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Modernization projects in the power industry: performance evaluation

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Abstract

The potential of industrial development of regions of the Russian Federation depends on the territory infrastructure condition. One of the key barriers to regional economic growth is now the depreciation of fixed assets of the grid companies, characterized by a significant loss of power during its transmission. Lack of tools, that would take into account all the external and internal parameters when evaluating the power modernization projects, does not allow to form a strategic vector of development of grid companies. The authors investigated the present methodological approaches to the evaluation of the power equipment modernization projects, foreign companies' approaches to the plant assets management. Based on the analysis, a list of the key requirements and the effects of modernization, which should be considered when evaluating projects, was defined. Evaluation of the proposed effects allows to take the most appropriate decision as to implementing the technical influences on the equipment in terms of the technical, economic and system-wide performance.

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Keywords: power equipment modernization project; RAB-regulation; asset management; EAM-system; RCM-concept; cost of ownership

1. Introduction

Electrical power industry is a strategic sector for the Russian Federation, the operation of which is directly related to the level of industrial development. The state economy modernization policy, designated in 2010 in the message of the President of the Russian Federation to the Federal Assembly and keeping the spread rates in all sectors of the economy, should include the advanced trend - the modernization of the electric power sector.

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One of the most important entities of the power industry for the modernization of developed and depressed areas is electric grid organization. This fact is due to the lack of a sovereign generation in some regions, the need for a mobile and reliable system of electricity transmission to the major consumer centers to ensure capacity, characterized by a significant loss of power during transmission over long distances.

Decision-making about the repair, reconstruction, or other types of technical effects, improving performance for tactical purposes do not allow to generate an impulse for sustainable strategic development. This development largely depends on the ability to make an accurate and balanced decision, especially on the choice of technical measures and evaluation. The complexity of such an evaluation is usually associated with the absence of the required set of methodological tools, linking the set of external and internal parameters, at the enterprises.

2. Analysis of evaluation techniques for grid company modernization projects

Currently the country's grid companies along with other industry participants use the methodological tools presented in the order of the Ministry of Energy of the Russian Federation of March 24, 2010 N 114 "On Approval of the investment programs of electric power engineering entities, the authorized capital of which includes the state's share, and grid companies". This tool is the simplest and when evaluating the effectiveness of technical influences on the equipment does not include a number of factors specific to the industry: industrial risks, long duration of investment projects, system-wide effects to assess the combined effectiveness of the project implementation.

A special method of evaluation and implementation of investment projects is a RAB-regulation. Regulatory Asset Base is a long-term tariff system, whose main aim is to attract investment for expansion and modernization of infrastructure. This method allows to increase the accuracy of the project performance evaluation compared to the previously discussed tools due to the provision of additional effects on the electric grid modernization that is presented in Table 1. The method does not take into account the high dependence on production risks of the electric grid companies and is primarily a way to evaluate the tariff rather than the project. It is important to note that RAB is not applicable for most companies due to the significant limitations: long term investment projects (35 years), strict requirements for the investment program for the regional grid companies.

The leading foreign electric power companies (General Electric, AEP (American Electric), Duke Energy, Champion Energy Services) consider the performance evaluation of the equipment modernization projects as part of the asset management methodology. Evolution of production assets management approaches allows to distinguish the features, advantages and disadvantages of both asset management system and its component - the planning and performance evaluation of projects of equipment replacement or modernization.

The most common industry approach is the renewal of production assets when the equipment reached the limit condition or the preventative maintenance. The significant disadvantage of this approach is the high cost of production during the equipment operation according to the normative period, emerging due to obsolete production technology, the high cost of equipment repairs and long downtimes, a significant share of waste or loss of enterprise resources in the production process, the lack of focus on the strategic goals. This factor, coupled with low quality products, generates a significant amount of lost profits and loss of market share. The use of this approach is characterized by a lack of resources, investment and time ones, for adoption and implementation of economically sound decision concerning the replacement of equipment and, consequently, cannot be effective.

The solution for optimization of repairs became the RCM (Reliability centered maintenance) concept, which made it possible to take into account the requirements of reliability and to optimize the cost of repair, defining the acceptable technical effects for each asset. This concept is based on the golden mean principle, proving the most effective ways of operation and maintenance of assets and evaluating their economic characteristics. RCM-analysis, in spite of its high efficiency, does not allow to generate the scenarios of technical effects, taking into account the interests of consumers and the preconditions for growth in revenue, since its main purpose is to reduce costs for repairs.

Some disadvantages of RCM were eliminated by large enterprises using EAM-system (Enterprise Asset Management). These companies manage production assets based on the assessment results of technical condition, potential equipment failures and equipment failure aggregate risk assessment, long-term yield, forming various scenarios of technical influences and implementing evaluation and selection of the most effective ones. The considered approach comprehensively takes into account the internal enterprise factors in asset management, but