

Organization and conduct of environmental and economic monitoring of the state of material flows in of thermal power facilities systems under the conditions of electromagnetic fields

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Abstract. The application of physicochemical analytical control for the determination of ecological compatibility of techno-natural systems as a factor mark of the state of material flows in the application of non-reagent water preparation in electromagnetic fields for heat-energy objects of the housing and communal sector and industrial enterprises with low production capacity is substantiated. Heat evaporation and hydrocarbons were selected as test gradients for the heating systems. In both cases, there was no excess emission limit value.

Introduction.

Problem statement

Managing enterprises that are geared towards obtaining stable profits and efficient work is a problem in improving the efficiency of the investment process with the optimal cost of all resources to achieve success in the modern development of Ukraine.

Taking into account the integral nature of the problem being solved, organizational and managerial decisions of the economy of nature management on heat energy objects should be considered everywhere in the prism of compatible interactions of engineering nanotechnologies and the ultimate technogenic impact of the impact on the environment (atmosphere).

Analysis of recent research and publications.

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The best practices of existing problems are reflected in works by well-known domestic and foreign scientists: A.P. Algini, L.J. Savage, G.V. Chernova, M.V. Tersky, V.M. Lycha, O.A. Bondar, V.O. Pokolenko, S.P. Stetsenko, V.G. Fedorenko, K. Lancaster, D. Levy, L. Murphy, C. Lee, J. Pitirin and others, who made a significant contribution to the effectiveness of the organization and management of the construction industry.

At the same time, it should be noted that solving this problem for heat-energy facilities is due to the achievements of the development of such branches of science as ecology, energy, economics. It is also necessary to take into account that thermal energy objects are one of the most important energy consumers when their total thermal power is about 10% of the total capacity of the Ukrainian heat supply systems (E.S. Malkin, B.K. Draganov, B.V. Davydenko, A.O. Redko, O.T. Vozniak, V.M. Zhelich, Y.P. Morozov, I.E. Furtat, 1998-2010, 2014, 2016-2018) [1, 2].

That is, such a methodological tool for conducting experimental works allows to determine the innovative nature of the proposed non-reagent preparation of water in electromagnetic fields (EMF). Thus, the basis of the development of such a concept for the evaluation of the functional state of heat supply systems is the theoretical part of the function and control of production activity of heat and power facilities, and Applied part - environmental management, as a factor attribute (subordinated) of the system of passive monitoring of the state of production processes, which gives an economic effect.

Environmental analysis [3, 4], according to the passive monitoring of the state of the production processes of thermal power objects, provides for their mathematical formalization, the results of which determine the assessment of the effectiveness of the technology and the assessment of environmental impacts. The obtained results are used as a forecast for the study of non-reagent water preparation in heat supply systems with the aid of electromagnetic fields at present and in perspective [5].

The goal is to provide environmentally safe nature management [6, 7]. The peculiarity of this technology lies in the fact that the study uses artificial purposeful technogenesis to obtain magnetized water, which in the future is the basis of material flows of thermal energy objects. In connection with this, a special place is given to physicochemical analysis, as a driving and regulating tool for the functioning of the techno-natural systems of these research objects. The work was carried out within the framework of the tasks of the Law of Ukraine on the main principles (strategies) of the state policy for the period up to 2030 (№ 8328, dated 28.03.19). In accordance with these tasks (tactical intentions), expanded by us, the framework of ecological and economic control for heat-energy objects of the housing utility sector and industrial objects of the construction industry. It is the efficiency of the spatial management of thermal energy objects systems, on the basis of the interconnections and the interaction of the components of material flows, have allowed to expand the database of information control of technogenic-natural systems (the motive structure of passive monitoring) and thereby ensure the relevance of the topic.

Materials and methods.

The systematic approach to research using factor analysis of the systematization and formalization of the components of material flows of thermal energy objects (TEs) systems in electromagnetic fields (EMF) [8] was used in this work.

The research was carried out for five years in the laboratories of the Kiev National University of Construction and Architecture [5, 7].

When interpreting the results, the validity of the results was determined using modern methods of control [7].

The work is a continuation of the expansion, existing, established by us, of the two-level control system [9, 10], as one of the effective components of organizational and managerial decisions in the operation of the TEO systems in EMF.

The scheme of organization of environmental and economic analytical control is shown in Fig. 1.

Results and discussion

This publication is a continuation of previous studies and the final stage in relation to the scheme of experimental work and its evaluation (Fig. 1). In this work, a generalized indicator - criterion of environmental friendliness of non-reagent water preparation in the EMF of heat supply systems is defined, which characterizes the ecology of the results of the operation of the TEO systems, and thus evaluates the completeness and efficiency of the operation of the proposed nanotechnology. The definition of such an indicator is due to specific relationships in complex heterogeneous inorganic systems, namely, that in them (under the influence of increased catalytic activity - for EMF) there are intermolecular interactions regardless of the characteristics of micro particles, which reflect their physical and chemical properties.

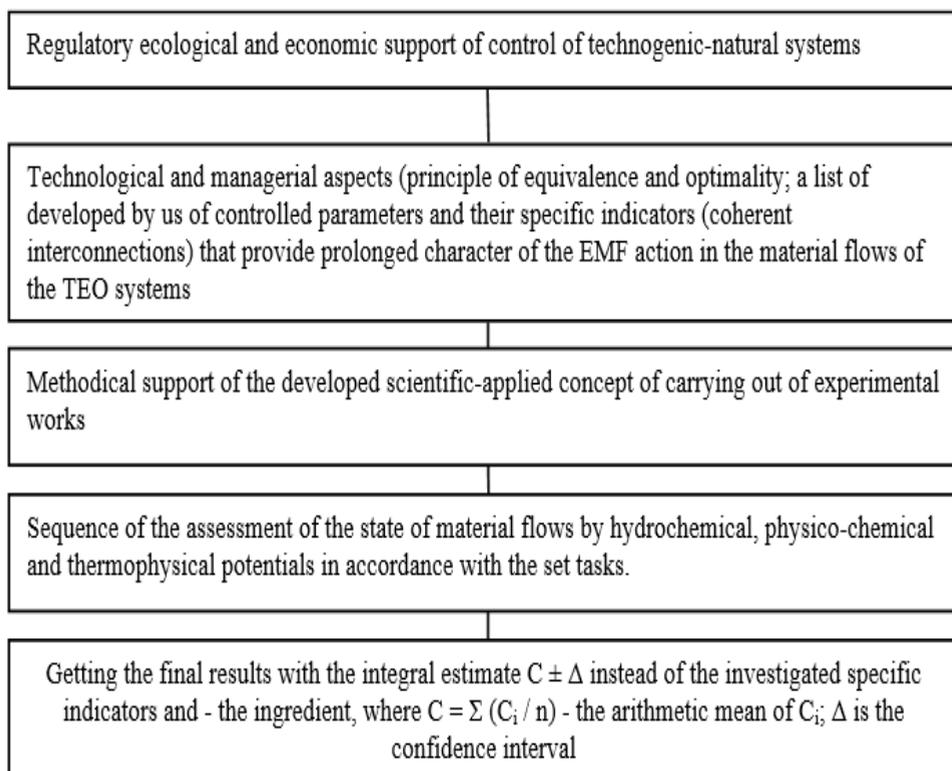


Fig. 1. Scheme of organization of ecological and economic (control) control

Such a course of physical and chemical reactions rules out the discrete nature of man-caused natural systems. Therefore, it is possible to determine the thermodynamic self-organization of them under the influence of artificial technogenesis (for EMF). In connection with this, there was a need to consider external costs (environmental protection) on the outside. In the process of various production processes in the industrial sphere there is a negative impact on the atmosphere - the ability to self-healing and self-organization of atmospheric processes [2] is partially lost.

Our studies have shown that volumes of evaporation heat decrease compared with the use of tap water by 20 % [5]. When the investigated nanotechnology is used, hydrocarbons in technological emissions do not exceed the normative data (Fig. 2).

It should be noted that in the city the X-ray diffraction systems of the TEO, where the pilot tests of nanotechnology took place, as shown in Fig. 2, negative environmental impacts were not determined.

Confirmation can be the calculations of the indicator-criterion of environmental friendliness (1):

$$J_{env} = \sum_{n=1}^i \left(\frac{C_1^h}{2DK_1} \right) K_r + \sum_{i=0}^n \left(\frac{C_1^{he}}{2DB_1} \right) K_r, \quad (1)$$

where J_{env} , indicator - criterion of efficiency of technological and economic results on the final effects on the atmosphere;

C_1^h – concentration of hydrocarbons in the atmospheric air;

C_2^{he} – volume, heat of evaporation;

$2DK_1$ - maximum permissible concentration of hydrocarbons in the atmosphere;

$2DB_1$ – maximum permissible emission according to technological norms (thermal balance);

K_r – constant rate of physicochemical reactions in material flows.

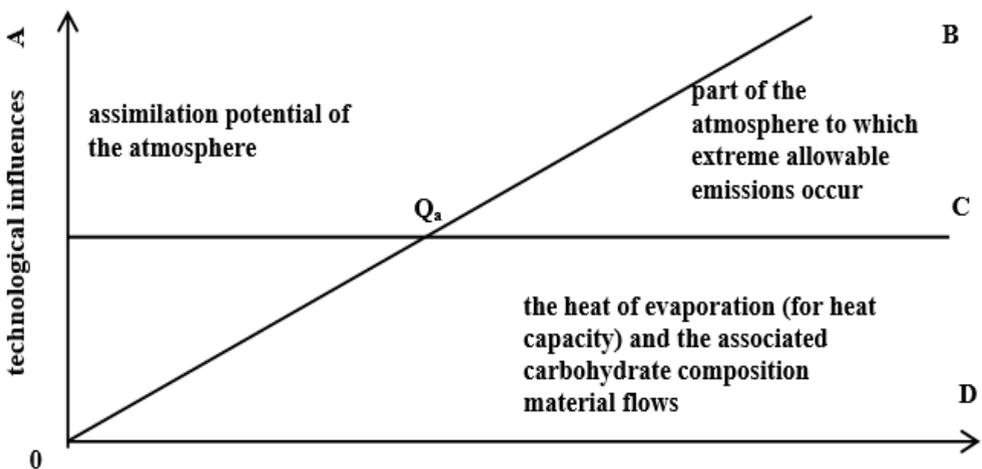


Fig. 2. Graphical conceptual model of external costs of thermal energy.

Q_a - volume of atmospheric emissions; BC – the content of heat of evaporation with hydrocarbon impurities not exceeding the regulated standards

According to practical results: the heat of evaporation is 0.01 cond. units (norm – 0.05) of the total thermal balance [regulation] – 0.901 cond. units in the case of hydrocarbons – 0.24, the indicator of relative aggressiveness (norm – 0.50).

Conclusions

In conclusion, it can be stated that:

1) we have made calculations for the most typical components entering the atmosphere with technological emissions for heat-energy facilities with a small amount of thermal energy production;

2) in both cases, normative indicators are identified.

Determining the ecological nature of man-caused processes by the final result of their implementation is an actual tactical tool for the economy of environmental protection measures.

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