

# Research on Safety Quality Credit Evaluation System of Power Construction Enterprises

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**Abstract:** In accordance with the guidelines for the construction of the national credit system and the demand for construction safety management in the power industry, this paper explores the establishment of a safety evaluation credit evaluation system for electric power construction enterprises by applying the credit evaluation index system and the evaluation criteria as the core, so as to lay the cornerstone to ensure quantitative output credit scores and qualitative output credit ratings. To that end, the paper further proposes the application scheme of safety quality credit evaluation system in terms of organizational security, application mechanism and management control measures, thereby contributing to the improvement of Safety quality management level for electric construction enterprises.

## 1. Introduction

In recent years, we have witnessed great progress made in regard to the safety quality management of China's power industry, with established policies and optimized regulations in various fields. The prevention capabilities of safety quality accident in power engineering have also been significantly improved. In spite of the greatly enhanced supervision and prevention, there still exists a structural gap between the main regulatory resources and the scale of engineering development. In addition, objective conditions, such as team building in the development of engineering enterprises, should be cemented further. Given that personal injury and death accidents during power construction have not been completely eliminated, power grid accidents and equipment accidents can occur from time to time.

Since the 18th National Congress of the Communist Party of China, the Party Central Committee and the State Council have been attaching great importance to the construction of a sound social credit system, in the hope of continuously improving credit laws and regulations. It serves to establish a diversified market credit supervision system and promotes the credit level of the whole society, thusly protecting and contributing the healthy development of China's market economy. In 2014, the State Council issued the Social Credit System Construction and Planning Framework (2014-2020), which clarifies the safety production credit announcement system, and improved the safety production commitment. It advocates that bad credit record of safe production and the disciplinary system for safe production and dishonesty should not be held accountable. The credit system at national level has put



forward higher requirements for power safety management, which by all means brings about great challenges for the safety supervision system of power construction.

Under such circumstance, the power industry began to introduce the actual integration of safety production credit management concepts and implement power safety management, so as to explore effective ways to promote power safety management.

## **2. Deficiencies in safety quality management of electric power construction enterprises**

### *2.1 Safety production of electric power construction enterprises*

The power industry is closely related to national economy and people's livelihood. The central government always holds safety production high, emphasizing that safety is the "lifeline" of electricity and regarding safety as the groundwork.

*2.1.1 New challenges in safety production.* In recent years, with the transformation of China's urban construction methods, power safety production is in the middle of dealing with new challenges in its development. For instance, in Beijing, the capital of China, the large-scale electric energy replacement construction and the key power supporting projects in urban core area, urban sub-center, winter Olympics, and new airport economic zone have greatly increased the overall construction burden of the power company within a short period of time. The risk of safety production has given rise to a multi-faceted situation, increasing the difficulty of control over operation safety, construction quality and safety risks.

*2.1.2 Significantly increased management complexity.* Power production is a huge systematic engineering which involves numerous sectors, organizations and companies. Most of the power engineering construction and on-site operation tasks involve outsourcing enterprises, including hundreds of various types of power outsourcing construction enterprises. Therefore, the management is becoming more complicated than ever before.

### *2.2 Deficiencies in safety quality management of electric power construction enterprises*

From the perspective of the management of power companies in terms of safety quality construction, there are still some deficiencies should be fixed.

*2.2.1 Management system needs to be improved.* The existing management system mainly focuses on its related responsibilities, and processes. It mainly involves the requirements of the company's internal safety quality management. The system of safety quality management for outsourcing enterprises is far from mature, since there is no effective means to evaluate the safety capability of outsourcing construction enterprises.

*2.2.2 The control effect needs to be improved.* The implementation of the existing control is mainly based on the construction qualification of the outsourcing enterprise, as well as the supervision of their construction sites. However, when it comes to promoting the active safety awareness of the outsourcing enterprise, the current control effect is not satisfactory. Specifically, some punitive measures cannot exert a notable impact on the outsourcing enterprises, owing to its constrained control pressure transmission.

*2.2.3 Insufficient coordination of safety quality management.* Generally, the safety management and quality management of construction enterprises are carried out separately, yet the inherent attributes of safety quality management are consistent. The current mode of separate control is fundamentally flawed, and therefore is not conducive to optimizing management resources and effects.

### 3. Construction of safety quality credit evaluation system for electric power construction enterprises

#### 3.1 Model of safety quality credit evaluation system for electric power construction enterprises

In order to solve the tricky problems in regard to the safety quality management of electric power construction enterprises and to implement the concept and requirements of the national credit system, this study proposes to establish a new safety quality credit evaluation system for power construction enterprise, making safety management pre-engineering, dynamic and integrated, so as to raise the intrinsic safety management level of the power industry to the utmost.

Given the inherent attributes of the evaluation model dynamics and the inherent requirements of practical application, this study constructs the core content and application mode of the safety quality credit system of the electric construction enterprise from the perspective of the design and the application of the safety quality credit evaluation system (Figure 1). Specifically, the system design consists of four parts, including evaluation plan, credit index, evaluation standard and rating standard. Meanwhile, the system application consists of three parts, including organizational guarantee, application mechanism and control measures.

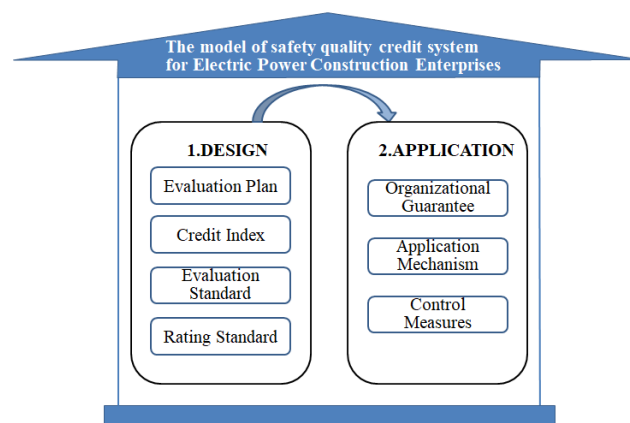


Figure 1. The model of safety quality credit system for electric power construction enterprises

#### 3.2 Safety quality credit evaluation system

**3.2.1 Evaluation plan.** (1) Classification of information. The safety quality credit information of power construction companies can be mainly divided into two categories: Basic information and bad information. The former involves the qualifications of enterprise safety production administrative licenses, including the related changes, continuations, cancellations and other information. The latter covers the violations and construction quality problems which are found during safety inspection and technical supervision. Security incidents can implicate individual, equipment and information, whereas construction quality incidents are normally caused by staff responsibilities, or some other acts that violate the law and cause great adverse social impact. (2) Evaluation algorithm. The safety quality credit evaluation adopts the “integration mechanism of positive and negative information”. After the normal and negative information has been normalized and converted, the credit evaluation results are accumulated based on their respective weights. Specifically, the credit evaluation can be calculated according to the following formula:

- Safety Quality Credit Rating Score =  $\sum(a_i * X_i)$
- Where:  $a_i$  is the evaluation weight of the positive and negative information
- $X_i$  refers to the evaluation score of the positive and negative information.
- The positive and negative information is normalized using the percentage system. The weighted cumulative credit evaluation score ranges from 0 to 100 points.

**3.2.2 Indicator system.** In order to reflect the safety quality credit status of power construction enterprises, the system builds an indicator system consisting of two aspects, including credit capacity and credit behavior. A veto indicator is set, and the evaluation indicator tree is shown in Figure 2.

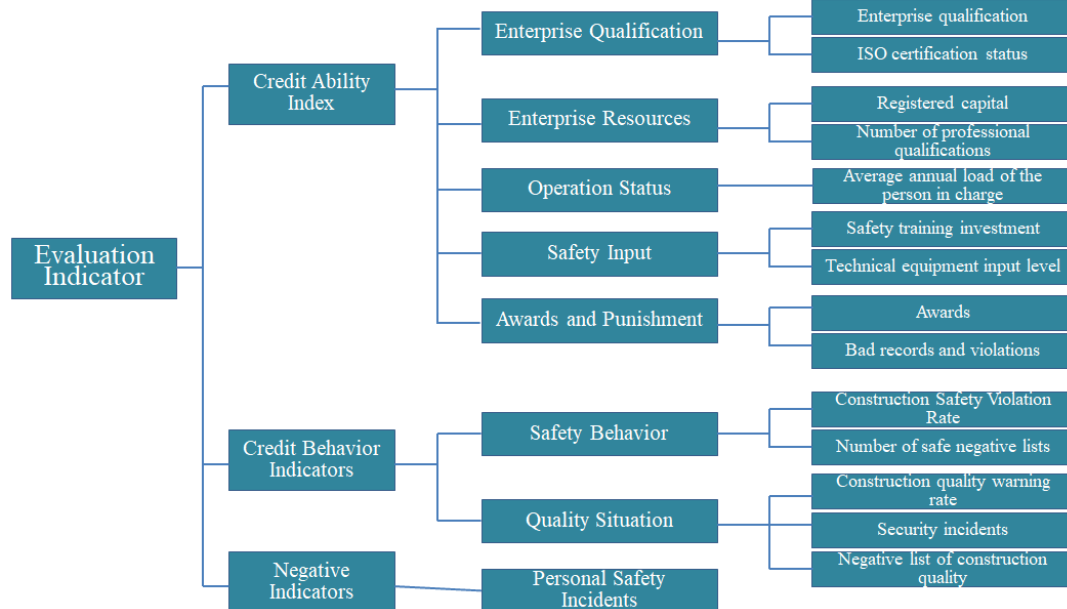


Figure 2. Safety quality credit evaluation indicator tree of construction enterprises

**3.2.3 Evaluation standard.** Based on the above indicators, the evaluation standards are given for the safety quality credit evaluation indicators after normalization (Table 1):

Table 1. Safety quality credit evaluation index of electric power construction enterprise

Number	Primary index	Secondary index	Level 3 index	Rating criteria (The scores of each sub-index are 100 points)
1	<b>Credit ability index</b>	Enterprise qualification	Enterprise qualification	The first-class qualification is 100 points; the second-level qualification is 80 points; The third-level qualification is 60 points; non-qualification is 0 points.
2			ISO certification status	100 points for completed certification; 0 points for not completed certification
3		Enterprise resources	Registered capital	60 million and above: 100 points 30 million (inclusive) - 60 million: 80 points; 20 million (inclusive) - 30 million: 60 points; 10 million (inclusive) - 20 million: 40 points; 10 million or less: 20 points
4			Number of professional qualifications	90 and above: 100 points; 60 (including) - 90: 80 points; 40 (including) - 60: 60 points; 20 to 40: 40 points; 20 and below: 20 points
5		Operation status	Average annual load of the person in charge	The average annual load of the person in charge of work is not more than 6 people/years: full marks.

				For each additional person/year, 20 points will be deducted.
6		Safety input	Safety training investment	According to the per capita safety training input calculation: 1000 yuan and above: 100 points; 300 yuan (inclusive) - 1000 people: 60 points; Below 300 yuan: 20 points.
7			Technical equipment input level	Calculated according to per capita technical equipment input: 2500 yuan and above: 100 points; 600 yuan (including) - 2500 people: 60 points; Below 600 yuan: 20 points.
8		Awards and punishment	Awards	100 points for national quality awards; 80 points for provincial quality awards; 60 points for the city-level quality awards; 40 points for district and county-level quality awards; 20 points for other awards; 0 points for no awards.
9			Bad records and violations	No bad records and violations scored 100 points; One time, the State Grid's safety quality related notifications deducted 30 points; A deduction of 20 points related to safety quality related notices of relevant government departments occurred; A media safety-related notification will be deducted for 10 points, with a minimum of 0 points.
10	<b>Credit Behavior Indicators</b>	Safety Behavior	Construction Safety Violation Rate	The construction safety violation rate is 0, then 100 points; for every 0.1 percentage point increase, 1 point is deducted, and the deduction will not be completed until point 0.
11			Number of safe negative lists	100 points for not included in the safety negative list; 50 points deduction for each additional one.
12		Quality situation	Construction quality warning rate	The construction quality warning rate is 0, then 100 points; for every 0.05 percentage points increase, 1 point is deducted, and the deduction will not be completed until point 0.
13			Number of power grids, equipment, and information security incidents	No occurrence of power grid, equipment, and information security incidents due to construction quality reasons, then 100 points; The eight-level power grid, equipment, and information security incidents due to construction quality will be deducted 50 points each time; 0 points for power grid, equipment and information security incidents of Level 7 and above due to construction quality.

14			Negative list of construction quality	Not included in the negative list of construction quality, then 100 points; 50 points are deducted for each additional increase.
15	<b>Negative indicators</b>	Personal safety incidents	Personal safety incidents	In case of personal safety incidents, corporate safety assessment will be scored with 0 point.

**3.2.4 Rating standard.** This system divides the safety quality credit rating of electric power construction enterprises into four grades, each of which was attached to the credit score:

- Level one: 90-100
- Level two: 70-90
- Level three: 60-70
- Level four: less than 60

Correspondingly, the enterprises belonging to Level one are “excellent”, those belonging to Level two are rated as “normal”, Level three indicates “noted” enterprises, and Level four is used to describe those of the “focused” state.

### 3.3 The application of safety quality credit evaluation system

**3.3.1 Organizational guarantee.** To ensure the progress of safety quality credit evaluation, power enterprises need to establish an organizational guarantee system (Figure 3) to clarify their respective responsibilities. To be more specific, the Leader of Safety Production is responsible for reviewing the regulations and the evaluation results of safety quality credit evaluation. The Safety Quality Department is responsible for the centralized management of safety quality credit evaluation, credit information collection and system entry of power construction enterprises. The Department of Transportation Inspection is responsible for the collection of construction quality information and the application of safety credit evaluation results. The Materials Department is responsible for holding “interviews” and issuing “bans” measures based on the results of safety quality credit evaluation. They are expected to provide prompt feedback to the company's safety quality credit evaluation leadership. Electric Power Research Institute is responsible for centralizing the collection and the input of basic information, reviewing and analyzing safety quality information. Contracting Companies are in charge of the collection and system entry of the basic information of business expansion projects, and the application of the safety quality credit evaluation results within the scope of business expansion projects.



Figure 3. Safety quality credit evaluation organization

**3.3.2 Application mechanism.** (1) Clear information collection mechanism. The collection of credit information is the foundation for conducting credit evaluation. Therefore, it is necessary to establish a normal and standardized information collection mechanism to ensure timely, effective and accurate acquisition of credit information. (2) Safety quality credit rating and release mechanism. In view of the principle of “monthly statistics and quarterly release”, the safety quality information is calculated on a monthly basis, while the safety quality credit rating should be assessed quarterly. After the company’s safety quality information assessment leading group has been viewed, the assessment report will be issued.

*3.3.3 Control measures.* Different management measures are in place and taking effect for enterprises of varying conditions:

(1) For “excellent” enterprises, we might add points in the process of bid evaluation to appropriately increase the probability of contracting projects of such enterprises, thereby cementing a positive guidance and incentive mechanism for each power construction enterprise to pursue excellence.

(2) For “normal” enterprises, the safety production management personnel of the on-site contracted project must present at the scene, and the company's two-level inspection should be fully inspected.

(3) For “noted” enterprises, a “ban” measure remains effective for 12 months. Specifically, they are not allowed to contract the production, operation and management of various projects, and may be discouraged from participating in construction in any subcontracting form.

(4) For “focused” enterprises, a “ban” measure will remain effective for three years. Specifically, they are not allowed to contract the production, operation management of various projects, and may not be allowed to participate in construction in any subcontracting form.

## 4. Conclusion

### 4.1 Research conclusions

By establishing and implementing a safety evaluation credit evaluation model for electric power construction enterprises, this study aims to develop a quantifiable credit scoring scheme based on an integrated and dynamic index system, and to further form a hierarchical management system through credit rating standards. The implementation of follow-up management is of great practical significance to the application of the power industry.

The innovation in this research is that the credit evaluation system covers two types of indicators, including credit ability and credit behavior. We take the indicator points as the core program for evaluation. As a result, in evaluating enterprises, the principle of “attaching equal importance to ability and behavior, safety quality, quantity and fairness, rating excellent and inferiority”, so as to effectively implement the credit evaluation system. Meanwhile, this study puts forward the management plan of organizational security and application mechanism, and further proposes the management and control measures based on the hierarchical management, providing more in-depth references to related domain.

### 4.2 Future research

Credit evaluation is a multi-cooperative and continuously-improved system engineering. This research has achieved preliminary exploration results in practice, yet some shortcomings in the application of the evaluation system should be addressed. In future studies, it is necessary to expand the application scope of the evaluation system, and further deepen the evaluation indicators and evaluation plans in accordance with policy requirements regarding to the national credit system construction, thereby fortifying the correlation for the coordinated and comprehensive development of the industry in the new era.

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