

СТАЛИЙ РОЗВИТОК, ЕКОЛОГІЧНИЙ МЕНЕДЖМЕНТ ТА АЛЬТЕРНАТИВНА ЕНЕРГЕТИКА

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THEORETICAL AND METHODOLOGICAL FOUNDATIONS OF ECOLOGICAL-ECONOMIC ACCOUNTING IN SNA

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The article investigates the theoretical and methodological foundations of environmental accounting based on the EU experience. The integration of the environmental component into national accounting of European countries has been generalized. It has been revealed that most European countries are paying attention to three types of environmental accounts: natural expenses accounts, utilization of natural resources by the economical system accounts (resource flows accounts) and air pollution accounts. The necessity of ecological and economic statistical records in national accounts has been revealed as well. There has been detected that environmental accounts are supplements to the economic system indicators and help to reflect environmental and economic situation in the country. The basic theoretical and methodological foundations of ecological and economic statistical records are exposed. There has been determined that there are three main functions of the environment: the function of resource, accumulation function and service function. The environment (more precisely, the atmosphere) performs primarily a function of emissions of production or consumption processes accumulation in the accounts of pollutant emissions. Based on the basis of the study, conclusions have been developed on statistical accounting of air pollution components.

Keywords: system of national accounts (SNA), environmental accounting, environmental and economic system of accounting, satellite accounts, air pollution, physical flows, economic system

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ТЕОРЕТИКО-МЕТОДОЛОГІЧНІ ОСНОВИ ЕКОЛОГО- ЕКОНОМІЧНОГО ОБЛІКУ В СНР

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В статті досліджено теоретико-методологічні основи екологічного обліку на базі використання досвіду Європейського Союзу. Узагальнено

інтеграцію екологічної складової в національне рахівництво європейських країн. Виявлено, що найбільше уваги Європейські країни приділяють трьом типам екологічних рахунків: рахунки природних витрат, рахунки використання природних ресурсів економікою (рахунки ресурсних потоків) і рахунки забруднення повітря. Визначено необхідність еколого-економічного статистичного обліку в системі національних рахунків. Виявлено, що екологічні рахунки – є доповненням до показників економічної системи та допомагають відобразити еколого-економічний стан країни. Розкрито основні теоретико-методологічні основи еколого-економічного статистичного обліку. Визначено, що існує три основні функції навколишнього середовища: функція ресурсу, функція накопичення та функція сервісу. У рахунках викидів забруднюючих речовин навколишнє середовище (точніше, атмосфера) виконує, в першу чергу, функцію накопичення викидів від процесів виробництва або споживання. На основі проведеного дослідження розроблено висновки щодо складових статистичного обліку забруднення атмосферного повітря.

Ключові слова: система національних рахунків, екологічний облік, система еколого-економічного обліку, сателітні рахунки, забруднення атмосферного повітря, фізичні потоки, економічна система

Actuality of issue. Development of state statistics implies the harmonization of national scorecard with international standards at the level recommended for the statistical offices of countries - candidates for EU membership.

According to the EU Law № 691/2011 (July 6, 2011), the environmental and economic accounting is grouped into three modules [1]:

- Module for air pollution accounts;
- Module for environmental taxes by types of industry;
- Module for general economic movement of materials accounts.

The inclusion of environmental accounts to SNA should provide an integrated assessment of policy tools that will help, in particular, to implement the previous analysis of the impact of various legislative initiatives. The question of the need to harmonize definitions and classifications associated with accounting of natural resources that are used in different areas: statistics of state, environmental statistics and traditional national accounts arises. For example, the system of national accounts considers exclusively economical assets, i.e. assets which are a

subject to the right of ownership and generate economical profit, while the system of integrated environmental-economic accounts considers the nature of capital.

In view of the above, it is extremely necessary to change strategically the approach to the collection and dissemination of information on the economic system interaction with the environment.

Analysis of previous research. The study of national accounting, due to environmental factors, was covered both by foreign and Ukrainian scientists. In particular, the study of choice between quantitative growth and qualitative development, balancing between the need for economic growth and the desire to preserve the ecosystem was performed by P. Bartelmus [2]; O. V. Ilyichova studied features of stability and adaptation of «live» systems in the process of economic development; N. Pakhomov and K. Richter studied major directions of economics formation based on the organizational, institutional, social and environmental innovations by international communities. Among Ukrainian scientists, O. O. Veklich considered the study of the nature and structure of theoretical models of economic mechanism of environmental regulation and the development of practical suggestions for improving the modern tools of environmental regulation; L. S. Hryniv explored the theoretical and methodological foundations of the national economy and a model of sustainable ecological and economic development. Thus, theoretical and methodological issues connected with the research, development and integration of the environmental component in the national accounts using existing methods of ecological-oriented accounts remain unstudied.

Purpose of the article. Based on the above we can formulate the purpose of the study, which is to analyze the experience of EU environmental accounting; determining components of statistical records of air pollution.

Statement of main research. The system of environmental-economic accounting (SEEOA) is developed by the United Nations in accordance with International Standards System of National Accounts, approved by the Commission of the European Communities, International Monetary Fund, Organization for Economic Cooperation and Development and approved as an International Standard on the

compilation of environmental accounts at a meeting of 43 session of the Statistical Commission of United Nations in 2012 [3].

SEEOA's task is to create a database for the implementation of sustainable development, focused on environmental issues in addition to the economic issue.

NAMEA matrix, which was first introduced in the Netherlands in 1994 and recognized by the European Union as an integral part of environmental accounts, supplementing the system of national accounts, should be distinguished in the system of environmental-economic accounting. Today NAMEA is a matrix that takes into account the environmental impacts on the economic situation of the country and is officially recognized by the Member States of the European Union as methodological account for the influence of environmental factors on the environment [4].

The information provided in the system of environmental-economic accounting NAMEA, makes it possible to track an impact of pollution emitted by economic activity on economic performance and assess the extent of anthropogenic impact on the environment. Matrix displays source of pollutant emissions and use of natural resources. Relevant emissions are provided by economic activity for each type of pollution from households and from other sources within the country and as well as transfer pollutions to other countries. It should be noted that NAMEA covers all types of data (in physical and value units) on the environment. Energy balance is also included (the use and supply of energy), and data on water resources, mineral resources and forests reserves.

The most-studied area in the system of environmental accounts includes the accounts of pollutants in the air (hereinafter - accounts). These accounts simultaneously perform general accounting of physical flows between the environment and the economy (natural resources, residues) and record physical flows within the economic system (production flow), resulting from accumulation processes of production and consumption. Due to this structure, a link between the environment and economy of the country occurs.

Accounts reflect data on emissions in accordance with the requirements of SNA. A characteristic feature of auxiliary accounts is that the basis of their development is the principle of consumption.

Physical emission reporting system is based on the principles of development of natural resources use tables.

Principles of National Accounts and their accounting rules belong only to indicators of the economic system. They determine economic components of SNA. Accounts of air emissions - as part of environmental accounts - are complementary to that of the ecological system and help to show the ecological and economic situation. This requires a clear definition of the term «ecological system» and of distinguishing between ecological and economic systems (Figure 1).

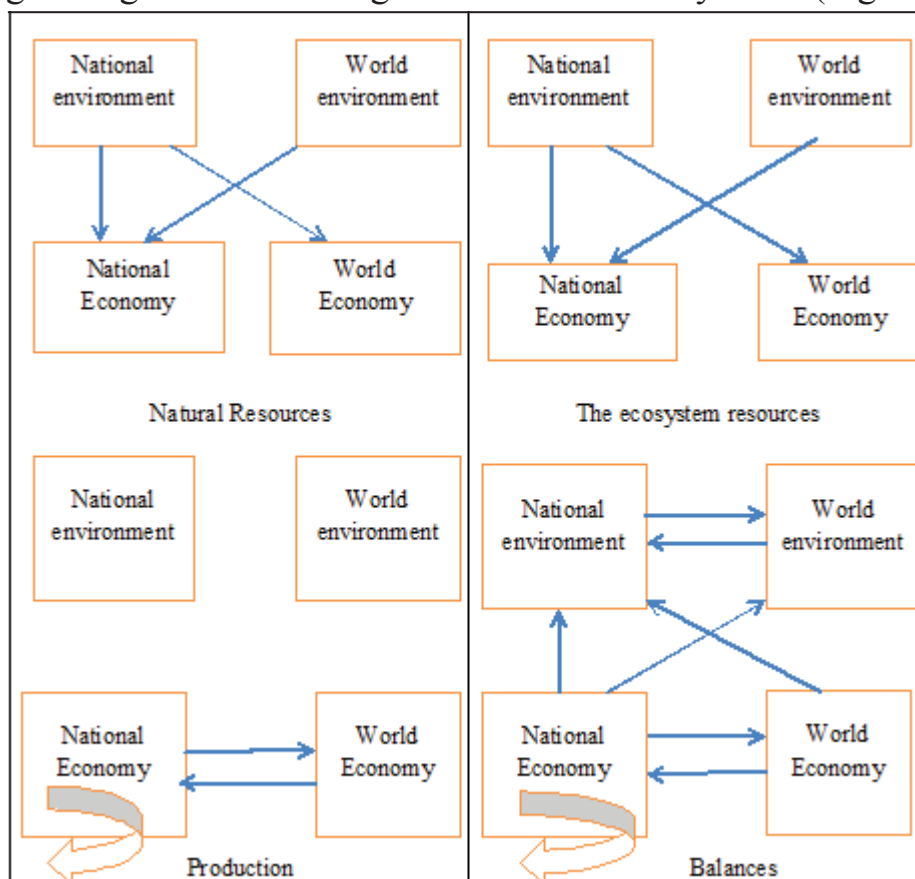


Fig.1 Origin, movement and relationship of physical flows

Source: constructed by [3].

Ecological system includes all natural assets and the environment flows, which are not included in the economic system. Environment is defined as the naturally created surroundings, from which humanity depends entirely on its activities [3].

Three main functions of the environment should be determined: the function of resource, accumulation function and service function. Environment (more precisely, the atmosphere) performs primarily a

function of accumulation of emissions from processes of production or consumption [3] in accounts of pollutant emissions.

There are four types of flows [3]:

1. Flows of products - the interaction of goods and services within the economic system.
2. Flows of natural resources - mineral and energy resources, water and biological resources generated in the environment and transferred to the economic system.
3. Ecosystems resources - include water and other natural resources (nutrients, CO₂) that plants and animals need for growth and life, as well as oxygen for the combustion process.
4. Residues - random and relative waste (byproducts) of economic activity, usually have no economic value and can be recycled or maintained within the economic environment or discharged into the environment. Residues may be in solid, liquid and gaseous states.

Table 1. List of air emissions

№	Gaseous or particulate substances	Code	Measurement unit
1	Carbon dioxide without emissions from biomass)	CO ₂	1000 tonnes
2	Carbon dioxide from biomass	CO ₂ (biomass)	1 000 tonnes
3	Nitrous oxide	N ₂ O	tonnes
4	Methane	CH ₄	tonnes
5	Perfluorocarbons	PFCs	tonnes CO ₂ -equivalents
6	Hydrofluorocarbons	HFCs	tonnes CO ₂ -equivalents
7	Sulphur hexafluorides	SF ₆	tonnes CO ₂ -equivalents
8	Nitrogen oxides	NO _x	tonnes NO ₂ -equivalents
9	Non-methane volatile organic compounds	NMVOCs	tonnes
10	Carbon monoxide	CO	tonnes
11	Particulate matter<10 micrometres	PM ₁₀	tonnes
12	Particulate matter<2.5 micrometres	PM _{2.5}	tonnes
13	Sulphur dioxide	SO ₂	SO ₂ -equivalents
14	Ammonia	NH ₃	tonnes

Source: constructed by [1].

For each country flows of natural resources and ecosystem resources are produced in the domestic and global environment and transferred to the National and World Economy, respectively, crossing functional boundaries between the economy and the environment.

Flows of products originate from economic activity and are used in the economic environment. They move between simple elements of the economy (e.g., from production to consumption). In addition, they can be sold, both within the national economy, and within the global economy.

Flows of residues (including emissions of pollutants into the air) originate from the economic environment. They move from National and World Economy, by crossing the boundaries of the system, get to the ecological system (national and global environment). However, it should be noted that some residual flows are further processed within the economic system.

Information about origin and destination of physical flows allows to clearly tracking the relationship between economic activity of the country and its natural environment. This knowledge is in the basis for tables of physical and cost indicators of environmental and economic accounting.

As an example, we offer to examine the European accounts of air pollution, which include [5]:

- 14 pollution indicators (table 1);
- classification by FEA.

In addition, the data must be prepared on:

- emissions of households (grouped by: transportation, heating and other (paint solvents, aerosols, open flame, lawn mowers, garden machinery, etc.);
- connecting elements.

It is advisable to use one of the main methods in order to form accounts [6]:

1. Calculation on the basis of data on emissions, based on data from the national inventory of emissions of pollutants that are set to match the format of National Accounts.

2. Calculation on the basis of data on energy, based on data from energy balance used to compile Energy accounts. On the basis of this Energy accounts appropriate coefficients emissions into the atmosphere are calculated. This topic is not disclosed in the international methodological recommendations, and each country uses individual methodological approaches depending on available statistical resources.

It is also possible to mix the two aforementioned methods.

Conclusion. Thus, environmental accounts in accordance with international standards are statistical information systems that link national accounts with environmental accounts.

The main functions of environmental accounts are:

- tracing the links between environment and economy;

- grouping pollution indexes according to various economic activities in quantitative terms;

- evaluating the impact of economic activity on the environment, and in accordance contribution of environment in the economic situation.

The system of environmental-economic accounting will allow tracking changes in the environment arising from the economic activities of mankind. In addition, it will be possible to analyze the direct and derivative effects on economic activity from resource use environment on its base.

Thus, the procedure for creating Accounts of air pollution can be represented by 3 stages.

Stage 1. Harmonization of data from national inventories with Accounts of air pollution.

Stage 2. Regrouping energy statistics data in accordance with the requirements (regulations) of Accounts of air pollution.

Stage 3. The connecting elements. These are the elements that help to harmonize national data on emissions with the Account on air pollution.

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