INVESTMENT PROGRAM OF POWER GRID COMPANIES: CHECK ALL CAN NOT BE SELECTED

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ABSTRACT

Starting in 2017, the carrying out of technological and price audit of investment programs (projects) of power grid companies and reports on their implementation has been secured as the necessary measures for the electric grid companies of Russia in the framework of approval procedures and approval of investment programs and oversee their implementation. Realization of technological and price audit requires to review large set of information in short period of time, which is limited by investment program validation procedures. Forming representative sample (which describes general population accurately) as an object of analysis could increase audit efficiency. The approach shown in the article is based on mathematical methods of analysis. On the example of the project of the investment program of PJSC “MOESK” the authors made an attempt to apply the described technique. This technique made it possible to perform the main task - the formation of a sample of investment projects, which allows without loss of quality and complexity of the investment program materials to preserve the validity and objectivity of the formed conclusion based on the results of technological and price audit.

KEY WORDS TECHNOLOGICAL AND PRICE AUDIT, ELECTRIC GRID COMPANY, INVESTMENT PROGRAM, REPRESENTATIVE SAMPLE, INVESTMENT PROJECT.

INTRODUCTION

In 2015 the changes in the Rules of confirmation of the electric power engineering entities investment programs were made. As a result, the standards of information disclosure by the entities of the electricity wholesale and retail markets (Regulation, 2015) it was determined necessary to perform a technological and price audit of investment programs (IP) and projects for the power grid companies and their implementation reports. Technological and price audit (TPA) is used in order to improve the efficiency of the IP formation and to increase the resulting quality of their performance.

In the course of the IP (IP project) TPA carrying out the expert organization investigates the package of the IP (IP project) materials and the documents, groundings the materials on an investment project-by-investment project basis. The IP of the power grid companies contains a big number of titles (it reaches about a few thousand investment projects), consequently, a 100% examination of the set of documents and the grounding materials (each IP title may contain up to several dozens of documents, which are subject to analysis) becomes ineffective from the point of view of the TPA goals achievement within available time resource. The authors set a task to find the best method of the data selection and analysis, which will on the one hand improve the effectiveness of the TPA carrying out and will on the other hand solve the crucial task of the IP project comprehensive checkout and preparing of a reasonable conclusion by the expert organization.

THE MAIN PRINCIPLES OF THE IP TPA AND PECULIARITIES OF ITS CARRYING OUT

For realization of the measures, established by the TPA, Methodological recommendations upon performance of the TPA of the IP (IP projects) and therefore their implementation reports were confirmed (Ordinance, 2016).

Herewith procedure and content differ significantly from the large investment projects with public ownership specified in terms of the TPA. The public technological and price audit of some specific investment projects was conducted by the power grid companies as well before making changes in the “Rules of confirmation of the electric power engineering entities investment programs” in 2015. In the meantime in terms of the IP co-ordination and confirmation procedure the power grid companies began to present the first conclusions according to the results of the TPA in the framework of materials to the IP projects.

In contrast to conclusions for the specific large investment projects in terms of the public TPA of the projects with public ownership, in terms of the IP (IP projects) TPA the analysis should be performed as well as conclusions should be made for all titles, included in the IP (IP project), for the following purposes:

- to check the IP (IP project) compliance with Law requirements of the Russian Federation, applicable to the invest activity of the grid companies;
- to check the necessity and sufficiency of the investment projects, which are to be implemented in terms of the IP (IP project) for achievement of the target and plan values of the IP quantitative indexes;
- to check carrying out of the Russian Federation legislation requirements to the price for (or) cost indexes of the investment projects, including with regard to non-exceedence of the announced financing in reference to the amount of financing, determined in accordance with legal norms of the Russian Federation (the law on the basis of the energy and typical technical solutions of the electricity generation facilities capital construction);
- to prepare change proposals to the IP (IP project) accord- ing to results of conducted audits and completed evaluations.

The conclusion is made generally for the IP (IP project) in conjunction with the investment projects, but carrying out of a check according to methodological recommendations range of points requires a detailed examination of some specific IP titles parameters. Indeed, for instance, in terms of a IP (IP project) TPA rationality of the financial needs for investment projects implementation is checked within particular objects. Within the present check an auditor should evaluate content of the materials, supporting the investment projects cost:

- for investment projects with confirmed project documentation: list of expenses, summary estimate, explanatory note to the estimate documentation, developed as a part of the confirmed project documentation, a copy of decision of the project documentation confirmation;
- for investment projects which are at the design stage: costing calculation of the investment project implementation value and copies of the documents, used as sources of the pricing for the costing preparation (excluding enlarged costing standards)3.

A detailed examination of the particular IP titles parameters within IP (IP project) TPA requires time, but it is limited in view of the approval procedure of the power grid companies IP.

According to the Methodological recommendations [Ordinance, 2016], the term for preparation and disposal of conclusion upon the results of the IP (IP projects) TPA carrying out by the expert organization to the power grid company should not less than 30 calendar days be provided an opportunity to publish information about the performed TPA on open access on the appropriate internet resources within a fixed timeframe (Reg- ulation, 2004; Regulation 2011).

Taking into account the time needed for the IP projects prepara- tion by the power grid company, by virtue of the received com- ments and suggestions, within intermediate stages of the approval procedure, an auditor has got not so much time left for an audit re- port preparation – approximately 15–20 days per each of the stages.

Various power grid companies possess various IP (IP project) titles quality (the number of titles may be up to 15 000 and more), even less time remains for analysis of the particular investment projects, sometimes a detailed checkout of the materials becomes impossible. Time limitation presses the auditor to look for the op- timal ways for meeting the requirements of the Methodological recommendations, to collect the data and to carry out the TPA. During performing of the technological and price audit of the IP (IP project) the auditor should use reliable data and apply scientifically proven methods of their analysis and processing. He/she is given a right to independently define the selection methods of data which are the subject to checkout for achievement of the TPA target results.

At the same time under that logic the auditor cannot reduce the quantity of the examined IP forms, he/she should check the whole set of the grounding documents, necessary and sufficient for achievement of the TPA results, and cannot make conclusions only on the basis of its part.

Applying the selection methods of the data, which are the subject to checkout for generation of the conclusion on the IP (IP project) on the whole, within the TPA it is allowed to change only the analyzed list of the IP titles. For the checkout the auditor should select the IP in such a way that they introduce a representative sample, and conclusions on the basis of its analysis cannot be reasonable extended to the whole IP (IP project). For carrying out of the power grid companies IP (IP projects) TPA generation of the representative sample is supposed as a selection method of the data, which are the subject to checkout for achievement of the TPA target results.

REPRESENTATIVE SAMPLE FORMATION METHODS

Representative sample is a finite sample, where all main properties of the entire population are introduced approximately by the same factor of proportionality or with the same frequency, with which the present property is presented within this entire population [4]. Representation defines the extent to which it's...
AN EXAMPLE OF THE REPRESENTATIVE SAMPLE FORMATION FOR THE TPA CARRYING OUT

Let’s consider application of the methodology with definition of the needed parameters for the sample formation when using the examined cluster of the PJSC “MOESK” IP project. Let’s take the information about the PJSC “MOESK” IP project of 2015-2022 yrs. as basic data [PJSC “MOESK” «, 1 (a)].

The PJSC “MOESK” IP project contains 13,532 separate titles, their total construction cost is 442,5 mln. RUB in accordance to the target prices of the relevant years. Investment projects of the PJSC “MOESK” are implemented on the territory of two constituents of the Russian Federation (Moscow and Moscow Region), consequently, IP of the power grid companies is divided into two parts, equal in structure.

For representative sample formation form 2 «Financing plan of the capital investments on investment projects» will function as a source [Ordinance, 2016, supplement 2]. It comprises a full description of the representative sample scope one should take into account an allowable value of the sampling error and set a confidence level: A standard deviation from the average value of the random variable is also an important factor.

For calculation of the representative sample scope a formula of finding the confidence interval for the expected mean is used (average value of the random variable) [Borovkov A. A., 1984; Levin D. M., 2004]:

$$ n = \frac{Z^2 \cdot \sigma^2}{\varepsilon^2} $$

Where $ n $ - sample average; $ Z $ - quantile of a standard normal distribution; $ \sigma $ - standard deviation from the entire population; $ \varepsilon $ - true expected mean (average value of the entire population) and set a confidence level with respect to $ Z $ correspond to a half of the confidence interval length.

The present value identifies measure of inaccuracy of the estimate, occurring as a result of a sampling error $ \varepsilon $:

$$ \varepsilon = \frac{Z \cdot \sigma}{\sqrt{n}} $$

Knowing the constants of the present congruence, one can define the sample scope $ n $:

$$ n = \frac{Z^2 \cdot \sigma^2}{\varepsilon^2} $$

Taking into account the initial random variable irregularity in the distribution within the entire population division into districts and a posteriori given approaches allow to distinguish uniform groups according to the specified criteria. Hereafter in light of the necessary and sufficient scope of the representative sample in conjunction with all clusters by random drawing (for instance, applying special algorithms sort the representative sample in conjunction with all clusters by regions. Segregated by districts titles are divided into clusters in accordance with investment projects groups based on their implementation directions.

The list of clusters consists of seven investment projects groups, corresponding to their implementation directions:

- technological connection of power receivers with power supply system.
- reconstruction of the electricity supply network facilities for strengthening of the electrical network for the purpose of technological connection performing.
- reconstruction, modernization, technical upgrading of transforming and other sub-stations, distribution points;
- reconstruction of power lines;
- new construction of the power supply network facilities;
- «other investment projects» group;
- projects, which are not included into the mentioned groups.

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grounded for the entire population (of the investment program on the whole).

**CONCLUSIONS**

Through the example of the PJSC "MOESK" IP project it is displayed that the suggested methodology allows to significantly reduce time expenditure for the power grid companies IP (IP projects) TPA, to improve results rating, effectiveness of the inspection and to optimize it on the whole. Such an approach doesn’t break the methodological recommendations provisions on TPA carrying out. To follow representativeness during applying of the suggested methodology one should be scrupulous about investment projects division into districts and clustering while distinguishing of the uniform according to their features groups (clusters) of the investment projects, corresponding to the random distribution.

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