

## ECOLOGICALLY LIMITED GROWTH: CROSSROADS OF THE REGIONAL TRANSITIONAL ECONOMICS

### ABSTRACT

The relationship between the economical growth and the contaminant emissions level is analyzed. Donetsk region is chosen as the analyzing one, as it most closely represent the situation in Ukraine in the whole – increasing GDP and emission level at the same time. To understand the necessity of improving the existing ecological policy are presented two correlation and regression models, which show the trends in ecological state in the Donetsk region. Proposals which can be used concerning the Ukrainian ecological policy are suggested in the research.

### INTRODUCTION

The problem of society and environment cooperation was extremely relevant in the industrial era, intensified in the 2<sup>nd</sup> half of XX century and while turning to XXI century obtained global scales.

Not analyzing the phenomenon “global ecological crisis”, we will mention the fact that mineral resource depletion and ecosystem destroying is the last point, after which – the precipice is. The history testifies that environment control loss has the disastrous effects on countries, nations, civilizations in general. Continuous intensification of ecological crisis, more precisely of the crisis in relations between society and nature, was the cause of reunderstanding necessity of the development aims and priorities in the end of XX century. Lots of famous scientists works helped to change the public realization orientation of this problem. Among these scientists we should mention J. St. Mill, J. Toynbee, B. Commoner and others.

The questions of environment conservation and ecological safety supplying are the issues of current importance for Ukraine, which now fulfills large social and economical transformations in the conditions of transitional economics difficult period. General ecological situation in Ukraine now is considered as critical. Literally, Ukraine is experiencing the ecological crisis, which badly influences on traditional life sustenance system. Exactly this crisis is one of the main reasons of Ukrainian society degradation. Today by the level of GDP, lifetime and educational level Ukraine occupies the 75 place, according to the global competitive ability index (GCI) it is on the 86 place among 104 countries.

Donetsk region is on the special place among the Ukrainian regions. Its industrial potential comes to 1/5 of nation-wide one. However, pollution that it produces is enormous. Annual part of Donetsk region pollution is estimated as 40% of emissions into atmosphere, 25% of wastes and 30% of sewage dumping into surface ponds.

The ecological crisis in the Donetsk region has been forming during a very continuous period. The priority-driven industrial fields of the region were energy, metallurgic, chemical and others environmentally-

dangerous ones. In addition to this there was lack of legal and economical mechanisms for environmental protection, low level of society ecological understanding and protective constructions effectiveness. All of these led to dangerous ecological state in Donetsk region.

Overcoming of existing ecological crisis is necessary for Ukraine not only to restore disturbed balance in eco-economical system, but also to intensify the positive tendencies in economy, and therefore to improve the population welfare.

Besides, today, when Ukraine is a country with transitional economy, its complete participation in international economic relations and in the process of world economy globalization is impossible without introduction of resource- and energy-saving technologies and orientation to international ecological standards. Whether these transformations will succeed or not highly depend on chosen strategy orientations, which include the following: the priorities of ecology policy, development and introduction of which is the task of national, regional and local authorities. Efficient ecology policy is called upon adjusting local, regional and global ecological and social-economical aims of society evolution. The neglect of even one of them leads to deficiency of taken decisions. Therefore, the effectiveness of social and economic policy highly depends on how the ecological limits of the growth are considered while its forming.

Corresponding to said above, the aim of this research is to find out the dependences between the economic growth and pollutions, as those which limit it, and to formulate the ecological policy priorities on the basis of this.

## THEORETICAL BACKGROUND

The research is based on correlation and regression analysis. There are built two regression models – linear and polynomial one. Linear regression represents the analytical dependence between two indications – factorial and giving result one. It is described by the equation (1):

$$y := a \cdot x + b \quad (1)$$

Another regression model used in the research is polynomial regression, which is described by equation (2):

$$y := a \cdot x^2 + b \cdot x + c \quad (2)$$

For analyzing the closeness level of linear dependence is used the correlation coefficient. The formula for its calculation is:

$$r_{xy} = \frac{M[(X - m_x) \cdot (Y - m_y)]}{\sigma_x \cdot \sigma_y}$$

(3)

If  $|r_{xy}| < 0.3$  there is practically no dependence between X and Y

If  $|r_{xy}|$  lays between 0.3 and 0.5 then the dependence between X and Y is weak.

If  $|r_{xy}|$  lays between 0.5 and 0.7 then the dependence between X and Y is medium

If  $|r_{xy}|$  lays between 0.7 and 1 then the dependence between X and Y is high.

To check if the correlation coefficient is significant it is necessary to calculate the value (4):

$$t = \sqrt{\frac{r^2}{1 - r^2}} \cdot (n - 2) \quad (4)$$

which has the Student distribution. Theoretical value of the Student distribution function  $t$  for specified probability is found in the tables.

If  $t > t$  then there exist the linear dependence between X and Y.

The provided theoretical background is the methodical basic of the research.

The proposals given about the ecological policy in Ukraine are based on the principle of sufficiency, formulated by Thomas Princen, which states that people have to decide what is needed to optimize the well-being of all life in the ecosystem, balance all interests and at the same time appreciate natural constraints. According to this principle, they should agree to produce only, but generously, what is needed, accepting and addressing all costs of production. Collectively, distribute what is needed to those who need it [12].

Industrial production development, if it is done without paying attention to nature, can cause such ecological crisis, the scales of which will be equal to use of weapons of mass destruction. For better understanding of the problem a model of ecosystem provided by Herman Daly can be built. If we outline the imaginary rectangular around the economical system, it will represent the environment in which we all live and which surrounds us. It is becoming obvious that economy can't endlessly grow and one day it will reach the point, when numerical growth should be replaced by qualitative changes in order to give the future progress right to exist. However, it is not enough to realize the problem, it is important to comprehend, when there comes a point, when it will be necessary to review the economy policy and proceed to qualitative change [6].

## RESEARCH

Donetsk region is a leader among other Ukrainian ones in the industrial fields. The region is the one with the highest level of urbanization – over 90%. There is 12% of all Ukrainian natural resources there. That is more than in any other region of the country. Donetsk region supplies its own needs and provides variable minerals to other regions of Ukraine.

Donetsk region has international trade partners in more than 132 countries. This plays important role for the region economy. More than 70% of production is sold in the foreign market. Main trade partners of Donetsk region are Russia, China, EU countries, the USA and Turkey.

Donetsk region is the one of great importance for Ukraine, as it is concentrated more than 20% of country's industrial potential there. Its structure is shown on the Figure 1 [23].

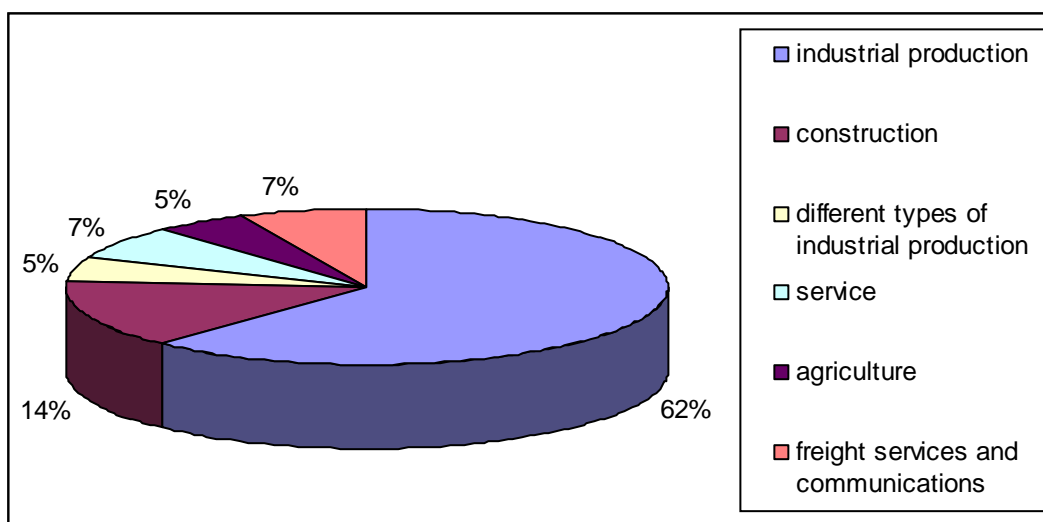


Figure 1. Structure of Donetsk region potential

Thus Donetsk region is first of all industrial one, as its industrial production is estimated as 62% of all economic potential. If we add to it construction (14%) and freight services and communications potential we

will receive the final economic potential of Donetsk region equal to 83%, that is approximately 16 times more than its agriculture potential. The structure of region's industrial potential is shown on the Figure 2.

At the same time the analysis of the Donetsk region potential, obviously doesn't reveal the real scene of its economical state, that can't be satisfactory under the conditions of deep ecological crisis in the difficult transitional period from command economy to market one. It's necessary to notice that high ecological potential is mainly formed with the help of environmentally-dangerous fields (see Figure 2). Stated above doesn't leave any doubts about the importance, which Donetsk region has in the scales of the country as a whole. The inevitable consequence of the high industrial potential of the region certainly is ecological crisis, which was formed during the continuous industrial history of the region. That's why getting over regional deep ecological crisis will cooperate overcoming the whole country's crisis.

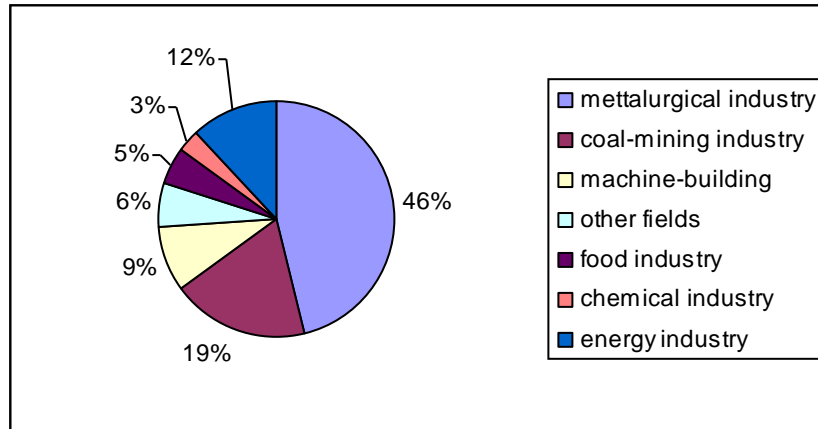


Figure 2. Structure of Donetsk region industrial potential

By analyzing the ecology state in one of the most ecology dangerous regions – Donetsk region we will figure out whether the moment to change existing ecological policy came in Ukraine or not. It is shown the dynamics of the contaminant emissions of the region, provided by the Statistical department on the Figure 3 [23].

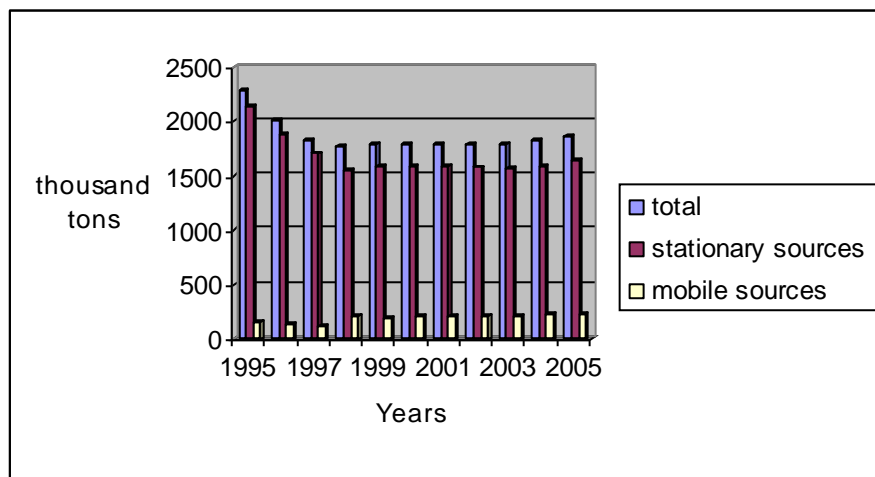


Figure 3. The contaminant emissions dynamics of Donetsk region

If analyzing the stationary sources of emissions we can come to the following results. The majority of the manufacturing firms have increased its emission level during the period from 2000 to 2005 (see Figure 4).. Using existing information about this level we can build a linear regression between the amount of emissions of three leading manufacturing firms of Donetsk region.

As we can see from the figure presented, the tendency of the three leading firms is to increase the amount of emissions from year to year. If nothing is done it's possible to suppose that emissions will extend even more in future.

Last years the tendency of GDP growing, as well as a tendency of Donetsk region production output growing exists in Ukraine. It's logical to assume that increasing in the production output level is followed by the same thing in emission amount. If we mark values of the production output and contaminant emissions on the plot, we can build a polynomial regression which is shown on the Figure 5 below.

If the correlation coefficient between Donetsk region production output and contaminant emissions is estimated, its value will be equal to 0.724. This states that there exists the high level of dependence between these two indexes.

While checking the correlation coefficient significance the following result was obtained – it is significant with the probability 0.9, as  $2.099 > 1.533$ .

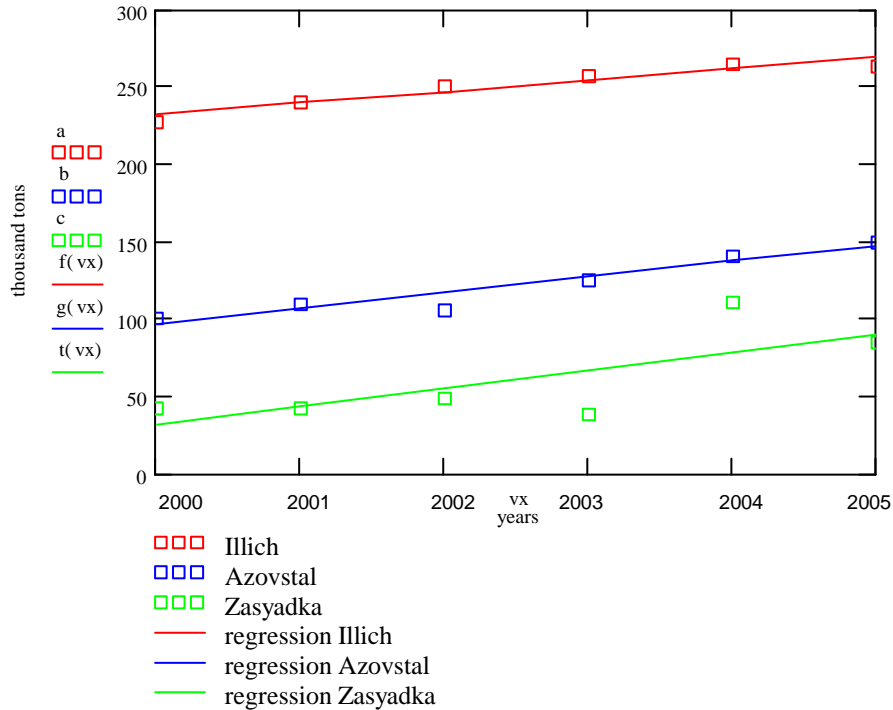


Figure 4. Regression model of emission level in Donetsk region (period 2000-2005)

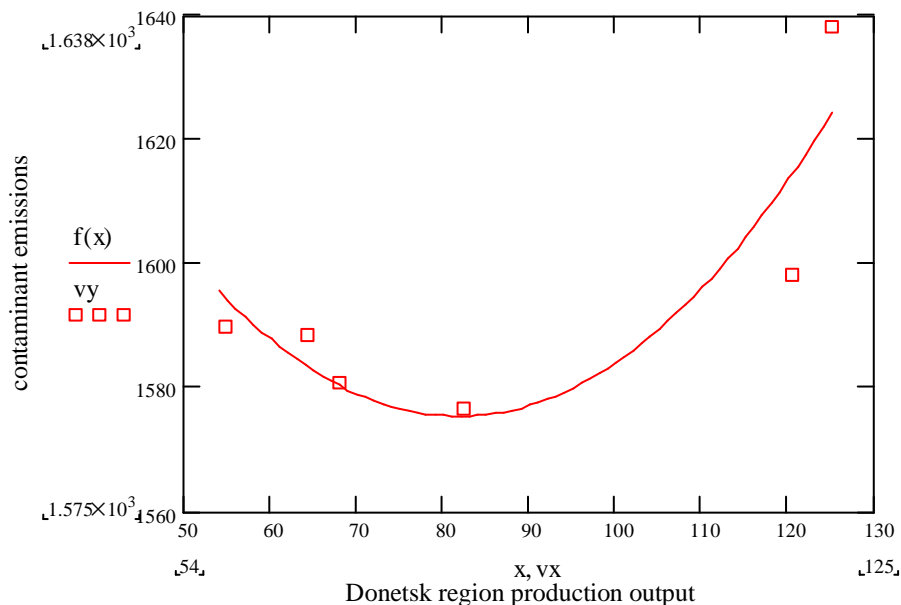


Figure 5. Regression model of Donetsk region production output and contaminant emissions level

## RESULTS AND PROPOSALS

Regression analysis results show that:

- majority of Donetsk region manufacturing firms increase the amount of emissions and therefore made the ecological crisis deeper and more complicated to go through;
- the suggestion of the direct relation between the Donetsk region production output and contaminant emissions level was confirmed.

It is now certain that the moment, when the ecological policy should be reviewed came. It is known that the main anthropogenic source of greenhouse gas (GHG) emissions in Ukraine is the energy sector, which according to IPCC Guidelines covers mining, transportation, storage, processing and combustion of organic fuel in stationary and mobile energy sources. GHG emissions in the energy sector of Ukraine account for above three-fourths of all GHG emissions. Compared with the EU-25, Ukraine uses 3.3 times more energy to produce each unit of GDP. By the way, if all former communist bloc nations in eastern Europe and central Asia could reach western European levels of energy efficiency, world energy consumption could fall 7.2% [5].

In order to clearly formulate the ecological policy priorities it seems important the results of modeling and analysis of GHG emissions in the economy of Ukraine. The model of energy sector was developed under the sponsoring of the U.S. Environmental Protection Agency, the Agency for Rational Energy Use and Ecology modeling and analysis of Greenhouse Gases Emissions (GHG) in Ukraine [].

There were elaborated three scenarios of energy consumption and GHG emissions under alternative assumptions of economic growth and implementation of energy efficiency.

Scenario 1 (Low) envisages slow structural reforms, eliminating the shadow economy, promoting engineering innovations, maintaining the unfavorable structure of the international energy market, and a lack of visible changes related to diversification of external energy sources. Under these conditions, annual average GDP will grow slowly from 2-3% in 2001-2010 to 4-5% in 2011-2020. Under this scenario Ukraine's GDP will grow to nearly twice its current level (1.99 times) over 20 years, however, this is short of the level reached in 1990.

Scenario 2 (Mid) envisages aggressive structural reforms, accelerated elimination of the shadow economy, rapid growth of engineering innovations, and diversification of external energy sources. The accelerated reforms and elimination of the shadow economy provides that GDP will achieve a high (up to 7%) rate of growth and decrease in energy intensity during the 2006-2010 period. After the complete elimination of the shadow economy, the rapid growth of GDP slows to 5-6%. In this scenario Ukraine's GDP grows times over 20 years and achieves the 1990 level in 17 years.

Scenario 3 (High), in addition to the assumptions in Scenario 2, envisages favorable conditions in the international energy market. This provides for GDP growth rate to increase by an additional 1% to 6-7% with a high of 8%. In this case Ukraine's GDP grows 3.36 times over 20 years and achieves the 1990 level of 1990 in 14 years.

Figure 6 provides the historical levels of GDP (in billion Hryvna) for the period 1990-2000 and the predicted levels of GDP for the three growth scenarios for the period 2001-2020.

The conclusion of analyzing three stated scenarios is the following: the implementation of energy efficiency measures will reduce energy consumption by approximately 36% in 2010 and by 45% in 2020 from the 1990 level and lower energy-related GHG emissions by approximately 46% (165 to 213 million tons of CO<sub>2</sub>) and by 51% (205 to 357 million tons of CO<sub>2</sub> equivalent) in 2020 from the 1990 level.

Taking to the consideration the results of correlation and regression analysis and presented scenarios we can finally formulate the proposals concerning the ecological policy in Ukraine. As it seems, the main task of development of Ukrainian economy is the search of right balance between ecological and economical aspects

of development. This way is called the sustainable development. That's why long-term economical development is impossible without providing the following:

- environment has to continue to supply the main ecological services for the future generations;
- the health of the human should be protected of negative effect of pollution;
- ecological services, as, for example, water-supply, sewerage system, collection and utilization of the wastes, which are favorable for all levels of society, especially for those poor;
- natural resources should be used the way not to damage long-term development;
- ecological risks should be operated.

**Gross Domestic Product of Ukraine  
for the period to 2020, billion Hr**

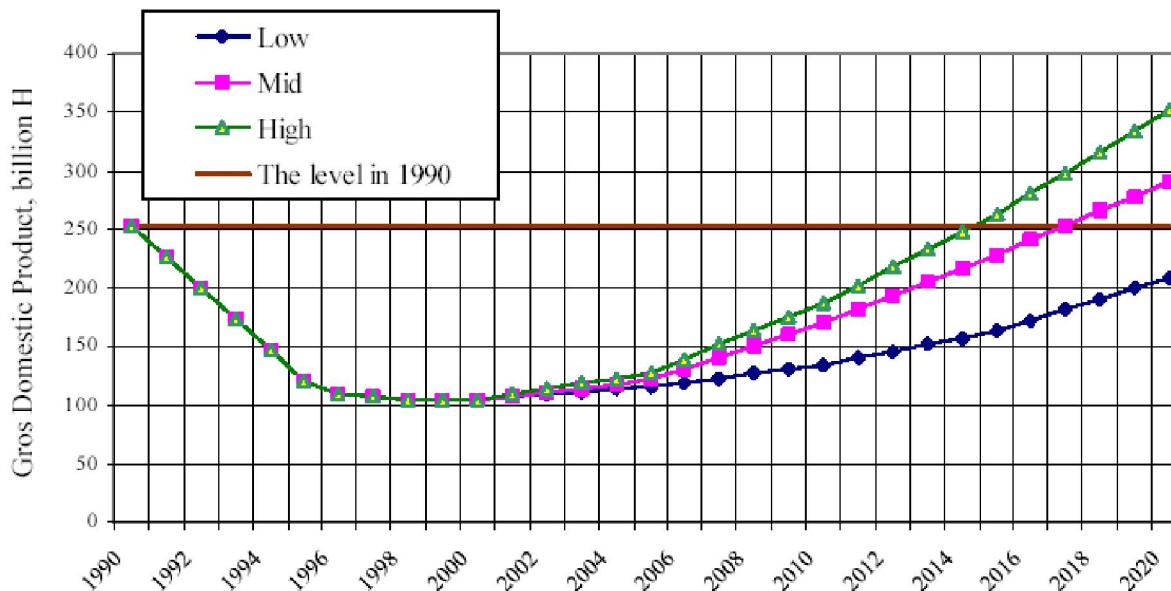


Figure 6. Historical and Predicted Gross Domestic Product of Ukraine for the Low, Mid, and High Growth Scenarios (1990-2020)

To make the task to review the ecological policy in Ukraine clear, the following measures should be done:

- biosphere culture organization;
- quality of life improvement;
- institutional base strengthening;
- economy procedure perfection;
- industry ecologisation ;
- rural economy ecologisation;
- natural system reconstruction.

## CONCLUSIONS

In this paper the question of the ecological and economical state of Donetsk region was raised. By exploring the existing statistical material it was found out that Donetsk region is not only highly economically developing one, it is also the most environmentally dangerous. This statement was proved by the built regression models.

According to the explored data and the model of GHG emissions in Ukraine, as well as to the ideas of famous ecological economists - Herman Daly and Thomas Princen, there were made such conclusions concerning the improvement of Ukrainian ecological policy:

- it should be based on the principals of sustainable development;

- it is important to define aims and most effective ways of their achievement;
- performance of ecological policy requires institutional transformations;
- Ukraine has to head for the developed countries in solving the ecological problems, as these countries have huge experience in using of the all instruments of ecological policy.

At the same time, beside ecological and economical aspects, it is important to take to the consideration social aspects, specificity existing of public relations, cultural features while decision-making.

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