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SYSTEMATIZATION AND FORMALIZATION OF PASSIVE MONITORING DATA IN ACCORDANCE WITH THE COMPONENT-FUNCTIONAL STATE OF HEAT SUPPLY SYSTEMS

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Introduction. The current mission of the leadership of Ukraine, according to the Cabinet of Ministers of Ukraine to discuss "Vectors of Economic Development 2030", is to create opportunities to realize the existing geographical, resource and human potential of the country to ensure prosperity, security and freedoms of every citizen of Ukraine through innovative economic growth [1]. At the same time, one of Ukraine's strategies is to stimulate the development of innovations and modernization of economic sectors to ensure their competitiveness. Also, according to the economic vision: human security, healthy nation, economic strategy, reform of the social sphere, energy, environmental protection, innovative economy and ensuring rapid and sustainable development of Ukraine in three stages, years:

- 1) Increasing competitiveness (2021-2022, 2022-2025),
- 2) Innovative growth (2026-2040),
- 3) Sustainable development (2041-2050).

According to the vision of the development of the sectoral sub-direction "Environment", "Public administration, monitoring and control", the matrix of economic recovery and development consists of: public administration, monitoring and control; rational use of nature; implementation of the principles of sustainable development and gradual transition to a "green economy" [1]. Therefore, the main task of today is the introduction of innovative technologies to improve and reduce the losses of the economy of nature management production activities in rich technological industries. To improve these processes, it is functional to use eco-management. The relevance of the proposed topic is a local solution through the analysis of the general environmental situation, technical condition of the system in the process of modernization or design, technology of reagent-free water treatment (use of electromagnetic fields) at thermal power facilities of rich industries and its environmental and economic viability and investment attractiveness.

Review of the recent research and methodology. Economists, researchers, scientists, and practitioners constantly pay a lot of attention to the study of resource availability and their effective use. In particular, they are widely covered in many scientific works, manuals, and textbooks of their best practices [2-4]. It is possible to draw theoretical and practical conclusions based on the results of economic activity of

industrial production through a comprehensive economic analysis and taking into account the relationship with the environment. Due to which the analysis of environmental activities is carried out in two directions:

- Determining the scale and results of environmental activities;

- Determining its impact on the formation and evaluation of performance indicators [2-6]. The relevance of today's socio-economic needs is determined in publications [7].

The analysis of the work leads to the conclusion that the publications confirm the compromise between economic development and environmental security. The authors carry out an ecological and economic analysis of the causal relationships that exist in socio-economic systems and are characterized by "interaction - change - consequences". Only the rational use of nature determines the ecological and economic balanced development of socio-economic systems. Studies of trial industrial nature management are related to the anthropological transformation of the biosphere [7-11]. Ostap Semerak: "Sustainable development should become a leading criterion of Ukraine's energy policy" Ukraine is ready to be an active participant in the international fight against climate change and recognizes the importance of the national economy's transition to a "green" model of development based on sustainable production and consumption and depletion of natural resources and environmental degradation. In particular, it will create new jobs in the field of environmental protection, promote energy efficiency and energy security, as well as allow Ukraine to access various financial resources to stimulate low-carbon development at the national level, "said Ostap Semerak, emphasizing that making strategic decisions in in the field of energy, Ukraine will take into account primarily the issues of national energy security and the possibility of using the latest achievements and developments in the field of "clean energy" [12].

On the basis of the presented literature review it is possible to form the concept of stable, ecologically and economically safe nature uses and ways of its practical realization. So, nowadays, at modernization of technological processes it is necessary to be guided by principles concerning forecasting of industrial nature management:

The methodological principle of the forecast is the system-generalizing level of research of industrial objects. Forecasting of environmental activities for thermal power facilities (TEO) is based on the following principles of integrated management of technological processes, our research is based on the following principles: system, scientific validity, optimally equivalent relationships between the components of technological processes; on the principle of adequacy (vector orientation of technological processes), which causes stable trends of change (interaction) of real processes; the principle of purposefulness, which determines the nature of action, by creating such a logical chain of methodological system of research, according to which there are interactions, when determining the overall purpose of the system and subordinate to this goal the activities of all components of subsystems. Due to this, this system is considered as a large system in which stability and sustainable development of the system is ensured, as a factor of ecological and economic balanced development of socio-economic systems (components of conceptual development). However, the works propose a thesis that states that the biosphere is the material basis of nature and therefore, modernized technologies should be not only environmentally friendly, but also biosphere-improving, as the basic principle of rationalization of nature. Other scientists who substantiate the use of "green" technologies to obtain a biosphere-enhancing effect. The authors define the "green" economy as a branch of the national economy that reduces environmental risks and environmental degradation. Based on the results of the literature review, it can be concluded that the central issues of nature management, which need to be clarified, should be considered the formalization of parameters that allow to clarify the compromise between economic development and environmental security. It is the economic and ecological analysis of the components of technological processes allows to establish the limiting factors of development in the system (action - state - improvement) and to identify certain patterns (trends) in order to overcome them.

Task statement. The purpose of the systematization and formalization of the data of the results of passive monitoring of the systems of the thermal power object under the conditions of action of electromagnetic fields on them. The object of research is the structure of functioning of heat supply systems as a factor of integrated management in the process of industrial nature management.

Subject of research: coherent connections and multifunctional interactions between system-forming units of technogenic-conditioned material flows of a thermal power object. The methodological basis of the study consisted of general scientific logical statistical, comparative research of scientific professional sources, economic analysis and more.

Basic material and results. Proposals that have tried to implement or are currently implementing projects in the field of air quality monitoring, in various industries have faced a number of problems that do not allow the use of their data in decision-making. This is hindered by:

- Insufficient ramifications of monitoring;
- Inconsistency of measurement methodology with practice;
- Unsystematic information on the collection of monitoring information (sometimes, the inability to compare historical monitoring periods due to the different frequency of data collected).

However, it should be noted that these shortcomings are not the result of insufficient efforts, but rather a confirmation of the thesis that air monitoring is a resource-intensive, systematic and long process that should be carried out professionally. And such attention to this issue, as well as the efforts they make to answer the question of air quality, should be taken as a request, methods of indication of passive monitoring are used in the natural environment under conditions of constant interaction with environmental factors. From the methodological point of view, passive condition monitoring for heat supply systems, thermal power facilities (TEO) using reagent-free water treatment in electromagnetic fields to increase the efficiency of innovative methods, we have introduced as a form of impact (anthropogenic) monitoring.

The hierarchical structure of passive monitoring, against the background of long-term analysis and systematization of the dynamics of transformations of the constituent material flows of feasibility studies, allows to identify trends and characterize the process of self-organization into complex heterogeneous inorganic systems due to electromagnetic fields and thermodynamic mechanism of their transformation. In previous studies [13] it was found that magnetized material flows are characterized by deceptive mass or energy exchange. And further research has shown the effectiveness of the mechanism of water treatment using electromagnetic fields in the heat supply systems of the feasibility study.

The passive monitoring system is characterized as an integrated system that is subordinated to solve the problems of eco-management of the feasibility study. The main components of the system of passive monitoring of heat supply systems are as follows: two-level system of information control, graphic conceptual models regarding the component and functional state of heat supply, as graphic signs of the preface of further scientific and applied research; engineering-technological, organizational-managerial aspects of reagent-free water treatment in electromagnetic fields of the feasibility study system.

Creation of a two-level control system for assessing the state of feasibility studies in the process of electromagnetic fields.

The main tactical pressure of the development of system indicators in the premises of equivalence between the formation of magnetized water in the device "Ilios-M" and directly with material flows, systems of thermal power facilities (parameters of magnetized water and their specific indicators in heating systems and artificial force of their heat-generating ability).

In addition, when monitoring the state of material flows, the principle of equivalence of interhydrochemical, electrophysical and thermophysical potentials should also be maintained (the trend of changing the concentration of components of material flows of different operating conditions of feasibility study systems).

In tab. 1 the indicator system of control of an estimation of a condition of material streams of systems of the feasibility study under various conditions of their operation is presented.

The table presents a complete description of the assessment of the state of material flows, in the process of their self-organization under the conditions of EMF and different operating conditions of the feasibility study systems. If you compare the quantitative values of the state of material flows with the corresponding gradations of tap water [16, 17], then, it can be stated that there is a self-organization of simple inorganic systems into complex inorganic systems.

System transformation (self-organization) is associated with the interaction of micro particles of constituent flows under the influence of EMF and the formation of new complexes due to structural changes in the component relationships in the material flows of feasibility studies in the process of organizing the process.

Table 1

Indicator information control system for assessing the condition of material systems of thermal power facilities under the conditions of electromagnetic fields

p / p	Control values-indications for hydro chemical, electro physical, thermophysical potentials and their specific indicators	Operation of systems HPO	
		opt. conditions	max. admissible (critical)
1.	Specific indicators (from the parameters of electromagnetic field oscillations and magnetic field induction)	0,45 0,56	0,8 0,96
2.	The total concentration of the components of material flows in the feasibility study system by specific indicators	1,1	0,8
3.	The pH value as a characteristic of the acid-base properties of material flows by specific indicators	1,2	1,7
4.	Values of OKV potential as a characteristic of physicochemical properties of material flows by specific indicators	1,5	1,1
5.	The magnitude of the specific conductivity as a characteristic of the thermophysical properties of material flows	1,6	1,4
6.	The value of the additive function of material flows, which have a man-made nature of development	0,54	0,22
7.	The magnitude of the specific heat of material flows that characterize the heat balance of feasibility studies	3,9	3,75
8.	The value of specific indicators of potentially possible endorrhics in the functional system of feasibility study	0,12	0,48
9.	The value of the saprobity index (as a specific indicator) characteristics of the content of biological elements in material flows	1,7	1,01
10.	The value is the potential of trends in changes in hydro chemical parameters in material flows by equations $C_{opt} \leq 0.5 C_{max}$ permissible	0,5	0,6
11.	The magnitude of the potential trends in electro physical parameters in material flows (technological norm-within the unit)	1,0	0,95
12.	The value is the potential of trends in changes in thermophysical parameters in% and corresponds to the ratio $Q_{\text{д}} / Q_{\text{таб}}$	90,5	90,01

Note:

1) indicators (1...11) have the dimensionality of the characteristics of quantitative gradations in conventional units, and 12 indicators – in %.

2) tap water was used as a control (according to items 1...5);

3) the specific indicator of the saprobity index was determined taking into account the saprobity index, which reflects the quality class of natural waters (tap water).

Conclusion. Thus, the results of the implementation of the concept and areas of efficiency are analyzed and presented.

On the basis of the established scientific laws of properties of technogenic-caused material streams preconditions are created:

1) determination of the cause and consequences of self-organization of heat supply systems of heat and power facilities;

2) determination of eco-ternary (energy and energy costs) indicators in our planned research methodology;

3) determining the limits of economic optimal gradations.

The scientific and methodological concept of passive monitoring for the assessment of the state of heat supply systems, under the conditions of initial action, on the material flows in them of electromagnetic fields has been created. An effective form of water treatment in electromagnetic fields is the man-made nature of material flows due to the electromagnetic dissociation of their micro particles and the formation of active complexes (due to the interaction between them).

The result of passive monitoring - systematization and formalization of its data should be carried out taking into account three aspects: engineering and technological, engineering and microbiological and organizational and management decisions. It is shown that the system of passive monitoring is a mandatory subordinate component of eco-management in the industrial sphere - thermal power facilities.

These used prerequisites for implementation, high efficiency of technological processes – 98 %, due to the preservation of natural resources (energy resources by 20%, water resources by 5 %), the estimates of the state of technology [13] belong to the main categories of nature economics due to provide tactical intentions to create a mechanism for implementing environmental measures with the condition of a permanent basis for the use of systematization and formalization of passive monitoring data, respectively, the competent and functional state of heat supply systems [14, 15].

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Журавська Наталія Євгенівна, кандидат технічних наук, доцент. **Ліхачький Валерій Володимирович**, студент. Київський національний університет будівництва і архітектури. **Систематизація та формалізація даних пасивного моніторингу відповідно до компонентно-функціонального стану систем теплопостачання.** Оцінено стан систем водяного та гарячого

теплопостачання теплоенергетичних об'єктів для інноваційного та конструктивного використання теплової енергії при ефективному застосуванні на усіх ділянках цих систем: генерації, нагріву води або утворення пари, транспортування до споживача, а також при використанні її споживачами багатьох галузей, у тому числі житлово-комунального комплексу та будівельної галузі. Створена науково-методологічну концепцію здійснення пасивного моніторингу для оцінювання стану систем теплопостачання за умов вихідної дії на матеріальні потоки в них електромагнітних полів. З'ясовано, що в результаті пасивного моніторингу систематизація й формалізація його даних повинна здійснюватися з урахуванням трьох аспектів: інженерно-технологічних, інженерно-мікробіологічних та організаційно-управлінських рішень. Показано, що система пасивного моніторингу є обов'язковою підпорядкованою складовою екоменеджменту у промисловій сфері – теплоенергетичних об'єктів систем водяного й парового теплопостачання інноваційного напрямку. Проведено критичний смисловий аналіз поглядів українських та зарубіжних вчених у сфері економіко-екологічних та нормативно-правових аспектів природокористування, формування біосфери за умов трансформації її окремих складових, методів управління природокористуванням та екологічної політики. За цих умов пріоритетне значення має формування ефективного економічного механізму природокористування із центрального питання інтегрального управління: чи слід вважати ефективною формалізацію параметрів, котрі дозволяють з'ясувати компроміс між економічним розвитком та екологічною безпекою. Саме економіко-екологічний аналіз складових технологічних процесів дозволяє встановити лімітуючі фактори розвитку в системі «дія – стан – вдосконалення» й визначити окремі закономірності (тенденції) з метою їх подолання. Запропоновані важелі поліпшують інтегральне управління в процесі модернізації технології безреагентної підготовки води (використання електромагнітних полів) на працюючих теплоенергетичних об'єктах та унеможливають процеси забруднення навколишнього природного середовища, забезпечуючи при цьому економію енергетичних витрат за умов планування нових об'єктів. Зазначене дозволяє підтвердити доцільність впровадження у промисловість розробленої системи систематизації та формалізації даних пасивного моніторингу.

Ключові слова: сталий розвиток, теплопостачання, пасивний моніторинг, природоохоронна діяльність.

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Zhuravska Nataliia, PhD, Associate Professor. **Likhatskyi Valerii**, student. Kyiv National University of Construction and Architecture. **Systematization and Formalization of Passive Monitoring Data in Accordance with the Component-Functional State of Heat Supply Systems.** The article examines the assessment of the state of water and hot heat supply systems of heat and power facilities for innovative and constructive use of thermal energy, with effective use in all areas of these systems: generation, for heating water or for generating steam, transporting it to the consumer, as well as when it is consumer so rich industries. Including the housing and communal complex and the construction industry – for example, a scientific and methodological concept has been created for the implementation of passive monitoring to assess the state of heat supply systems, under the conditions of the initial action, on material flows in them of electromagnetic fields. It has been established that an effective form of reagent-free water preparation in electromagnetic fields is technogenic – the nature of material flows due to the electromagnetic dissociation of their micro particles and the formation of active complexes (due to the interaction between them) is determined. It has been established that as a result of passive monitoring, the systematization and formalization of its data should be carried out taking into account three aspects: engineering - technological, engineering – microbiological and organizational – managerial decisions. It is shown that the passive monitoring system is an obligatory subordinate component of environmental management in the industrial sphere – heat and power facilities of water and steam heat supply systems of an innovative direction. The analysis of the content of the point of view of Ukrainian and foreign scientists, monographs is carried out and joint conclusions are made in the conditions of the illuminated literary material under the following headings: the main economic, environmental and regulatory aspects of nature management; the formation of the biosphere in the conditions of transformation of its individual components; methods of environmental management and environmental policy and the like. In these conditions, the formation of an effective economic mechanism for environmental management is of priority; on the central issue of integral management, it requires clarification – formalization of parameters should be considered effective, which make it possible to clarify a compromise between economic development and environmental safety. It is the

economic and environmental analysis of the components of technological processes that makes it possible to establish the limiting factors of development in the system (action – state – improvement) and to determine individual patterns (tendencies) in order to overcome them. The theoretical principles of magnetized water are presented in the works, and the priority level is confirmed by the receipt of three patents of Ukraine for useful action and one copyright certificate for intellectual property, and received support at domestic and foreign conferences. The proposed levers improve integral control in the process of modernizing the technology of non-reagent water treatment (use of electromagnetic fields) at heat and power facilities of rich operating industries and make it impossible to process environmental pollution and save energy costs with effective continuous planning of new facilities. Therefore, through the analysis of the general environmental situation, the technical state of the initial data systems, it is possible to confirm the developed classification and formalization of passive monitoring data, on the use of theoretical foundations in practice – the regulations for industrial implementation, is the basis of the concept of sustainable development.

Keywords: sustainable development, heat supply, passive monitoring, environmental protection.