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Financial Management, Resource Efficiency and Resource Saving

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Abstract

This paper discusses the issues of competitiveness, resource efficiency and resource saving, as well as financial costs regarding the project of relay protection of the autotransformer 220/110/35 kV at the "Krokhalevskaya" substation. Despite the fact that all energy facilities are built according to a large list of requirements, rules and standards, each facility remains unique, so it is important to choose the most appropriate equipment. Competitiveness analysis is carried out for this purpose. SWOT analysis helps to identify strengths, weaknesses, opportunities and threats associated with the project, and give an idea of working with them in each particular case. For the development of the project requires funds that go to the salaries of project participants and the necessary equipment, a complete list is given in the relevant section. The calculation of the resource efficiency indicator helps to make a final assessment of the technical decision on individual criteria and in general.

Keywords: Resource efficiency, relay protection, energy facilities;

1. Introduction

To date, the possibility of implementing a project depends not only on technical capabilities, but also on economic, namely, commercial potential, attractiveness to the target audience, etc.

In this paper, the relay protection autotransformer 220/110/35 kV of the substation "Krokhalevskaya" Kemerovo's energy system is described. The most optimal terminal for protection of the autotransformer should be chosen.

Moreover, it is also necessary to undertake SWOT analysis to study the external and internal environment of the project, to plan the work, to calculate the budget, which takes into account all the costs associated with its implementation, and to calculate the integrated resource efficiency indicator.

2. Competitiveness analysis of technical solutions

In order to find sources of financing for the project, it is necessary, first, to determine the commercial value of the work.

Analysis of competitive technical solutions in terms of resource efficiency and resource saving allows to evaluate the comparative effectiveness of scientific development. This analysis is advisable to carry out using an evaluation card.

First of all, it is necessary to analyze possible technical solutions and choose the best one based on the considered economic criteria. The following cabinets were selected for comparison: SHE 2607 042 manufactured by "ECRA", SHTE 2309 by "SIBEL" and MiCOM P63x by Schneider Electric.

The model of expert evaluation is based on the following criteria:

- price;
- noise immunity;
- set of terminals relay protection;
- reliability of relay protection;
- smart interface quality;
- energy efficiency;

- ease of operation;
- ability to connect to PC;
- estimated lifetime;
- safety [2].

Table 1. Evaluation card for comparison of competitive technical solutions

Evaluation criteria	Criterion weight	Points			Taking into account weight coefficients		
		SHE 2607	SHTE 2309	MiCOM P63x	SHE 2607	SHTE 2309	MiCOM P63x
1	2	3	4	5	6	7	8
1. Price, million rubles	0,1	5	4	3	0,5	0,4	0,3
2. Noise immunity	0,05	5	5	5	0,25	0,25	0,25
3. Set of terminals relay protection	0,1	4	3	5	0,4	0,3	0,5
4. Reliability of relay protection, %	0,15	5	3	4	0,75	0,45	0,6
5. Smart interface quality	0,05	5	4	5	0,25	0,2	0,25
6. Energy efficiency, W/h	0,15	4	4	5	0,6	0,6	0,75
7. Ease of operation	0,1	5	4	3	0,5	0,4	0,3
8. Ability to connect to PC	0,1	5	5	5	0,5	0,5	0,5
9. Estimated lifetime, years	0,1	4	4	5	0,4	0,4	0,5
10. Safety	0,1	5	5	5	0,5	0,5	0,5
Total	1	47	41	45	4,65	4	4,45

According to the results of the competitiveness analysis, terminal SHE 2607 042 presented by the company "ECRA " is the best. This result is explained by the fact that the products of this manufacturer are widespread in the domestic market and have well-deserved popularity primarily due to reliability and quality at a fairly low cost.

3. SWOT analysis

Complex analysis solution with the greatest competitiveness is carried out with the method of the SWOT analysis: Strengths, Weaknesses, Opportunities and Threats. The analysis has several stages.

The first stage consists of describing the strengths and weaknesses of the project, identifying opportunities and threats to the project that have emerged or may appear in its external environment.

The second stage consists of identifying the compatibility of the strengths and weaknesses of the project with the external environmental conditions. This compatibility or incompatibility should help to identify what strategic changes are needed [1].

Table 2. Final SWOT Analysis Matrix

	Strengths: S1. Ease of operation; S2. Reducing the size of the equipment; S3. Improving the accuracy of the data analysis; S4. Response; S5. Long lifetime.	**Weaknesses:** W1. Necessity for staff training; W2. Complication of the functional scheme; W3. Weak element base of domestic production; W4. High price.
Opportunities: O1. Use of relay protection devices based on microprocessor technology in the construction of new power facilities; O2. Use of relay protection devices based on microprocessor technology in the modernization of power facilities; O3. Technological development in this industry.	*Strategy which based on strengths and opportunities:* 1. Raising state funds for modernization of electric power facilities; 2. Development and maximum unification of a universal project for the purpose of application on similar objects.	*Strategy which based on weaknesses and opportunities:* 1. Cost reduction due to the use of analogues of another production (including foreign); 2. Lectures for staff education and training.
Threats: T1. Lack of demand for new technologies; T2. The increasing cost of imported components; T3. Reduction of investments in modernization of the electric power industry; T4. Economic situation in the country affecting demand; T5. Emergence of new competitive technologies.	*Strategy which based on strengths and threats:* 1. Cost reduction due to the use of analogues of another production; 2. Promotion of the project with emphasis on its advantages.	*Strategy which based on weaknesses and threats:* 1. Additional project development for successful competition with other solutions; 2. Finding new ways of supplying equipment and investments.

Analysis of the final table of SWOT analysis and comparison of strengths and weaknesses with threats and opportunities leads to the conclusion that the advantages of using relay protection devices based on microprocessor technology "EKRA" exceed the shortcomings, and therefore the project is the most appropriate. Possible obstacles to the implementation of the technical solution can be corrected or avoided through proper allocation of resources and right prioritization.

4. Scientific and technical research budget

The amount of costs associated with the implementation of this work is the basis for the formation of the project budget. This budget will be presented as the lower limit of project costs when forming a contract with the customer.

To form the final cost value, all calculated costs for individual items related to the manager and the student are summed.

The budget for scientific and technical research is shown in table 3.

Table 3. Budget for scientific and technical research

Item of expenditure	Sum, thousand rubles	Share of the budget %
1. Material costs of scientific and technical research	2,63	2,1
2. Salary:		
• Basic salary	69,193	55,5
• Additional salary	8,995	7,2
3. Deductions to off-budget funds	21,189	17
4. Depreciation of equipment used for design	22,713	18,2
Total	124,72	100

5. Resource Efficiency

The resource efficiency of the relay protection terminal is determined by the integral criterion of resource efficiency, which has the following form:

$$I_{pi} = \sum a_i \cdot b_i , \quad (1)$$

Ipi – integral indicator of resource efficiency;
ai – weight factor of the project;
bi – point evaluation of the project, is established expertly on the chosen scale of assessment [1].
The calculation of the integral indicator of resource efficiency is presented in table 4.

Table 4. Comparative evaluation of project characteristics

Criteria	Weight factor	Point evaluation
1. Safety	0,25	5
2. Reliability	0,25	5
3. Ease of operation (meets the requirements of consumers)	0,20	4
4. Estimated lifetime	0,15	4
5. Energy efficiency	0,15	3
Total:	1,00	

Integral indicator of resource efficiency for the developed project:

$$I_{pi} = 0,25 \cdot 5 + 0,25 \cdot 5 + 0,20 \cdot 4 + 0,15 \cdot 4 + 0,15 \cdot 3 = 4,35$$

The calculation of the integrated indicator of the project's resource efficiency is of great importance in the development. Its high importance indicates the effectiveness of using a technical project. High points of safety and reliability, ease of use and estimated lifetime allow to estimate the correctly done development of the system.

6. Conclusion

The competitiveness of this technical solution in comparison with other options has been proved. With the help of the SWOT analysis the strengths and weaknesses and also opportunities and threats of the project have been evaluated.

In addition, the budget of scientific and technical research which was 124,72 thousand rubles was calculated. Most of the costs are for the payment of salary.

The evaluation of the resource efficiency of the project gives quite a good result (4.35 out of 5), which indicates the efficiency of the technical project implementation.

References

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