IMPROVING THE ECONOMIC TOOLKIT OF REGULATION OF ATMOSPHERIC EMISSIONS FROM STATIONARY SOURCES IN ARMENIA

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Key words: atmospheric air, emissions, externalities, environmental tax, inflation, ETS

Introduction

Atmospheric air pollution, endangering the public health and destroying the environment, is considered one of the universal problems, efforts to solve which stem from the need to ensure sustainable development of society. Therefore, realizing the importance of preventing atmospheric emissions, in recent times, society pays more attention to the improvement and development of levers aimed at protecting atmospheric air, and in a market economy, among such levers, economic instruments, that provide the most cost-effective opportunities to reduce emissions, play a key role. Nevertheless, the statistical data on atmospheric emissions in Armenia are of serious concern and indicate the urgency of improving the effectiveness of the national economic toolkit.

Methodology

In order to acquire factual material and solve the tasks set in the study, such methods of scientific cognition as historical, statistical, methods of analysis and comparison, abstraction, induction and deduction, as well as methods of graphic representation were used. The applied methods made it possible to observe the dynamics of emissions into the atmosphere over the past ten years, clarify the main factors causing changes, evaluate the effectiveness of the economic tools used in the field of atmospheric air protection and identify the possible ways to improve the efficiency of the economic toolkit.

Literature review

For the first time, the need to use an economic tool in the field of environmental protection was announced in 1920 by Pigou, who, in his work “The Economics of Welfare”, proposed establishing a tax equivalent to the marginal negative external costs caused by environmental pollution, aimed at smoothing the gap that arises between marginal private costs and marginal social costs [Pigou, 1920, 149-180]. As a result of the development of this idea already in 1992, the United Nations Conference on Environment and Development, held in Rio de Janeiro in June, emphasized the paramount importance of economic instruments for environmental protection and sustainable development [Report of the UN Conference on Environment and Development, 1992, 3]. In that period, after the independence of Armenia, the national economic mechanism of environmental protection began to be formed, the significant part of which is environmental tax for atmospheric emissions. Nevertheless, the national economic mechanism is characterized by certain imperfections, which have been rather deeply addressed by Armenian scientists in the scientific

research "The Problems of Development of Determination Methodology the Environmental Fees and Natural Resources Payments" [Gevorgyan et al., 2014]. However, it should be emphasized that after the mentioned research, key changes were made in the regulatory framework related to the economic mechanism, as a result of which environmental fees were replaced by environmental taxes, and in 2018-2020 environmental tax rates for atmospheric air emissions gradually increased by 30%. And since the studies carried out on the improvement of the economic toolkit of atmospheric air protection in Armenia are few and, in our opinion, scientific studies have not been carried out after the mentioned key legal changes, the implementation of this work becomes quite relevant.

Scientific novelty

Within the framework of the study, analyzing the dynamics of harmful substances detached, captured and emitted into the atmosphere from stationary sources and identifying the main factors causing them, the relevance of enhancing the efficiency of economic toolkit for regulating atmospheric emissions was recorded, to ensure that improvent, by identifying existing imperfections of the toolkit and drawing from successful international experiences, the possible ways and necessary measures have been outlined.

Analysis

According to the World Health Organization (WHO), the number of deaths caused by air pollution worldwide is 4.2 million annually [WHO, 2024]. In the case of Armenia, according to the latest data from the United Nations, in 2019, the number of deaths caused by suspended particle air pollution reached approximately 3,091, and the annual level of particulate matter less than 2.5 microns (PM2.5) in the air is 6.8 times higher than the WHO guideline limit [UNEP, 2024]. The situation becomes even more alarming when considering statistical data on harmful substances detached, captured and emitted into the atmosphere from stationary sources in Armenia in recent years (see Chart 1). According to Chart 1, from 2013 to 2017, the quantity of harmful substances emitted into the atmosphere continuously increased from around 120 thousand tons to more than 141 thousand tons, but in 2018-2019 the amount of harmful substances emitted into the atmosphere significantly decreased to around 90 thousand tons, mainly due to the shutdown of the Alaverdi copper smelting plant in the second half of 2018, which had an annual atmospheric emission volume of around 38 thousand tons [Gasparyan, 2022, 139]. From 2020 to 2023 the amount of harmful substances released into the atmosphere increased again, in parallel with the development of the RA economy, reaching more than 105 thousand tons. As for the amount of harmful substances captured and emitted from stationary sources of emissions, when looking at the chart, it becomes obvious that their dynamics coincide significantly due to changes in cement production. In particular, the capturing of pollutants detached from stationary sources of emissions in Armenia is carried out mainly in Ararat and Kotayk regions, which is due to the organization of cement production in these areas and technological features of cement production, and in

other regions and the capital Yerevan, the rate of the capturing of detached pollutants is zero or at a very low level [Gasparyan, 2022, 138-139].

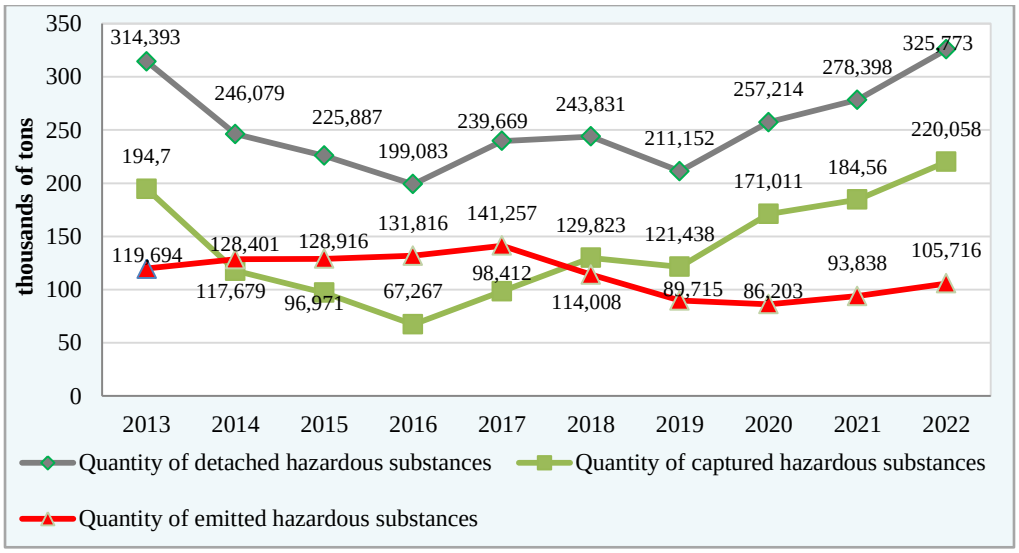

Figure 1. The quantity of hazardous substances detached, captured and emitted into the atmosphere from stationary sources in Armenia in 2013-2022 [The chart is compiled by the author, based on: RA Statistical Committee: Environment and Natural Resources in the RA for 2017, 2018, 49-50; 2022, 2023, 86-87]

In particular, it should be noted, that in 2022 the amount of the captured pollutants in the Ararat region amounted to more than 197 thousand tons, which is almost 90% of the total amount of the captured pollutants throughout the republic in the same year, in the Kotayk region - about 19 thousand tons, which is more than 8% of the total amount, at the same time it is worth to mention that the rate of capturing of detached pollutants in these areas was 98% and 43%, respectively [RA Statistical Committee, 2023, 86-87]. In Yerevan in 2022 only 14% of detached pollutants was captured, the rate of captured pollutants was 6% in Syunik marz, 0.03% in Lori marz, and zero in the rest of marzes [RA Statistical Committee, 2023, 86-87]. Thus, if we exclude the relevant indicators of Ararat and Kotayk regions from the amount of detached and captured pollutants from stationary sources of emission in Armenia, then the level of capturing of detached substances will be only 4%, which is quite worrying and proves the urgency of increasing the efficiency of mechanisms aimed at reducing atmospheric emissions in Armenia. In general, in terms of protecting the environment and its elements, including atmospheric air, the economic mechanism takes a key role in the conditions of the market economy due to the need to internalize externalities and economic promotion of ecologically safer activities [Gasparyan, 2023, 183-197]. Since the establishment of independent statehood in Armenia, a certain economic mechanism for the protection of atmospheric air has been formed and

operates, the toolkit of which mainly consist of environmental taxes, the legal relations related to which are regulated by the Tax Code of the Republic of Armenia [Tax Code 2016]. According to the latter, the environmental tax is determined by multiplying the actual volumes of harmful substances released into the atmospheric air by the rates respectively established for them by the Code. Between 2018 and 2020, the established rates were gradually increased by 30%, resulting in the following values (see Table 1):

Table 1. Environmental tax rates for the emission of harmful substances into the atmospheric air from stationary emission sources in RA [The Tax Code, 2016, Art.167]

Harmful substances polluting atmospheric air	**Rate per ton emitted during reporting period (AMD)**
Dust	2340
Carbon monoxide	312
Nitrogen oxides (recalculated to nitrogen dioxide)	19240
Sulfuric anhydride	2340
Chlorine	15600
Chloroprene	117000

It is noteworthy that the rates established for the release of harmful substances into the atmospheric air from stationary emission sources in Yerevan city, as well as in the territories of national parks, increase by 1.5 times, and in case of exceeding the marginal allowable emissions (MAE) defined in accordance with the RA Law "On Atmospheric Air Protection" and illegal emissions, rates, that are 5-fold, 10-fold and even 25-fold higher, are applied [The Tax Code, 2016, Article 167]. Nevertheless, the existing extremely low level of capturing of detached pollutants from stationary sources of emissions indicates that the environmental taxes in Armenia do not stimulate the implementation of environmental measures aimed at reducing emissions, and for economic entities paying environmental taxes is more economically beneficial than the implementation of environmental measures. Such a situation is probably due to the current tax rates, because the environmental taxes set for atmospheric emissions in Armenia do not correspond to the damage caused to the environment as a result of emissions. A clear proof of which is that according to the results of recent OECD studies, in Armenia, in 2019 the social cost of premature death from $PM_{2.5}$ air pollution alone was equivalent to approximately 12% of GDP (the EU average did not exceed 3.5%) [OECD.Stat, 2024], which is equal to more than 78 billion drams [RA Statistical Committee, GDP, 2024], meanwhile, in the same year, total environmental taxes on emissions into the atmosphere amounted to only 2.8 billion drams, of which 2.7 billion drams were received from vehicles [RA Ministry of Finance, 2024], and about 80 million drams from environmental taxation of the atmospheric air emissions from stationary sources [RA Statistical Committee, 2024]. Consequently, it turns out that environmental taxes amounted to more than 27 times less than the indicated

damage, while this is only a part of the social costs arising from atmospheric air pollution, since atmospheric pollution also damages crops and buildings, negatively affects ecosystem services, etc [Juřík & Nils, 2021, 24]. As a result, it can be noted that there is a deep gap between external costs caused by air emissions from stationary sources and environmental taxes levied for these emissions, and that environmental taxes do not economically stimulate the implementation of environmental measures, which, in particular, is unacceptable. To solve this problem, it is first necessary to review the current rates of environmental taxation of atmospheric emissions. Although there was a 30% increase in rates in 2018-2020, it is obvious that this is not enough, and as a result of a deeper analysis of the situation, the picture is changing. The issue is that the base rates have been in effect since January 1st 2007 [The Law on Environmental Payment Rates, 2006, Article 2], meanwhile, compared to the same period in 2024, as of January 1, inflation in Armenia amounted to 92.33% [RA Statistical Committee, 2024], as a result, it turns out that the current rates have actually fallen rather than increased since their establishment. This issue was addressed by Panayotou as early as 1994, noting that tools must have sufficient flexibility to adapt to market conditions and presenting inflation as a problem, in which case the instrument would either maintain its power or gradually turn into an ineffective instrument, and as a possible solution for preserving the value of the instrument, inflation-adjusted indexing was proposed [Panayotou, 1994, 50]. The approach used in Kazakhstan can be considered as an example of practical implementation of what was mentioned. Here, the emission tax rates are set in the form of coefficients, which are multiplied by the monthly calculation index (MCI). For example, the rate of one ton of SOx emissions is equivalent to ten times the MCI. The MCI is set by the government each year, taking into account inflation and other factors, and then used to determine taxes [OECD, 2019, 28-29]. In particular, if in 2023, from January 1, the MCI amounted to 3450 tenge, then in 2024, from January 1, it amounted to 3692 tenge [MCI, 2024]. After providing a systemic solution to the problem of rate adjustment to inflation it is also necessary, taking into account the socio-economic capabilities of the country, to review the environmental tax rates of atmospheric emissions. Targeting the rate level that would allow full internalization of negative external costs is perhaps not realistic in the coming decades, but setting such rates that would make it more economically beneficial for business entities to invest in the best available technologies to reduce atmospheric emissions than to pay environmental taxes, is the imperative of the time. In general, it is obvious that reducing emissions is preferable to compensating for the resulting damage. As studies have shown, the costs incurred due to emissions are many times higher than the environmental taxes collected for them, therefore providing tax reductions in exchange for reducing emissions becomes economically preferable. As a similar approach, the experience of the Czech Republic can be mentioned, where the tax is not paid at all, if the economic entity carries out emission-decreasing measures that produce at least a 30%

decrease in the total suspended particles (TSP) emissions, a 55% decrease in the SO_2 or NOx emissions or a 30% decrease in the NMVOCs emissions, compared with the emissions in 2010 [Juřík, Richard and Nils Axel Braathen, 2021, 22]. Such an approach may be applied in parallel with the increase of environmental tax rates in Armenia, which will provide an opportunity to ease the increased tax burden of business entities and will additionally economically stimulate the implementation of emission prevention measures. However, in addition to the identified problems, it should be noted that the full potential of the economic toolkit for atmospheric air protection in Armenia is not realized also because such an effective tool as the Emissions Trading System (ETS) has not been localized and has not yet received national application, while it is widely used in a number of developed and even developing countries around the world and has proven to have the potential to provide positive environmental and economic results [Gasparyan, 2024, 213-220]. Therefore, in parallel with the increase in the effectiveness of the implementation of environmental taxe, it is necessary to take advantage of the opportunities provided by ETS. Yerevan can be considered as the primary place for the implementation of the pilot program for the implementation of the ETS in Armenia. This choice is due to the fact that Yerevan is the absolute leader in the amount of atmospheric emissions per km^2 from stationary emission sources in Armenia, in particular, it is worth to note that only in 2022 in the case of Yerevan, this index was 72,950 kg, and in the case of Kotayk region, which took the next place, it was more than 6 times less or about 11,852 kg [RA Statistical Committee, Environment, 2023, 88-89], meanwhile, about 37% of the Armenian population, or more than 1.1 million people, live in Yerevan [RA Statistical Committee, Census data, 2024, 8], and the social costs due to premature deaths alone due to $PM_{2.5}$ atmospheric air pollution in Armenia reach tens of billions of drams annually, from which it can be concluded that social costs due to emissions into the atmosphere prevail in Yerevan.

According to the data of the World Air Quality Index Project for the entire observation period in the Armenian capital Yerevan, in about 26% of the last 1,391 days, the $PM_{2.5}$ air pollution index characterizes air quality as moderate to dangerous (see Chart 3). In addition, the numbers at the bottom of the columns in Chart 3 are the Air Quality Indexes, which is based on a scale from 0 (good) to 500 (bad) and the colors correspond to the different health impact categories (good, moderate, unhealthy... hazardous) [Air Pollution in the World, 2024]. Nevertheless, it should be noted that in Armenia, the responsible state bodies do not represent information on atmospheric air pollution by suspended particles, which, in fact, is due to the technically insufficient equipment of the appropriate monitoring system. Therefore, in the air quality statistics of Armenia, the concept of "dust" replaces " particle matters" (PM) and is defined as the totality of solid particles of organic or mineral origin (limits cannot be specified because there are no porous filters, diameter ≈0.1 mm) [RA Statistical Committee, Dictionary, 2020, 5].

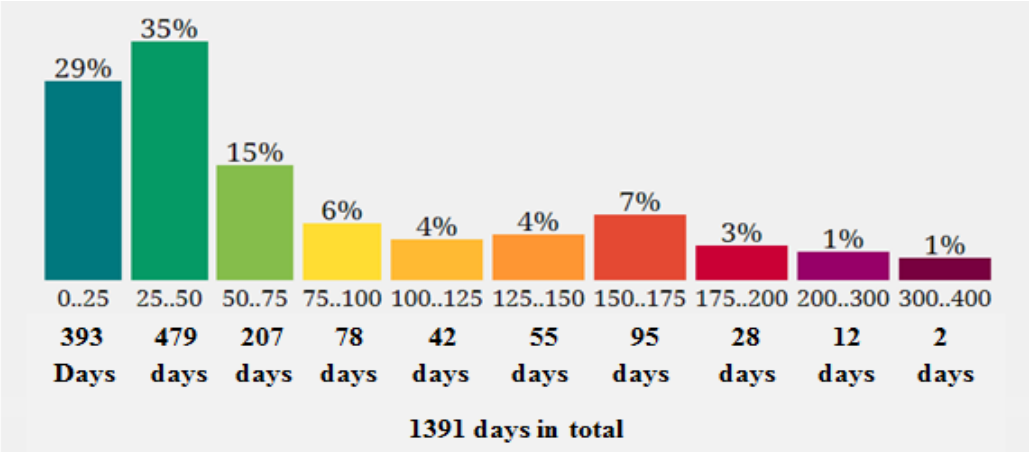

Figure 2. Air quality index in Yerevan [World Air Quality Index, 2024]

According to the data presented by "HYDROMETEOROLOGY AND MONITORING CENTER" SNOC, exceeding the relevant marginal allowed concentrations (MAC) in Yerevan is mostly observed in the case of dust, in particular, in 2023 in 35% of the observations carried out in Yerevan showed excess levels of dust, 29% showed excess levels of nitrogen dioxide, and 18% showed excess levels of sulfur dioxide from the respective MACs. Therefore, taking into account the above circumstances, we consider dust as the primary pollutant to be included by ETS, since the task of implementing measures aimed at its reduction is the most urgent from an ecological and economic point of view. It is noteworthy that a similar pilot program of ETS has already been implemented in the world, in particular, it concerns the city of Surat, Gujarat, India, where in 2019 the world's first ETS was launched, aimed at reducing atmospheric air pollution with suspended particles [BBC, 2024]. Within the framework of that program, the subject of trade are the permits for the emission of suspended particles, the amount of which is initially limited, in other words, the ETS presents itself as a "Cap and Trade System". it is also important to emphasize that enterprises, regardless of their emissions limit, must ensure compliance with the standard of 150 milligrams per cubic meter of suspended particulate emissions [BBC, 2024]. By 2021, the pilot program had already produced positive results, providing a 24% reduction in particulate matter emissions [IndiaSpend, 2024], moreover, in 2023 a similar ETS was launched in Ahmedabad, Gujarat [Yale Economic Growth Center, 2024], which indicates the potential of ETS to provide positive environmental and economic results in the field of atmospheric air protection. Therefore, taking into account the successful experience of Gujarat, it can be expected that the success of launching the ETS pilot project for Yerevan city is quite realistic. However, in contrast to Gujarat's experience, in order to avoid economic shocks when developing the national ETS program, it is more appropriate to follow the experience of China and Kazakhstan, giving preference to the "Baseline and Credit system", in which case, the

upper emission limit is not set initially, but a bottom-up approach is applied, that is, each economic entity is provided with emission permits in accordance with its past emissions and production volumes, as a result, the sum of the permits granted to all economic entities forms the upper limit of the system's total emissions [Gasparyan, 2024, 215-216]. The distribution of emission permits in order to prevent a reduction in government revenues can be carried out on a fee basis, charging an amount equivalent to an environmental tax for proportional dust emissions. The implementation of such a system will make it possible to prevent possible economic shocks, and at the same time, it will create favorable economic conditions for business entities that plan activities that involve emissions, as well as those that carry out emissions exceeding the norms. The creation of favorable economic conditions is due to the fact that, in accordance with the RA Law "On Atmospheric Air Protection", the MAE standards for substances polluting atmospheric air are set in such a way, that the near-ground concentration of pollutants formed as a result of the dispersion of the emitted pollutant (under adverse meteorological conditions of dispersion) in a given territory with the background concentration of this substances does not exceed the MAC of the pollutant [RA Law, 1994, Article 9]. It follows that, under the current regulations, those economic entities planning activities involving emissions, in the case of which emissions will exceed the allowable level of dust in the air, simply have one option for carrying out the activity, that is, to carry out costs aimed at air protection measures to ensure the specified permissible level of the pollutant's MAE, which is sometimes technically impossible, meanwhile, in case of operation of ETS, it will be possible to obtain emission permits from those polluters, whose marginal costs of reducing emissions will be lower than in the case of an economic entity planning an activity. And the economic entities carrying out super-normative emissions, instead of paying environmental taxes at higher than the assumed basic rates, will have the opportunity to acquire additional emission permits, as a result, violation of the established level of MAC of pollutants in the air will be prevented, which is quite favorable from an ecological and economic point of view.

It is noteworthy, that the implementation of such an ETS program may not lead to undesirable economic and ecological results, while it will create an opportunity to increase the efficiency of the system localization and operation, as well as to adapt business entities to the “new rules of the game” , moreover, in the case of successful implementation of the pilot program, the accumulated experience can be used to expand the geographical areas covered by ETS and the list of included pollutants. In addition, if successful, it will be necessary to initiate the transition from the "Baseline and Credit System" to the "Cap and Trade System" and the implementation of measures aimed at organizing the distribution of emission permits through auctions, thus ensuring more effective and complete realization of the potential of ETS.

Conclusions

Summing up, it can be stated that the initiation of measures aimed at improving and developing economic toolkit of the protection of atmospheric air in Armenia is highly relevant. Currently, the main economic tool is the environmental tax on atmospheric emissions, which does not economically stimulate the implementation of air protection measures. As a matter of fact, the set rates play a key role in the effectiveness of the environmental tax, which not only do not provide an opportunity to compensate for the damage caused as a result of atmospheric air pollution, but also have been subject to depreciation due to inflation over time. Therefore, the implementation of recommenddations formulated on the basis of successful international experience can serve to improve the current situation by providing a systematic solution for maintaining the value of rates and contributing to the increase in the incentive properties of the environmental tax. Moreover, the localization and operation of the ETS, which has achieved success at the international level, will fill the gap in the realization of the full potential of the economic toolkit in the field of atmospheric air protection, creating favorable economic conditions for emissions reduction.

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Improving the Economic Toolkit of Regulation of Atmospheric Emissions from Stationary Sources in Armenia

Key words: atmospheric air, emissions, externalities, environmental tax, inflation, ETS

In recent times escalating environmental problems have posed serious challenges to the sustainable development of society. Among those problems, the reduction of atmospheric air pollution has received a global and primary manifestation due to the threats of global climate change and deterioration of public health. Thus, the development and implementtation of measures aimed at the improvement and development of atmospheric emission prevention mechanisms in the context of sustainable development plays a key role. Efforts aimed at reducing emissions into the atmosphere are also highly relevant in Armenia. The low level of capturing of harmful substances detached from stationary sources of atmospheric emissions and the tendency of emissions to increase in the republic indicate the urgency of improving the efficiency of the national economic mechanism of atmospheric air protection. Therefore, the identification of the existing problems of the applied economic toolkit, the implementation of steps and programs developed on the basis of successful international experience to solve them, as well as to replenish the economic tools, can contribute to a more effective realization of the potential of the economic toolkit and the provision of ecological and economic comparable results, creating real opportunities for ensuring the sustainable development of Armenia.