City Logistics and Air Quality

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Abstract The paper focuses on the impact of city logistics on air quality. The first chapter focuses on the EU's transport policy for 2030-2050 to reduce greenhouse gas emissions. The second chapter focuses on air quality in the Slovak Republic and the amount of greenhouse gases in the air. The aim of the contribution is to highlight the impact of road transport on air quality and air pollution as well as the need to reduce these harmful emissions.

Key words city logistics, emissions from transport, reduction

JEL R41, R42

1. Introduction

Due to the growing number of people living in urban areas, there is a growing need for urban mobility and urban logistics. This growth needs an increase in vehicles moving in city streets. Some cities try to tackle the problem of increasing the number of vehicles because they have a negative impact on the environment, they affect the health of the population and also affect the quality of roads and public spaces in the city. In practice, urban mobility, with logistics associated with urban settlements, we meet two basic concepts, urban logistics and urban logistics. Although these terms may appear to be synonymous, the opposite is true.

City logistics is defined in a narrower sense only in relation to the flows of goods induced by industry and commerce, sometimes even only within the urban centre [8].

Urban logistics presents a wider view where concepts include not only logistics chains of industrial and commercial entities operating on the city's territory, agglomerations, but also logistic chains created by entities operating in the areas of communal services, healthcare, banking and insurance, as well as in the administration. [1]

City logistics is part of logistics that deals with the movement of shipments in cities. The so-called traffic hubs are used, where distribution, allocation and translation of shipments to more suitable types of vehicles results in reduced and optimized number of routes. City logistics is defined as a process of complete optimization of logistics and transport activities by private enterprises in urban areas, taking into account the environment, the transport, environment, congestion and energy consumption within the market economy. [2]

2. The European Transport Policy by 2030 – 2050

The EU White Paper on Transport also deals with air pollution from transport. The European Union has called on the need to drastically reduce world greenhouse gas emissions, with the goal of limiting climate change. Overall, the EU needs to reduce emissions by 80-95% below 1990 levels by 2050, in the context of the necessary reductions of the developed countries as a group, in order to achieve this goal. Commission analysis shows that while deeper cuts can be achieved in other sectors of the economy, a reduction of at least 60% of GHGs by 2050 with respect to 1990 is required from the transport sector, which is a significant and still growing source of GHGs. By 2030, the goal for transport will be to reduce GHG emissions to around 20% below their 2008 level. New technologies for vehicles and traffic management will be key to lower transport emissions in the EU as in the rest of the world.

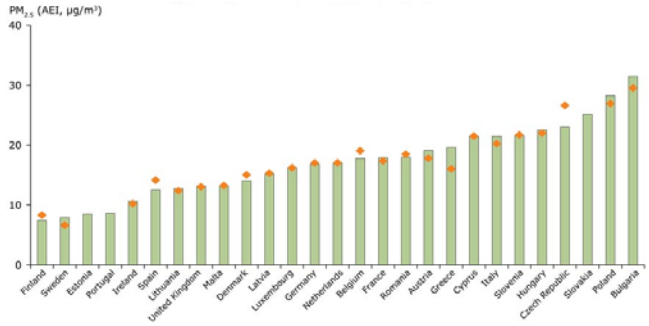

Figure 1. Urban $PM_{2,5}$ concentrations presented as multi-annual average in EU,2009-2011 [3]

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In the cities there are big problems with the crossing of particulate matter in the air. In Fig. 1 and 2 are the results of measurements in EU countries. Exceeded allowable values are in some Slovak cities.

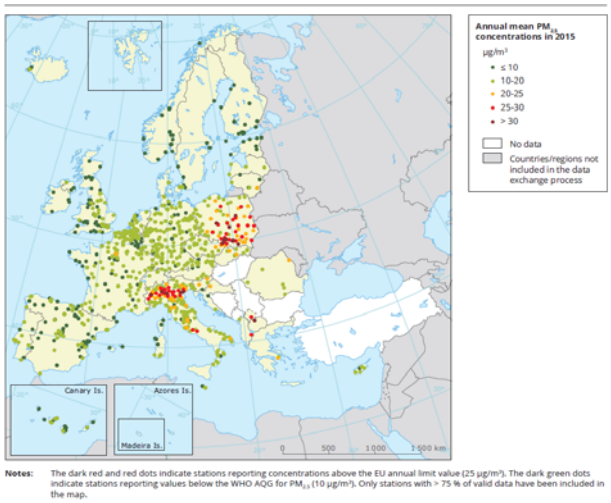

Figure 2. Concentrations of $PM_{2.5}$ 2015 [6]

2.1. Transport and Supporting Mobility While Reaching The 60% Emission Reduction Target

The challenge is to break the transport system's dependence on oil without sacrificing its efficiency and compromising mobility. In line with the flagship initiative "Resource efficient Europe" set up in the Europe 2020 Strategy and the new Energy Efficiency Plan 2011, the paramount goal of European transport policy is to help establish a system that underpins European economic progress, enhances competitiveness and offers high quality mobility services while using resources more efficiently. In practice, transport has to use less and cleaner energy, better exploit a modern infrastructure and reduce its negative impact on the environment and key natural assets like water, land and ecosystems.

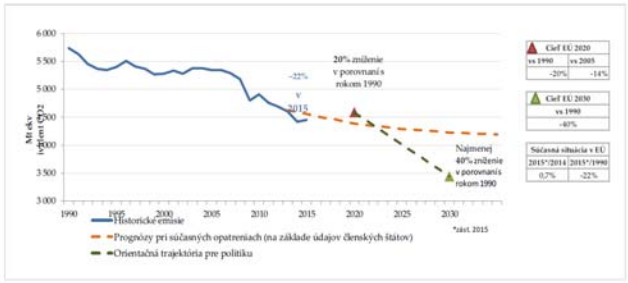

Figure 3. Progress towards the Europe 2020 objectives [5]

In Fig. 3 shows progress in meeting the Europe 2020 targets. As it seems, the pace of decline is not in line with the EU's 2030 goals. Unfortunately, the Slovak Republic didn´t respond much to the progress. There are no low-emission zones in the SR, although the legislation already has it. Even with government support for the procurement of electric vehicles (5000 euros) and plug-in hybrids (3000 euros), the number of these environmentally friendly vehicles in the SR did not increase significantly. Even from the disbursed subsidy of 5.2 mil. Euro exhausted just 1.85 mil in 2017 and only 445 vehicles were supported. The remaining subsidy will be available until the end of June 2018.

2.2. Clean Urban Transport and Commuting

Urban transport is responsible for about a quarter of CO2 emissions from transport, and 69% of road accidents occur in cities. The gradual phasing out of 'conventionally-fuelled' vehicles from the urban environment is a major contribution to significant reduction of oil dependence, greenhouse gas emissions and local air and noise pollution.

The interface between long distance and last-mile freight transport should be organised more efficiently. The aim is to limit individual deliveries, the most 'inefficient' part of the journey, to the shortest possible route. The use of Intelligent Transport Systems contributes to real-time traffic management, reducing delivery times and congestion for last mile distribution. This could be performed with low-emission urban trucks. The use of electric, hydrogen and hybrid technologies would not only reduce air emissions, but also noise, allowing a greater portion of freight transport within the urban areas to take place at night time. This would ease the problem of road congestion during morning and afternoon peak hours.

The goals European Union are halve the use of 'conventionally-fuelled' cars in urban transport by 2030; phase them out in cities by 2050; achieve essentially CO2-free city logistics in major urban centres by 2030. The European Commission will ensure a reduction in greenhouse gas emissions from transport by at least 60% in 2050 in order to increase the competitiveness of transport.

2.3. EU Framework For Urban Road User Charging

Develop a validated framework for urban road user charging and access restriction schemes and their applications, including a legal and validated operational and technical framework covering vehicle and infrastructure applications.

2.4. A Strategy For Near- 'Zero-Emission Urban Logistics' 2030

The strategy includes the following objectives:

- produce best practice guidelines to better monitor and manage urban freight flows (e.g. consolidation centres, size of vehicles in old centres, regulatory limitations, delivery windows, unused potential of transport by river),
- define a strategy for moving towards 'zero-emission urban logistics', bringing together aspects of land planning, rail and river access, business practices and information, charging and vehicle technology standards,
- promote joint public procurement for low emission vehicles in commercial fleets (delivery vans, taxis, buses…).

2.5. A regulatory framework for innovative transport

Identify the necessary regulatory framework conditions through standardisation or regulation:

- Appropriate standards for CO2 emissions of vehicles in all modes, where necessary supplemented by requirements on energy efficiency to address all types of propulsion systems;
- Vehicle standards for noise emission levels;
- Ensure that CO2 and pollutant emissions are reduced under real-world driving conditions by proposing at the latest by 2013 a revised test cycle to measure emissions;
- Public procurement strategies to ensure rapid up take of new technologies;
- Rules on the interoperability of charging infrastructure for clean vehicles;
- Guidelines and standards for refuelling infrastructures;
- Interface standards for infrastructure-to-infrastructure, vehicle-to-infrastructure, and vehicle-to-vehicle communications;
- Access conditions to transport data for safety and security purposes;
- Specifications and conditions for transport related smart charging and payment systems;
- Better implementation of existing rules and standards.

In Fig. 4 is an ex post impact assessment of the EU ETS, renewable policies, taxation and other policies on CO_2 emissions from incineration.

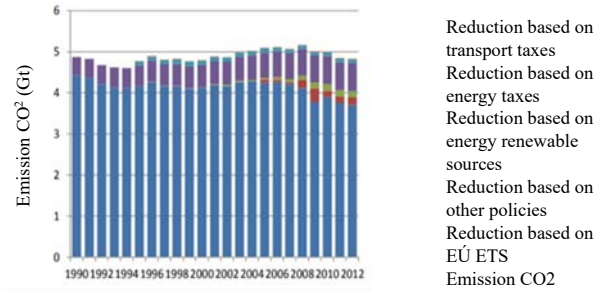

Figure 4: Ex post impact assessment of EU ETS, renewable policies, taxation and other policies on CO2 emissions from combustion [5]

3. Air Quality In Slovak Republic

The reason for these mentioned measures within European cities is, in particular, the pursuit of achieving the cleanest environment in the areas where thousands of people move daily. They get to direct contact with traffic and its externalities, basically every day, so it is important to eliminate these negative phenomena as much as possible. Among the worst within European cities is just air pollution and this fact is not avoided even in towns and villages in the territory of the Slovak Republic.

Quality of air is generally determined by the level of pollutants in the air, including nitrogen oxides, sulphur dioxide, carbon monoxide, PM10 and PM22,5, benzene, as well as various hazardous metals such as nickel, cadmium, lead and so on. The Decree of the Ministry of the Environment of the Slovak Republic sets limits and target values for these substances in the air. The basis for the air quality assessment is the results of measurements of the concentration of pollutants in the air. These are realized by the Slovak Hydrometeorological Institute (SHMU) through their stations of the National Air Quality Monitoring Network. For area air quality evaluation, mathematical modelling methods are used.

The most dangerous pollutants from transport, from a human health perspective, are PM10 and PM2,5 particles. These come from different sources of pollution, but about 5-15% of the total emissions of these particles come from mobile sources – which including transport, whereby the largest polluter is road transport. However, the share of air pollution from mobile sources is higher in the Bratislava and Košice agglomerations, where it represents 11-25%.

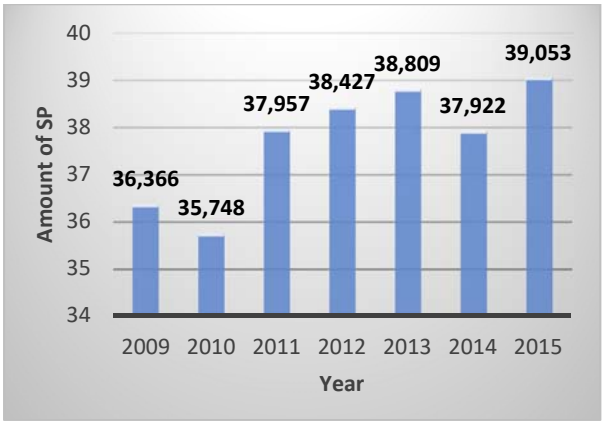

Figure 5. Graph of the total amount of solid pollutants (SP) in the air [7]

Regarding the total level of pollution of the territory of the Slovak Republic, whether PM10 or PM2,5, in both cases, this level in Slovakia achieves good results and the established limit value of the annual concentration of these particles has not been exceeded. The average annual concentration of both types of particles in the air is slightly declining. This is the case for the absolute amount of solid pollutants, PM10 and PM2,5 in the air. In this case, the level of these substances is fluctuating, with a slight increase compared to 2014 and 2015, as shown in figure 5.

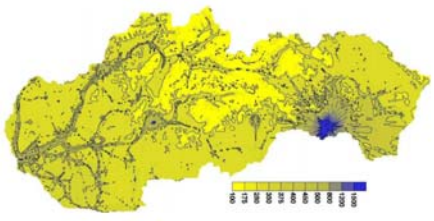

Figure 6. Maximum daily 8 – hour rolling average CO concentrations [$\mu g.m^{-3}$] per year 2015. [7]

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Figure 6, which shows the nationwide distribution of the maximum 8 - hour rolling average CO concentrations in 2015, shows the road network as a line source in terms of the dominance of mobile resources. The highest concentration can be seen in the vicinity of major road trips - the D1, D2, R1 highways and first-class roads in south-western Slovakia. Large concentration is also in the surroundings of the city Košice, but this is due to emissions from U.S Steel Košice company. [7]

4. Conclusion

Air pollution is a key environmental and social problem and, at the same time, is a complex issue, which has many implications for the management and mitigation of harmful pollutants. The setting of the current Emission Control System for motor vehicles has not produced the required results [10].

Air pollution continues to have a significant impact on the health of the European population, particularly in urban areas. The most serious pollutants in Europe are PMx, NO2 and ground-based O3 in terms of human health damage.

The air in Slovakia is over-polluted from the point of view of the European Union. The main reasons of air pollution are the high share of solid fuels, including biomass used in households, and the use of lower-quality internal combustion engines in passenger transport. It is therefore necessary to take concrete steps in the Slovak Republic to reverse this contrarious situation.

One of the actions to get this issue into the program is to monitor the air condition and inform it about it in real time (see Figure 7).

Figure 7. Monitoring of air pollution in the city of Prievidza building of the City office (SK); Source: J. Gnap

Even in the Slovak Republic, it is necessary to take concrete steps to reverse this unfavourable state. The greatest effectiveness of the actions will be reflected in the cities and therefore it is necessary to take concrete actions also in the Slovak Republic. This can be greatly helped by managed and constantly improved city logistics.

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