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INNOVATIVE TECHNOLOGIES TO INCREASE ENVIRONMENTAL AND ENERGY SAFETY OF URBAN TRANSPORT AND MUNICIPAL ENERGY

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Exploitation of transport engines and municipal boiler plants is accompanied by significant negative environmental impact - emissions of CO_2 and pollutants into the atmosphere, which contributes to the development and strengthening of local and global environmental problems. The use in cities of vehicles, boiler plants and thermal power stations requires the provision of fuel, the amount of which with the expansion of the transport sector and heating networks is increasing. In this regard, the problem of increasing the ecological and energy security of transport engines and communal energy systems in the context of increasing their impact on the natural environment and rising energy prices is highly relevant.

In recent years, a significant number cities of Ukrainian, in particular, Kyiv, Kharkiv, Lviv, Ternopil, Chernivtsi and others. joined the «Covenant of Mayors on Climate and Energy», which provides carrying out measures by the municipal authorities on a significant reduction of greenhouse gas emissions by 30% by 2030 [1]. Achieving this result requires a new strategy for the use and development of urban transport and heating networks, which envisages increasing the ecological safety of vehicles, boiler plants and heat-energy centers through the introduction of innovative highly effective energy and environmental technologies of combustion of fuel combined with the use of non-traditional energy sources: heat pumps, wind energy, sun, bioresources, geothermal sources, etc. [2]. It should take into account such

problems homeland transport and heat energy as: outdated technology of production and equipment, high energy intensity and material capacity, which exceeds 2-3 times the corresponding indicators of developed countries; the lack of proper environmental protection systems, the lack of proper legal and economic mechanisms which would stimulate development of environmentally sound technologies and environmental protection systems, etc. [3].

In order to ensure effective control over the implementation of existing and prospective environmental standards in the field of transport ecology, the authors created and experimentally tested an automated system for environmental diagnostics of transport engines for various purposes (fig. 1). When creating this system, a set of innovative design and technical solutions was introduced that increase its multifunctionality, compactness, mobility, ease of use, information content of the results, etc. [4, 5].

Figure 1. General view of the test bench of the automobile diesel 4ChN12/14 with universal system of ecological diagnostics:

1 – air flow meter; 2 – fuel consumption meter; 3 – dynamometer; 4 – tachometer; 5 – multicomponent gas analyzer; 6 – exhaust gas smoke meter; 7 – particulate emission meter - microtunnel; 8 – electronic module; 9 – chamber for weighing filters.

A new approach in solving the problem of improving the environmental and energy security of municipal energy is to unite the producer, supplier and consumer of heat energy into a single technical system (TS) for which search is done optimal technical solutions from raising its ecological, resource and economic efficiency (fig. 2, 3) [6].

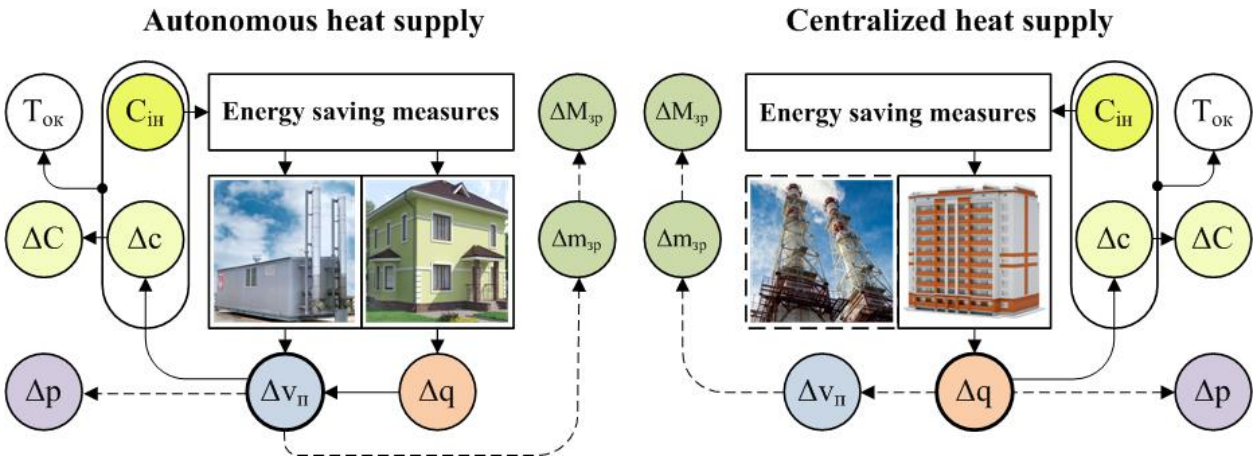

Figure 2. Criteria for the effectiveness of a unified TS:
Δq – energy saving, Δv – resource saving, Δc – economical effect and others.

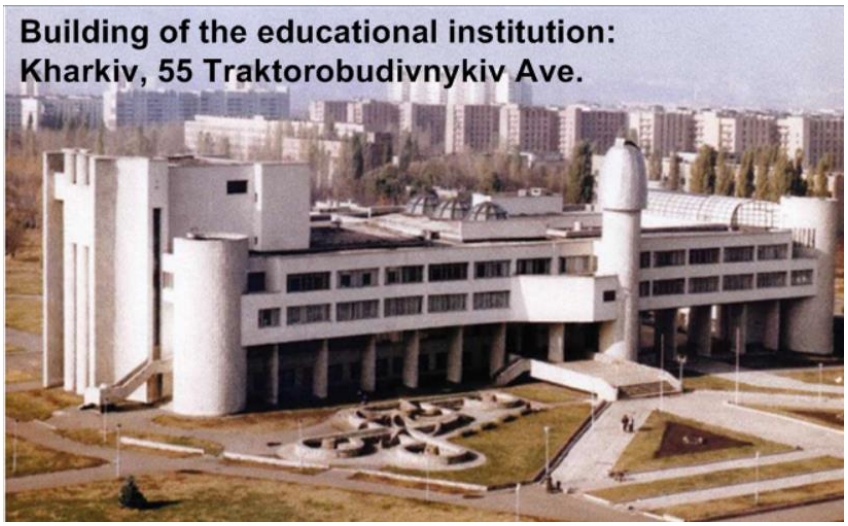

Figure 3. General view of the natural object for studying the effectiveness of TS

At the same time, the choice of procedures for implementing measures that increase the energy efficiency of buildings and their heat supply systems is determined by the availability of the necessary financial resources. With sufficient financial security, the procedure of one-time integrated implementation (OII) is performed, which is characterized by the minimum payback period of investments, as well as a significant amount of financial costs. In conditions of insufficient funding, an alternative procedure of phased rational implementation (PRI) is used, which is characterized by longer payback periods with less financial resources spent (fig. 4).

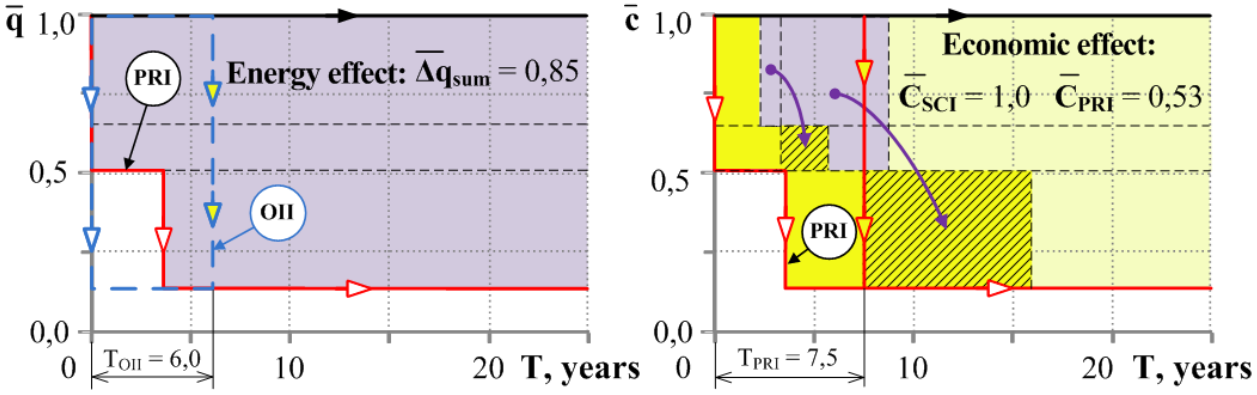

Figure 4. Results of studies on the effectiveness of OII and PRI procedures

The results of field studies of vehicles showed the following advantages of the PRI procedure compared to the OII procedure: to achieve a given level of energy efficiency of the TC, the PRI procedure requires less investment - 5.9 times to start implementation and 1.9 times - for full implementation; the increase in payback period is acceptable and is 1.5 years, or 25% [7].

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