

SECURING SUSTAINABLE ASSET MANAGEMENT BY LIFE CYCLE INITIATIVES

Letian TENG

Shanghai Municipal Electric Power Company Shanghai Municipal Electric Power Company Shanghai Municipal Electric Power Company
tenglt@sh.sgcc.com.cn

Wanrong XU

xuwr@sh.sgcc.com.cn

Wei XIE

xiew@sh.sgcc.com.cn

ABSTRACT

Abstract: A flat growth of economy is foreseeable after a period of high growth path, which will make the Grid Companies earn less and get fewer profits. However the clients' requirement on reliability and power quality remains high. In order to balance the investment and asset performance effectively in such a stressful environment, Shanghai Municipal Electric Power Company (SMEPC) had carried out a series of initiatives under the guidance of Life Cycle Asset Management (LCAM). SMEPC established an asset-focused, end-to-end management system which contains close interaction between asset strategy and business processes and powerful supporting IT system and asset data. Major technology and management practice covers 7 aspects including Asset Strategy and Performance Evaluation, Asset Planning and Investment Planning, Bidding and Procurement, Construction, Operation and Maintenance, Disposal, and related IT systems for supporting these processes. What mentioned above helps Shanghai Power better managed its huge asset base to achieve the sustainable development goal—balancing safety, efficiency, reliability and cost requirements.

1. Background

A flat growth of economy is foreseeable after a period of high growth path, which will also make the grid companies' revenue and profit growth enter into a low-speed, flat development path accordingly. However, the clients' requirement on reliability and power quality remains high. In the meanwhile, high capital investment due to rapid economy growth will inevitably cause a centralize reform for the life of assets invested over the same period and therefore may lead serious challenges to the follow-up funding and reliability.

On the other hand, Shanghai Municipal Electric Power Company's (SMEPC) original asset management method has the problem of department-focused and lack of information transparency. Each stage pursuits lowest cost of its own without a long-term consideration, which often leads difficulty to achieve the integrated optimum performance of assets. With the rapid development of cities, SMEPC is facing problems such as high asset reconstruction and decommission quantity, high net asset value of disposal assets, and slow capitalization speed of completed projects. Therefore, adopting the Life Cycle Asset Management (LCAM) working system is also the

need of SMEPC. In order to effectively balance the investment and performance to cope with the increasing internal and external pressure, State Grid Corporation of China (i.e. parent company of SMEPC) has made an overall strategic plan of LCAM since 2008 as the key tasks to achieve development of the company to a new level of strategic initiatives. SMEPC in accordance with the unified arrangements of State Grid Corporation of China, take LCAM method and scientific concept of development as guidance, conducted a series of highly effective initiatives, established a LCAM system which is able to adapt sustainable development and satisfy the goal of 'one strong three excellent' (i.e. strong grid, high quality assets, quality service, performance excellence).

2. Establish a LCAM Working System

Under the guidance of LCAM concept, SMEPC uses the existing asset management system as a breaking point, conducted a series of highly effective initiatives. SMEPC has formed an asset focused, various stages management close-loop working system, thus to achieve the interaction between asset strategy and each stage business, established a comprehensive integrated IT system support and data protection. Related technology and management experience includes asset strategy and performance evaluation, planning, procurement and bidding, construction, operation and maintenance, decommissioning and disposal, as well as the IT system construction for supporting these processes loop-closed linkage.

2.1 Asset Strategy and Performance Evaluation

In the asset strategy and performance evaluation aspect, SMEPC adopted a comprehensive systematic of diagnose and perfect design, set up a LCAM working system, relevant strategy and scientific integrity LCAM evaluation KPI system, computational model to conduct a comprehensive and integrated evaluation for the asset management performance. To unify the whole company's understanding of the LCAM concept and direction, SMEPC established a LCAM framework and related strategies. Through monitoring multi-KPI (Key Performance Index), analyzing bottlenecks, making decision and analyzing business supported by relevant IT systems (data warehouse, etc.), continuous improvement were made.

2.2 Initiatives for Asset Planning and Investment Planning

Planning stage includes asset planning, investment planning and project development.

In the asset planning aspect, in order to improve the economic evaluation standard of power system planning, SMEPC processed a research on LCAM concept integrated with the power system planning method, established a power system planning IT system, By coordination of different areas planning, full voltage level of integrated planning and adopting multi-objective optimization and visualization tools, power system planning can be achieved under unified consideration and overall optimization.

In the investment planning aspect, in order to improve the current circumstance of plan implementation difficult to be timely and comprehensive monitored, a sound investment optimization system is established, a investment management committee is set up, and the cross-section and whole process coordination and supervision is achieved. SMEPC established a scientific and reasonable allocation of total investment as well as a project prioritization method, which had already been applied in 2010 during the preparation phase of annual investment plan.

In the project development phase, in order to enhance the economic evaluation and optimize the investment of projects, SMEPC conducts capital project evaluation based on economic value analysis during feasibility study phase. This evaluation method conducts quantitative estimation of overall benefit in the view of project's whole life cycle by comparing the LCC (Life Cycle Cost, including initial investment, O&M expense and disposal cost) and the overall profit (converted into present value). This initiative optimized project design and extended economy evaluation cycle. Secondly, during project evaluation of replacement projects, SMEPC took full account of both technological and economic factors, by utilizing LCC calculation method, developed a quantitative data model to support the decision of which measures should be taken to minimize the LCC. This method had been widely used in the decision process of equipment replacement.

2.3 Initiatives for Asset Bidding and Procurement

In the bidding and procurement aspect, SMEPC's bidding operation is based on the LCAM concept. The company take full advantage of the existing experience and data of equipment testing, and required suppliers to provide both technical and economic data in bidding documents and procurement contracts. Especially during the electrical equipment bidding for important occasions, equipments

with high availability and reliability, low LCC would be consider first according to LCC calculation result. SMEPC had developed the computational model for main equipments, such as cable, transformer, GIS, switchgear and circuit breaker. Through the introduction of LCC evaluation, framework procurement and other important measures, effectively increased procurement efficiency and reduced procurement cost. To avoid the problem of minimum purchase price may cause high LCC, SMEPC had implemented a LCC evaluation pilot for the EXPO Substation (a 500kV substation) since 2005 and achieved a good result.

2.4 Initiatives for Construction

In the construction aspect, SMEPC introduced the idea of life-cycle since the beginning of project design phase, to conduct auxiliary design for the substation. By optimizing the layout mode, cable connection mode, equipment selection and the combination of different type equipments' life cycle, the LCC of project can be effectively reduced.

In the project implementation phase, to avoid the problem of hard to grasp and monitor project process details, SMEPC had established and implemented an integrated project management IT system. By using the system to continuously monitor progresses, qualities and expenditures, refined management for key nodes of a project, SMEPC effectively ensured project progress to comply with the plan requirement, enabled the whole investment plan matched with actual investments. In addition, SMEPC applied continues improvement to optimize the cost of construction phase. Especially for the specific categories projects with great cost reducing potential, SMEPC had revised the standard cost according to the actual accounting situation, set up a security mechanism to ensure the project progress matching with payment, and implemented project waste material management. Supplemented with WBS (Work Breakdown Structure) in the ERP system, SMEPC had successfully controlled the construction cost.

In the operation of capital investment business, in order to solve the persistent problem of untimely capitalization, SMEPC keeps optimizing the process of project commission and capitalization. Through the introduction of a project completion acceptance check list, use PMS(Production Management System) actual operational equipment amount as the capitalization amount, ensured the consistence between book value, equipment records and physical equipments, thus to enhance the linkage management between two systems(PMS and ERP) and three module(PMS, ERP-AM and ERP-PM), strengthened automatic capital transfer and guaranteed operational equipments transfer to fixed assets accurately

and on time.

2.5 Initiatives for Asset Operation and Maintenance

In the operation and maintenance aspect, SMEPC had already rolled out a condition-based maintenance method extensively. In order to monitor equipments' condition effectively, SMEPC strengthened the collection of equipments' condition information as well as the standardization of work (such as establish a database of standard defects and roll out standardized work, etc.). On this basis, SMEPC established a PMS-based evaluation supporting system which integrated the PMS Mobile Working Management, Operation Management, Power Distribution Management, Fault and Emergency Repair Management module and supplier evaluation system. As a result, equipments' basic information, defect/fault records, repair and test reports, operation records could be shared, to generate evaluation result automatically. The whole evaluation process doesn't need any manual intervention, which saves the time for evaluation staff significantly. This initiative achieved real-time evaluation of equipments' condition, supported the decision-making of equipment repair cycle and strategy and provided an effective basis for condition-based maintenance.

In order to improve cost management, SMEPC took advantage of powerful IT systems to support the overhaul project management process. The system could generate projects based on the inspection and repair cycle set by the equipment condition evaluation result in the PMS system. By using workflow function, the project will then be approved. The approved projects would be put into the integrated plan module of PMS, this module would automatically balance all the replacement projects, construction projects and overhaul projects with the monthly planned outage time. Additionally, SMEPC had adopted a standard cost for equipment repair. After the system generated overhaul task for single equipment based on monthly plan, there will be a corresponding ERP work order generated automatically through data interface. When the repair task is completed after acceptance, the expense will be automatically charged, thus to form an end-to-end work process. Through the integration between work order, finance management and material management modules, the information of workforce, finance and material could be well managed, thus to realized the matching of cost and single equipment.

2.6 Initiatives for Asset Disposal

In decommission and disposal aspect, SMEPC used to have the problems of high newness rate of assets to be disposed, insufficient disposal budget and large quantity of reusable assets. To solve these problems, SMEPC has

been continuously improving the asset disposal process, established disposal pre-approval and planning regulation which created a link between project sanction and asset disposal application, and applied this management initiative in IT system.

Regarding to the considerable amount of reusable assets within the decommissioned assets, SMEPC had established a decommission asset reuse platform which integrated the information of decommissioned reusable assets of each sub-companies in this unified IT system. Sub-companies could select assets from this system when doing project feasibility design. This initiative unified the management and allocation of whole company's decommissioned reusable assets which improved the usage rate of these assets.

In the waste material disposal aspect, SMEPC had conducted a unified method for waste material disposal. By selling waste and old equipments through a bidding process, SMEPC achieved the benefits of reclaim fund maximization. In the recent three years, by centralized bidding and disposing the assets, SMEPC had reclaimed more than 300 million Yuan of residual value. By designing and deploying waste materials on-site disposal method, bidding process and related IT platform, SMEPC could acquire the asset disposal information directly from system data, and realized asset analysis and evaluation. Through all these initiatives, the company achieved an end-to-end management of asset disposal, maximized the reclaim of asset residual value and reduced the transportation and warehouse cost for decommissioned assets.

2.7 Initiatives for IT Systems

To support the LCAM critical businesses, SMEPC had conducted a diagnostic analysis for existing IT systems compared with LCAM requirements, which found out the opportunity of system functional optimization and data integration. On the basis of existing IT platform, SMEPC realized the integration between key businesses, and improved system function and the data interaction between different systems. Thus, SMEPC achieved the monitor, matching and integration of the asset / project focused LCAM information flow. The LCAM IT platform provides technique information and asset management information (including performance information) of six business phases: From Asset Strategy and Performance Evaluation, Asset Planning and Investment Planning, Bidding and Procurement, Construction, Operation and Maintenance to Disposal. This IT platform provides a strong support to the end-to-end and loop-closed process management.

3. Benefits of LCAM Initiatives

The construction of LCAM is a very important strategic initiative to achieve the company's development to a new level, it has a significant guidance and obvious promote effect to the asset management level upgrade of SMEPC. Relevant outcomes successfully promoted SMEPC's various departments and Sub-companies asset management concept and enhanced the management standard magnificently.

Through the construction and implementation of the LCAM system, SMPEC had raised a series of strategic initiatives which reflected the LCAM concept in the asset strategy aspect. SMPEC conducted a comprehensive and appropriate supplement to the business process related to the key asset management in the business process aspect, and transferred the LCAM concept into operable routine tasks. Also, a multi-department committee is founded to promote the LCAM tasks, fully mobilized and integrated internal resources to comprehensively promote the related work. The company raised IT systems LCAM information integration in order to achieve asset and project life-cycle information loop-closed management and laid the foundation for asset management information fully shared across departments.

In the economic effect aspect, through the implementation of the LCAM system, SMEPC had optimized asset investment, reduced LCC, and ensured assets' health performance and maintained a high level of reliability. Specifically, via the optimization technique standard based on the LCAM concept, company's average annual revenue and expenditure cuts counted for 546 million Yuan and a total of 1.64 billion Yuan from 2007 to 2009. Material procurement cycles were reduced more than 50%, procurement prices were cut down by an average of 8% or more and an annual saving of 480 million Yuan was realized. The company refined the management for cable waste material and saved investment over 90 million Yuan. SMPEC also reduced 20% of electricity channel cost, saved investment of 298.2 million Yuan.

Per unit of assets (initial value) repair cost is decreased by 0.34 %, under the same condition, the annual repair cost saved 54.56 million Yuan. By transferring into accident spare according to accident spare, an investment of 51.44 million Yuan on accident spare was avoided. Via the waste materials disposal bidding, SMEPC reclaimed residual value of 318 million Yuan since 2007 to 2009, per unit asset (initial value) residual recovery rate increased from 5.18% (2006) to 12.46% (average rate from 2007 to 2009), residual value increased by 18.6 million Yuan. Through the implementation of LCC bidding, the company can save 2.03 million Yuan for 110kV cable a year (Taken the cable with a length of 150km (three-phase) for measurement) and 30.6 million Yuan in the life-cycle. SMEPC made full utilize of the external environment mechanism and policies, conscientiously implement the tariff adjustment policies and tax policies, achieved fixed asset value-added tax deductible 1.49 billion Yuan in the whole year which led to an optimization space for about 1.5 billion Yuan in investment.

Through the induction of LCAM concept and the implementation of relevant management system, SMEPC achieved the conversion from functional management to process management, further strengthened management efficiency, which suits company's development objective. SMEPC's overall LCAM practice has a remarkable positive impact to improve its own operation performance.

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