The Improvement of Russian Environmental Protection Methods Using a Dynamic Input-Output Model.

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Environmental issues are very important for Russia as it is one of the most polluting countries in the world. Russia accounts for 13% of total world emissions of major hazardous substances (solid substances, sulphurous oxide, nitrous oxide and carbonic gas). There is a strong relation of environmental pollution and GDP (Fig.1). The graph shows that there is no improvement of production and environmental protection technologies from the point of view of their influence on quality of ecology.

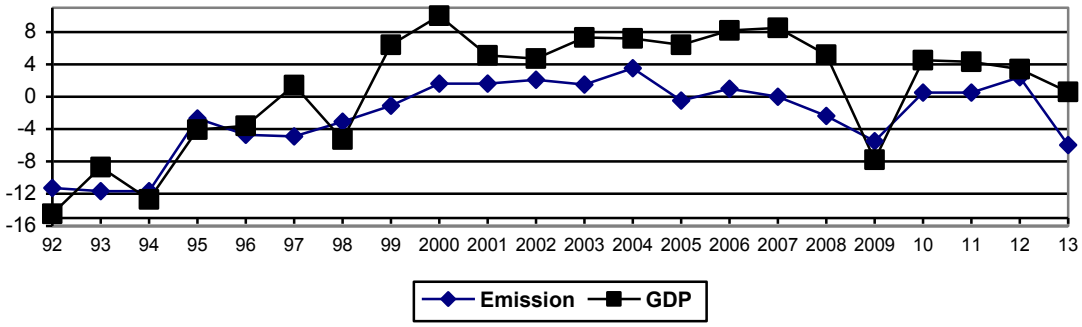

Fig. 1. Change rates of stationary emission GDP
Source: Statistical data of Federal State Statistics Service

In spite of some decrease in yearly pollution in the crisis period nature does not have time to neutralize pollution accumulated before, and as a result there is an increase in their general level. Maximum concentration level of harmful substances is higher than permitted level in the atmosphere of 205 Russian cities. Sadly, the number of polluted cities is increasing. In 2012 the number of cities with high pollution level (maximum concentration level of harmful substances is 5-10 times higher) was 138 (compared to 98 in 2000). According to the Russian State Committee on Statistics, only 15% of urban population lives on the territories where air pollution does not exceed hygienic regulations, with 1/5 of urban population living in environmentally harmful conditions. A very hard situation with water supply of population emerges as a result of river and underground water pollution, the need for clean drinking water is met by only 50% of Russians.

In the opinion of many experts ecological factor is the main one among other risk factors (economic, cultural and others) that have had a negative influence on health of the Russians during recent years. The number of yearly registered people with the first diagnosed cancer for every thousand people increased twice during 1992-2013, the common morbidity increased by 30 % in this period (Fig. 2).

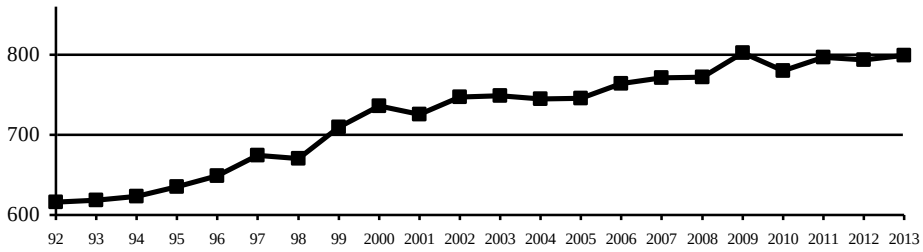

Fig.2. Morbidity in Russia (registered patients with the first diagnosed disease for every thousand people). *Source: Statistical data of Federal State Statistics Service*

So, we can see Russia has very serious ecological problems. Nonetheless, the Russian economy spends intolerably little on these goals. The proportion of environmental protection investment in total national investments is about 1.2%–to 2.6 % per year, in comparison with developed countries where this figure ranges from 6% to 25%. The growth rate of Russian environmental protection investment in 2013 constituted 76.2% of the 1995 level. The growth rate of the current environmental costs in 2013 constituted only 38.5% of the 1995 level. This situation in the field of environment protection costs has determined the dynamics of employing the production facilities for trapping and liquidation of hazardous substances in waste gases (Fig. 3). So, there is obviously a necessity of increasing ecological expenditures.

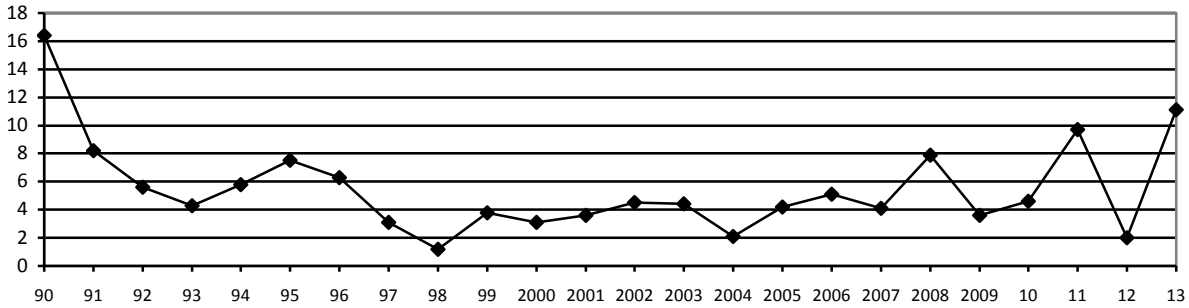

Fig. 3. The production facilities for trapping and liquidation of hazardous substances in waste gases (million cubic meters per hour).
Source: Statistical data of Federal State Statistics Service

The fundamental question is where we should find additional financial sources to improve the environmental situation in the country. First, it is necessary both to increase centralized investments and create incentives for enterprises to construct environmental protection facilities. The main task is to improve the economic mechanism of environmental management. Our ecological legislation is not perfect. Enterprises find it more profitable to emit harmful substances rather than invest in pollution abatements. According to the opinions of the leading economists and ecologists, ecologization of the tax system is necessary. The current level of pollution taxes does not provide for the necessary amount of investment or cover current expenditures for the purpose of pollution abatement. To make it worse, pollution taxes are declining quickly in real terms because of inflation. For instance, in 2014 average prices stage increased from the level of 2003 by 3.41 times, whereas the index of pollution taxes was only 2.33 times.

In developed countries there is currently an increase in the rates of environmental taxes with the collected amount being 1% of GDP (in Russia it is 0.03%–to 0.04 % of GDP), despite the fact that the standards of pollution charges are 10–to 100 times higher for various ingredients.

Expect stimulant function pollution taxes should play also compensation role. On our opinion the accumulative pollution taxes should compensate the ecological costs. It means that size of ecological payments should be based on assessment of necessary expenditures for environmental protection goals. But there are difficulties in such assessment. The method suggested by researchers of the Institute of Economics and Industrial Engineering of the Siberian Branch of the Russian Academy of Sciences (Institute of Economics and IE SB RAS) makes it possible to estimate the costs of preventing air pollution. The assessment of the environmental protection costs was carried out according to the results of predictive calculations using the dynamic input-output model (DIOM) of the Russian economy with an environmental protection block (EP block). A detailed description of the economic and ecological units of the model complex is given in the papers [1, 2].

The model calculation was based on several scenarios of Russia's economic development in the period of overcoming the global economic crisis in 2015-2020: pessimistic scenario with slowdown of economic growth and optimistic scenario with acceleration of economic growth. The optimistic scenario is realized under hypothesis about oil prices increase and real ruble exchange rate strengthening beginning of the end of 2015, the revival of investment processes, the successful policy of import substitution, and the competent using of instruments of monetary and fiscal policy. The pessimistic scenario is implemented under assumption of negative economic tendency prolongation of the 2014. The Table 1 shows key indexes according to these scenarios. You can see the future increase of environmental pressure, which will be expected in optimistic scenario (see Fig. 4).

Table1.

Forecast key factors of national economy in Russia in 2014-2020

The pessimistic scenario							
	2014	2015	2016	2017	2018	2019	2020
GDP growth rate, %	100,0	96,6	94,5	92,1	100,0	100,0	100,0
Investment growth rate, %	97,5	92,0	86,5	79,2	100,0	100,0	100,0
Growth of real dollar rate, %	102,7	105,0	105,0	105,0	105,0	105,0	105,0
Average current dollar rate, rubles per dollar	35,57	41,09	47,45	54,81	58,65	62,17	65,90
Change of Urals Price (in dollar per barrel)	-7,67	-10,37	-3,24	-1,47	0,0	0,0	0,0
The optimistic scenario							
	2014	2015	2016	2017	2018	2019	2020
GDP growth rate, %	100,0	99,1	102,4	106,6	106,6	106,6	106,6
Investment growth rate, %	97,5	97,8	104,8	113,9	113,9	113,9	113,9
Growth of real dollar rate, %	102,7	105,0	95,5	90,9	95,0	95,0	95,0
Average current dollar rate, rubles per dollar	35,57	41,09	43,14	43,14	43,14	43,14	43,14
Change of Urals Price (in dollar per barrel)	-7,67	-4,41	9,60	10,56	10,56	10,56	10,56

Source: results of forecast using DIOM

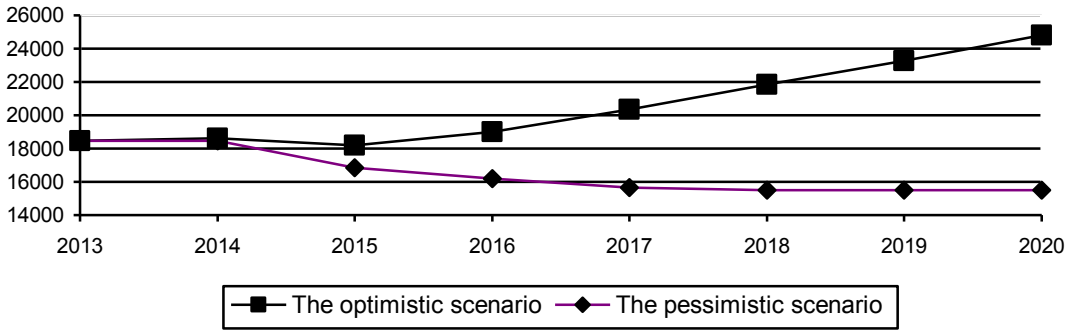

Fig.4. Forecast stationary emissions (thou tons)
Source: results of forecast using DIOM

The next step of forecast calculation considers increase of expenditures for trapping air pollutants. This scenario assumes meeting Russian government goal to reduce greenhouse emissions to 75% of the 1990 level by 2020. In 1990 Russian GHG (greenhouse gases) emissions were estimated at 3314 million tons in CO_2- equivalent, and in accordance with the government requirements they have to be reduced to 2,486 million tons in CO_2- equivalent by 2020, that corresponds with 2,1262.8 thou tons of total emissions from stationary sources for 2020 (31.263 million tons). You can see that this level is obviously achieved in accordance with pessimistic scenario (see Fig. 4). So the only optimistic scenario will be discussed now.

The estimate received as a result of predictive calculations of the amount of air pollutants produced by different industries and in the national economy as a whole in the optimistic scenario, makes it possible to determine the dynamics of trapping air pollutants in the forecast period in accordance with the objective of Russian government. Calculations based on the model complex allow for estimating the total amounts of current and investment expenditures in 2016-2020 (at 2013 prices) to ensure compliance with the specified environmental objectives, i.e. 566.2 billion rubles for the capture of atmospheric pollutants according to the forecast scenario.

Let us estimate the average regional rate of pollution tax and compare these results with those of similar existing rates. We shall proceed from the principle of cost recovery for the destruction of atmospheric pollution based on charges collected. Since records are maintained for a fairly large number of ingredients which enter the atmosphere, let us consider the problem of assessing environmental charges on the example of air-polluting nitrogen oxide, the reduction of emissions of which, along with other greenhouse gases, is assumed by government. Since the proportion of this substance among all pollutants in the atmosphere is 10.3%, we will proceed from the corresponding share in the total costs of its capture, i.e. 566.2 billion rubles x 0.103 = 58.3 billion rubles at 2013 prices. These costs were distributed by the federal districts in proportion to the current regional cost structure for the protection of air resources (Table 2, column 1).

Table 2.

Real and model-calculated regional norms of payment for NO_x in 2016-2020 (price of 2013)

	Total environmental cost in 2016-2020 (million Rbl)	Total emission in 2016-2020 (thou tons)	Forecast payment norms (Rbl per ton)	Lower and upper boundaries of the regional coefficients of the environmental situation	Real payment norms (Rbl per ton)
	[1]	[2]	[3]=[1]:[2]	[4]	[5]=[4]x479,6
Central FO	5259.4	1594.3	3299	1.12-1.21	537-580
North-West FO	8947.3	1006.6	8889	1.06-1.33	508-638
South FO	4658.1	480.3	9698	1.23-1.46	590-700
North-Caucasian FO	337.6	149.6	2257	1.23-1.46	590-700
Privolzhskiy FO	11341.8	1671.4	6786	1.14-1.21	547-580
Ural FO	14647.5	2726.4	5373	1.07-1.18	513-566
Siberian FO	10628.7	2285.5	4651	1.02-1.13	489-542
Far East FO	2494.3	625.9	3985	1.00-1.20	480-576
Russia	58314.6	10540	-		-

Source: results of forecast using DIOM

Column 2 in Table 2 shows the projected total volumes of regional emissions of nitrogen oxide in 2016-2020 (for all of Russia it is 10.3% out of 102,330 thou tons of emissions of air pollutants, that is, 10,540 thou tons). We compare the pollution taxes which are estimated based on predictive calculations (column 3 in Table 4) and obtained by dividing the data from column 1 by the data in column 2, with real payment rates at 2013 prices given in column 5. According to the Government Decree of the Russian Federation № 344 of June 12, 2003, the average standard payment for emitting nitrogen oxide is 218 rubles. We used the inflation index of ecological payment (2.2 in 2013 to the level of 2003) and obtained the average standard payment for emitting nitrogen oxide at 2013 prices – 479.6 rubles per ton. Given the lower and upper boundaries of the regional coefficients of the environmental situation and environmental significance (column 4 in Table 4), this base rate of payments was differentiated by the federal district (see column 5 = column 4 x 479.6 rubles). It is obvious from Table 4 that in all federal districts, even the upper limits of the existing rates do not coincide with those in the forecast of the required size of payments for air pollution with nitrogen oxides. In addition, forecasts of payments are more differentiated depending on the environmental situation in each district compared to the actual standards.

Thus, the results of the calculations make it possible to assess the extent of increases in payments for environmental pollution in Russia, which correspond to world practice. Although most Russian economists and ecologists recognize the need to increase pollution taxes, many oppose this measure, citing the inability of enterprises to pay higher fees for pollution. Of course, the improvement of environmental legislation should occur in a complex interactive way along with improving of the entire tax system. In particular, it is proposed to aim fiscal policy at solving environmental problems with a general decline in direct taxes. In addition, in order to reduce the tax burden, a practice of granting tax reliefs and other financial incentives should be more widely used (offsets of environmental payments in the amount of the environmental costs incurred, provision of favorable loans, state guarantees for environmental loans, schemes of accelerated depreciation of environmental capital stock) to stimulate the implementation of advanced technologies, unconventional energy types, the use of recycled resources and waste management, as well as the implementation of other effective measures to protect the environment. All these measures are obviously an effective means of economic and environmental procedures.

References

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