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## Economic efficiency of innovative corrosion resistant coating for sectors of Russian national economy

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### Abstract

The paper proposes an approach to the assessment of the economic efficiency of innovative anti-corrosion coatings for sectors of the national economy of the Russian Federation on the basis of a synthesis of strategic sectoral and cost analysis, field research methods. According to the authors, a comparative analysis of composite polymeric anticorrosion protecting coatings with similar products, estimating of direct and indirect economic effect and prognosis of implementation, forms a deeper understanding of the role of innovative technologies in the Russian state development of import substitution, the investment attractiveness of Russian industries in the new part technologies, applied research activities of private companies. Metal consumption sectors of the economy were chosen as an object of research, as they are characterized by the use of the following products: industrial construction and reconstruction, nuclear and thermal power, chemical, oil and gas, utilities, food processing, automotive, shipbuilding, aviation and rocket science, other industry. Basic modeling of implementation of anticorrosion protecting coatings in industrial enterprises was carried out on the basis of generating energy enterprises as one of the main end-users of anti-corrosive materials that also issue accurate statements.

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**Keywords:** total economic effect, economic efficiency industries, qualitative research, field research, innovative corrosion resistant coating, direct and indirect economic effect, Gordon's Model, present value of economic benefit results.

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Analysis of the current state of innovative development of the Russian Federation and the authors' experience in the design of innovative development programs and models of basic industries (oil and gas industry, energy) shows the relevance of innovation when achieving a high innovation potential of the economy. Under this theme, we should note that commercial enterprises, leading their own innovations not only have effective practices in introducing them to the market, but also provide economic effect. We carried out a study of the impact of innovative development of the Russian company LLC "Antikor". The enterprise's development of corrosion protection of metals exposed to corrosive environments and thermal effects is used to protect metal surfaces and reinforced concrete structures, dead works and bottom of vessels and hydraulic structures, steel structures in industrial atmosphere, gas transportation, production, storage and processing of oil, heat transfer equipment, drinking water supply facilities, food proceeding equipment, equipment exposed to vibration and vacuum, which are widely used in various industries, such as at nuclear and thermal power plants, chemical and metallurgical plants, ships of various classes, utilities, equipment, water supply and food industry. High chemical resistance of coatings applied to the most common aggressive environment

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(acids, alkalis, salt solutions, and others.) Together with resistance to pressure changes and abrasion wear, exposure to vibration and heat, help to protect a variety of surfaces, and industrial machinery, providing it with additional lifetime from 10 to 20 years without implementing process-related maintenance and cleaning of a covered surface during a specified period.

### **The purpose of this study**

The purpose of this study is to evaluate the total economic impact of anti-corrosion coatings introduced by a group of companies, taking into account the prospects of its activities for sectors of the economy of the Russian Federation. The main problems to be solved in the work are: firstly, to confirm the hypothesis about the effectiveness of the protective properties of corrosion products for metals estimated by the end-users - representatives of industrial enterprises of the Russian Federation; secondly, to estimate economic effectiveness of developing aimed to protect corrosion prevention; thirdly, to evaluate the economic effect of industrial enterprises of all branches of the Russian Federation. Methodical approach to achieving this goal is to measure the direct and indirect economic impact of the group of companies "Antikor" for Russian industries. The direct economic effect refers to the effect received by the companies of national economy, that acquires unique covers of LLC"Antikor" to protect different surfaces and their production equipment. The direct economic effect is based on reducing the cost of protecting and extending the life of surfaces and equipment of the corporate consumers. It is calculated by determining the net present value of the economic effects of corrosion protection. In the process of calculation the average value of direct economic effect for anticorrosion coatings was determined on the basis of 7-8 corporate consumers per 1 sq. m. of the protected surface of equipment per year. In the course of these calculations average value effect equal to \$136/ sqm/ year or about 4080 rubles. /Sqm/ year was obtained. [1]

The indirect economic effect refers to the following spillover effects.

First point. An effect that is achieved by eliminating the technological losses and downtime of production equipment caused by corrosion. Downtime due to equipment failure, is either completely absent or significantly reduced by using corrosion-resistant coatings. Time needed to produce core products is reduced. This effect is calculated as the cost of goods (volume of services), produced by corporate consumers for the time spent on downtime and loss.

Second point. The effect achieved by reducing the metal content in the industry. The calculation is based on the principle of comparing the effect of alternative methods of surface protection against corrosion of equipment, for example, by using corrosion-resistant metals (stainless steel, copper-nickel alloys, and other special alloys) instead of black metal corrode intensively. This effect is calculated as the value of the volume of non-corrosive metal, which would be sent to the corporate consumers of the anticorrosive coating to protect their surfaces and equipment in case they were not to protect their surfaces and equipment with innovative anti-corrosion coating. [5]

### **Basic principles of calculation**

Key assumptions and limitations taken into account are as follows: the economic impact is calculated using those industries in which there has been a practical use and application of these coatings.

#### *The economic effect for the period of the actual existence of the enterprise*

The economic effect was calculated for the period of the actual existence of the development enterprise (18y.) taking into account the prospects of application in the fields of enterprise development in the forecast period for the next 4 years. The economic effect was calculated for 4 years.

#### *The economic effect for in post-forecast period*

The economic effect in post-forecast period (fifth and subsequent years of the LLC"Antikor") was estimated on the Gordon model, which takes into account only the results of the company achieved in the 4th year of the forecast and the fixed rate of development. [2] This approach stems from the fact that it is difficult to predict the development and identify current trends in this field of science - the development of corrosion protection for the long term. Evaluation of the economic effect was based on cash flow forecasting formed LLC"Antikor" from the proceeds from the sale of protective coatings for a variety of surfaces and equipment.

#### *Basic data for calculation*

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