GREENHOUSE GAS EMISSIONS OF THE HUNGARIAN TRANSPORT SECTOR

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ABSTRACT

Transport cannot be replaced because it is the part of the production chain. The importance of the transport sector is indicated by the sector's production which is 10% of the GDP of the European Union and more than 10 million people are working in this sector. Economic growth contributes to the increasing demand of transport, consequently global demand for transport is unlikely to decrease in the future. Moreover transport is projected to grow by 58% by 2030. The transport sector, led by automobiles, has been cited constantly as a major contributor through human intervention to climate change. In the future greenhouse gas emissions and global warming will be key issues of the society. Other energy consuming sectors are unable to compensate for transport related emissions, therefore the transport sector has to contribute to emissions abatement itself. There is a need to investigate those action combinations which might be able to reduce the absolute amount of CO_2 produced by automobiles and as a consequence the greenhouse gas emission growth in a non-marginal way. However, the possible methods of greenhouse gas emission reduction must be assessed in the context of cost effectiveness. There are several ways to reduce CO_2 that deliver equivalent reductions; however some impose greater costs on society than others.

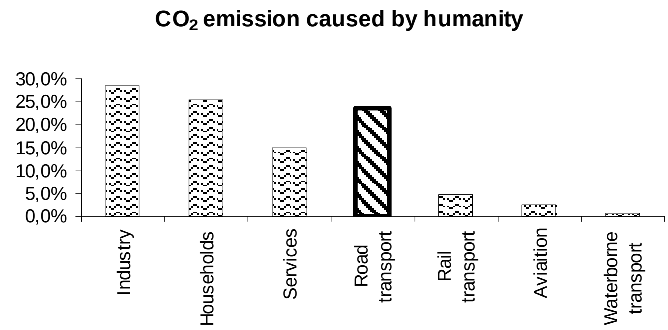
Recently, sectoral approaches have been gaining attention in international and national climate policies for emission reduction. A sectoral approach may be of particular interest for internationally oriented sectors and their businesses, where a fairly limited number of actors are given, such as, for example, the car manufacturing industry. An essential step to sectoral abatement targets is the quantification of global sectoral and regionalized baseline scenarios of CO_2 emissions.

The aim of this paper is the estimation of transport related carbon dioxide emission in Hungary due to fossil fuel consumption. This could serve as a basis for further research on true cost estimation of transport related emissions.

KEYWORDS: CO_2 emission, climate change, mobility

1. INTRODUCTION

The European Conference of Ministers of Transport (2007) review of progress in Organisation for Economic Development (OECD) countries suggests that measures adopted to date in the transport sector should cut CO_2 emissions by 2050, approximately by 50% of the projected increase in emissions between 1990 and 2010 otherwise this would have serious consequences for both the natural environment and for human well-being. Passenger car demand and use is one key sector of fossil fuel consumption. Road transportation operates on oil as the fuel of choice but first signs of a diversification of the fuel base have appeared, favouring natural gas, biofuels and synthetic fuels. Global transportation energy use accounts for roughly 25% of global carbon emissions deriving from energy use (Fig 1.). Road transport is currently the dominant modal sector in contributing to CO_2 emissions, with road passenger modes accounting for close to two-thirds of emissions. The Hungarian transport sector is responsible for a significant part of the total national energy consumption, and therefore could significantly contribute to saving energy and greenhouse gas mitigation in Hungary. At the design of policies, it is important to understand the reason behind the dynamics of energy consumption and its structure in the Hungarian transport sector. Future emission levels will largely depend on population and economic growth and on advances in technology.



1. Fig. Carbon dioxide emission of humanity
(source: The linkage of climate change and energy consumption of Hungary in the road transportation sector: Katalin Tánczos, Török Á., Transport Journal (ISSN 1648-4142) 2007/2, (p134–138))

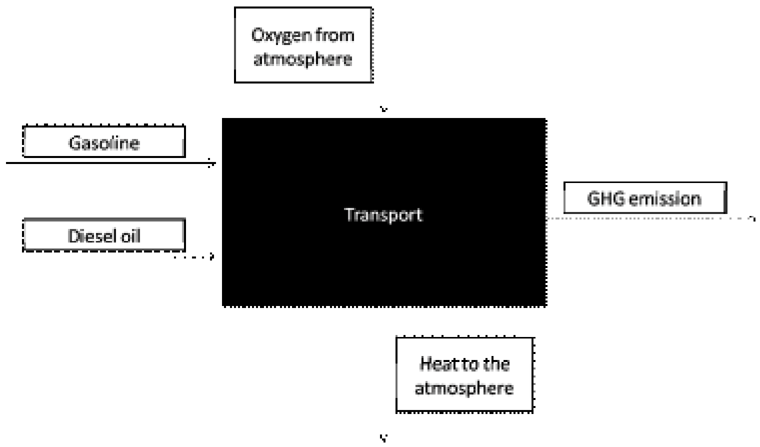
There was a decrease in CO_2 emissions in the major energy consuming sectors except for the transport sector. The share of emissions is projected to rise to about 25% if business-as-usual patterns of mobility are to prevail (OECD/IEA, 2004). We analysed the car related fuel consumption and estimated the associated CO_2 emissions, which were calculated on the basis of chemical equations. The level and dynamics of transport related GHG emissions challenge international climate policies. Pursuing ambitious climate goals like the +2°C target, to which the EU itself has committed, requires a long term reduction of more than 50% by 2050 compared to the 1990 baseline and a reduction of more than 90% until the end of the century (WBGU, 2007). The transport sector has to contribute to emissions abatement because other energy consuming sectors are unable to compensate for transport related emissions. The persisting problem of increasing emissions from transport is mirrored in multiple studies on decarbonising and decoupling transport emissions from economic growth, e.g. IEA (1993, 2001), OECD (2006) and EEA (2007).

However, national or supranational attempts to cut emissions from the transport sector have not been able to reverse the current trends in growing transport emissions.

With a potential substitution of fossil fuels with hydrogen, the possibility that the road transport sector reduces its relative contribution to CO_2 is real. Achieving major reductions in GHG emissions in the road passenger transport sector is not beyond the realms of possibility (European Conference of Ministers of Transport, 2007). Reducing GHG emissions however must be assessed in the context of cost effectiveness. There are a number of possible ways of reducing CO_2 that deliver equivalent reductions; however some impose greater costs on society than others. Examples include variable user charges and a carbon tax, but the change in consumer surplus and end user money and time costs are likely to be substantially different, as are the revenue implications for government.

2. MODELLING CO_2 EMISSION

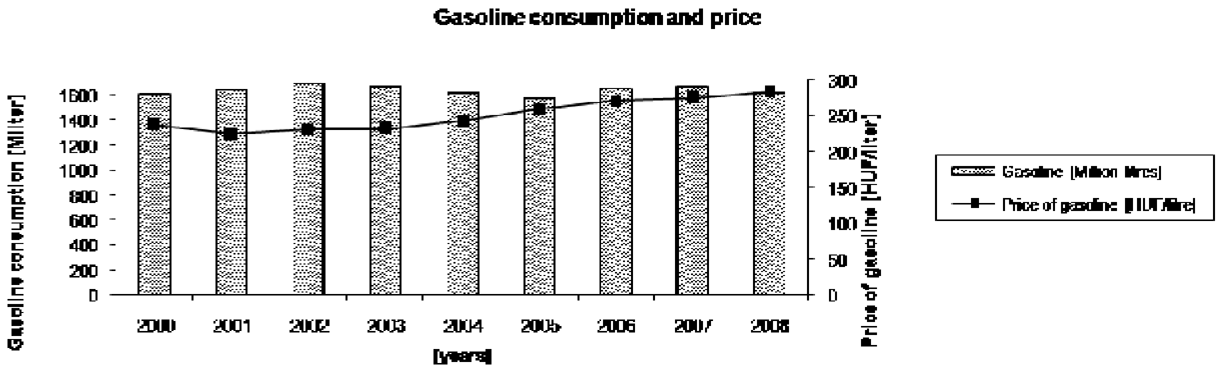
Rather than ignoring the problem and following a business-as-usual approach, the international community could decide to make an effort to lower its greenhouse gas emissions. While the inertia of the climate system now makes some warming inevitable, we can limit future climate change by stabilizing and then reducing emission. One aim is to calculate global CO_2 emissions from passenger car use. Carbon dioxide is produced when fossil fuels are used, burnt (2. Fig.).



2. Fig. Environmental impact of transport
(source: own research)

The fuel consumption of the road transport sector has increased considerably during the past two decades (3. Fig., 4. Fig.). It is attributed generally to a larger share of traffic handled by road transport, especially by trucks hauling goods over longer distances, and rapid growth of energy-intensive private modes of road transport. Comparatively higher growth rates (and volume of use) have been observed in gasoline consumption beyond the mid-1990s. The expansion of cheaper diesel vehicles caused rapid growth in gasoline demands in recent years.

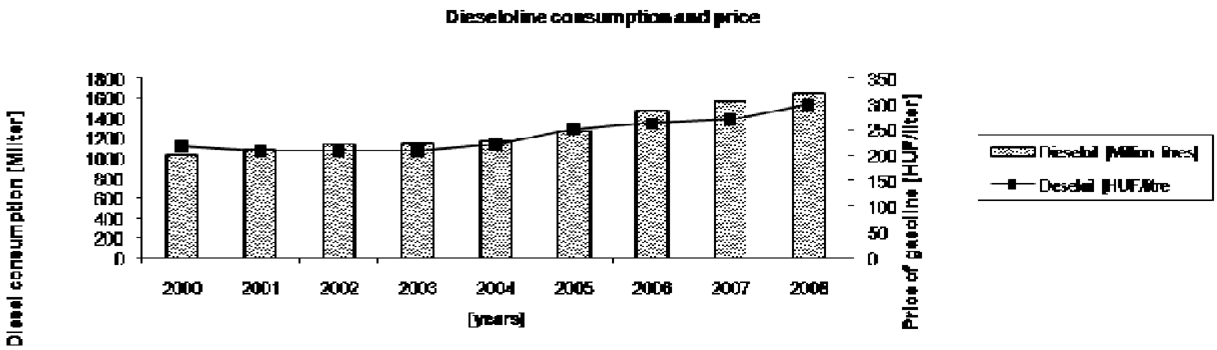
2.1 GASOLINE CONSUMPTION, PRICE AND CO_2 EMISSION IN HUNGARY



3. Fig. Gasoline consumption and price in Hungary
(source: dr. György WILDE, Annual report of Hungarian Petrol Asociation)

The total, national gasoline consumption fluctuated between 1570 million litres of gasoline as a minimum in 2005 and 1700 million litres of gasoline as a maximum in 2002 [2]. The gasoline consumption mentioned above has been consumed by internal combustion driven motor vehicles in Hungary. The dynamic change in gasoline consumption was attributable to the dynamic change in passenger car usage. According to our modelling the combustion of gasoline in the year 2005 caused 1 980 720 000 m^3 of CO_2 and used 2 923 920 000 m^3 of oxygen from our atmosphere, if ideal combustion is supposed. Due to the consumption of gasoline in 2008 approximately 50 PJ energy was produced and consumed by the transport sector in Hungary. This energy was heating the environment.

2.2 DIESEL OIL CONSUMPTION, PRICE AND CO_2 EMISSION IN HUNGARY



4. Fig. Diesel oil consumption and price
(source: dr. György WILDE, Annual report of Hungarian Petrol Asociation)

The total diesel consumption increased from nearly 1000 million litres of diesel oil in 2000 to almost 1650 million litres of diesel oil in 2008 [2], registering 700 million litres of increase. The diesel oil consumption mentioned above was consumed by motor vehicles in Hungary. The relative share of diesel-powered vehicles showed an increasing trend in the 2000-2005 period. The dynamic change in diesel oil consumption was attributable to the dynamic increase in freight transport. All freight and passenger transport vehicles (light, medium and heavy-duty commercial vehicles) were mainly powered by diesel engines in Hungary. According to our modelling the combustion of diesel oil in the year 2008 produced 2 248 715 000 m^3 of CO_2 and consumed 3 413 375 000 m^3 of oxygen from our atmosphere, if ideal combustion is supposed. Due to the consumption of diesel oil in 2008 approximately 56 PJ energy was produced and consumed by the transport sector in Hungary. This energy was heating the environment.

3. REDUCING CO_2 EMISSION

Table 1.
Climate changing strategies [1]

		Do we do anything against climate change?	
		Yes	**No**
Is there climate changing?	**Yes**	• Changing behaviour • Changing society • Changing economy • Decreasing damages	Increasing damages, both frequency and value
	No	• Changing behaviour • Changing society • Changing economy	Stay in current form of behaviour, society and economy

Because our socio-economic and decision-making systems are also have huge inertia, even a target of 3°C would require us to start taking serious action now. So delay is clearly no longer an option: the next two or three decades will be critical for avoiding the most serious consequences of global warming. Reducing greenhouse gas emission will cost money, but the amounts required are clearly affordable (Table 1.). It is important to remember that climate policies can bring many win-win benefits for all the subgroup elements of the society.

Recently, sectoral approaches to emissions reduction have been gaining attention in international/national climate policy, i.e. in the design of a post-Kyoto agreement [4]. A sector wide approach to emissions mitigation may — in certain cases — be more successful than national approaches, as competitiveness risks and carbon leakage can be overcome. A sectoral approach is particularly interesting for internationally oriented sectors and their businesses, given a fairly limited number of actors, such as, for example, the car manufacturing industry. An essential step to sectoral abatement targets is to quantify global sectoral and regionalized baseline scenarios of CO_2 emissions.

Importantly, the assessment of the overall impact of any policy instrument or mixes of instruments must be established through a framework that can account for the system-wide responses and not just the obvious direct and partial responses. Although there will be adjustments beyond the transport sector, there is great merit in tracking the ways in which specific policy instruments impact, in direct and indirect ways, on activities that are linked to transportation and location decisions for the population of interest. To understand how a system-wide approach can identify the impact of a specific policy instrument, consider a fuel tax increase. The imposition of an increase in the tax on automobile fuel, via its impact on unit operating cost has an immediate and direct influence on: the use of each vehicle for particular trips such as the commuter trip; i.e. mode choice, which includes both a switch to public transport and vehicle-substitution from within the household's vehicle park, a possible change in the timing of the commuter journey to reduce the increased costs associated with traffic congestion, and hence a change in the overall and non-commuting use of each automobile available to a household. It also directly affects the household's choice of types of automobiles from the set of conventional and hybrid-fuel vehicles. The indirect impacts include a change in residential location over time via the change in modal and spatial accessibility to work opportunities and a change in the number of vehicles in a household (given the increased operating costs). Changes in residential location may further affect the use of each automobile, as well as the mix of urban commuting and non-commuting, and non-urban kilometres. The adjustment in commuter travel may also affect non-commuting car use if a vehicle previously used for commuting is released for use by another non-working member of the household. Some adjustment in the loss rate of automobiles will also occur

The demand for vehicles and transport fuel responds only weakly to higher prices. Prospects for reducing emissions therefore depend very much on advances in transport technologies and regulations encouraging their adoption. Improving road vehicles will require continued technological progress together with strong policies to ensure that engineers focus on boosting fuel economy rather than on increasing horsepower and vehicle mass [3]. Providing public transport systems and promoting walking and bicycling can further reduce emissions significantly. Making towns and cities more pedestrian friendly should be a top priority for urban planners. The associated health and other benefits can also be significant. Governments can play a major role in convincing industry and consumers to be climate-friendly by providing incentives that are clear, predictable, long term and robust. It is important to ensure that policies are not counterproductive. Many public policies promoting the development, deployment and diffusion of new technologies are applicable to a wide range of economic sectors. Examples of policies and measures already in use

- Regulations and standards (fuel economy standards, emission standards)
- Taxes and charges for raising the costs of emission
- Subsidies or financial incentives that reward the buyers and sellers of low emission technologies, thus enabling these technologies gain a footing in the marketplace.
- Research and development programmes, which can lower the cost of launching new technologies
- By reflecting the true cost of emissions, it can be a signal to users to cut emissions. It can also stimulate the research and development of low carbon technologies.

This paper aims at estimating the sectoral carbon dioxide emission of transportation (Fig. 5.) and evaluates the potentially effective instruments that are aimed to increase the efficiency, sustainability and equity. Reducing greenhouse gas emission will have to be one of the international community's top priorities over the coming decades. There will be many difficulties and detour along the road to build climate friendly economies.

Fossil fuel will dominate our global energy supply for the next several decades unless we make deliberate changes. The commercialization of new types of bioenergy may also offer significant potential. Business-as-usual emissions scenarios of passenger car demand and use reveal a development of emissions portfolios that is far from achieving stabilization and thus far from striving toward climate protection, assuming other energy consuming sectors will not be able to compensate for transport related emissions growth. Projections validate a trend towards continued growth in fuel consumption and correlated CO_2 emissions, which could be substantial if the behavioural and technological aspects of passenger vehicle use persist. But the analysis puts forward a remarkable potential for mitigation through technological improvements in fuel economy standards. Some of the cheapest option for reducing emission is the fuel saving in vehicles.

One of the cornerstones of a transition towards more climate friendly on-road mobility schemes must therefore be to optimal for technological innovations in emissions reduction, in particular, through fuel economy improvements and moving transportation away from its persistent dependence on oil to a more sustainable track through alternative propulsion systems like hybrid technologies.

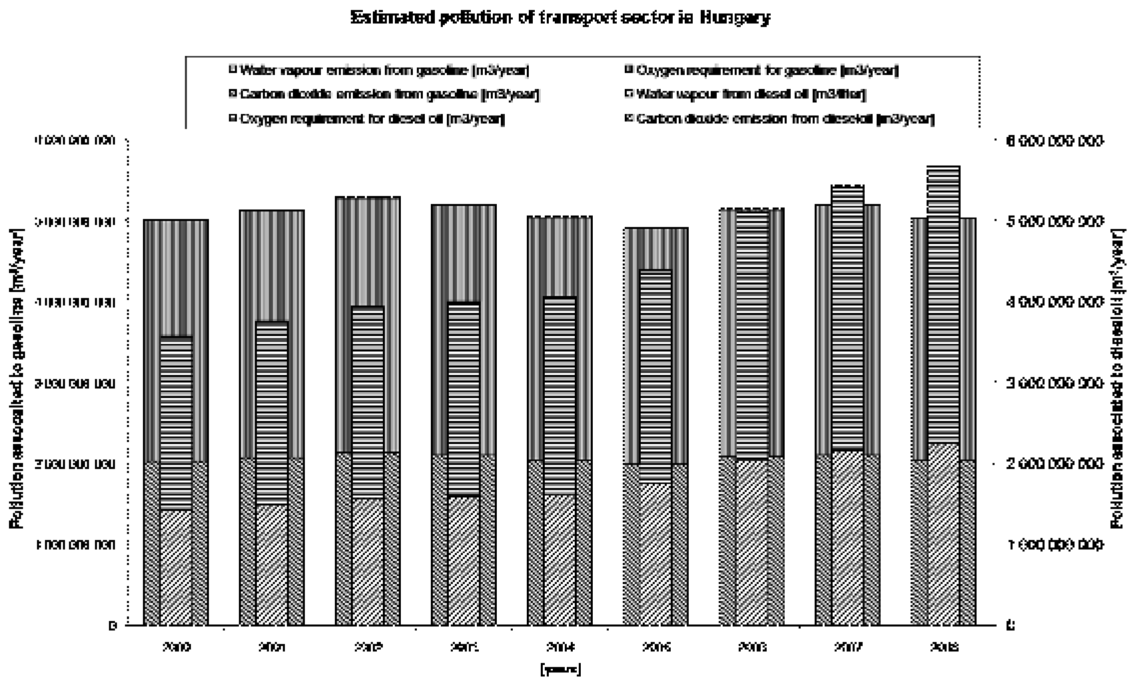


Fig. 5. Estimated emission of transport sector in Hungary
(source: own research)

According to our estimation, in 2000 3 435 885 000 m^3 of CO_2 were emitted by the road transport sector which increased to 4 279 835 000 m^3 in 2005. Therefore, it is important that accurate emission inventories are prepared for the road transport sector in order to design and implement suitable technological and policy options for appropriate mitigation measures. An attempt has been made in the present exercise to reduce uncertainties in the emission estimates of the road transport sector. It is evident from the discussion that improvement in documentation of activity data (i.e. fuel use) at segregated levels of consumption by sources and fuel types is necessary at the compilation stage itself along with the generation of country specific emission factors for estimating the GHG emissions. The uncertainties associated with the activity data and emission factors could then be reduced, at least at the national level, for major categories of gasoline and diesel-powered vehicles.

4. CONCLUSIONS

Reducing greenhouse gas emission will cost money, but the amounts required are clearly affordable. It is important to remember that climate policies can bring many win-win benefits. Reducing greenhouse gas emission will have to be one of the international community's top priorities over the coming decades. There will be many difficulties and detour along the road to build climate friendly economies.

An alternative or complementary policy approach can be the promotion of intermodal services, mainly in freight transport. Higher market share of intermodal transport can lead to lower performance volumes in unimodal road haulage. Intermodal transport, however, still needs to be supported by different public interventions as it is not competitive enough [5].

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