

THE LOGISTICS METHODS OF CONTROLLING FINANCIAL FLOWS OF DISTRIBUTION NETWORK COMPANIES

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Between electric energy producers and consumers, electric power networks serve as a connecting link, with whose help individual electric energy sources and consumers are united into an electric power system. According to the GOST 19431–84 Standard, an electric network is represented by an assemblage of substations, switchgear units and electric lines connecting them, which can be located on some district territory, in a point of residence, or at the location of another electric power consumer. An electric line which stretches beyond the perimeter limits of a power station or a substation and which is designed for electric power transmission over a certain distance, is called an overhead transmission line (OTL). According to their functional application, OTLs can be subdivided into two big groups: inter-system lines (main power lines) and distribution power lines. The said inter-system (main) lines OTLs perform the function of transporting energy between power grids. These are power lines of high voltages: 750, 500, 330, and 220 kV, and rather rarely of 110 kV. Distribution overhead lines bring energy to consumers. These are lines of 1-20, 35, 110 kV for the electric power supply of industrial companies, transport companies, agricultural firms, etc. For residential consumers distribution lines of 220, 380 V and 1-20 kV are in use.

Distribution network companies (DNCs) provide services in the area of transporting electric energy over distribution networks. Therefore, a DNC is a logistic system for distributing electric power received from power producers by consumers, which are connected to the DNC electric circuits.

From the point of view of logistics, an energy company is a socio-economic system whose development and functioning should be examined, considering the socio-economic environment of the company on the regional level. A DNC, as a logistic system, incorporates a subsystem to control financial flows. The financial flow of a DNC can take different forms: as cash; as special-purpose bank deposits; as share deposits; as security papers; loans; property rights and other rights that can be assessed in the monetary form. A logistics system for controlling financial flows which secure the development of energy companies has its goal (to secure the highest growth of the social-economic potential of the energy company, with due account of ecology limitations), it has its functions (to investigate the medium, the situation, to select alternatives and assess actions), it has its own flows (of financial resources, materials, of information circulated between planners and consumers) and it has a structure of its own (a general plan, within

whose limits the most probable and desirable results of the logistics system development can be brought close to one another).

The control of DNC financial flows is a complex problem. We should distinguish between what is a complex problem and what is a difficult one. A difficult problem has one solution, whose purpose is clear. A complex problem has a multitude of possible solutions and these solutions can lead to different consequences. The principle of structural arrangement of utilities capital investment flows lies in grouping together the elements being considered, in accordance with the distribution of certain properties between the elements. This process can be repeated in such a way that these groups, namely their properties which define them, are considered as the next coming level of the system, and this is to be done until a single element is reached, i.e., its apex or the goal of the decision-making process. This kind of a system when individual layers are superimposed is called a hierarchy. Based on this hierarchy, the influence of the lowest level elements on the uppermost element (the common goal) will be determined.

It is worthwhile to examine the hierarchy structure that controls financial resources flows within the system of logistics by grouping together these financial resources in accordance with the goals set for the utility in question (including DNCs). The purpose of building up a logistics hierarchy lies in the study of the functional interaction between the elements of the logistics system and their effect upon the system as a whole.

Financial resources within the logistics system of an energy company are distributed between the areas of capital investments. A DNC should consider the required volume of works within the various ranges of power distribution systems. Within the hierarchy of financial resources distribution in the logistics system, sources of financing the development of a DNC are grouped together according to investment areas (new construction, expansion, reconstruction and introduction of new equipment). The process of distributing financial flows in the logistics system of a DNC covers four stages:

1. The weight factors of the DNC investment sphere are to be determined proceeding from the aims of shareholders (the Board of Directors), considering the development of the area infrastructure, improvement of the quality and reliability of consumers' power supply.

2. The said DNC must determine the volume of works, which are to be fulfilled for different switchgear voltages in its distribution networks.

3. A list of investment projects is to be formed up which is to be approved by the capital investment sources financing power system facilities.

4. Distribution of financial flows according to the areas of DNC development, considering the interests of the DNC shareholders, while also fulfilling requirements concerning the improvement of the quality and reliability of power supply, its ecological security and social effects on the regional level.

DNC financial flows must be distributed with due consideration of the special features of operation processes taking place in the DNC. DNC electric power circuits, as a system, incorporate distribution lines for power transmission and power substations (for raising and reducing voltages). An electric substation is the center of supply, from which feeding lines come out, leading to consumers; this is why any electric power substation should be regarded as part of the electric power grid that provides services in the area of electric energy distribution via DNC power networks.

In any power grid its electric energy balance is to be calculated, based on balances generated by power stations and substations as centers of supply. Financial flows for the development of DNCs are planned on the basis of forecast aggregate power balances and supply centers capacity, made up with due consideration of power consumption increases and schedules of connecting new capacities. The required gross revenue (RGR) of a DNC, resulting from the implementation of a concrete investment project (e.g., from the construction of a 110/10kV substation), can be calculated proceeding from the increase in power consumption by every consumer group to be multiplied by the properly approved energy tariffs.

Based on the logistics hierarchy it is possible to calculate investment projects priorities and distribute financial flows from investment sources down to DNC investment objects. A calculation of DNC investment project priorities, depending on what sources of financing are available, can be made on the basis of the LENENERGO DNC, used as an example. As its alternative, ten investment projects (IPs) which can be implemented before the year 2010: IP-1, IP-2, IP-3, IP-4, IP-5, IP-6, IP-7, IP-8, IP-9, IP-10 have been examined. Those investment sources that are being examined here include the following elements:

- own funds (net profit, depreciation charges, payments for process connection to electric networks);
- borrowed funds (bank loans, bonds loans, financial leasing).

It is necessary to distribute investment projects in accordance with their importance for the DNC and considering dependences from finance sources.

In the process of building up the said hierarchy, those projects should be singled out as separate alternatives, which could be implemented jointly; this means it is those that do not exclude one another. Following that, these alternatives can be grouped into clusters based on the size of capital investment: 1) a group of a large projects; 2) a

group of medium size projects; 3) a group of small projects.

In this manner, three groups can be formed for a DNC. The large-size projects are: IP-3, IP-4, IP-11, IP-12; the medium size projects are: IP-5, IP-7, IP-8; the small size projects are: IP-1, IP-2, IP-6, IP-9, IP-10.

In this case, in the first place the problem of calculating priorities for the implementation of DNC investment projects should be solved on the basis of project groupings. After that this must be done inside each of the groups, taking into account the mutual dependence of the projects. In the process of discovering the relative significance of the elements being compared, the expert who is doing this should make his judgment about the superiority of elements at each level in the hierarchy on the basis of the method of analysis of hierarchy structures (MAI).

This application of logistics methodology enables the person who takes decisions (PTD) to do the following:

- 1) to assess alternatives (investment projects under appraisal) along each of the investment directions in accordance with the weight factors of the chosen criteria (both from the financial and technical points of view, also considering the social effect and ecological safety);
- 2) to compare risky and uncertain investment projects, regardless of any qualitative or quantitative expression of the risk;
- 3) to arrange investment projects according to their relative significance;
- 4) to appraise the sensitivity of the formed up investment program structure in relation to a change of judgment by the PTD;
- 5) to analyze the investment capabilities of a DNC, examining specific investment projects as a combination, taking into account their mutual interaction and contribution into the development of the power grid.

When determining investment projects dependence from finance sources, the following question was put to the experts: to what extent the accessibility of each finance source can affect a specific DNC investment project in each group of investment projects.

Taking into account the said interrelationship allows us to determine more exactly the priorities of investment project implementation. In such a way those projects that are more preferable from the point of view of their feasibility can be selected, bearing in mind the importance of voltage ranges, the weight factors of investment directions, the social significance and the dependence of DNC investment projects from investment sources.