Sustainable transport roadmap to support sustainable economy in the Slovak Republic

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Introduction

Global efforts to fight climate change are intensifying, with a focus on accurately distributing GHG emissions across sectors. Slovakia's use of **Air Emission Accounts (AEA)** marks significant progress in pinpointing emission sources optimizing the design of targeted **Policies and Measures (PaMs)**.

The transport sector, accounting for a notable portion of EU and Slovakia's emissions, is identified as key for decarbonization. Slovakia's advanced AEA methodology has revealed overlooked emission contributors, such as the retail sector's use of N1 category vehicles, while highlighting areas for policy improvement. This insight supports the refinement of PaMs, ensuring they are both environmentally and economically sustainable.

Conceptual Foundation

Emissions allocation

The emissions allocation methodology relies on four main parameters: vehicle category, annual mileage, transported goods quantity and vehicle owner (private or company). The methodology employs a detailed analysis, utilizing data from various sources and integrating COPERT emission model outputs. The resulting allocation matrix provides a comprehensive breakdown of the vehicle fleet for a specific year, offering detailed information for each NACE rev.2 category.

National GHG projections and PaMs

Emission projections are primarily being developed at the national level, encompassing the entire country. These projections, coupled with proposed PaMs, serve as a robust basis for more precise targeting and quantification of greenhouse gas (GHG) emission savings across various economic sectors. Among the most significant measures are initiatives aimed at electrifying transportation and promoting intermodal transport, both of which play a pivotal role in transitioning toward a more sustainable and low-carbon economy. These projections and policies are an integral part of broader efforts to reduce GHG emissions and achieve environmentally acceptable and economically sustainable goals at the national, local or sectoral level.

Calculation of carbon footprint

The carbon footprint was calculated as an average value for the period from 2013 to 2021, aiming to smooth out potential year-to-year economic fluctuations. This value was determined as the production of fossil CO_2 per 1 million Euro of gross value added (GVA) and computed separately for each main NACE rev.2 category (A-U) based on data available in the Statistical Office of the Slovak Republic's databases and the emissions allocation methodology. These data serve the purpose of estimating the amount of emissions produced for generating 1 million Euro within a specific economic activity. Furthermore, this value facilitates the identification of the most pollutant sectors.

A similar approach was employed in determining the production of fossil CO_2 per employee, allowing for an assessment of potential socio-economic impacts. It is important to note that this section primarily serves an illustrative function and should be incorporated into further studies that primarily focus on the social impacts of emissions reduction in economic activities.

Results

In Slovakia, in the year 2021, there were more than 2,970,000 registered vehicles. The detailed breakdown of these vehicles is presented in ***Table 1***. Out of the total number of passenger vehicles, on average only **18% are utilized for economic activities**.

Table 1: *Breakdown of registered vehicles*

Vehicle category	Total number	NACE rev.2 registration	Physical entity registration
Passenger cars	2 460 567	452 193	2 008 374
Light commercial vehicles	267 080	125 505	141 575
Heavy-duty vehicles	77 551	64 876	12 675
Buses	7 871	7 280	591
L-category vehicles	157 092	17 487	139 605

Conversely, a substantial 84% of heavy-duty vehicles are employed within specific economic activities classified under NACE rev.2. The sector responsible for the highest emissions production – transportation activities (Category H, covering road and pipeline transportation, water and air transportation, warehousing, support activities for transportation, postal, and courier activities) – comprises just 11% of all economically used vehicles (see ***Fig. 1***). However, it contributes in average to as much as 45% of all emissions from economic activities (see ***Fig. 2***).

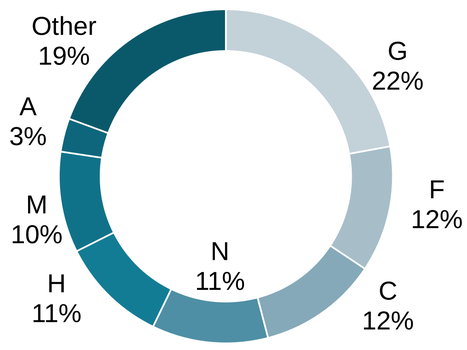

Fig. 1: *Breakdown of vehicles to NACE rev.2 categories in 2021*

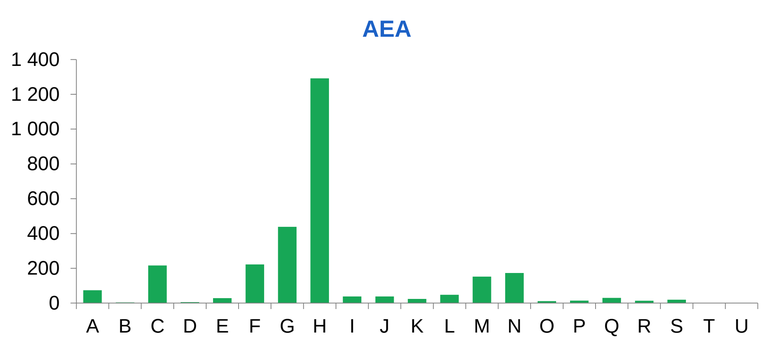

Fig. 2: *Breakdown of road transport CO_2 emissions into basic NACE rev.2 categories in kilotons (kt) (average of 2013 – 2021)*

Based on emissions calculations and obtained data on GVA, and thus CO_2 per million €, the sectors with the highest carbon footprint were identified. These sectors include Category H (Transportation and storage), which produce an average of 537tCO_2/mil.€, category L (Real estate activities) producing 210tCO_2/mil.€, category G (Wholesale and retail trade) generating 203tCO_2/mil.€, and category F (Construction) with 92tCO_2/mil.€ (see ***Fig. 3***). Each of these categories surpasses the emissions per million euros as compared to the national average, which stands at 68tCO_2/mil.€.

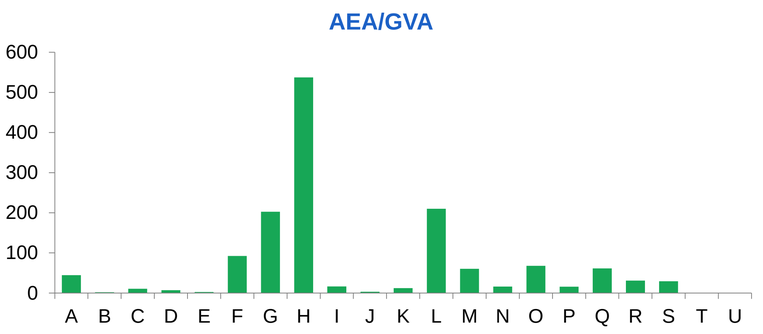

Fig. 3: *CO_2 emission production per 1 million EURO (tCO_2/mil.€)*

When it comes to CO_2 emissions per employee, these categories exhibit variations. The **highest CO_2 production per employee is observed in Category H**, with 13tCO_2/employee in the sector. It is followed by Categories G, with 6tCO_2/employee in the sector, L (Real Estate Activities) producing 4tCO_2/employee in the sector, F (Constructions) generating 2.6tCO_2/employee in the sector, P (Education) producing 2tCO_2/employee, and O (Public Services), producing 1.7tCO_2/employee in the sector.

The national average is 1.75tCO_2/employee in the sector (see ***Fig. 4***).

These data have shown us that the most substantial emission reductions are required in Categories H, F, and G. Category H stands out significantly in terms of absolute values, and according to calculations, it will necessitate **a reduction of approximately 1,110kt CO_2**.

Fig.4: *CO_2 emission production per employee in sector (tCO_2/emp.)*

Achieving this reduction is feasible through robust support for intermodal transportation and, consequently, an overall modal shift in the freight sector. According to this study and Slovakia's commitment within the White Paper on Transportation, the country should **reduce freight transport by 30% by 2030 and 50% by 2050**. In the case of the other two categories, emissions need to be reduced by approximately 350 kt CO_2 in total. Since a significant portion (22% in Category G and 12% in C) of emissions originates from personal vehicles used in this sector, it is appropriate to direct some low-carbon personal vehicle measures to this category.

The full potential of monitoring the carbon footprint in conjunction with gross value added and employment undoubtedly necessitates a more comprehensive analysis. Nonetheless, these outcomes indicate that this approach may offer a promising avenue for more precise implementation of policies and measures within the realm of transportation, particularly at a sub-national level. By scrutinizing the interplay between carbon emissions, economic output, and employment, a deeper understanding of emissions' socio-economic impact can be obtained.

Such insights can inform the targeted design of interventions, not only on a national scale but also at the sectoral level, enabling more effective mitigation strategies tailored to specific contexts and requirements.

Conclusion

The carbon footprint analysis for the period 2013 – 2021 has identified significant emissions in specific sectors. Notably, **Category H**, which includes road and pipeline transportation, water and air transportation, and related activities, contributes the **highest emissions**. Achieving the required reductions in these sectors may involve promoting **intermodal transportation**.

The study highlights the importance of targeting emission reductions in NACE rev.2 categories H, F, and G.

While Category H requires the most substantial reduction, other sectors need emissions reduction efforts as well, particularly those involving personal vehicles. The potential for monitoring the carbon footprint, combined with gross value added and employment data, promises a more precise approach to transportation policy implementation at various levels, ensuring that interventions are tailored to specific contexts and requirements. **This approach offers a promising path towards effective mitigation of GHG emissions and a sustainable future and can possibly redirect the financial support to economic sectors that need it.**

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