

Construction And Application of Investment Execution Analysis Index System for Distribution Network Infrastructure Projects

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Abstract. With the slowdown of external economic growth, more stringent review of investment execution, and in-depth promotion and implementation of transmission and distribution price reform, the implementation of lean management of state grid investment has been accelerated. The improvement of lean management level of 10kV projects, which account for more than half of the investment in power grid infrastructure, plays a greater role in promoting the overall investment efficiency of power grid. The lean management of power grid investment emphasizes "scientific decision making before investment - precise implementation in the event - scientific evaluation after the event". From the perspective of investment lean management - strengthening the precise implementation in the matter, this paper takes the power grid infrastructure projects of 10kV and below as the research object, through combing the management key points and relevant management requirements of key nodes in the whole process, from the aspects of compliance, rationality and effectiveness of investment execution, this paper sorts out and determines the investment execution analysis indicators and evaluation rules, which provides the basis for the next step of investment execution index scenario application, and also provides support for comprehensively improving the lean management level of investment in 10kV and below power grid infrastructure projects.

1. Research background and objectives

The growth momentum of external economic situation is slowing down, the transmission and distribution price approval and the policies of the first round of cost supervision are becoming more and more strict, which requires the power grid to improve investment efficiency and efficiency through internal management, and the accuracy and effectiveness of grid investment execution. However, at present, the investment process management of 10 kV and below power grid infrastructure projects is not standardized, the whole chain link is blocked, and the lack of quantitative index tools for investment execution analysis, it is unable to timely locate and early warn the abnormal investment execution process, and it is difficult to make timely feedback on the problems, which hinders the process of lean management of project investment. Therefore, it is urgent to sort out the investment management process of 10kV and below power grid infrastructure projects, grasp the risk



and management requirements of its key nodes, and construct the investment execution analysis index and evaluation rules of 10kV and below power grid infrastructure projects, so as to provide tools for timely positioning, analysis and rectification of distribution network project investment execution,,it also provides an application basis for further deepening the role of evaluation results of investment execution indicators in the lean investment management of distribution network.

2. Construction of investment execution analysis index system for 10 kV and below power grid infrastructure projects

Combined with the key business contents and relevant management requirements of investment management milestone nodes of 10kV and below power grid infrastructure projects, from the aspects of compliance, rationality and effectiveness of investment execution to sort out the analysis indicators and evaluation rules of investment execution, so as to provide the basis for multi scenario application of distribution network investment execution.

2.1. Construction framework of investment execution process analysis index system

The construction of executive analysis indicators takes the key links of investment execution process as the main line, takes the management requirements, relevant systems and business management experience of various professional departments as the basis, and focuses on the analysis and evaluation of investment execution risks and efficient problem-solving as the goal, and determines the construction framework of investment execution process analysis indicators. The specific construction framework is as follows:

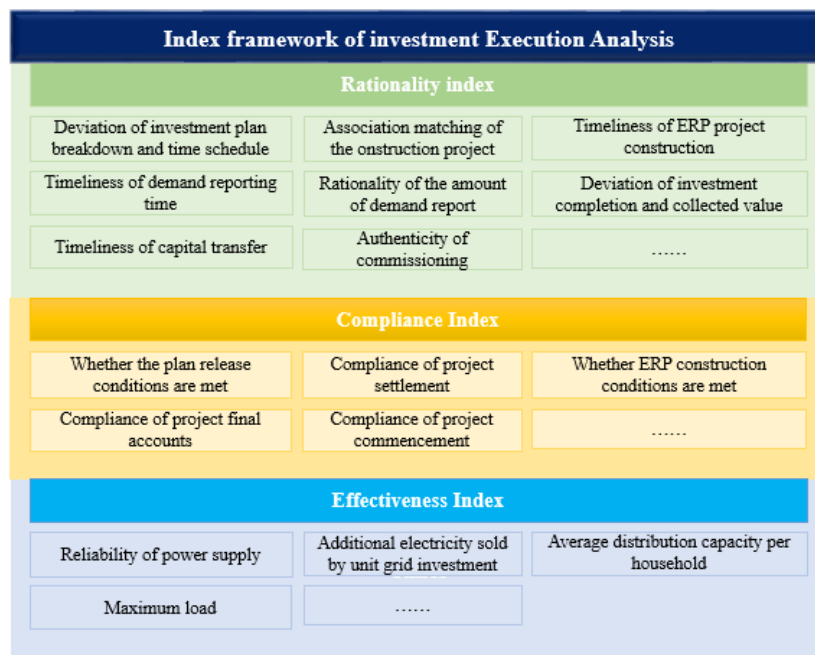


Figure 1. Index framework of investment Execution Analysis

2.2. Calculation method and evaluation rules of investment execution analysis index

According to the index framework, the calculation methods and rules of key indicators are analyzed as follows:

2.2.1. Compliance index of investment execution

There are standard management systems or documents for the relevant professional management involved in the implementation management of distribution network investment. Compliance index will be set according to the business contents with national policy provisions or clear system standards

of the power grid company in the process of investment implementation. The key indexes are as follows:

(1) Whether the plan release conditions are met

According to the relevant documents of distribution network management, Before the project is included in the annual investment plan, the feasibility study review shall be completed. Therefore, the index of whether the project released by the plan meets the conditions is introduced, which is a judgment index. The specific judgment rules are as follows: check whether the project to which the investment plan is issued has the review opinion of feasibility study. If not, it will be judged as non-compliance.

(2) Whether the ERP items are in compliance

The condition of project construction in ERP is that the investment plan is issued and the investment budget has been released. Therefore, this paper introduces the index of compliance of ERP construction project, which is a judgment index. The specific judgment rules are as follows: if there is no investment plan or budget for the project built in ERP, it will be judged that the project is not in conformity, otherwise it will be regarded as compliance.

(3) Whether the commencement of the project in compliance

The relevant management measures of distribution network point out that a commencement report must be submitted for the commencement of distribution network projects. Therefore, the index of compliance of project commencement is introduced, which is a judgment index. The specific judgment rules are as follows: If there is no commencement report for the project reported to be started, it will be judged that the commencement procedure is not in conformity.

(4) Whether the project settlement time compliant

The distribution network management method has clear provisions on the settlement time of the project: after the project is completed and put into operation, the construction project department shall prepare the project settlement statement within 10 working days, and submit the completion data to the owner's project department. The owner's project department shall review the completion materials within 2 working days and submit them to relevant departments, the relevant departments shall complete the price review and issue the price review report within 10 working days. The construction unit shall issue settlement invoice within 3 working days; the owner's project department shall complete the price review and cost settlement within 2 months.

In order to reflect the compliance of project settlement time, the index of compliance of project settlement time is introduced. According to the provisions of the above-mentioned documents, the judgment standard of project settlement time compliance is refined: the completion settlement should be completed within 3 months after the commissioning, if the specified time is exceeded, the project settlement time is not in conformity.

(5) Whether the final settlement time of the project is in compliance

According to the distribution network management measures, the final accounts shall be prepared and submitted within 3 months after the project is completed and put into operation, the approval shall be completed within 30 days, the formal transfer of capital shall be completed within 30 days after the approval of the final accounts, and the account adjustment shall be carried out within 30 days.

In order to reflect the compliance of project final settlement time, the index of whether the final settlement time is in compliance is introduced. According to the provisions of the documents, the judgment standard for the compliance of the final account time of the project is refined. the final account of the project should be completed within 6 months after the actual production. If the time exceeds the specified time, the final account time of the project is not in conformity.

2.2.2. Rationality index of investment execution

This paper introduces investment execution rationality index from the perspective of reasonable business execution of distribution network project, considering the comparison between actual and planned business index and cross checking between business index.

(1) Deviation of investment plan breakdown and time schedule

According to the management requirements of the power grid infrastructure project for investment "half the time, half the task". the investment plan decomposition and time schedule deviation are introduced, that is, the difference between investment plan decomposition rate and time schedule is compared based on the time schedule. The specific judgment rule is that if the decomposition rate of investment plan is less than the current time schedule, the decomposition rate of current investment plan is judged to be slow, and different evaluations are made according to the degree of lag time progress. At the same time, it can analyze and forecast the annual investment completion of the units whose investment plans are slow to decompose in the evaluation results, so as to support the adjustment of investment plans.

(2) Rationality of the amount of investment plan

The investment plan is based on the feasibility study estimate (preliminary estimate), and the investment plan issued by it can not break through the feasibility study estimate (preliminary estimate), except for the feasibility study change according to the change process. Therefore, the following rules will be introduced to reflect the rationality of the amount issued by the investment plan. Unless there is a change in the feasibility study, the amount issued by the investment plan should be less than or equal to the feasibility study estimate (preliminary estimate). If the amount is exceeded, the amount issued by the investment plan is unreasonable.

(3) Rate of project initiation

New projects enter the construction management stage after ERP Construction and are managed in PMS system. Therefore, to judge whether the ERP construction projects are maintained in PMS in a timely manner can analyze the start-up situation of the projects issued by the investment plan. Therefore, the rate of project initiation is introduced, that is, the items have been built in ERP and maintained in PMS in the list of projects issued by the investment plan.

$$Q = F / D$$

Q, rate of project initiation.

F, the number of investment plans of the projects that have been broken down and issued, which have been built in PMS and ERP.

D, the annual large-scale number of 10kV projects.

(4) Rationality of reporting investment completion

Compare the investment completion with the value of investment collection (automatically generate the investment completion according to the project progress), and measure the rationality and accuracy of reporting investment completion.

Calculation method of investment collection value:

Pre construction stage T_0 : since the investment statistics period of distribution network infrastructure project starts from the commencement of the project, the investment amount of fixed assets of distribution network is not calculated before the construction, and the formula is as follows:

$$\text{The stage of } T_0: FAI_0 = 0$$

FAI_0 , the investment amount of fixed assets before construction.

The period from the month of commencement to the month before the month of commissioning T_{1-n-1} : from the month of commencement to the month before the month of production, the investment completion amount of fixed assets is calculated according to the net amount of materials received after tax reduction and the accumulated recorded cost of services. The formula is as follows:

$$\text{The stage of } T_{1-n-1}: FAI_{1-n-1} = (Pa - Ra) * (1 + Tm) / (1 - 20\%) + Sc * (1 + Ts) / (1 + 20\%)$$

FAI_{1-n-1} , the investment amount of fixed assets from the month of commencement to the month before the month of production.

Pa, the total amount of materials received.

Ra, the total amount of material returned.

TM, the comprehensive value-added tax rate of materials, which is currently calculated at 13%.

SC, the accumulated recorded cost of service construction since its inception.

TS, the comprehensive value-added tax rate of services, which is temporarily calculated at 6%.

20%, balance rate.

The total amount of materials received, the total amount of returned materials and the accumulated recorded cost of service construction since the beginning are all taken from the ERP system.

Month of commissioning T_n : The investment amount of the month in which the project is put into operation is calculated according to the difference between the approved estimated amount of the project and the accumulated amount of completed investment. The formula is as follows:

Time point of T_n : $F AI_n = \text{Approved Estimate} - \sum F AI_{1-n-1}$

Note: The project start time is taken from the actual start time of the planning and planning system project, and the project start time is taken from the actual start time of the planning and system project.

(5) Accuracy of the time of operation

The commissioning time of the project is the end point of the investment submission, and its accuracy will have a great impact on the accuracy of the completion of the investment. Therefore, considering the data verification of the planning and planning system and the PMS system, the actual commissioning time of the reported actual production project is compared with the commissioning time of the PMS(ERP) equipment account to judge the authenticity and accuracy of the project. The judgment rule of indicators is that if the absolute value of deviation between the actual commissioning time and the commissioning time of PMS equipment account is less than 3 months, then the judgment of its commissioning time is accurate and true.

2.2.3. Investment effectiveness indicators

With the continuous advancement of the reform of transmission and distribution electricity price, the effectiveness of investment execution is required. Therefore, based on the analysis of the execution process of investment, from the perspective of index system integrity, the index of effectiveness of investment execution of distribution network project is considered. From the perspectives of investment efficiency, equipment level, power supply quality and capacity are considered to construct the effective investment execution. It also reflects the effect of investment execution.

(1) Additional sales per unit of grid investment

In order to reflect the efficiency of new investment, the index of additional sales per unit of grid investment is introduced. the formula is as follows:

$$A = (P - S) / E$$

A, the additional sales per unit of grid investment.

P, the power supply of substation one year after commissioning.

S, the substation power supply in the year before construction.

E, estimated investment of Substation.

(2) Average distribution transformer capacity per household

In order to reflect the level of new investment equipment, the index of average distribution transformer capacity per household is introduced. the formula is as follows:

$$AD = CO / LV$$

AD, average distribution transformer capacity per household.

CO, the capacity of distribution transformer.

LV, the low voltage users.

Note: It is suitable for the layer of equipment and unit.

(3) Reliability of power supply

In order to reflect the power supply quality of new investment, the reliability index of power supply is introduced, it can be obtained directly.

(4) Maximum load

In order to reflect the power supply capacity of new investment, the index of maximum load is introduced, it can be obtained directly.

3. Application scenarios

On the basis of the above construction index, calculation and evaluation principles, and taking into full account the actual situation of investment business, the following application scenarios are constructed:

(1) *The pre-warning model of investment execution process is constructed to support the early warning of investment execution of project.*

Taking the key links of investment execution process as the main line, the pre-warning rules of investment execution are formed on the basis of its discrimination rules. The pre-warning model of major risks in the process of investment implementation is constructed with the project as the basic unit, so as to timely issue instructions for the possible problems in investment implementation, and urge relevant professionals to solve them in time, so as to ensure the investment is implemented as scheduled.

(2) *The evaluation model of investment execution process is constructed to support the closed-loop management of project investment execution.*

Using the index system of investment execution analysis and its evaluation rules to realize the automatic measurement of indicators; according to the importance of indicators, set the index weight, build the evaluation model of investment execution process to realize the overall evaluation of the project; at the same time, according to the management attribute of the unit, the investment execution evaluation model of the unit is constructed to support the investment process management of the unit.

Based on the evaluation of the project level, combined with the nature of construction, voltage level and other multi-dimensional attributes, this paper summarizes the law of investment execution, and provides practical basis for the improvement of follow-up investment execution management and early warning rules, and promotes the closed-loop of investment management.

4. Conclusion

This project takes 10kV and below power grid infrastructure projects as the research object, through carding the key business contents of investment execution, combing and determining the investment execution analysis indicators and evaluation rules from the aspects of compliance, rationality and effectiveness of investment execution, so as to support the design of multi business scenarios. In particular, it provides support means for the construction of evaluation model of investment execution analysis, timely and accurate positioning of abnormal project problems, improvement of rectification and feedback efficiency, acceleration of benefit transformation of project investment, and overall improvement of lean management of distribution network investment.

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