

REDUCING THE NEGATIVE IMPACT OF TOURISM ON THE ENVIRONMENT BY USING RAIL TRANSPORT. CASE STUDY: BUCHAREST NORD-BRASOV ROUTE

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Abstract

Tourism represents an essential component in the socio-economic development of a state. However, often the methods used affect components of the natural environment. The main source of pollution when it comes to tourism is transport. The transport sector currently generates a quarter of all greenhouse gas emissions in Europe, with the road sector making the largest contribution at around 72%. Projections indicate that emissions generated by the transport sector will increase by approximately 32% in 2030 compared to 1990. A perspective on road transport is given by the use of hybrid cars or alternative fuels (CNG, LPG, hydrogen). By 2025, it is desired to install approximately one million public recharging and refueling stations that will contribute to achieving the goals of zero-emission or low-emission vehicles desired by the European Union. Until these objectives are met, rail transport has multiple advantages over road transport when it comes to environmental protection in the practice of tourism.

Keywords: rail tourism, train, pollution, railways, sustainable development

Introduction

Transport represents a strategic sector of national interest and an essential service for society, whose role is to contribute to the safe and efficient circulation of goods, goods and people, both on the territory of Romania and outside the country.

The transport sector is not only a pillar of support for other sectors, but makes a major contribution to the resilience of an economy, providing a solid basis for accelerated recovery in the event of prolonged crises with a significant negative impact on society as a whole (PNRR, 2023).

Rail has long been recognized as one of the greenest means of mass transit, offering lower carbon emissions, energy efficiency and reduced emissions congestion compared to other modes of transport (Milewicz, J. et al, 2023).

The transport system plays an important role in the development of the tourist destination, thus, railway tourism in Romania started timidly, starting in the 2000s and developed slowly. It is currently found on narrow gauge railway lines (760mm) and very rarely on broad gauge railway lines (1435mm).

Analyzing broad-gauge railway tourism, Valea Prahova represents the largest tourist axis in Romania and, at the same time, an important tourist point. It is crossed both by road (National Road 1) and by rail (CFR Highway 300). Along the valley there are tourist resorts of national and international interest (Predeal, Azuga, Bușteni, Sinaia), as well as a spectacular relief created by the Bucegi and Baiului Mountains, the two massifs that delimit the Prahova valley.

The CFR 300 highway, on the Bucharest Nord-Brașov sector, is crossed by electric trains (being a double electrified railway), as well as diesel trains. According to Mersul Trenurilor 2023, 33 pairs of trains run daily, of which 18 are electric and 15 are diesel. In addition, the CF 300 highway has two electrified traffic directions and has undergone the modernization process, thus the operating speed is over 100 km/h from Ploiești Vest to Câmpina and, at least, 80 km/h h from Câmpina to Predeal. Therefore, compared to the other Carpathian crossings, the railway infrastructure on Prahova Valley is characterized as being the most efficient.

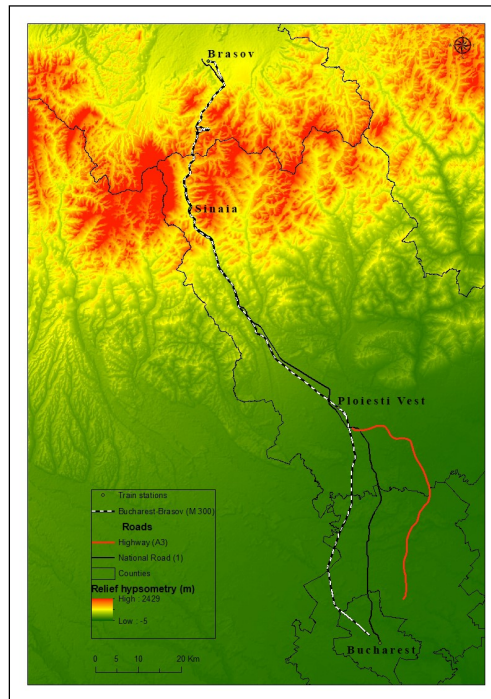


Fig. 1: The analyzed area. Route: Bucharest Nord-Braşov; Source: personal archive

Methodology

The data source was provided by the ESRS Methodology and the Zero Carbon Railways Report. To analyze the impact of emissions and consumption of rail and road transport, EcoPassenger, an internet tool that uses a sound scientific methodology, was used by the Institute for Energy Research and Environment (ifeu) from Heidelberg and the Foundation for Sustainable Development (SusDev) from Romm, scientific partners of this tool, collecting values of emission factors and consumptions of European railways based on the Environmental Strategy Reporting System. Thus, by using EcoPassenger, energy consumption, CO₂ and atmospheric exhaust emissions for cars and passenger trains were determined. At the same time, in making this comparison of the emissions released by means of transport, the method of observation and comparison was also used.

Also, the cartographic method was also used in making the map of the location of the studied area (Bucureşti Nord-Braşov route). Vector data (point, line and polygon type) and raster data (DEM containing relief hypsometry) were used. The map was made in specialized software, from the GIS programming suite (ArcMap 10.6.1).

Results

The tourism phenomenon has the highest growth in the world, in terms of industries. However, in addition to the positive effects on the community (development, income) and the environment (conservation), tourism can also have negative effects such as: depletion of natural resources, environmental pollution. Greenhouse gas emissions and contribution to global warming, physical degradation of ecosystems and loss of biodiversity, soil erosion and unsustainable land use, and overconsumption and waste production.

According to the Annual Transport and Environment Report 2020 (TERM), transport accounted for 25% of the European Union's greenhouse gas emissions in 2018. Emissions from this sector come mainly from road transport (72%), while maritime transport and air had weights of 14% and 13%, respectively, and rail transport only a weight of 0.4%. This 0.4% comes from diesel locomotives, but there are also harmful particles in the air from locomotive and railcar brake pads, tires and rolling stock damage.

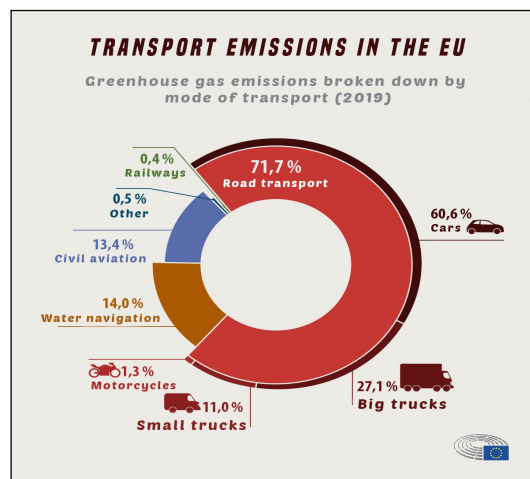


Fig. 2: Emissions from transport in the European Union
Source: European Environment Agency

In order to put into practice the objectives of the European policy regarding climate neutrality included in the European Ecological Pact, respectively in the EU Strategy for Sustainable and Intelligent Mobility, as well as the actions proposed in the Fit for 55 package, it is necessary to establish measures at the national level. Therefore, 3 prospects for the development of rail transport on the Bucharest North-Braşov sector were identified, as follows: the construction of an 8 km tunnel, which avoids the slope from Predeal to facilitate the transport of rolling stock; modernization of the Predeal-Braşov railway sector; introducing the concept of pedal trains on the mocanica trails (Valea Doftanei). Among the advantages of railway tourism are: the revitalization of former industrial platforms and exploitation areas that have lost their initial usefulness; the constructions related to the railways were no longer subjected to demolition or degradation processes, thus avoiding the effect of visual pollution; the former industrial cities affected by the cessation of specific activities showed an intensification of HoReCa activities due to the presence of tourists; some of the employees serving the railway were able to continue their work, not being affected by redundancies or postings. In addition, among the disadvantages, the following can be specified: high operating costs, generated by the salaries of personnel that require special training for this type of activity (for example mechanics, clerks, inspectors); rolling stock maintenance and high fuel consumption; the need for approvals from specialized authorities, such as AFER, in the case of railways that are part of the CFR network.

On a daily basis, Valea Prahova is served by 33 pairs of trains, of which 18 are electric and 15 are diesel. The strengths and weaknesses of electric and diesel trains were identified in order to observe the impact of this means of transport on the environment, as follows:

Tab. 1: Strengths and weaknesses of diesel and electric trains

<i>Diesel train</i>	<i>Electric train</i>
Strengths	Strengths
<i>Accessibility in non-electrified areas</i>	It doesn't pollute
<i>They are not affected by meteorological phenomena</i>	High carrying capacity (high traction power)
<i>It can supplement if the electrical network fails</i>	Comfort assured to travelers
Weaknesses	Weaknesses
<i>Excessive pollution</i>	It is affected by weather conditions
<i>Weaker pulling power</i>	If the power grid fails, the electric trains can no longer run
<i>Noise – passenger discomfort</i>	It does not cover all areas of the country

According to a publicized experiment, the distance covered on the Bucharest-Sinaia sector, by road, on a Friday (during the winter season), the distance was covered in 4-5 hours, while on the railway it was covered in 1 hour and 30 minutes. A train ticket costs approximately 50 lei/adult, while a journey by car costs at least 100 lei (depending on the consumption of the car).

Carrying out an analysis with the help of ECOPassenger, an internet tool, which compares energy consumption, CO₂ and atmospheric exhaust emissions for means of transport, we could see that the train is much more ecological and beneficial for the environment within Prahova Valley. The comparison was made between the tourist train IR 1631 (Bucharest Nord-Braşov) and a car (middle class, EURO 4 diesel). The duration of traveling the distance by rail is 2 hours and 28 minutes, and by road 2 hours and 41 minutes.



Start/destination	Details	Term	Transport
 BUCURESTI NORD (Romania) [RO] BRASOV (Romania) [RO]	From Thursday, 02/01/24, 07:17 to Thursday, 02/01/24, 09:45	2:28	IR 1631
 BUCURESTI NORD (Romania) [RO] BRASOV (Romania) [RO]	Middle class; Diesel Euro 4	1:57	Car

Fig. 3 Subjects compared (train vs. car)

Source: <https://ecopassenger.org/>

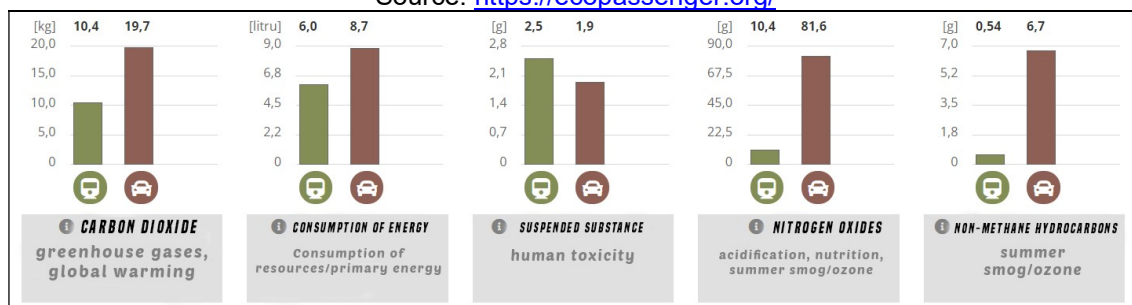


Fig. 4: Emissions generated by the two means of transport

Source: <https://ecopassenger.org/>



COMPOUND	 TRAIN	 CAR
KILOGRAMS OF CARBON DIOXIDE	10,4	19,7
CONSUMPTION OF ENERGY RESOURCES (EQUIVALENT LITER OF PETROL)	6,0	8,7
GRAMS OF PARTICLES	2,5	1,9
GRAMS OF NITROGEN	10,4	81,6
GRAMS OF NONMETHANIC HYDROCARBONS	0,54	6,7

Fig. 5: The composition of the emissions of the two means of transport

Source: <https://ecopassenger.org/>

The results of the comparison show that the rail means of transport have an impact of less than half that of the road. CO₂ emissions are halved (10.4 kg), and nitrogen oxides and non-methane hydrocarbons are substantially lower than those emitted by passenger cars.

Conclusion

The train is considered the least polluting means of transport, compared to road, air or sea. The European Environment Agency claims that transport is responsible for 25% of greenhouse gas emissions in the European Union.

The train can be considered a solution for reducing the negative impact on the environment, because it has the lowest share of released emissions among the means of transport used within Prahova Valley.

Greenhouse gas emissions released by rail transport account for only 0.4% of the total transport emissions in the European Union.

According to transport decision-makers, trains will represent the means of transport that will neutralize global warming, by purchasing sustainable rolling stock (electric or using hydrogen), as well as by modernizing the existing rolling stock with electric traction equipment with low energy consumption . The Prahova Valley remains the most traveled tourist axis in Romania, where the train plays a very important role among national and international tourists, but also in protecting the natural areas in the vicinity (the Prahovean Abruptul of the Bucegi Mountains and the Baiului Mountains).

References

- Azam, Muhammad, Md Mahmudul Alam, și Muhammad Haroon Hafeez. (2018). „Effect of Tourism on Environmental Pollution: Further Evidence from Malaysia, Singapore and Thailand”. *Journal of Cleaner Production* 190 (July 2018): 330–38. <https://doi.org/10.1016/j.jclepro.2018.04.168>.
- Katircioglu, Salih Turan. (2014). „International Tourism, Energy Consumption, and Environmental Pollution: The Case of Turkey”. *Renewable and Sustainable Energy Reviews* 36 (August 2014): 180–87. <https://doi.org/10.1016/j.rser.2014.04.058>.
- Milewicz, Julia, Daniel Mokrzan, și Grzegorz M. Szymański. (2023). „Environmental Impact Evaluation as a Key Element in Ensuring Sustainable Development of Rail Transport”. *Sustainability* 15, nr. 18 (15 september 2023): 13754. <https://doi.org/10.3390/su151813754>.
- Niță, Mihai R., Denisa L. Badiu, Diana A. Onose, Athanasios A. Gavrilidis, Simona R. Grădinaru, Irina I. Năstase, și Raffaele Laforzezza. (2018). „Using Local Knowledge and Sustainable Transport to Promote a Greener City: The Case of Bucharest, Romania”. *Environmental Research* 160 (January 2018): 331–38. <https://doi.org/10.1016/j.envres.2017.10.007>.
- Olentsevich, V A, Yu I Belogolov, și N N Grigoryeva. (2020). „Analysis of reliability and sustainability of organizational and technical systems of railway transportation process”. *IOP Conference Series: Materials Science and Engineering* 832, nr. 1 (1 April 2020): 012061. <https://doi.org/10.1088/1757-899X/832/1/012061>.
- Wang, Yangjie, Shoujuan Zang, Hongjie Qiang, și Jinxian Wang. (2023). „Air Pollution Disclosing and Tourism: Who Are Winners?” *Annals of Tourism Research* 103 (November 2023): 103659. <https://doi.org/10.1016/j.annals.2023.103659>.
- Ministry of European Investments and Projects, Pillar I: Green Transition.
Component C4. Sustainable transport, National Recovery and Resilience Plan, 2023, Bucharest.
*** https://ecopassenger.org/bin/query.exe/en?ld=uic-eco&L=vs_uic&protocol=https:&seqnr=3&ident=61.0166781.1707052471&OK#focus
*** <https://www.naturetalks.ro/stiri-despre-mediul/analiza-tren-avion-masina-ambarcatiune-care-e-mai-verde>
*** <https://www.naturetalks.ro/stiri-despre-mediul/ce-este-ruta-ecologica-din-google-maps-si-cum-functioneaza>
*** <https://www.eea.europa.eu/highlights/motorised-transport-train-plane-road>
*** <https://www.eea.europa.eu/publications/transport-and-environment-report-2020>

Souhrn

Cestovní ruch je dynamický a komplexní fenomén, který zahrnuje několik složek, mezi něž patří i doprava. Ta většinou není šetrná k životnímu prostředí, takže železniční doprava vítězí nad ostatními druhy dopravy, pokud jde o množství vyprodukovaných emisí, které je velmi malé. Vlak je tedy považován za řešení pro snížení negativního dopadu na životní prostředí, přičemž je zapojen i do cestovního ruchu.

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