SUBSTANTIATION OF SELECTION OF RATIONAL UNITS OF EXPRESSION OF MONETARY COMPONENTS OF INDICATOR OF ECOLOGICAL SAFETY LEVEL OF ICE EXPLOITATION

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In order to carry out a comprehensive assessment of the level of ecological safety of exploitation process of power plants with reciprocating ICE, it is rational to use a mathematical apparatus of complex fuel and ecological criterion of prof. I.V. Parsadanov (NTU «KPI») K_{fe} [1]. One of its main advantages over alternatives is the presence in the structure of components having monetary units of expression, namely: monetary costs for consumed motor fuel $Z_f = g_e \cdot P_f$, compensation for ecological damage to the environment and human $Z_e = g_e \cdot \delta \cdot \sigma \cdot f \cdot \sum(A_k \cdot G_{ki} / G_{fi})$, and total fuel and ecological costs $Z_{fe} = Z_f + Z_e$. In that formulas: g_e – specific effective mass hourly fuel consumption, kg/(kW·h); P_f – price per unit weight of motor fuel, \$/kg; σ – dimensionless indicator of the relative risk of contamination in different territories; f – dimensionless coefficient that takes into account the nature of the scattering of EG in the atmosphere; $\delta = P_f$ – dimension indicator that converts a score assessment into a value, \$/kg; G_{fuel} – mass hourly fuel consumption, kg/h; G_k – mass hourly emission of k-th pollutant in EG flow, kg/h; A_k – dimensionless indicator of the relative aggressiveness of the k-th pollutant in EG flow.

However, when performing a comparative calculation study for reciprocating ICE of the same and different brands and/or models, of different release dates or experimentally investigated at different time periods, or of the same engine in different technical condition or, in the rest, of are in exploitation process in the territories of different countries of the world there is a problem of bringing the units of expression Z_f, Z_e and Z_{fe} to each other. In the original mathematical apparatus at the time of its creation (2003), such units were ₴/(kW·h), in previous works, the authors proposed to switch to the use of one of the world's reserve freely convertible currencies, the history of which completely covers the history of reciprocating ICE as such – US Dollar, i.e. \$/(kWh). However, due to the extremely volatile exchange rate of the Ukrainian Hryvnia to the US Dollar, there is some ambiguity in determining the numerical values of Z_f, Z_e and Z_{fe} for different historical periods. The results of a comparative calculation study for substantiation of this choice are summarized in Table 1.

Table 1 – Results of the study

Monetary costs	Year	Units of expression					
		₴/(kW·h)			\$/(kW·h)		
Z_e	**2003**	2,081	2,729	2,553	0,391	0,513	0,480
	2018	27,050	35,472	33,185	0,567	0,744	0,696
Z_f	**2003**	0,574	0,685	0,899	0,108	0,129	0,169
	2018	7,463	8,903	11,681	0,156	0,187	0,245
ICE operational regime		N_{enom}	M_{max}	**idle**	N_{enom}	M_{max}	**idle**

References:
1. Кондратенко О.М. Обґрунтування вибору раціональних одиниць вираження вартісних складових комплексного паливно-екологічного критерію / О.М. Кондратенко, С.А. Коваленко // Електронна збірка наукових праць «Е-КОНОМІКА». – 2019. – № 1(3)/2019. – С. 114-118.