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ELABORATION OF A PROGRAM TO FACILITATE THE IMPLEMENTATION OF THE DIRECTIVE 2009/33/EC ON THE PROMOTION OF CLEAN AND ENERGY-EFFICIENT ROAD MOTOR VEHICLES

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Abstract: The energy consumption, carbon-dioxide and other air pollutant emissions of motor vehicles can be reduced substantially by various recently developed technical solutions. The use of these new technologies increases the price of the vehicles which causes an unwanted economic burden for the purchasers of such vehicles. The market competition between manufacturers requires low prices which delays the adaptation of the new, more efficient technologies. The recently enacted legislation, aimed at the promotion of purchasing clean and energy-efficient road transport vehicles, intends to remedy this problem.

Keywords: emission, energy efficiency, green public procurement.

1. Introduction

The 48/2011 (III.30.) Government Regulation on the promotion of the purchase of environmentally friendly and energy-efficient road transport vehicles has entered into force on 30 March 2011. The Regulation complies with the Directive 2009/33/EC of the European Parliament and of the Council (Clean Vehicles Directive). KTI Institute for Transport Sciences has been mandated by the Hungarian ministry responsible for transport issues to elaborate a program helping the implementation of the Clean Vehicles Directive. During the harmonization process:

A detailed analysis was performed on existing national and EU legislations that concern the purchase of road vehicles covered by the scope of the Directive, to establish the basis of the necessary legislative amendments;

The necessary legal conditions for the domestic application have been determined. Based on these conditions, a proposal was developed for the necessary laws, regulations and

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administrative provisions, in accordance with the legal harmonization proposal;

An impact assessment was performed about the possible effect of the proposed measures using all the necessary background information.

The reduction of the environmental impact of road transport has long been on the agenda of the Commission. The GHG (Green House Gases) emission and road transport pollution were specified as the most important burdens of sustainable development in the EU document COM(2001) 264: A Sustainable Europe for a Better World: A European Union Strategy for Sustainable Development.

COM(2006) 545 Action Plan for Energy Efficiency: Realising the Potential communication document of the Commission confirmed the intention that efforts should be made to develop markets for cleaner and energy efficient vehicles through public procurement and awareness-raising, especially in the public and governmental sectors.

In addition, the Commission proposed an EU commitment to achieve at least a 20% reduction of GHG by 2020 as compared to 1990 in its document COM(2007) 1: An Energy Policy for Europe.

The COM(2007) 551: Towards a new culture for urban mobility, also known as Green Paper, it was stated that the market introduction of clean and energy efficient vehicles could be supported by green procurement. According to the document a possible approach could be based on the internalisation of the external costs by using life-time costs for energy consumption, CO_2 emissions, and pollutant emissions linked to the operation of the vehicles to be procured as award criteria, in addition to vehicle price.

The goal is clear and unambiguous: the rapid introduction of clean vehicles to help improve air quality in urban areas.

Finally, the Directive 2009/33/EC of the European Parliament and of the Council on the promotion of clean and energy-efficient road transport vehicles (Clean Car Directive) has been elaborated after a long consultative process.

The Clean Car Directive of the European Parliament and of the Council has a dual purpose. On the one hand, it would help to achieve the goals of the EU on the increment of energy efficiency and environment protection by decreasing the carbon-dioxide emissions of road vehicles. On the other hand, it would stimulate operators to purchase cleaner and more energy-efficient vehicles. Through the expectations of market players it would also help manufacturers interested in faster and more efficient development of the new technologies to have them spread on a larger scale. To reach its goals, the Directive requires contracting authorities, entities as well as certain operators to take into account the energy consumption and emission of CO_2 and of certain pollutants when purchasing road transport vehicles.

The legislation provides opportunities for taking environmental effects into account. According to the first methodology, the purchaser can set technical specifications for energy and environmental performance in the documentation for the purchase of road transport vehicles on each of the impacts considered. In that case, any additional

environmental impact can be involved into the documentation. In case of the second methodology the energy and environmental impacts shall be used as award criteria in the purchasing methodology. According to the third methodology, the operational lifetime costs for energetic and environmental impacts shall be quantified, and the vehicle purchase price should be taken into account as well. It means that the two amounts shall be added in the procurement process.

2. The Method of Impact Assessment

Studying the availability of the necessary data, it was noted that the more detailed and appropriate database relates to the year 2007. Moreover, the Clean Car Directive uses the cost of road transport emissions at 2007 price level. For this reason, the year 2007 was chosen as a basis for the impact assessment.

For the purposes of the Directive, road transport vehicle means a motor vehicle covered by the following categories: passenger cars (M1 category), light commercial vehicles (N1 category), heavy goods vehicles (N2 and N3 categories) and buses (M2 and M3 categories). It was impossible to define the exact annual number of the public procurements in Hungary from the available statistical data. Therefore, we decided that the impact assessment should cover only the bus sector. This is the segment which is clearly identified and there

Table 1
Yearly Emission by Vehicle Categories (2007)

	NMHC [t]	NOX [t]	PM total [t]	PM exhaust [t]	CO2 [kt]
Passenger cars	21800	22500	1600	1000	7140
Light commercial vehicles	2000	13400	1400	1100	2840
Heavy goods vehicles	1500	20000	800	650	1720
Urban buses	750	6400	350	300	500
Coaches	150	2400	80	60	232

Source: KTI Institute for Transport Sciences, Own Research

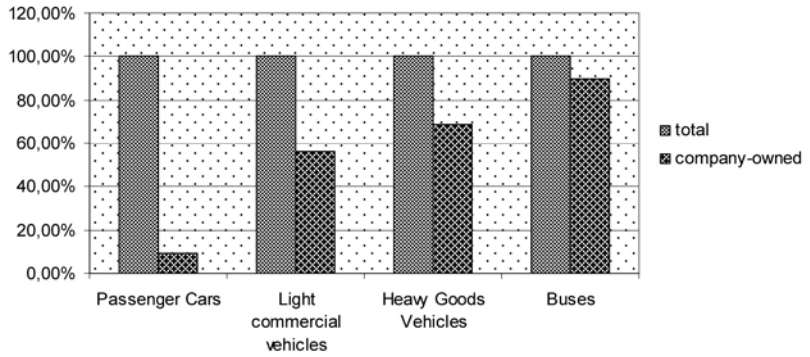

Fig. 1.
Ratio of Private and Company-Owned Road Vehicles
Source: KTI Institute for Transport Sciences, Own Research

is enough data and information for making a comprehensive assessment.

Before taking a decision, the annual emission by pollutants and vehicle categories covered by the Directive in Hungary, the non private-owned vehicles were analysed using the COPERT4 programme (Computer Programme to Calculate Emission from Road Transport) (Table 1). These data are assigned with the private and company cars nationwide distribution. The diagram shows that almost all buses are company-owned, while more than 90% of passenger cars are private-owned (Fig. 1).

Although the annual pollutant emissions of buses appear to be significantly less, it should also be taken into account that the impact assessment needs to apply vehicles affected by the procurement process. In case of buses (categories M2 and M3) – and in particular urban buses – it is correct to suggest that almost the entire stock is purchased through public procurement. Furthermore, the Clean Car Directive should cover the purchase of road transport vehicles used for performing public passenger transport services under a public service contract.

As a first step, the Hungarian bus fleet has been examined. After that, the size of the bus stock had to be defined according to the annual road transport emissions of the year 2007. That was the basis of the two possible scenarios in the impact assessment. In the first scenario-calculations it was assumed that the oldest, most polluting vehicles can be replaced by used, but still considerably modern buses and in the second scenario, those buses can be replaced by brand new ones.

A short calculation was performed after the national vehicle fleet calculation where only the vehicles operated by public bus transport companies had been taken into account. In this case, two versions were tested within both scenarios. In one case, only the oldest so-called Pre-Euro vehicles were replaced, and in the other both the Pre-Euro and the Euro I vehicles. Consequently, four different versions were tested according to this calculation.

In terms of emissions, cost implications set out in the Directive were used during the calculations. The specific calculations take into account the pollutant emission components at least the carbon-dioxide emissions and NO_x, NMHC and particulate matter (PM) emissions.

After that the possible impact of environmental considerations into the procurement decisions were examined using a dynamic assignment model, taking into account the limited purchase resources of the vehicle operators as well as the increasing role of the environmental concerns in green procurements.

Table 2
Pollutant Emission Trends for the Four Scenarios

Pollutant	Basis	Used buses 1.	Used buses 2.	New buses 1.	New buses 2.
NMHC [t]	320	227	190	207	105
NOX [t]	4586	4247	4291	4252	3567
PM(exhaust) [t]	150	113	80	107	53
PM(total) [t]	180	143	109	140	85
CO2 [kt]	437	420	412	461	450

Source: KTI Institute for Transport Sciences, Own Research

3. The Results of the Impact Assessment

The results of the calculations clearly showed (Table 2 and Table 3) that irrespective of whether operators would choose used buses or new ones, replacing the numerous old and highly polluting vehicles would cause a significant decrease for most of the exhaust gas components. The calculations also indicated that for replacement to be effective, improvement of at least two emission categories is necessary. Otherwise, it is also possible that the effect would be negative regarding some polluting components. The model also showed (Fig. 2) an increase in CO_2 emissions, which results from the higher fuel consumption of modern buses. In extreme cases, this can reach up to 10%.

Table 3
Change of the Emissions for the Four Scenarios

Change of the emission				
Pollutant	Used buses 1.	Used buses 2.	New buses 1.	New buses 2.
NMHC [t]	-93	-130	-113	-215
NOX [t]	-339	-295	-334	-1019
PM(exhaust) [t]	-37	-70	-43	-97
PM(total) [t]	-37	-71	-40	-95
CO2 [kt]	-17	-25	+24	+13

Source: KTI Institute for Transport Sciences, Own Research

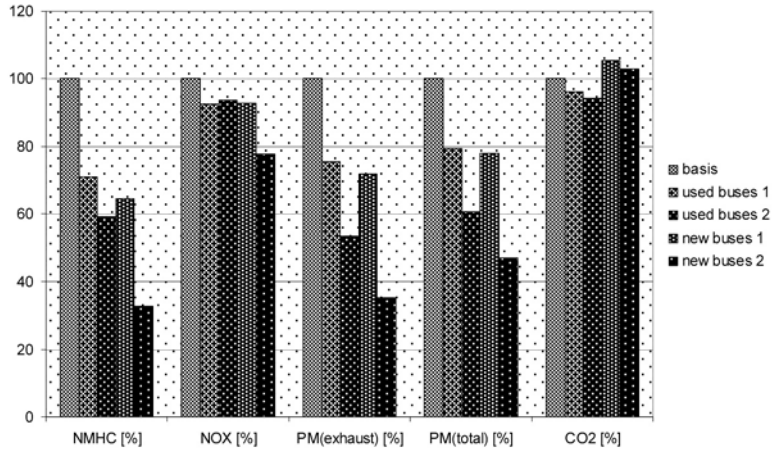

Fig. 2.
Change of the Emission by Pollutants in Case of the Four Scenarios
Source: KTI Institute for Transport Sciences, Own Research

4. Results of the Economic Assessment

Testing the economic assessment of the environmental considerations appearing in purchasing decisions, a dynamic model has been used which is suitable to examine the economic, environmental and social parameters equally. It was assumed that the financial resources for vehicle purchases are limited, and the environmental considerations used in the evaluation of investments have an increasing role in the spirit of green procurement. As a first step, the possible investments aiming to reduce the vehicle fleet age and increasing the technical level were defined. After that, the evaluation criteria of investments, the efficiency criteria and the boundary conditions were selected. The objective function (Eq. (1)) was defined as the total investment project cost function, which includes investment costs, discounted operating costs, environmental impact and energy consumption over time.

$$Z = \sum_{t=0}^{m}\left(\sum_{i=1}^{n}\left(k_{it}\cdot x_{it}\right)\right)+\sum_{t=0}^{m}\left(\sum_{i=1}^{n}\left(\frac{s_{it}}{(1+r)^{t}}\cdot x_{it}\right)\right) \quad (1)$$

Where:

Z: costs of realization of investment projects (HUF)

k_{it}: the project's investment cost in year t (HUF)

x_{it}: in the t^{th} year the i^{th} number of projects to be realized (piece)

s_{it}: annual operating cost of the i-th project in the t-th year (HUF/year)

r: discount rate calculated for an investment unit (%), in our model takes 5%

t: the period of the assessment (year)

Our goal is to minimize the objective function while satisfying the restrictive conditions (Eq. (2)):

$$x_{it} \geq 0 \quad (2)$$

(i = 1, 2,…, n) and (t = 0, 1, …, m)

The number of different projects to be realized in the t-th year is not negative (Eq. (3)):

$$\sum_{t=0}^{m} a_{ij}\cdot x_{t} = A_{j} \quad (3)$$

(j = 1, 2, …, k)

Where:

a_{ij}: coefficients, which indicate the effectiveness of the i-th version of the j-th feature contrast (e.g. the "green bus" will cause a reduction of CO_2 emissions that can be achieved [CO_2e/year/bus])

A_j: the limit values of the efficiency indicators

Running the model does not provide a meaningful result. Investigating the cause, it is noted that although the model is good, and also the input parameters were appropriate, the model has not issued solution due to having too much and too severe narrowing conditions. The model has showed that the problem cannot be solved due to the lack of the legal and institutional framework and the economical and political problems, given as boundary conditions.

All this predicts that in case of the forthcoming bus purchases it is not expected that environmental and energy considerations would become dominant. As the directive does not set specific requirements for the impacts to be considered, it can be assumed that the purchaser will determine the weighting factors in such a way as not to have any essential effect on the primary economic factors. It is even less possible for the principles laid down by

the Directive to be used in bus procurement, because in general the purchased vehicle's technical parameters used to be determined on the basis of the current market supply.

5. Differences, Local Peculiarities

It is rare to find such a legislation, which already in its first version is fully able to fulfil its function, and entering into force immediately solves the problems. Therefore, revision from time to time is natural. So, it is with the European Union directives and regulations as well. The Clean Vehicle Directive, unlike the regulation, has not to be directly applied, but in order to provide direction, it defines a minimum requirements for the Member States to develop their national legislation accordingly. The impact assessment showed that the relative freedom of the Directive could result in some negative effects. This also means that the legislation does not reach its goal. For example, any applicant may specify such weighting factors, which, though indicating the environmental impacts, cannot affect essentially the decision on relevant offers, because other considerations (performance, reliability, purchase price) have substantially greater importance. In order to avoid this, the national regulation sets out the minimum for the allowance for environmental considerations. This 10% value is determined based on those public procurements - already surveyed and announced - which covered environmental factors, as well. Such an offset does not cause any problem to the inviter of the procurement; however, it provides sufficient safeguards against the regulation's „frivolous" application. According to the Hungarian regulation, the purchaser has to submit the detailed description of the procurement to the Ministry, indicating the way to consider the energetic and environmental effects and aspects relating to the vehicle's lifetime. Based on those reports we can then conclude that the requirements of the Clean Vehicles Directive are sufficient enough, and if not, how and in what way they need to be changed.

Acknowledgement

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IZRADA PROGRAMA ZA OMOGUĆAVANJE UVOĐENJA DIREKTIVE 2009/33/EC O PROMOCIJI EKOLOŠKI ČISTIH I ENERGETSKI EFIKASNIH DRUMSKIH MOTORNIH VOZILA

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Sažetak: Razvojem savremenih tehničkih rešenja moguće je postići značajno smanjenje potrošnje energije, emisije ugljen-dioksida i ostalih emisije gasova iz motornih vozila. Primena novih tehnologija utiče na povećanje cene vozila, što se negativno odražava na zahteve kupaca u finansijskom smislu. Tržišna konkurencija između proizvođača uslovljava niske cene vozila, čime se usporava uvođenje novih i efikasnijih tehnologija. U cilju prevazilaženja ovih problema, novousvojene legislativne mere imaju za cilj promovisanje kupovine čistih i energetski efikasnih drumskih motornih vozila.

Ključne reči: emisija, energetska efikasnost, zelena javna nabavka.