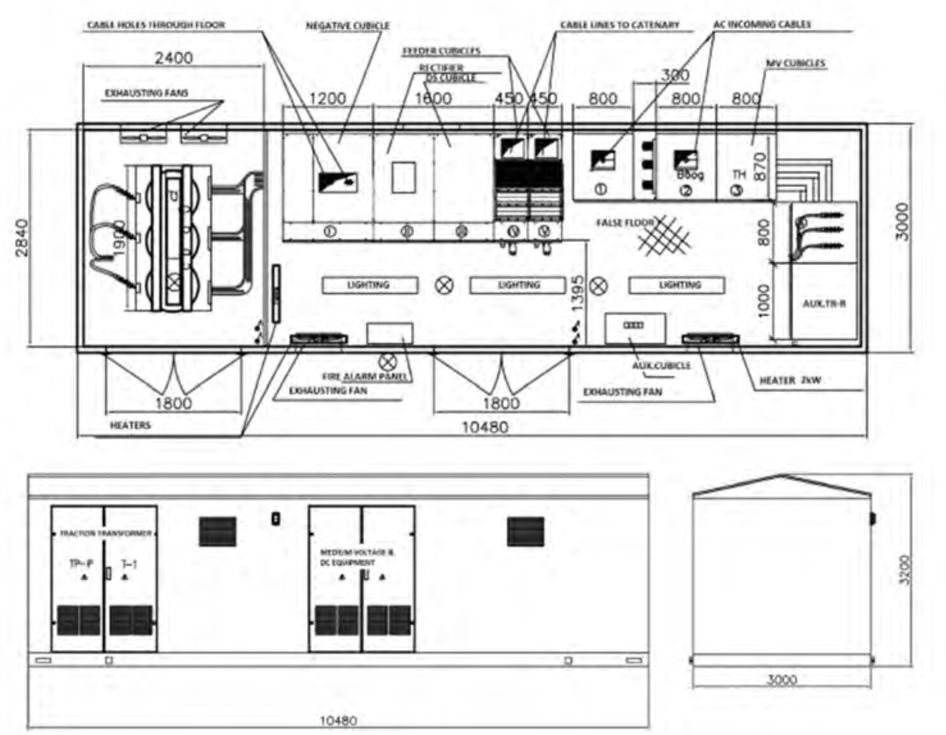

Fig.2 One floor plan of the substation

4.1 Informational Family Library and Its Engineering Quantity

The measurement of electrical equipment is mainly in units of numbers, such as switch cabinets, insulators, fittings, transformers, etc., but such as busbars are not counted in units, the quota sub-division is judged according to the cross-sectional area, we need to create the busbar When choosing a family, choose the appropriate method and embed the required amount of engineering. In this project, based on the total length of the busbar, the total length of the busbar can be calculated by setting parameters for the distance of the adaptive point.

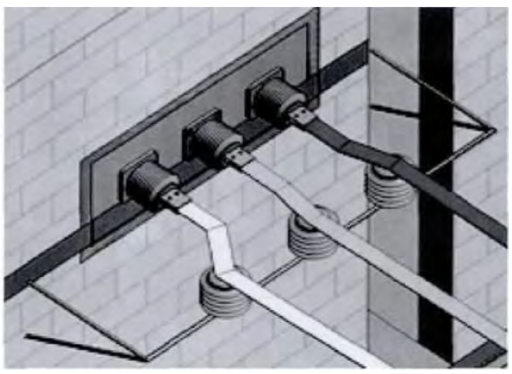

Fig.3 Bus wiring

Tab. 1 Busbar Usage Table

Family	Types of	Total length of busbar (m)	A	B	C	D
Ribbon copper busbar (4 segments)	Cross-sectional area 1000	3.096	321	350	1317	1109
Ribbon copper busbar (4 segments)	Cross-sectional area 1000	2.997	335	359	1338	1105
Ribbon copper busbar (4 segments)	Cross-sectional area 1000	3.035	337	298	1325	1124
Ribbon copper busbar (4 segments)	Cross-sectional area 1000	2.998	335	305	1347	1135
Ribbon copper busbar (4 segments)	Cross-sectional area 1000	3.059	325	309	1357	1099
Ribbon copper busbar (4 segments)	Cross-sectional area 1000	3.088	321	321	1347	1098

4.2 Wall and its Engineering Quantity

According to the 2013 new power budget quota requirements, when calculating the 35kv substation engineering quantity, the power engineering object wall should meet the following measurement rules when calculating the engineering quantity: the wall length is calculated according to the power engineering axis dimension length, when there is a daughter wall, The height of the wall is the elevation of the base beam to the height of the top of the parapet; when there is no parapet, the height of the wall is the elevation of the base beam to the bottom of the frame beam. This requires that the starting point of the wall should be based on the power engineering axis when modeling, and the top elevation of the wall should be set at the bottom of the beam [6]. If there is a daughter wall, the wall elevation will be offset to the height of the daughter wall. In the hole deduction of the wall, the Revit software calculation rule is consistent with the electric power quota requirement. It should be noted that when constructing the structural column and the ring beam and the lintel in the wall, it should be modeled in the same way as the door and window, and the structure will be constructed. The columns are embedded in the wall without the need to separate the components in the wall. This is also a basic requirement for general modeling.

Tab. 2 Wall Error Analysis Table

Quota	Model output	Hand calculation	error	Modified quantity	Cause Analysis
Hollow brick exterior wall	161. 18	167. 59	3. 8%	166. 78	In the 14th edition of the quota, reinforced brick lintels, ventilation ducts, and openings of less than 1 m2 are not deducted.
Hollow brick wall	75. 02	93. 56	19. 8%	93. 56	In the 14th edition quota, the reinforced brick lintel, the power engineering column part and the structural column are not deducted, so the inner wall volume on the model will be smaller than the quota.

4.3 Floor and its Engineering Quantity

According to the requirements of the 2013 version of the power construction project budget calculation, the floor is calculated according to the area according to the area, and the area is calculated according to the power engineering axis size of the floor slab laying site, without deducting the area occupied by stairwells, openings, equipment foundations, etc. However, in the Revit inline measurement rule, the floor is measured as the model area, and all the holes on the board will be deducted. This will inevitably lead to the difference between the model output and the 2013 version of the electricity quota measurement rule. To solve this problem, the author uses the room. The tool divides the room according to the power engineering axis network, and the room area is counted. The room area is the corresponding floor area. As long as the axis network is established accurately, the model output is consistent with the hand calculation amount.

5. Conclusion

Along with the intelligent process of the power industry, the informational of power engineering cost will also usher in a wave of rapid development. The future development of informational will be based on solving existing problems and upcoming problems, and BIM information technology. The emergence of the problem has solved the current problems of power engineering cost. At the same time, the emergence of new technologies such as cloud computing and big data can solve the problem of massive data storage, call and analysis generated by engineering cost management based on BIM technology. The future of power engineering cost informational will certainly develop along with the development of BIM technology. At the same time, cloud computing and big data will accelerate the BIM process of power engineering cost information.

References

[1]. Xu Yan. Application and Promotion of BIM Technology in Power Engineering Cost. Vol.9 (2015) No.28, p. 148-151.

[2]. Lu Fengxia, Zhang Bing. Research on Power Engineering Cost Management Based on BIM Technology. Jiangxi Building Materials, Vol.9 (2017) No.24, p.242-243.

[3]. Ye Wei. Discussion on the Application and Promotion of BIM Technology in Power Engineering Cost. Engineering Technology: Citation, Vol.1 (2017) No.5, p.212-215.

[4]. Ji Wenjuan, Peng Zhengbin, Wang Xiaozhong. Value Analysis of BIM-Based Construction Project Life Cycle Engineering. Fujian Electric Power Engineering, Vol.5 (2014) No.15, p.16-17.

[5]. Chen Nan, Xu Zhao, Li Qiming. Research on Environmental Impact Assessment and Decision Analysis Method of Engineering Projects with BIM. Journal of Engineering Management, Vol.2 (2016) No.30, p.97-102.

[6]. Zhang Yanlin, Tang Jie. Application of BIM Technology in Construction Management of Small and Medium-sized Projects. Read the world, Vol.19 (2016) No.11, p.192-193.