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## Assessment of commercial potential and prospects of carrying out scientific research from a position of a resource efficiency and resource-saving

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### Abstract

The growth of population leads to the fact that natural resources are being used up very fast. Making our world more resource efficient is a way to achieve economic and social goals at lower cost. Thus, the implementation of any project significantly depends on economic efficiency and its potential of technology. Nowadays there are different types of implementation of relay protection. Thus, to make a project successful it is necessary to choose the most modern, high-demand, knowledge-based variant of implementation of relay protection. In this paper comparative assessment of a desirable development of technological projects based on the implementation of relay protection on the power lines of 220kV has been carried out. Moreover, SWOT analysis for microprocessor option of relay protection implementation has been done.

*Keywords:* Relay protection, design, financial management, resource efficiency, SWOT analysis;

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### 1. Introduction

Relay protection indicate damages and the abnormal modes in an electric part of power supply system automatically. Moreover, it is the major automatic equipment ensuring the reliable and steady functioning of power supply system.

The value of relay protection increases in modern power systems and it is connected with the capacity growth of power supply systems, their integration in the electrically connected systems.

The development of networks of high and ultrahigh voltage that help to integrate power systems and transfer big streams of electric energy from powerful power plants to the large centers of consumption is natural for modern power supply systems. In this regard the design of relay protection of backbone power lines still remains relevant.

Designing devices of relay protection it is necessary to take into account that the choice of a concrete type of protection. It must be done due to the economic efficiency including the absolute cost, cost of installation and adjustment, operational costs, possible damage from underproduction of industrial output and decrease of its quality in case of protection failure.

## 2. Analysis of competitive technical solutions

The analysis of competitive technical solutions of the relay types which are most extended at the moment has been made. These relay types are a microprocessor, relay's analog, an electromechanical relay. (Table 1).

Comparison helps to identify the most competitive type of the relay, which is demanded in the market, has various directions of development in the future, and has a potential that is needed for reliable and effective work in power industry.

Table 1. The evaluation map for comparing competitive technical solutions

Criteria for evaluation	Weight of the criterion	Points			Competitiveness		
		$P_{mp}$	$P_{ah}$	$P_{a/m}$	$C_{mp}$	$C_{ah}$	$C_{a/m}$
1	2	3	4	5	6	7	8
<b>Technical criteria for evaluation of a resource efficiency</b>							
1. Precision of measurement	0,2	5	3	3	1	0,6	0,6
2. Compactness	0,08	5	4	3	0,4	0,32	0,24
3. Safety	0,16	5	3	2	0,8	0,48	0,32
4. Safety in operation	0,12	5	3	3	0,6	0,36	0,36
5. Restoration by own efforts	0,04	1	2	5	0,04	0,08	0,2
7. Functionality (for example, a conclusion of the measurable values)	0,05	5	4	3	0,25	0,2	0,15
8. Operation simplicity	0,06	2	3	5	0,12	0,18	0,3
9. Operation in the wide range of working temperatures	0,05	3	4	4	0,15	0,2	0,2
10. Possibility of connecting to personal computer	0,09	5	2	1	0,45	0,18	0,09
<b>Economic criteria for evaluating the efficiency</b>							
1. Price of installation	0,04	2	3	5	0,08	0,12	0,2
2. Cost of service	0,03	2	3	4	0,06	0,09	0,12
3. Operation lifetime	0,05	5	4	3	0,25	0,2	0,15
4. Need for training of personnel	0,03	1	3	4	0,03	0,09	0,12
<b>Total</b>	<b>1</b>	<b>46</b>	<b>41</b>	<b>45</b>	<b>4,23</b>	<b>3,1</b>	<b>3,05</b>

Based on the analysis, the microprocessor relay has got the highest point in comparison with other competitors ( $C=4,23$ ).

## 3. SWOT- analysis

SWOT-analysis helps us to see the following points:

- strengths and advantages of the microprocessor relay that can be involved in the strategy of its implementation in power industry;
- Weaknesses and vulnerabilities of the microprocessor relay in comparison with other types of the relay;
- Opportunities for its development;

- Risks and the most effective actions to protection against them. (Table 2).

Table 2 – SWOT-analysis Matrix

	<p><b>Strengths of the research project:</b></p> <p>S1. Simplicity in operation;  S2. High safety and reliability in operating time;  S3. Little overall dimensions;  S4. Big term of operation;  S5. High precision of measurement;  S6. An opportunity to bring measurable quantities onto the personal computer display and RP case.</p>	<p><b>Weaknesses of the research project:</b></p> <p>W1. High cost;  W2. Need for training of the personnel;  W3. Small maintainability;  W4. Big susceptibility to high and low temperatures.</p>
<p><b>Opportunities:</b></p> <p>B1. Development of this branch in Russia;  B2. Support from the state for development of technologies in this branch;  B3. Demand for a product with advanced technologies;  B4. Possibility of cooperation with the world advanced companies;  B5. Involvement of young engineers in the developing branch.</p>	<p><b>Strengths and opportunities:</b></p> <p>Implementation of the microprocessor relay will allow to prolong the term of operation of RP, to increase reliability of protection of the protected object and will involve support in the development of the technology from outside of the state that will allow to improve constantly technology of microprocessor relay protection to the high quality standard, comparable with global manufacturers.</p>	<p><b>Weaknesses and opportunities:</b></p> <p>Introduction of the new technologically developed equipment, namely microprocessor relay will lead to expenditures connected with training and re-qualification of personnel, to additional expenditures for introducing this type of the relay to the market.</p>
<p><b>Threats:</b></p> <p>U1. Lack of demand for new technologies because of economic situation in the country;  U2. Lack of an incentive for re-equipment of the protected objects;  U3. Emergence of more technologically developed competitive developments.</p>	<p><b>Strengths and threats:</b></p> <p>Introduction of the microprocessor relay will allow to reduce the number of the accidents connected with failure of relay protection that will lead to increase in demand for this type of the relay and there will be an incentive to re-equipment of the power line and also constant improvement of this type of the relay will allow to keep the leading positions in the market.</p>	<p><b>Weaknesses and threats:</b></p> <p>The big cost of the equipment. The costs needed for training of personnel can lead to the fact that there won't be enough selected budget for re-equipment of power lines that will result in lack of an incentive for further replacement of old types of the relay.</p>

The SWOT-analysis shows that the project has more potential strengths, than weaknesses; therefore, the microprocessor relay has good chances to compete with other types of the relay and to occupy a leading position on the market.

#### 4. Conclusion

The results of the analysis show that microprocessor relay has got the highest point in comparison with other competitors, such as relay's analog and electromechanical relay. Moreover, SWOT analysis for introducing a microprocessor relay to the market shows that this device has more advantages than disadvantages.

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