

IMPACT OF TRANSPORT MEANS IN POSTAL TRAFFIC ON ENVIRONMENT

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Abstract: *It is well known that transport significantly contributes to economic growth. Beside positive effect on society, transport, especially road transport has negative impacts such as air pollution, congestion, accidents, noise and climate change. In order to increase energy efficiency in transport, by the introduction of electric bicycles in the postal sector, Croatian Post Inc. contributes to the reduction of negative impact of transport on the environment. This paper examines the impact on the environment by replacing the existing fleet of bicycles in more environmentally friendly form of transport, and the calculation of external costs.*

Key words: *transport, electric bicycle, external costs, ecology*

1. Introduction

As a subject of economic growth in the past (until 2008) steadily increasing transport volumes and performance were recorded. Despite the slower economic development, macroeconomic indicators and the recession in the transport sector, recent traffic forecasts implied increase in the traffic volumes in future period. Main drivers of transport demand could be divided in several groups: economy, energy, society, technology, environment and policy.

Postal items are main input value for future forecasting of transport¹ in postal traffic. Due to oil price dependence of transportation costs, technology improvements should result in improved loading factors, reduction of consumptions, new fuel types and better management of supply chain. To reduce consumptions and improve energy efficiency in postal traffic, *Croatian Post Inc* . introduced electric bikes.

The European Commission is working towards a form of mobility that is sustainable, energy-efficient and respectful of the environment. Transport activities give

¹ Generally, input variables for future forecasting of transport are GDP growth rates; energy prices, in particular oil price; and globalization, due to the importance of international trade and the organization of production processes at global scale.

rise to environmental impacts, accidents and congestion. In contrast to the benefits, the costs of these effects of transport are generally not borne by the transport users. According to the results of relevant EU studies [1] on external cost of transport, the sector of road transport has by far the largest share in the total sum of transport related external costs (93%). The studies show that the total external costs of transport in the EU plus Norway and Switzerland in 2008 amount to more than € 500 billion, or 4% of the total GDP. About 77% of the costs are caused by passenger transport and 23% by freight. On top of these, the annual congestion cost of road transport delays amounts to between € 146 and 243 billion (1 to 2% of the total GDP). Each external cost has specific characteristics which require the use of the appropriate instruments.

In general, sustainable development of the transport system involves the application of an appropriate concept of development based on the principles of energy efficiency, taking care of environmental protection while ensuring the safety and security of all stakeholders. Environmental protection in the modern business environment influences the development of business processes and the formation of strategic guidelines for development of certain sectors or companies.

2. External costs

Transport affects society in a positive way but also generates side effects. For instance, vehicles, especially in road transport contribute significantly to air pollution. Such side effects cause various resource costs that can be expressed in monetary terms such as health costs caused by air pollution. When side effects of a certain activity impose a cost upon society, those costs are classified as external costs.

Environmental externalities are imposed on society in general and will affect different generations. Environmental costs could be seen as already paid for, such as through energy taxes or environmental charges.

External cost categories are congestion, accidents, noise, air pollution, climate change, other environmental impacts, infrastructure wear and tear for road and rail.

In this article climate change costs are analysed because climate change induced by worldwide greenhouse gas (GHG) emissions is quite relevant. Methodology for external cost calculations encompass quantification of GHG emission factors for vehicles expressed in tonnes CO₂ equivalent per vkm, valuation of climate change costs per tonne of CO₂ equivalent and calculation of climate change costs for vehicle and fuel type.

The TREMOVE² database is reliable source, and TREMOVE average emission factors for EU-27 in 2010 are given in table 1.

² TREMOVE is a policy assessment model, designed to study the effects of different transport and environment policies on the transport sector. The model estimates for technical and non-technical measures and policies such as road pricing, public transport pricing, emission standards, subsidies for cleaner cars etc., the transport demand, modal shifts, vehicle stock renewal and scrappage decisions as well as the emissions of green house gases, air pollutants and the welfare level. Available at: <http://ec.europa.eu/environment/archives/air/models/tremove.htm> (23.10.2015)

Table 1. *TREMOVE average GHG emission factors, in gram CO2 eq/vkm*

Vehicle category	Diesel	Gasoline	All fuel types
Moped		59	59
Car	179	197	189
Light commercial vehicle	218	278	228
HGV 3,5-7,5t	312	/	312
HGV 7,5-16t	534	/	534

Source: Update of the Handbook on External Costs of Transport, Report for the European Commission: DG MOVE, Ricardo-AEA, 2014.

3. Sustainable Development of Postal Sector

Sustainable development of the postal sector as an integral part of the economic system is based on the definition and implementation of all necessary measures and activities with an aim to minimize the negative impact on the environment. Identified necessary activities aimed at reducing emissions, more rational use of transport parks, investment in new (“green”) means of transport and other environmentally friendly technologies.

Key segments of sustainable development of the postal sector are:

- Means of transport in the postal traffic: through measures to reduce emissions, more efficient use of transport units, training employees on environmentally friendly driving and investing in more environmentally friendly means of transport (hybrid vehicles, electric vehicles)
- The units of the postal network (post offices, access points): the measures of improving the energy efficiency of buildings to reduce energy consumption.
- Ecological waste management (toners, batteries, electronic components, waste oil, paper, etc.): separation of waste, the use of materials that can be fully recycled and the development of applications improving the environmental aspects of business.

It is proposed to implement measures and activities that encourage postal service providers to harmonize their operations with the above segments³. The ecological aspect of the postal services includes the set goals of reducing⁴ negative impact on the environment compared to the current situation [2].

IPC’s Environmental Measurement and Monitoring System (EMMS) programme is one of the few, sector-wide initiatives responding to the risks posed by climate change. Developed in 2008, the programme⁵ is a direct response to CEO and stakeholder calls for the postal sector to minimise its carbon footprint.

³ Some service providers, amongst global leaders in the market, incorporated the impact on the environment as the basic paradigms of their business. Among other things, their fleet increasingly include electric vehicles, or develop applications that enable service users to obtain information on the amount of exhaust gas while performing services. Cf. Deutsche Post DHL: 2013 Annual Report.

⁴ Carbon footprint measures the total greenhouse gas emissions, which is directly or indirectly caused by a person, product, company or event.

⁵ Twenty-five participants from five continents – Europe, North America, South America, Australasia and Africa are participating. Following extensive collaboration and dialogue, the 20

3. External Cost Calculation

Croatian Post will replace 180 motorcycles with electric bikes, shown at figure 1. Compared with the expenditure on operation of motorcycles, Croatian Post will on annual basis on one electric bicycle that replaces a moped save seven thousand kuna, or allocate 86.5% less for fuel of delivery vehicle⁶. Beside cost savings another important issue is improved energy efficiency and lower environmental impact.



Figure 1. *Electric bicycle*

Source: Ministry of Maritime Affairs, Transport and Infrastructure, 2015.

The input data for the calculation of external costs are total kilometres of distribution area, the average kilometres travelled in one year and the average fuel consumption per delivery district.

Table 2. The exploitation data of the replaced mopeds

Moped (piece)	Average distribution area (km/moped)	Total km per year (km/moped)	Average fuel consumption per distribution area (l/moped)
180	25,33	6332,38	256,09

The values of CO₂ emissions of replaced mopeds can be calculated taking into account the data in Table 1⁷. The following is the total value of CO₂ emissions expressed in kg:

$$CO_2 \text{ Emission} = 180 * 6332,38 * 0,059 = 67249,87kg \quad (1)$$

Recommended values [3] for the external costs of climate change are presented in the table 3.

original participants set themselves two targets to reach collectively by 2020 (from a 2008 baseline year): to achieve a score of at least 90% in carbon management proficiency and to reduce combined carbon emissions from own operations by 20%.

⁶ Available at <http://www.mppi.hr/default.aspx?id=23999> (in Croatian 10.10.2015)

⁷ According to the Environmental Protection and Energy Efficiency Fund, in Croatia values of CO₂ per liter/kg or kWh of consumed fuel amounts to 2,673 kg of diesel and 2,322 kg of petrol. Cf. Public Call (EE -15/ 2015) for direct co-financing of other energy efficiency measures in transport, Available at http://www.fzoeu.hr/hr/nacionalni_javni_pozivi_i_natjecaji/ (30.09.2015)

Table 3. Recommended values for the external costs of climate change

Godina	Iznos (EUR / tonne CO ₂)		
	Lower value	Central value	Upper value
2010	7	25	45
2020	17	40	70
2030	22	55	100
2040	22	70	135
2050	20	85	180

Given the average values, by interpolation trend for the period of 2010 – 2020, values of CO₂ emissions and external costs in the case of replacing 180 mopeds with electric bicycles (base scenario) and the entire fleet of mopeds (overall scenario) were calculated as shown in Table 4.

Table 4. CO₂ emission values and external costs

Godina	Cost category	Base scenario		Total scenario	
	Climate change (EUR/tonne)	CO ₂ (tonne)	External cost (EUR)	CO ₂ (tonne)	External cost (EUR)
2015	32,5	67,24985	2185,62	784,3537	25491,5
2016	34	67,24985	2286,495	784,3537	26668,03
2017	35,5	67,24985	2387,37	784,3537	27844,56
2018	37	67,24985	2488,245	784,3537	29021,09
2019	38,5	67,24985	2589,119	784,3537	30197,62
2020	40	67,24985	2689,994	784,3537	31374,15
Total		403,4991	14626,84	4706,122	170596,9

Although mopeds used for delivery by Croatian Post are transport means with the lowest exhaust emissions, these calculations indicate that the replacement moped electric bikes can significantly reduce the negative impact of transport on the environment. If the calculation of climate change and other impacts such as impacts on air pollution and the impact on biological differences, along with other categories of external costs, these costs would be much higher, especially taking into account other categories of means of transport used for the delivery of postal items.

The main objective of environmental protection can be achieved by predicting, monitoring, preventing, limiting and eliminating adverse impacts on the environment, and encouraging the use of renewable natural resources and energy [4]. On the example of Croatian Post Inc., replacing the fleet of mopeds with more environmentally friendly mode of transportation indicates the care of provider of postal services for environmental protection.

According to the welfare theory approach, internalisation of external costs by market-based instruments (taxes, charges) may lead to a more efficient use of infrastructure, reduce the negative side effects of transport activity and improve the fairness between transport users.

3. Conclusions

Sustainable development of the postal sector is based on the definition and implementation of all necessary measures and activities aimed at reducing the negative impact on the environment. More efficient use of transport units, training employees about environmentally friendly driving and investments in hybrid vehicles or electric vehicles can reduce negative environmental impacts. Measures of replacing the existing fleet of road vehicles for more environmentally friendly in the postal system are outstanding. The impact of transport or selection of different means of transport on the environment by calculating external costs can be quantified and displayed by monetary units. A good example concerns the protection of the environment is a partial replacement of the fleet of mopeds of Croatian Post in the technological process of delivery by more environmentally friendly electric bicycles.

Literature

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Sažetak: *Poznato da je promet znatno pridonosi gospodarskom rastu. Osim pozitivnog utjecaja na društvo, promet, osobito cestovni promet ima negativne učinke, kao što su zagađenje zraka, zagušenje, nesreća, buka i klimatske promjene. U cilju povećanja energetske učinkovitosti u prometu, Hrvatska pošta d.d. uvođenjem električnih bicikala u poštanski promet doprinosi smanjenju negativnih utjecaja odvijanja transporta na okoliš. U radu se istražuje utjecaj na okoliš zamjenom postojeće flote mopeda u ekološki prihvatljivijim oblicima transporta, te izračun eksternih troškova*

Cljučne riječi: *transport, električni bicikli, eksterni troškovi, ekologija*

UTJECAJ ODABIRA PRIJEVOZNIH SREDSTVA U POŠTANSKOM PROMETU NA OKOLIŠ

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