

Ecological and Economic Foundations of Air Protection in the Industrial City of Dnipropetrovsk Region

Lyubov Tymoshenko¹,
Oleksandra Us²

¹Department of Applied Economics, SHEE «National Mining University», UKRAINE, Dnipro, prospekt Dmytra Yavornyts'koho, 19, E-mail: timoshenkolv@ukr.net

²Department of System Analysis and Control, SHEE «National Mining University», UKRAINE, Dnipro, prospekt Dmytra Yavornyts'koho, 19, E-mail: us-aleksa@yandex.ua

Abstract – Based on statistical data of economic and ecological indicators in industrial cities of the Dnipropetrovsk region the dynamics of state of the air and its quality was estimated using the statistical methods and methods of decisions making in conditions of uncertainty. The interrelation between pollution levels and some economic factors was examined. The necessity of strengthening the economic levers at the municipal level in the field of ecological state of air quality in an industrial city was proved.

Key words – industrial contaminating plants, production volumes, the level of air pollution, factors, forecasting, eco-environmental indicators, economic levers.

I. Introduction

The current state of the environmental situation in the Dnipropetrovsk region can be described as very serious. The air is a vital element of the environment. Main human impacts on the air are created by environmentally dangerous objects – metallurgical and energetic enterprises and industry areas which are major sources of pollution. There is a lack of economic interest in the industry to use natural resources efficiently, and in environmental protection. Therefore, the management on regions, which are subject to significant influence of industry, requires a balanced approach taking into account environmental priorities.

II. Problem statement

The ecological situation within urban areas in Ukraine is different in nature and severity of problems, that determine the ways and possibilities of their practical solution. Hence the objective need for differentiation managerial decisions and practical measures for stabilize and improve the environmental situation in the industrial cities is rising, especially it concern of the state of air, which significantly affects on the environmental safety of the city and the health of its inhabitants.

III. The main material research.

Conceptual bases of eco-oriented areas of development and technological-ecological safety of urban areas, the ecological state of the urban environment is the subject of research TP Galushkina, L. Granovsky, 3. V. Gerasymchuk, V. Polishchuk, V. Hymyntsya, AV Baluev and

other scientists. The establishment of ecological and economic instruments has created incentives for more efficient use of natural resources and has identified sources of funding environmental activities.

Dnipropetrovsk region is one of the most industrialized regions in Ukraine. The industrial facilities concentration in region exceeds the average for Ukraine in 2 times. The powerful energy base is the foundation for the development of mining and metallurgical complex. There are more than 500 industrial enterprises in the region, significant part of them is large enterprises of mining, metallurgical, chemical, machinery and fuel and energy industries. Most of these were created in 1930-70 years without the environmental impact consideration of their activities. These enterprises are the main sources of air pollution. Gross pollutant emission into the air reaches more than 1 mln. t. per year, which is 17% of the national volume.

Comprehensive air pollution index (ISA) was applied for comparative assessment of air pollution in selected cities and for the ranking them in terms of pollution and contamination trending. ISA is calculated based on fixed observation and considering the whole range of harmful substances. The dynamic of air pollution in Dnipropetrovsk, Dniprodzerzhynsk and Kryvyi Rih was studied using the monthly indicators of air pollution index for 2014-2015 years. As a result of analysis it determined that the level of air pollution in the investigated cities of Dnipropetrovsk region exceeds average and in some month the excess is very significant.

This qualitative state of the atmosphere depends not only of the quantity and quality of emissions, but also on the seasonal component, which to some extent determines the ability of nature to cleanse itself. One of the real possibilities of improvement of the air state is the reduction of emissions and concentrations of contaminants in the same periods of adverse weather conditions.

Based on the analysis it was found that the Dniprodzerzhynsk has the most polluted air among the cities Dnipropetrovsk region. The main sources of pollution are stationary sources, namely large industrial enterprises, especially metallurgical and energy complexes. Thus, in 2014 only one production activity of industrial enterprises, such as PJSC Dneprovsky Integrated Iron&Steel Works named after Dzershinsky to 59.67% was determined air pollution in Dneprodzerzhinsk[1].

The dynamic of environmental costs, which are aimed to the protecting of air was analysed [2]. The funds of enterprises and organizations were the main source of financing environmental expenditures in 2013, as in previous years. They accounted for respectively 99.6% of capital investment and 96.6% of current costs. 41,8% of investments was directed on air protection. The growth of both capital and current spending should help to reduce pollutant emissions to the atmosphere, but unfortunately this is not observed. It was established that there is not a correlation between the amount of capital investment and the amount of harmful emissions. Furthermore, the growth of current expenditure to the protection of air does not lead to lower emissions from stationary sources of pollution. Equipment for environmental is worn out, and that's why it has low efficacy for the prevention of air

pollution, and require significant resources to maintain it in operative conditions. The impact of volume commercial production industry Dneprodzerzhinsk on the amount of harmful emissions into the air was investigated (Fig. 1).

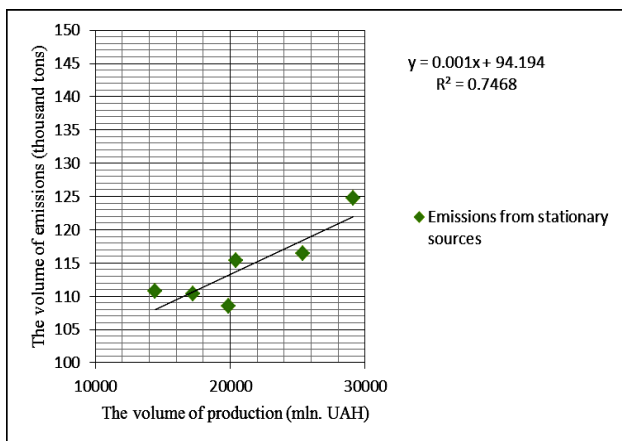


Fig. 1. Dependence between amounts of emissions from stationary sources and production volume

The resulting dependence can be used for predicting emissions. The quality of the predictive model was defined. The result of predicted values was compared with real data. The calculation results are presented in Table 1.

TABLE 1

RESULTS OF FORECASTING

The volume of production (mln. UAH)	Actual scope of air emissions (thousand tons)	Results of forecasting	Error forecast
14439.1	110.8	108.6	-2.17
17242.2	110.3	111.4	1.14
19893.3	108.5	114.1	5.59
20400	115.4	114.6	-0.80
25362.8	116.4	119.6	3.16
29102.5	124.7	123.3	-1.40
mean square error prediction			2.99

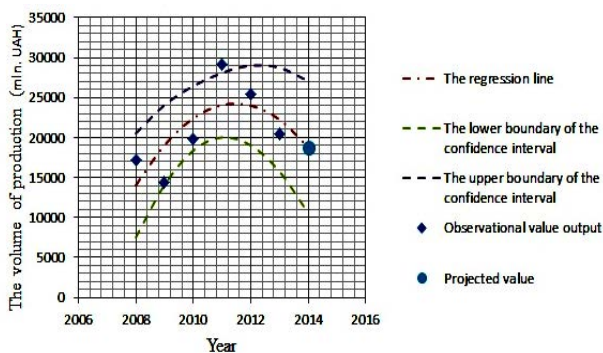


Fig. 2. Confidence interval for forecast output

The forecasting of harmful emissions into the air in the city Dneprodzerzhinsk was done and the dependence between the level of air pollution and the volume of commercial production major industrial polluters was set. Taking into account the small amount of data, the confidence interval was built for obtained dependence. Fig. 2 shows the resulting line of regression, confidence interval and obtained predictive value.

Management of air protection at the municipal level provides for a system of planned measures to reduce the total emissions reductions and restructuring of capture by the most dangerous toxic substances. The protection of city air from harmful substances pollution is most effective when it aimed to reduction of the weight of harmful substances that enter the atmosphere. It means that it must be done by directly responsible for air pollutions, namely by industrial companies. That's why the implementation of effective systems capture and utilization of the most dangerous toxic substances is the main measure of prevention of air emissions of harmful substances. Municipal authorities and the public must implement constant monitoring of air. They must also regularly inform the local community about the result of monitoring and fully support the implementation in large industrial cities innovative eco-technologies and environmental standards.

Conclusion

As a result of the research, it was found that the prediction based only on the time factor alone did not accurately reflect existing trends. In addition, a significant seasonal component was detected by while examining the level of pollution in the industrial cities. Thus, for prediction harmful emissions into the air of industrial cities we should take into account the economic performance of industrial polluters. The necessity of strengthening the economic levers at the municipal level in the field of ecological state of air quality in an industrial city was proved. To reduce the eco destructive impact on air quality in the city recommend to use economic instruments to promote at the municipal level. Taking into account environmental priorities, the practical guidance was developed for the city that is undergoing a significant impact eco destructive industry.

References

- [1] Environment m. Dneprodzerzhinsk [Statistical digest](in Ukrainian) / Office of Statistics in the city. Dneprodzerzhinsk – 2014. – 47 c..
- [2] L.V. Tymoshenko, O.M. Us, " Environmental and economic aspects of evaluation and prediction of air pollution in industrial city" (in Ukrainian) Economic Bulletin of the National Mining University , pp.156-168, 2016.