УДК 330.552:338.47
Original scientific article

THE CHALLENGES OF THE TRADABLE-PERMITS USE IN TRANSPORT SECTOR

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Извод: Сва скорашња технолошка побољшања у сфери саобраћаја: коришћење енергетски ефикаснијих горива, пораст учешћа дизел-возила, побољшано (директно) убризгавање горива, увођење електричних и хибридних возила итд., нису у стању да пониште ефекат драматичног пораста обима путничких километара, нити све већег коришћења знатно тежих, комфорнијих, енергетски све захтевнијих моторних возила. Све оштрији стандарди везани за квалитет горива и технологију мотора, не представљају спасоносно решење ни за проблеме потрошње енергије, нити за емисију CO_2. Фокусирањем искључиво на стандарде се, у ствари, само занемарује утицај наглог пораста коришћења моторних возила на потрошњу енергије и загађење ваздуха. Стога смо се у овом раду оријентисали на тржишне економске инструменте који могу да смање обим тражње за саобраћајем – посебно на изазове примене трансферабилних дозвола у саобраћају.

Кључне речи: саобраћај, потрошња енергије, емисија CO_2, економски инструменти, трансферабилне дозволе

Abstract: All recent technological improvements and changes in transport sector: substitution of fuels, increased use of diesel vehicles, direct gasoline injection, supercharging, electric vehicles, hybrid vehicles, etc., cannot offset massive growth in traffic, combined with significantly heavier, more powerful, more luxurious and thus more fuel consuming vehicles. Increasingly stringent standards, related to fuel quality and technology of vehicle engines, prove not to be a life-saving solution either to problems of energy consumption, nor to CO_2 emission. Focusing on the implementation of increasingly strict energy and emission standards, the effect of the rapid increase in the use of motor vehicles on the degree of energy consumption and air pollution is completely neglected. Hence, in this article we focused on the market-driven instruments that can reduce transport demand, especially on the challenges of tradable permits use in transport.

Key words: transport, energy consumption, CO_2 emission, economic instruments, tradable permits

Date submitted: 10 September 2013; *Date accepted*: 25 December 2013

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Introduction

Transport is characterized by significant market failures that lead to environmental degradation and, on a global scale – the major depletion of non-renewable resources and global climate change. In order to eliminate these negative effects of transport a wide range of instruments for environmental protection can be used. Some of them, like standards and taxes, traditionally regulate transport sector, and other, like tradable permits, are still waiting for their full application.

Main role of transport in global energy consumption and CO_2 emission

In 2009 transport became the highest single energy-consuming human activity: it became responsible for 27.3% of world energy-consumption (compared to 23% in 1973) and finally managed to surpass industry, which dropped from 33% in 1973 to 27.3% in 2009 (IEA, 2011).

Also, since transport predominantly (95%) relies on a single fossil resource – petroleum, this sector is responsible for 24% of world energy-related GHG emissions, with about three quarters coming from road vehicles. Over the past decade, transport's green-house gases (GHG) emissions have increased at a faster rate than any other energy using sector.

Moreover, transport activity is expected to grow robustly over the next several decades, and total transport energy use and carbon emissions are projected to be about 80% higher than current levels by 2030, and to at least double by 2050. Also, it is estimated that around 75% of the projected total increase in world oil demand is going to come from the transport sector (Metz, Davidson, Bosch, Dave & Meyer 2007; Creutzig, McGlynn, Minx, & Edenhofer, 2011; IEA, 2008).

Of all transport modes, off course, road transport has by far the most pronounced impact on global energy consumption and CO_2 emissions - in EU, for example, approximately 75% (EEA, 2013).

A variety of measures have been suggested to counter rising energy consumption and GHG emissions in the (road) transport sector, including land-use policies, transport demand management, infrastructure investments, and alternative fuel technologies, including biofuels (Ribeiro et al., 2007; Creutzig & He, 2009; Cervero & Murakami, 2010; Creutzig & Edenhofer, 2010).

Actually, GHG emissions can be decomposed into:

1) carbon intensity,
2) energy efficiency and
3) total transport demand (Creutzig et al., 2010)

Also, Stern review underline that transport is one of the most expensive sectors to cut emissions from, because the low carbon technologies tend to be expensive and the welfare costs of reducing demand for travel are high. Transport is also expected to be one of the fastest growing sectors in the future. For these two reasons, studies point out that transport will be among the last sectors to bring its emissions down below current levels (Stern, 2007).

Actually, there are two main factors leading to such a huge increase in energy consumption and CO_2 emissions in transport:

a) the first is the dependency on the internal combustion engine, with no wide-scale economically viable alternative available in the next decades;
b) the second is the sharp increase in vehicle-kilometres travelled, which seems to be an inherent feature of economic growth (Raux, 2010).

This technological and economic dependency points out a challenging energy efficiency issue.

It is obvious that all recent technological improvements and changes in (road) transport sector (substitution of fuels - increased use of diesel vehicles, direct gasoline injection, supercharging, electric vehicles, hybrid vehicles, etc.) cannot offset massive growth in traffic, combined with growing demand for comfort (air-conditioning, etc.), which is very energy expensive (Joumard, 2005).

For example, there is reported continuous downward trend of fuel consumption, due to the technological innovations introduced in modern passenger cars, as well as certain market shifts towards less fuel consuming (diesel) vehicles (ACEA, 2002). Nevertheless, a large part of this benefit in fuel consumption and CO_2 emissions was counterbalanced by various reasons, amongst which are stricter safety regulations, consumer demands and improvements in the car's comfort that resulted in significantly heavier, more powerful, more luxurious and thus more fuel consuming vehicles (Mehlin, Guehnermann & Aoki 2004; Joumard, 2005). Actually, important factor that has accelerated the increase in transport energy use and carbon emissions is the gradual growth in the size, weight and power of passenger vehicles, especially in the industrialized world. For example, the US Environmental Protection Agency has concluded that the US new Light-duty Vehicle (LDV) fleet fuel economy in 2005 would have been 24% lower had the fleet remained at the weight and performance distribution it had in 1987. Instead, over that time period, it became 27% heavier and 30% faster in 0–60 mph (0–97 km/h) time, and achieved 5% poorer fuel economy (Heavenrich, 2005).

Also, since increased fuel efficiency, in fact, effectively decrease the unit cost of driving - energy effectiveness and reduced (CO_2) emissions are seriously offset - by increased demand for car travel. Latest research clearly shows that at least 60% of the potential energy saving from efficiency improvements is lost due to increased driving – that is called ‘rebound effect’ (Frondel, Ritter & Vance, 2012).

Hence, the overall picture, in fact, shows only a modest improvement in the fuel consumption of the average vehicle (Fontaras & Samaras, 2007).

Electric (and, also, hybrid) vehicles are strongly promoted lately – due to the fact that they have minor GHG emissions, related to the vehicle technology itself – but their total GHG emissions is rather significant, when the electricity (that they use) has been produced in a coal power plants. Hence, their total carbon footprint, when the fuel production is included, is, actually, very high (Creutzig et al., 2011). This is of a major significance, since two thirds of global electricity has been produced from fossil fuels (EIA, 2013).

Actually, worldwide travel studies have shown that the average time budget for travel is roughly constant worldwide, with the relative speed of travel determining distances travelled yearly (Schafer, 2000). As incomes have risen, travellers have shifted to faster – and more energy-intensive – modes (Metz et al., 2007).

Transport fuel use worldwide is currently dominated by petroleum, with over 95% of fuel being either gasoline or distillate fuels such as diesel, kerosene or jet fuel. A new analysis of fuel costs indicates that in the near term (and with oil prices around USD 60/bbl), most alternative fuels will be more expensive than gasoline or diesel (IEA, 2009). While oil extraction is expected to peak and decline within this decade (IEA, 2010), the shortfall will likely to be partially compensated with non-conventional oil (such as tar sands) and other fossil resources such as gas-to-liquids and coal-to-liquids. On average, these fuels are more energy and carbon intensive than oil, caused by upstream emissions in the supply chain (Charpentier, Bergerson & MacLean, 2009).

Obviously, increasingly stringent standards related to fuel quality and the technology of vehicle engines prove not to be a life-saving solution either to problems of energy consumption, or to CO_2 emission. Focusing on the implementation of increasingly strict energy and emission standards, the effect of the rapid increase in the use of motor vehicles on the degree of energy consumption and air pollution is completely neglected (Jovanović, 2012).

Also, it must be stressed that the (industrial) stationary source emission can be reduced relatively effectively by means of a stricter regulation, because the stationary sources represent (individually) extremely large polluters of the environment and they are far fewer than the mobile sources (in the U.S., for example, only 27,000 compared to 200 million motor vehicles). In short, what crucially affects the emission from mobile sources (motor vehicles), is not only the level of emission per 1 vehicle kilometer travelled, but - actual volume of vehicle-kilometers per capita (see Heningen & Shah, 1998; Jovanović, 2012).

Finally, worldwide, transport sector energy and CO_2 trends are strongly linked to rising population and incomes. Another crucial aspect of global transport system is that much of the world is not yet motorized (due to low incomes). The majority of the world's population does not have access to personal vehicles, and many do not even have access to motorized public transport services of any sort. As incomes in the developing nations grow, transport will grow rapidly. When these areas develop and their population's incomes rise, the prospects for a vast expansion of motorization and increase in fossil fuel use and GHG emissions is very real (Metz et al, 2007). And these prospects are exacerbated by the evidence that the most attractive form of transport for most people as their incomes rise is the motorized personal vehicle, which is seen as a status symbol as well as being faster, flexible, convenient and more comfortable than public transport.

If the aim is to achieve ambitious energy consumption and GHG reduction for transport within the next few decades, the policies will have to be more determined: they should aim at reducing total consumption which means reducing vehicle kilometres travelled, not just vehicle specific consumption (Jovanović, 2012; Raux, 2010).

Due to the growth rates in the volume of traffic, it is unlikely that technical progress of engines will be sufficient to reduce overall emissions or even keep them at today's levels. For that reason, the focus is increasingly shifting to market-driven instruments, which, apart from creating incentives to develop and use low-emission technologies, can also reduce the demand for travel (Federal Environmental Agency, 2003).

So, Joumard rightfully stresses that "only 40% of the effort required should focus on technology, while the remaining 60% should focus on managing demand for transport and the adoption of more sustainable modes of transport" (see Joumard, 2005).

Managing transport demand – inclusion of the environmental degradation into the transport market

The main problem concerning environmental degradation, from the economic point of view, stems from the fact that the environment (on the market) does not have a defined *price*, although, apparently, it does have a (priceless) *value*. In other words, the domain of environmental protection is characterized by significant market imperfections:

1) external effects
2) public goods
3) common goods
4) incomplete information (see Hanley, Shogren & White 2001; Jovanović, 2012).

Market imperfections arise when the property cannot be clearly defined, when the property cannot be freely transferable, when the use of the goods cannot exclude the others, and when the privacy rights cannot be protected. Hence, the state intervention is necessary in this sphere – or when it comes to global public goods, the intervention of the international community.
Main economic measures to protect the environment from pollution are: 1. control of scope/amount of pollution (I+M programs – Inspection and Mainte-

nance) and 2. market instruments, that include: fiscal instruments – mainly taxes and tradable permit system (Jovanovic & Vračarević, 2012).

Actually, there are three basic ways to create new markets in addressing market failure associated with environment (Hanley et al, 2001). First, to assign *property rights* for environmental assets and let economic actors negotiate over the price and quantity of the good. Second, work through regulators to set a market *price* per unit of the environmental asset. Third, use regulators to set the *quantity* of the asset that can be bought and let economic actors decide what price they are willing to pay for the fixed quantity.

1) Set the price of social damage – green taxes. For nearly a century economists have promoted the idea that we have to adjust market prices to fix environmental dilemmas, to price the pollution for an otherwise unpriced environmental asset. The economist Alfred Pigou first suggested that an effective solution to pollution problems is to add a tax on to the market price. This Pigovian tax (*green tax)* must equal the external cost, suffered by those affected by the pollution. But, setting an efficient green tax requires information on all associated costs and benefits, and this information is not free, as had been presumed in the original green tax models. In fact, costly information for green taxes prompted ideas of property rights, negotiations, transaction costs. Economist Ronald Coase pointed out that if one could assign an efficient green tax, transaction costs must be very low.

2) Assign property rights and bargain over price and quantity. In 1960 Coase argued that we can create new markets for non-market goods like the environment. The key point is that it does not matter which party gets the property rights, only that they are assigned to someone. The outcome will be the same – an efficient allocation of resources. This is the Coase theorem, which holds *provided that transaction costs are low and legal entitlements can be freely exchanged and enforced*. Transaction costs are the price paid to organize economic activity, including information, negotiation, writing and enforcing contracts, specifying property rights, and changing institutional designs. The Coase theorem is more likely to work the fewer actors involved in the dispute. More actors increase the transaction costs necessary to come to an agreement, and make the market less efficient.

3) Set the quantity of social damages – tradable permit systems. An alternative to setting a Pigovian tax is to set a fixed quantity of the environmental good in question, and to allow people to trade the good on the open market. Thomas Crocker and J. Dales introduced the idea of tradable permits for environmental protection independently in the mid-1960s. Emission markets work by assigning the property rights to pollute to firms, governments, and people. These rights create value to something that was otherwise a free good, e.g. clean air or water.

Tradable permits focus on the quantity side of the market equation. A regulator selects a fixed quantity of pollution, then sets the number of permits, and allocate them (usually for free) to firms and people. If they keep pollution below their permit level, they can sell their surplus permits, if they exceed their allocation, then they must buy permits.

What makes a tradable permit system effective? Permits must be well defined and scarce so their value can be estimated accurately. Free trade should dominate the permit market. Government intervention, bottlenecks, and transaction costs that limit the scope of trading should be minimal.

A key issue in any tradable permit program is the initial allocation of permits. Despite a common preference for auctioned permits among economists, grandfathering of incumbent emitters (based on previous emission levels) has been applied in virtually all applications to date to gain political consensus for implementing the program.

Tradable emission permits have been at the center of this discussion due to the theoretical promise of cost-effectiveness and because they have been used successfully in the United States to reduce sulphur dioxide (SO_2) and nitrogen oxides (NOx). However, it remains an open question whether tradable permits are appropriate for use in the transport sector.

Obviously, the main point here is the volume/amount of transaction costs that depends on number of economic actors involved in process. Number of economic actors in industry is dramatically smaller than in transport. Therefore, industry is much more suitable for tradable permits use, than transport sector. Hence, it doesn't come as a surprise that the "most successful tradable permit story" is from the industry sector (U.S. SO_2, "acid rain" tradable permit system).

European Union's Emission Trading Scheme

There was a gradual learning process that led to the successful U.S. tradable permit program to control acid rain by cutting nationwide *emissions of* SO_2. The rise of interest in tradable permit programs occurred at the same time as when many of the basic environmental laws were being written in the United States. They were used to provide air pollutant emissions (U.S. Environmental Protection Agency's [EPA] Emission Trading Programs), to phase out leaded gasoline and ozone-depleting chlorofluorocarbons (CFC) from the market and to reduce sulphur dioxides (SO_2) and nitrogen oxides (NOx) in the Los Angeles basin (RECLAIM).

Since taxes and other instruments were used in Europe more frequently, few applications of tradable permits existed previously in Europe, before the European Union's Emission Trading Scheme (EU ETS), the world's first launched large-scale CO_2 *emissions* trading program.

EU ETS was adopted in 2003 with a pilot phase that became active in 2005. It covers approximately one third of EU CO_2 emissions in thirty countries in a region of the world that accounts for about 20 percent of global GDP and 17 percent of world energy-related CO_2 emissions (Ellerman & Buchner, 2007).

As Peter Zapfel points out, major point of criticism that mounted against the EU ETS scheme was its narrow focus, i.e. the coverage of only around 40% of total EU greenhouse gas emissions (Zapfel, 2005). Actually, in the first/initial phase EU ETS covered only carbon dioxide (CO_2) emissions from four sectors: 1) production and processing of iron and steel; 2) minerals (such as cement, glass, or ceramic production); 3) energy (such as electric power and direct emissions from oil refineries); and 4) pulp and paper (installations are included in the program if they exceed industry-specific production or capacity thresholds specified in the EU Directive) (Kruger & Pizer, 2004).

The program did not cover some major sources of emission: transportation, commercial or residential sectors (Ellerman & Buchner, 2007; Aldy & Stavins, 2011). Since transaction costs for transport are so high, transport was included in the famous EU ETS scheme in 2012, but only partly - not the whole sector, only aviation.

Also, extremely important issue here is the fuel 'production chain'. There are three possible points at which the energy system can be regulated – the upstream, midstream and downstream approach (upper, middle and lower sections in the value chain of a national economy) (Deuber, 2001; IFEU, ZEW, 2001).

In the downstream approach, it is the emitter who must obtain allowances, in other words the road user (e.g. the customer at a petrol station). The attraction of this approach is that emissions are directly recorded and monitored where they are actually generated and there is a high degree of certainty that the reduction target will be achieved. However, it entails considerable administrative problems and high transaction costs (Federal Environmental Agency, 2003).

The approach that can most easily be integrated into a general trading system is the *upstream* approach, in which it is the fuel manufacturers (refineries) who are required to obtain allowances. The allowances are based on the carbon content of the fuels, which generate CO_2 when subsequently combusted. The advantage here is that the number of actors and therefore transaction costs are low and that all energy-related CO_2 emissions can easily be covered by the trading system (Federal Environmental Agency, 2003).

Albrecht (2001) favors an open *midstream* trading system in which automobile producers have to hold permits for the lifecycle emissions of the sold vehicles (Abrell, 2009).

Raux and Marlot (2005), proponents of *downstream* approach, argue that an electronic system for permit sales and purchases can minimize transaction costs (if the system is compatible to automatic teller machines, which already exist at gas stations).

In conclusion, the main disadvantage of all three abovementioned approaches is that they mainly deal with fuel (and only indirectly with motor vehicle) energy efficiency. Also, recent improvements of automakers motor efficiency resulted with only relatively modest total energy savings in transport sector (ACAE, 2002; Fontaras & Samaras, 2007).

Actually, the main problem here is that all these approaches do not specifically target vehicle kilometres travelled (German, 2006; Abrell, 2009). For that reason the main proponents of another economic instrument – green taxes – stress that taxes achieve better results, no matter whether they specifically target better environmental protection, or not (Sterner, 2007).

And finally, it seems that EU ETS has failed to successfully reduce emissions. As Reyes stresses, companies have consistently received generous allocations of permits to pollute, meaning they have no obligation to cut their carbon dioxide emissions. A surplus of around 970 million of these allowances from the second phase of the scheme (2008-2012), which can be used in the third phase, means that polluters need take no action domestically until 2017 (Reyes, 2011).

Conclusion

Although ambitiously designed projects (like European Union's Emission Trading Scheme) are in full progress, world transport energy use and emissions have been projected to increase by more than 50% by 2030 and to at least double by 2050. Hence, it seems that the role of tradable permits in transport sector is not very promising in this moment. The main reason is, obviously, the volume/amount of transaction costs that depends on huge number of economic actors involved in the process. Since the number of economic actors in industry is dramatically smaller, industry is still much more suitable for tradable permits use than transport sector.

Acknowledgements

This work was supported by the Ministry of Science and Technological Development of the Republic of Serbia under Grant No 37010.

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Оригинални научни рад

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ИЗАЗОВИ ПРИМЕНЕ ТРАНСФЕРАБИЛНИХ ДОЗВОЛА У САОБРАЋАЈУ

Резиме

Сва скорашња технолошка побољшања у сфери саобраћаја: коришћење енергетски ефикаснијих горива, пораст учешћа дизел-возила, побољшано (директно) убризгавање горива, увођење електричних и хибридних возила итд., нису у стању да пониште ефекат драматичног пораста обима путничких километара, нити све већег коришћења знатно тежих, комфорнијих, енергетски све захтевнијих моторних возила. Све оштрији стандарди везани за квалитет горива и технологију мотора, не представљају спасоносно решење ни за проблеме потрошње енергије, нити за емисију CO_2. Фокусирањем искључиво на стандарде се, у ствари, само занемарује утицај наглог пораста коришћења моторних возила на потрошњу енергије и загађење ваздуха. Стога смо се у овом раду оријентисали на тржишне економске инструменте који могу да смање обим тражње за саобраћајем – посебно на изазове примене трансферабилних дозвола у саобраћају. Анализа показује да коришћење трансферабилних дозвола у саобраћају још увек наилази на непремостиве тешкоће, због огромних трансакционих трошкова које узрокује огроман број економски актера у овој сфери.