Research on Collaboration between Electric Material Procurement Lead-time and Transmission and Transformation Project Milestone Schedule

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Abstract. For electricity material management, the mismatch between transmission and transformation project material procurement requirements management and the project milestone schedule always leads to the mistiming response of material procurement and supply. Through learning the materials requirements in each process of different voltage project milestone schedule point, analyzing the material procurement lead-time, the company will establish the synergy mechanism to improve the material management active service for grid project, to enhance the timely supply and its supporting capabilities.

Introduction

State Grid Shanghai Municipal Electric Power Company has an important social responsibility of providing international metropolis with safe and reliable power, protecting power grid security and serving for economic and social development. To build strong grid and ensure the power grid running safely, material management shoulders mission and responsibility as important as power production and construction department does. However, along with the fast development of different voltage of power grid construction, tasks get harder and construction cycle becomes compressed. Also, the higher requests of grid construction are for the material supporting capabilities, the more importance the material management is.

In order to make material procurement-supply more accurate and response timelier, continuous connections must be urgently established between material procurement-supply and construction schedule, which can effectively resolve the contradiction between demands-submitting and materials procurement-supply lead-time during construction period.

As a major one of electric power enterprise’s infrastructure projects, transmission and transformation project faces higher request of schedule as well as stronger plan. Relatively, accuracy of demand is higher and plays an important role in managing synergy of procurement lead-time and project schedule.

Analysis on Electric Materials Procurement Lead-time and Milestones of the Project

Composition and Distribution of Electric Materials Procurement Lead-time

Electric materials procurement lead-time is composed of all links from materials demand application to its arrival. It can be divided into internal and external part. The internal part refers to the total processing time from application of procurement to purchase order creation. Each way of materials procurement is different in time, so the corresponding internal lead-time is also different. The external part refers to the total processing time the supplier deliver the materials to the demand side after receiving the procurement contracts or purchase orders. As the procurement-supply modes and materials types changing, the external lead-time changes.

Procurement lead-time distribution is different according to the way of purchasing and
The lead-time of main equipment like power transformer is about 3-6 months. For the secondary equipment it’s about 70-80 days, and for cable materials it’s about 40-50 days.

![Material Procurement Lead-time Diagram]

Figure 1. The Structure of Electric Material Procurement Lead-time.

**Stages of Transmission and Transformation Project Milestones and the Distribution of Demands**

The first stage is examination and approval stage of the project. It includes the feasibility assessment and approval, the project approval, the preliminary design assessment and approval, etc. The uncertainty of this stage’s lasting time is relatively huge due to the affection of various objective factors.

The second stage is the pre-project stage, namely the preparing period. Dealing with relevant documents and approvals is the major work in this stage, such as environmental protection approval, land use planning license, construction license, etc. In general, the duration of this stage is about 2 or 3 months.

The third stage is the civil construction, namely the infrastructure works which includes buildings, foundation, structures and so on. Different projects are slightly different in construction period. For 35 kV project, it’s 11-13 months. For 110 kV project, it’s usually 13-16 months. For 220 kV and 500 kV project, it’s around 12 months.

The fourth stage is the construction stage, including electric installation engineering, overhead line engineering and the underground pipe engineering. Electric installation engineering usually refers to installation and testing of main equipment such as transformers, switches, communication equipment, etc. In general, the electric installation duration of 35kV and 110kV projects is 2-3 months. For 220kV and 500kV projects, it’s about 6 months. Overhead wire engineering usually refers to the set of tower line, also contains its infrastructure, such as tower foundation, vertical steel bar, etc. The underground pipe engineering usually refers to the installation conditions for engineering work well infrastructure construction, pipe measurement, laying cable in later period. The time of overhead wire and underground pipe engineering is uncertain, generally based on the progress of the electrical installation engineering, in order to makes the final node consistent with the electrical installation node.

**Collaborative application scheme of electric materials procurement lead-time and project milestones plan**

**Materials Demand Report Mechanism Based on Collaboration of Procurement Lead-time and Project Milestones Plan**

**Different Delivery Time Requirement of Typical Materials in Power Transmission Project**
(1) Main materials like the primary and secondary equipment, electrical appliances, communications equipment, are mostly requested to reach the construction site within half a month before the electrical installation. In 35kV and 110kV new power transmission project, the requested delivery time of transformers, switchgears, combined electrical appliances and communications equipment are relatively concentrated, usually within a week before the start of electrical installation. Other equipment, such as reactors, capacitors, transformers are required to arrive at the 2nd week. In 220kV and 500kV new power transmission and transformation project, as the electrical installation period is longer, the equipment delivery time is a little loose, generally within three months before the electrical installation.

(2) Delivery time of enter-wire line materials, cement poles, steel pipes and other equipment need to be determined according to the actual construction situation. Enter-wire line materials mainly refer to the cable and cable accessories. For those materials, the delivery time should be eventually determined according to the underground pipe construction situation. Infrastructure construction should be carried out before the installation of cement poles and steel pipes, therefore, the delivery time will be affected by the infrastructure construction progress.

Demand Management Mechanism of Typical Materials in Power Transmission and Transformation Project

Through numbers of investigation and research, the delivery time of each kind of materials has been determined in power transmission and transformation project of different voltage levels, which provide data support and guarantee for deriving reasonable demand report period. Based on the requirements of delivery time, material requirements for power transmission and transformation project submission model is optimized and mechanism is solidified. Through the research and analysis of material submission, the demand submission time of the material requirements is more normative to make the procurement supply under control and match the needs of the engineering construction. On the other hand, optimizing the procurement supply strategy makes the supply and demand coordinate seamless.

(1) Primary and secondary equipment, communication equipment, etc are relatively fixed in point of time at different stages, their report time of the materials demand are relatively clear. As the demand information of materials above are basically clear in the feasibility study stage, the arrival time is relatively fixed and procurement-supply period is relatively stable, report time of this kind of materials can be reported as planned in the whole project schedule, and is able to ensure the supply meets the construction schedule.

(2) Materials like cable and cable accessories are influenced by uncertainties on construction site such as underground pipe, so setting up a demand information updating mechanism is particularly important. The demand side should continuously update materials demand information in order to ensure the accurate information transfer between supply and demand.

Supplier Capacity Coordination Mechanism Construction Based on Cooperation of Materials Lead-time and Project Milestones Point

Strengthening Associated Suppliers Collaborative Reserve Capacity

For switchgears, protection devices, intelligent boxes, the equipment manufacturers and key components manufacturers are different, requiring parts alignment during production, coordinated duties of key components manufacturers supply problems are unclear, once the key components are not delivered in time, the subsequent performance of coordinative communication between manufacturers is difficult, will bring risk for timely supply. In the tender and contract stage, specify coordinative requirements of manufacturers and key components manufacturer production, reserves and supply, implement performance coordination responsibilities between the manufacturers as well. According to the bidding and contract conditions, promote the implementation tracking feedback closed-loop system of suppliers’ collaborative and joint reserves.
Improve Concentrated Demand Forecasting and Coordination Capacity

According to the laws of the project implementation, establish materials demand forecasting collaborative mechanism with investment department and engineering department. Forecasting materials demand concentration condition in advance, to coordinate supplier’s productivity ahead under circumstances.

Active Warning Mechanism of Power Transmission and Transformation Project Demand Report

To promote the coordination between materials procurement-supply and project construction progress, effectively solve the process contradiction between supplies and engineering materials demand, engineering materials purchasing lead-time and demand report forewarning are established, on basis of present situation research analysis.

(1) Depending on process maps of different projects, the procurement supply can check delivery time requirements, build collaborative relationship between materials demand and materials purchasing plan under the project milestones plan point, and actively follow up the main equipment requirements and performance.

(2) To promoting effective coordination of procurement-supply and construction progress, materials demand plan and purchasing batch plan synergy results need to be put into the system, the best materials demand report time need to be formed, the demand report early warning system need to be established, and the mechanism of advance warning need to be set up.

Summary

Through carrying out collaborative research and application of materials procurement-supply lead-time and project milestone schedule, putting forward controllable demand report time under the requirements of construction progress, combined with reasonable lead-time, the following effects can be achieved.

(1) Promote the interoperability of procurement supply and construction progress, effectively solve the problems between demand report and material procurement and supply cycle.
(2) Improve the efficiency of demand report works; provide reasonable demand report time for demanders to ensure supplies to meet project schedule needs.
(3) Effectively verify the reasonableness of materials procurement lead-time, optimized material procurement lead-time according to the demand of materials, provide material security for construction projects.
(4) Promote effective collaboration of procurement supply and construction progress, material
demand report is closely related to information system, comprehensive early warning system will highly enhance the quality of service provisioning.

(5) Match the materials requirements of electric construction, operation and maintenance. Enhancing the awareness of initiative service and establishing agile distribution, to provide protection for the safe operation of Grid.

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