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INDICATORS FOR ASSESSING THE EFFICIENCY OF FUEL USE IN ROAD TRANSPORT

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ABSTRACT: - This article discusses the evaluation of fuel efficiency indicators in road transport. At the same time, the main criterion for evaluating the efficiency of the use of automotive fuel is the specific fuel consumption in grams per unit of transport work. The energy intensity is calculated by dividing the total amount of energy consumed by the fuel by the transport work performed at the same time.

KEYWORDS: Efficiency of use, energy intensity of transportation, specific fuel consumption, the method of conditional natural meters, the efficiency of a new design, a simplified meter.

INTRODUCTION

Fuel efficiency indicators characterize the consumer qualities of the car. The cost of fuel is up to 20-30% of all transportation costs, so fuel efficiency has a significant impact on the economic efficiency of road transport. The analysis of fuel efficiency makes it possible to make a reasonable choice of the rolling stock of a motor transport company and its rational use when performing transport work. The main measure of the fuel efficiency of a car in most countries is fuel consumption in liters per 100 km of distance traveled – travel fuel consumption.

For road transport, the indicators for assessing the efficiency of fuel use include: the energy intensity of transportation, linear fuel consumption rates per 100 km of vehicle mileage and specific fuel consumption per unit of transport work.

In the practice of car operation, a simplified fuel efficiency meter has become widespread, which is the fuel consumption rate per unit of the distance traveled by the car. These standards are necessary for accounting and control of fuel consumption at motor transport enterprises.

MATERIALS AND METHODS

The energy intensity of transportation by truck or bus characterizes the amount of energy that needs to be spent on performing a unit of work. It is calculated by dividing the total amount of energy consumed by the fuel by the transport work performed at the same time

$$E = 100 \cdot G \cdot p \cdot \lambda / Re$$

where:

E - energy intensity of transportation, kcal /100 tkm or kcal /100 pass. km;

G - amount of automobile fuel consumed for transportation per year, l;

λ- calorific value (calorific value) of fuel: for gasoline, an average of 10600 kcal / kg, for diesel fuel 10460 kcal /kg;

Re - energy caloric equivalent showing that part of the calorific value of conventional fuel that contributes to the calorific value of natural fuel (for gasoline it is assumed to be equal to 1.49; diesel fuels 1.45; compressed natural gas 1.142; liquefied gas 1.57).

If necessary, the energy intensity is expressed in electrical units of measurement using transferable equivalents:

1 kcal = 1/860 kw/hour = 4186,8 joule

The determination of the energy intensity of transportation is essential when assessing the fuel efficiency of cars and buses of a new design, especially if a new type of engine is used. However, when analyzing the work of motor transport enterprises to determine the efficiency of the use of motor fuel, the indicator of the energy intensity of transportation is not applied.

This is explained by a number of reasons:

- the unit of measurement of energy intensity in kilocalories is not comparable with the units of measurement of fuel adopted for accounting and reporting.

- it is advisable to use the indicator of energy intensity of transportation to compare cars of two brands, since motor transport enterprises, as a rule, operate cars of various brands, including diesel, gasoline and gas cylinders.

The efficiency of fuel use is estimated by its consumption per unit of transport work performed – specific fuel consumption. Specific fuel consumption is the ratio of the average travel fuel consumption to the useful work performed for the transportation of goods or passengers.

Due to the wide variety of operating conditions of cars, determining the generalizing indicators of fuel efficiency is a difficult and time-consuming task. Therefore, the regulatory documents establish private (single) estimated parameters of fuel efficiency, determined in specific road conditions, indicating the speed and load modes of operation.

Currently, the main criterion for evaluating the efficiency of the use of automotive fuel is the specific fuel consumption in grams per unit of transport work. As can be seen, the difference between the minimum and maximum unit costs for freight transportation at enterprises for automobile gasoline reaches 75.7%, diesel fuel 76.9% and compressed gas 77.0%. These data show that in enterprises with approximately equal operating conditions, specific fuel consumption exceeds the minimum cost level by 75-76%.

This indicates that there are still significant reserves for improving fuel efficiency in road transport.

Having analyzed the level of efficiency of the use of motor fuel by indicators, the unit costs of freight transportation for gasoline, diesel and gas-cylinder cars at enterprises, it is practically very difficult to determine in general which of them use fuel more efficiently. Therefore, the assessment of the efficiency of the use of motor fuel by motor transport enterprises, concerns of motor transport, ministries and departments is not carried out.

Therefore, being the main indicators of fuel efficiency, specific fuel consumption is not without a number of drawbacks:

firstly, this indicator is differentiated by types of fuel and transportation, which means that it cannot be reduced to a single indicator for all road transport. Since gasoline, diesel and gas-cylinder cars are available at motor transport enterprises, and mixed enterprises carry out cargo and passenger transportation, it is almost impossible to compare their activities in terms of specific fuel consumption;

secondly, with the existing accounting, the volumes of transportation carried out by diesel, gasoline and gas-cylinder cars are not always accurately determined. This leads to an incorrect calculation of the actual unit costs for diesel and gasoline cars, fuel savings due to the transfer of a significant volume of traffic from gasoline cars to diesel cars are not taken into account.

Thus, the existing fuel efficiency indicators are unsuitable for determining the results of using different types of fuel by all modes of transport. The criteria used to assess efficiency and control fuel consumption should objectively reflect all the work being done on energy supply, ensure the possibility of high-quality fuel distribution, and stimulate the widespread introduction of alternative fuels.

The estimated fuel efficiency indicators of the car are largely determined by such engine indicators as hourly fuel consumption GT, kg /h – the mass of fuel consumed in one hour, and specific fuel consumption de, g / (kWh) – the mass of fuel consumed in one hour per unit of engine power.

As an example, we can give a methodology for determining a single integral indicator of fuel efficiency, as a single integral indicator of the amount of transport work performed by a car when burning 1 kg of conventional fuel.

Kt=P/G•p•Re

where:

Kt - the fuel efficiency coefficient;

Re - an energy caloric equivalent showing that part of the calorific value of conventional fuel that contributes to the calorific value of natural fuel (for gasoline it is assumed to be equal to 1.49; diesel fuels 1.45; compressed natural gas 1.142; liquefied gas 1.57).

Further, this indicator can be expanded by fuel types and by types of transportation. To calculate the coefficient of the fuel efficiency indicator by fuel type, the following formula is proposed:

$$Kt = \frac{\sum_{i=1}^{n} Pi}{\sum_{i=1}^{n} Gi \cdot Pi \cdot Rэi}$$

where:

Kt - the fuel efficiency coefficient;

i=1.....n - index of the type of automobile fuel (gasoline, diesel or gaseous).

For mixed road transport companies, car manufacturers and transport corporations in general, Kt is calculated in the given tonne-kilometers according to the formula

$$Kt = \frac{\sum_{i=1}^{n} \cdot \sum_{\ell=1}^{n} Pi\ell}{\sum_{i=1}^{n} \cdot \sum_{\ell=1}^{n} Gi\ell \cdot Pi\ell \cdot Rэi\ell}$$

where:

ℓ=1…..n – index of the type of transportation.

Analyzing the above formulas, we believe that the fuel efficiency coefficient with specific costs is inversely proportional. The lower the specific fuel consumption rate, the higher the fuel efficiency coefficient. The increase in the fuel efficiency coefficient indicates that in the reporting period, a reduction in the specific consumption of motor fuel was achieved.

Thus, the fuel efficiency coefficient, reflecting fuel costs in conditional terms per unit of transport work, allows us to present the dynamics of the efficiency of the use of motor fuel in the whole enterprise. A common disadvantage of the above fuel efficiency indicators is that when determining these indicators, only the fuels actually used and consumed in the transportation process are taken into account. It should be noted here that in market conditions, acting as a consumer, a motor transport company strives to acquire as many resources as possible so that their shortage does not restrain the transportation process. Therefore, the considered indicators give only a partial idea of the efficiency of fuel use.

CONCLUSIONS

Completing the analysis of indicators for assessing the efficiency of fuel use, based on the results of the study of the economic levers of fuel savings, methodological and organizational foundations of the fuel consumption rationing system in road transport, it is possible to draw the following conclusions and set tasks for solving in the methodological part of the study.

One of the main levers of fuel savings is the balance of fuel demand and the volume of transport work. Achieving balance involves solving a number of issues: it is necessary to achieve proportionality between the volume of transport work and its consumption, income and their resource provision. This, in turn, leads to the development of a methodology for determining the economically justified volume of fuel demand, taking into account all factors affecting fuel consumption conditions, promptly consistent with their changes.

The analysis of the fuel consumption rationing system in road transport allowed us to conclude that, at present, there is no scientifically sound and acceptable method of rationing fuel consumption at motor transport enterprises. The system of indicators should be sufficient to disclose and measure patterns, it is also necessary to study cause-and-effect relationships, i.e. direct indicators of the phenomenon under study should be supplemented with indicators characterizing significant factors of fuel efficiency.

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