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Directions of transport system development according to the national environmental policy

Kierunki rozwoju krajowego systemu transportowego a polityka klimatyczna

Abstract. The article is the second in a series of articles on the negative externalities of passenger road, rail and air transport. It reviews the national documents in the field of environmental policy, identifies their content concerning transport which is used as a basis to determine the expected directions of development of this branch of economy. The authors presented a review of national strategic documents defining the directions of the Polish environmental policy, identified objectives and priorities relating directly or indirectly to transport activities, and compared the theoretical assumptions with the actual changes taking place on the transport markets, which allowed for an analysis of the compatibility of intentions with their implementation. The summary presents conclusions concerning the necessity of mutual co-ordination of transport development planning and environmental protection. The following articles will present the results of research on the above-mentioned negative effects of transport and recommendations for various stakeholder groups in relation to the analyzed topic.

Key words: climate policy, environmental policy, transport, transport ecology

JEL codes: O13, O30, O31, O33, O55

Synopsis. Artykuł jest drugim z serii opracowań na temat negatywnych efektów zewnętrznych pasażerskiego transportu drogowego, kolejowego i lotniczego. Zaprezentowano w nim przegląd aktualnych opracowań z zakresu krajowej polityki klimatycznej w odniesieniu do systemu transportowego, na podstawie którego przedstawiono zakładane kierunki rozwoju tej gałęzi gospodarki. Dokonano przeglądu istniejących dokumentów, zidentyfikowano cele i priorytety rozwoju branży transportowej oraz zawarto porównanie teoretycznych założeń zawartych w analizowanych dokumentach z rzeczywistymi zmianami odbywającymi się na rynku transportowym. Następnie zaprezentowano wnioski z przeprowadzonych analiz jednocześnie proponując w jaki sposób strategie klimatyczne powinny w rzeczywistości być wdrażane. W kolejnych artykułach przedstawione zostaną wyniki badań nad wspomnianymi negatywnymi efektami transportu oraz rekomendacje dla różnych grup interesariuszy w odniesieniu do analizowanej tematyki.

Słowa kluczowe: polityka klimatyczna, polityka środowiskowa, transport, ekologia transportu

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Introduction

The article is the second in a series of articles on the impact of transport on the population and the environment in Poland. In the first one [Zych-Lewandowska and Majewski 2021a], an analysis analogous to this one, but of international documents, is presented. The following will present the results of research on the level of environmental negative externalities (air pollution, climate change, noise) caused by road, rail and air passenger transport and their comparison with freight transport.

First, however, one should look at the national studies obliging Poland to implement measures related to environmental protection in transport. Poland, having ratified the international documents related to environmental protection and the development of sustainable transport, has been obliged to prepare appropriate legal regulations in this field. The greatest role in the implementation of goals and objectives in this area is played by the government departments responsible for the environment, infrastructure and power industry. They present varied solutions concerning ecological policy, including reduction of external costs. What is important, however, is whether these solutions are adequate, secondly, whether they properly transfer the European recommendations to the Polish reality and, thirdly, if they are duly implemented. The article presents a detailed review of current studies in this field, looking for references to proper transport management, i.e. one that takes into account the pyramid of sustainable mobility [Zych-Lewandowska and Majewski et.al. 2021b].

The topic of relations between transport and climatic policy has so far been discussed mainly in the form of expert statements, press releases or popular science articles. Studies that make reference to this type of comparison are largely published as strategies or policies. Documents of this type usually focus on proposing methods of measuring the impact and evaluation of strategic documents [UNIFY 2021a], concise and legible presentation of the applicable regulations to a wider group of readers, together with an analysis of the current state, forecasts and potential impact on the current economy [IOŚ-PIB 2019a, b] or presenting good practices, interregional connections and recommendations [LIFE UNIFY 2021]. Less scientific studies on the border of the environment and transport are also worth exploring, shedding a slightly different light on the whole issue, such as the study "Zero-emission Poland 2050. Transport" [WWF 2020].

Studies analogous to this one are also published, from the border of transport and environment, taking up the challenge of assessing the links between these areas in relation to actual management activities in individual countries [UNIFY 2021b, CAN Europe 2022].

Research objective and methods

The aim of the research was to answer the question: how do the applicable regulations, strategies, policies, etc. related to transport relate to the climatic policy, are the assumed goals properly formulated and whether they are implemented and bring the intended results. Moreover, whether they are logically related and realistic. Then, an assessment of the impact of environmental policy on the development of the transport system in Poland was undertaken.

Goals have been achieved by means of a critical review of documents related to the environmental protection, pollutant emissions, climate change, and by confronting centrally

formulated recommendations with trends observed in the transport sector. As the responsibilities are divided between individual ministries, the analysis comprised in parallel documents prepared not only by the administration directly responsible for the environment, but also programmes of ministries responsible for energy. The entire analysis was additionally enriched with expert conclusions.

Sustainable mobility pyramid

The basis for reducing the negative impact of transport on all spheres of human life is the reduction of the total amount of transport. Less transport means proportionally lower external costs, and it can even be assumed that these costs will be reduced more than proportionally [Zych-Lewandowska and Majewski et.al. 2021b]. This is because a reduction of transport activities alone will not only eliminate emissions from these activities, but it will also make the remaining traffic smoother, thus creating an environmental synergy [Kachmar 2022, Ustaoglu et. al. 2022]. In this new anticipated transport market, where only actually necessary transport would take place, with empty vehicle transport reduced to the minimum, or preferably non-existent at all, strict rules would have to be implemented for a new division of transport tasks, favouring all environmentally friendly means of transport, i.e. in the case of Poland, mainly railways. Road transport should only play a supplementary role to train transport, i.e. the function of the so-called "last mile", which is consistent with the assumptions of intermodal transport and thus with all European studies determining the directions of transport development [European Commission 2011].

Only finally, the actions should focus on the development of those means of transport, which will continue to operate, above all on limiting their emissions, e.g. by changing the used fuel to power from RES, including the development of electromobility.

Bearing in mind the presented assumptions of the sustainable mobility pyramid, an analysis of transport documents and their compliance with these assumptions was carried out.

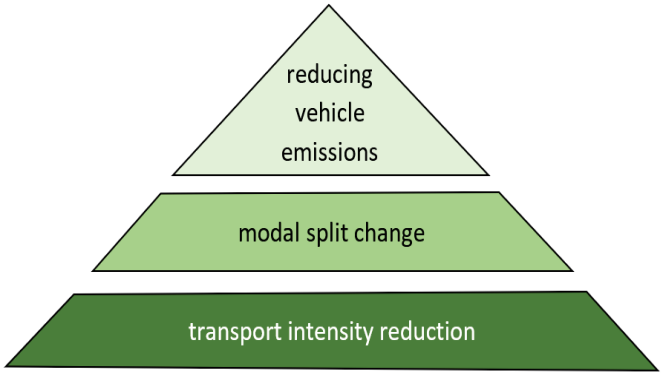

Figure 1. Sustainable mobility pyramid
Rysunek 1. Piramida zrównoważonej mobilności.
Source: [Zych-Lewandowska and Majewski 2021b, p. 8].

Documents of ministries responsible for the environment

In the implementation of international environmental obligations in the country, there are five key documents prepared by the government administration. These are:

- National Waste Prevention Programme (in Polish: Krajowy program zapobiegania powstawaniu odpadów), developed by the Ministry of Environment, adopted in 2014 [Ministerstwo Środowiska 2014],
- National Air Protection Programme to 2020 (with an Outlook to 2030) (in Polish: Krajowy program ochrony powietrza do roku 2020 <z perspektywą do 2030>), developed by the Ministry of Environment, adopted in 2015 [Ministerstwo Środowiska 2015],
- National Ecological Policy of the State until 2030 – development strategy in the area of environment and water management (in Polish: Polityka ekologiczna państwa do 2030 – strategia rozwoju w obszarze środowiska i gospodarki wodnej), developed by the Ministry of Environment, adopted in 2019 [Ministerstwo Środowiska 2019],
- National Programme for Air Pollution Reduction (in Polish: Krajowy program ograniczania zanieczyszczania powietrza), developed by the Ministry of Environment, adopted in 2019 [Ministerstwo Środowiska 2019],
- Energy Policy of Poland until 2040 (in Polish: Polityka energetyczna Polski do 2040 r), developed by the Ministry of Climate, adopted in 2021 [Ministerstwo Klimatu 2021].

National Waste Prevention Programme

The National Waste Prevention Programme is a strategic document defining, inter alia, quantitative and qualitative objectives of waste management and a description of good practices for the prevention of waste generation. It is one of the few documents that indicates the necessity to reduce the global number of transports as a measure that would actually reduce the negative external effects of transport. It highlights issues of waste in transport, congestion-related delays, and "redundant" transport the purpose of which is not so much the provision of supplies as is adding to the variety of products in shops. Reducing this type of traffic would probably significantly reduce the need for transport in general. The scheme provides methods to prevent waste generation. These, among others, include:

- use of local agricultural produce (reducing waste generation at the transport stage),
- trading in regional products (reducing food transport, consequently reducing food waste and waste generation),
- promotion of returnable and collective packaging and unification of transport packaging.

In addition, one of the recommended methods of reducing waste generation is to resign from commuting by private car in favour of public transport.

Although the subject of transport was not included in this document in a very extensive manner, still it was treated much more thoroughly than in many other studies (including those presented below), in which the consideration of transport could be deemed to be very important.

National Air Protection Programme to 2020 (with an Outlook to 2030)

The National Air Protection Programme defines directions of actions both at the national and the local level. The main objectives included the improvement of the quality of life of the population, protection of their health and living conditions as well as protection

of the environment. The document was intended to provide a basis for achieving the acceptable levels of suspended particulates and other harmful substances in air by 2030, as determined by the World Health Organization.

While the Programme does not refer to the issue of transport intensity management at all, to small extent it touches upon the possibility of regulating the division of transport tasks in a more ecological manner. The environmental problems signalled in the document boil down to a description of emissions from motor vehicles. The diagnosis describes the problem of outdated cars, inadequate road infrastructure and inappropriate driving styles. However, nothing was mentioned about aviation and the possibility of reducing external transport costs by increasing the volume of rail transport.

According to the authors of the document, the key actions aimed at improving the quality of the natural environment, and thus health, should be focused on the development of low-emission transport (in particular electric and gas-powered vehicles) and on the support for collective passenger transport in urban agglomerations. However, given the significant contribution of transport to negative externalities, including the environmental ones, the package of solutions that should be adopted to mitigate them should be much broader. Examples of solutions are presented in Table 1.

Table 1. Examples of air quality improvement measures related to the transport sector
Tabela 1. Przykłady działań na rzecz poprawy jakości powietrza związanych z sektorem transportu

Actions
– introduction of zones of limited transport emissions,
– shaping paid parking time rates by local governments,
– financial support for the modernisation of urban public transport, including infrastructure and development of alternative fuels,
– informing the public about the advantages of the zones with limited transport emissions,
– creating traffic management systems and priorities for collective transport,
– improving the comfort and safety of public transport transfer hubs,
– increasing the role of eco-mobility chains, especially bike/rail systems
– introducing buses that meet the highest emission requirements,
– optimising urban freight transport, developing urban logistics,
– development of alternative non-motorised forms of transport – e.g. construction of cycle paths and urban bicycle and electric-assisted bicycle hire systems
– construction of Park&Ride and Park&Bike car parks,
– construction of ring roads in order to eliminate transit traffic,
– preference for public transport through price.

Source: [Zych-Lewandowska and Majewski 2021b, p. 17].

National Environmental Policy

The National Environmental Policy is one of the strategic documents in the management of the sustainable development of the country. It sets ecological objectives for Poland concerning: climate, health, economy and ecological education as well as the effectiveness of the functioning of environmental protection instruments. The information contained in the study should support the implementation of the objectives of the climate and energy policy and Poland's commitments until 2030 at the international level.

The document makes general references to the impact of transport on the environment, or to the relationship between sustainable planning and urban design, as well as to mobility behaviour, e.g. choosing a greener mode of transport. The document recommends shifting long-distance freight transport from road to rail or water transport and points out the negative impact of air transport. It also stresses the need to reduce road transport in general and on the other hand, to develop other forms of transport (e.g. cycling). It is also noted that air pollution is caused not only by emissions from fuel combustion, but also by abrasion of brakes, tyres and the road surface, which also applies to rail transport. As in other studies, the focus is also on large urban agglomerations and the development of electromobility.

Figure 2. Instruments of transport policy in the National Environmental Policy Document
Rysunek 2. Instrumenty polityki transportowej w dokumencie Polityka Ekologiczna Państwa
Source: Source: [Zych-Lewandowska and Majewski 2021b, p. 18].

The document also contains important remarks on the need to reduce noise from transport. While the increase in road transport noise in Poland in recent years due to the continuous increase in road traffic is obvious [Zych-Lewandowska 2020, GUS 2021b, Zych-Lewandowska and Majewski 2021b], the reasons for the reduced rail noise may be come from various sources. The authors consider it may result not only from the development of infrastructure (construction of noise barriers, replacement of rails with contactless rails, use of anti-vibration mats) and modernization of rolling stock (especially better quality brakes). Unfortunately, the main reason for limiting noise emission on the railway is simply a smaller number of running trains and continuous shortening of the length of railway lines [Zych-Lewandowska 2020, GUS 2021b]. However, in terms of minimising the environmental impact of transport, the authors of the document did not propose any wide range of solutions, instead, they referred directly to the "Strategy for Sustainable Transport Development until 2030".

National Programme for the Reduction of Air Pollution

This study was adopted in order to reduce the annual emissions of substances covered by the national commitments related to their reduction.

With respect to transport, the document recommends:

- the need to increase restrictions on individual cars and lorries,
- introduction of exclusion zones or zones restricting car and/or exhaust traffic,

- changes to vehicle roadworthiness tests,
- increasing the minimum acceptable EURO standards,
- increasing the share of cars powered by alternative energy sources, including the development of electric vehicles,
- use of bio-components and bio-fuels,
- development of infrastructure for electromobility.

In the field of transport intensity management, instruments for optimising transport demand have been identified, such as:

- using the remote working model,
- offering favourable ticket prices,
- using carsharing[1] and carpooling[2] systems,
- educating the public on the risks caused by transport,
- implementation of Sustainable Urban Mobility Plans,
- development of cycling systems,
- investing in modern rolling stock for public transport,
- investing in Intelligent Transport Systems,
- use of the Low Emission Transport Fund.

In authors opinion the key to achieving the assumed emission reductions should be the development of railways as an alternative to road transport, the only references to this topic were the National Railway Programme and the Plan for Sustainable Development of Public Collective Transport concerning the transport network in inter-voivodship and international passenger transport.

Energy Policy of Poland until 2040

The main objective included in the Energy Policy of Poland until 2040 is the reduction of greenhouse gas emissions by at least 30% in comparison to 1990. The share of coal in electricity generation is to decrease to 56% and the share of renewable energy sources (RES) is to increase by at least 23% by 2030. It is also assumed that photovoltaic capacity will reach 5.9 GW and wind power 5–7 GW. Importantly, these provisions still need to be adjusted to the new greenhouse gas emission reduction target adopted by the European Council in December 2020.

Power generation in traditional power plants is to be gradually replaced by an increase in renewable energy sources, such as photovoltaic and wind power plants, as well as the establishment of nuclear power plants. The expected development of energy technologies and investments is expected to enable widespread use of:

- energy storage technologies,
- smart metering and energy management systems,
- electromobility and alternative fuels,
- hydrogen technologies.

[1] In car sharing system, vehicles are provided for a fee, usually based on time or kilometres travelled.
[2] System that allows for increasing the number of passengers on a journey, mainly by integrating commuters who travel to the place of work/study on the same route.

However, the authors noted, that the share of renewable energy in transport is to be lower than the average in the economy and - despite the widespread use of electromobility - not exceed 14%. The document omits the issues of reducing transport intensity and changing modal split, and among the measures aimed at the improvement of air quality it indicates mainly the introduction of "zero-emission public transport by 2030 in cities with more than 100,000 inhabitants".

The Energy Policy of Poland until 2040 describes changes in road transport, including replacement of passenger car and bus fleets with low-emission ones. However, there is no analogous reference to the rail fleet or even trams in cities. This is due to the fact that rail transport has been completely omitted in the document, both in the section describing the energy demand and in the descriptions of electromobility.

Documents of ministries responsible for energy

Technologies and energy carriers used in transport play an important role in the discussed environmental impact of this sector. Therefore, it is important to include the energy issues in all the analyses and recommendations related to this branch of economy. Among the documents of the ministries responsible for energy and related to transport, the most important are the following:

- Plan for Electromobility Development in Poland (in Polish: Plan rozwoju elektromobilności w Polsce), developed by the Ministry of Energy and adopted in 2017 [Ministerstwo Energii 2017c],
- National Policy Framework for the Development of Alternative Fuel Infrastructure (in Polish: Krajowe ramy polityki rozwoju infrastruktury paliw alternatywnych), developed by the Ministry of Energy and adopted in 2017 [Ministerstwo Energii 2017b],
- Directions for the Development of Energy Innovation (in Polish: Kierunki rozwoju innowacji energetycznych), developed by the Ministry of Energy and adopted in 2017 [Ministerstwo Energii 2017a],
- National Energy and Climate Plan for 2021–2030 (in Polish: Krajowy plan na rzecz energii i klimatu na lata 2021–2030), developed by the Ministry of State Assets and adopted in 2019 [Ministerstwo Aktywów Państwowych 2019].

Plan for the Development of Electromobility in Poland

This document sets out the directions for the development of electromobility in Poland until 2025, noting the need to achieve synergies in the operation of the power, transport and telecommunications sectors, as well as the need to create a fund for this purpose (Low Emission Transport Fund).

The main demands listed in this plan concern are to increase the number of electric road vehicles and to prepare the infrastructure for them with simultaneous limiting the number of combustion vehicles. In parallel, the public should be encouraged to completely resign from their own vehicles in favour of using public transport. Potential was also seen in the electrification of water transport, both maritime and inland, as well as the need to modernise the offer of public transport and extend it to suburban areas. It is incomprehensible,

that reference to rail only appears in the context of developing services such as carsharing, carpooling to complement rail transport services.

National Policy Framework for the Development of Alternative Fuel Infrastructure

This is a document that refers to the development of the market and infrastructure for electricity and natural gas (CNG and LNG) in road and water transport. It defines general and specific objectives for the development of the above-mentioned infrastructure, and lists areas where charging points for electricity and gas will be created. The authors of the document decided that railways can use alternative fuels only to a limited extent, hence they did not include rail in the report, despite the fact that EU legislation indicates such a possibility.

Directions for the Development of Energy Innovation

According to a study prepared by the Ministry of Energy, energy innovations in Poland should result from strategic documents from the level of the government administration. The following are mentioned as priority actions: launching a smart power grid, modernisation of individual heat sources, reducing energy intensity of buildings, increasing flexibility and efficiency of energy production from coal and alternative ways of its use, new methods of using energy resources and energy sources. In relation to transport, the document shows the potential arising from the dissemination of electric transport and electromobility and the use of energy storage systems. However, the document contains no references to rail transport.

National Energy and Climate Programme 2021–2030 (NECP)

In this document, the Ministry of State Assets has included content related to the sustainable and ecological development of transport. The reduction target for Poland in terms of GHG emissions in sectors not covered by the EU Emissions Trading Scheme (non-ETS) has been set at –7% in 2030[3] compared to 2005 levels. Measures are also envisaged to increase energy efficiency by promoting more sustainable methods of freight transport (e.g. intermodal transport, rail transport). Taking into account the requirements for low-carbon energy generation, the NECP envisages a reduction in the share of coal in electricity generation to 56–60% in 2030 and a further reduction by 2040.

Strategies vs. reality

A common feature of Polish studies related to environmental protection, and in particular to air pollution reduction, is the focus on emissions from households. They are the main source of air pollution in Poland [GUS 2021a]. Depending on the source and type of pollution

[3] Raising the EU reduction target to –55% in 2030 means the necessity to increase the emission reduction in the non-ETS sector with transport included from –7 to –16%.

analysed, this share can be estimated at about 80% of the total emission. In the case of transport this share is 10%. The third place is taken by the industry. Transport is therefore in second place in terms of the scale of environmental impact, just after the social and living sector. Moreover, it not only has a negative impact on the environment, but also is a source of such external costs as congestion and accidents. However, both in the documents of the Ministry of Environment and in other national studies, references to it are laconic. This is all the more worrying as the international documents described in the previous article deem the reduction of the negative impact of transport on society and the environment to be a priority. In particular, the need to look for alternatives to road and air transport was emphasised.

However, as the analysis has shown, the references to transport in Polish studies are reduced to the analysis of the structure of road vehicles. As a result, national documents put the main emphasis on the development of electromobility in road transport as a remedy for the majority of environmental problems, without any reference to the first two levels of the sustainable mobility pyramid. In addition, a problem that appears in practically all of the discussed studies is the significant difference between the assumptions/objectives and the proposals for concrete solutions.

In the majority of the reviewed documents, a reference is made to the key objective of transport measures, i.e. the construction of an integrated, interconnected transport network serving a competitive economy. However, it is not clear whether the network is understood solely on the infrastructural level or whether it means a coherent transport system. The way of creating such a system has not been indicated either.

The studies carried out by the Ministry of the Environment emphasise the need for the development of electromobility and the use of low-emission energy sources for powering vehicles, as well as the development of alternative forms of transport. Emphasis was also placed on raising public awareness of the negative external effects of transport and activating society to undertake bottom-up actions to reduce them.

At the same time, references to transport in these studies are few, imprecise and laconic, and primarily they focus on the development of road transport, often completely ignoring alternative modes of transport.

Summarising the review of the documents, it should be emphasised that the recommendations concerning the reduction of transport performance – that is, the basic instrument for the actual minimisation of the negative external effects of transport and thus the basis of the sustainable mobility pyramid - are the least frequent. They also make only limited reference to modal shift, in particular from road to rail. Most of the studies focus on reducing already generated emissions and on looking for solutions and technologies to reduce emissions at the level of vehicles used in the different modes of transport, with electromobility as the "key word". It was considered to be the most important objective to be achieved without taking into account other, more important and more beneficial recommendations, which may bring real changes in the transport market in Poland.

The far-reaching discrepancy between programme assumptions and their implementation in practice is partly the result of limited access to effective methods and instruments of influence, and partially results from the systemic disintegration of environmental and transport policies. Reasons for this can be found, inter alia, in the following areas:

- fragmentary transposition of internationally defined transport sector objectives and transformation methods,

- very limited diagnosis and scarcity of recommendations and instruments indicating the necessity to limit transport pollution,
- concentration on road transport and neglecting the place and tasks for alternative means of transport,
- inconsistency of documents and recommendations prepared at the level of individual ministries.

Summary and conclusions

If Europe is to be a climate-neutral continent, a change in transport policy is inevitable. It is not enough just to transform the power systems in individual branches and introduce alternative fuels. Change means reviewing and remodelling the distribution of transport tasks, renewing the fleet, both privately owned and operated by public authorities and companies. What is essential is digitalisation, automation and preparation of innovative platforms for mobility and the transfer of goods.

In Polish conditions, the change must be even deeper. Although Poland was involved in international climate negotiations as early as in the 1990s, it did not pursue any active climate policy before joining the European Union. The reductions in emissions that have taken place have been the result of political and economic changes rather than actions focused on climate protection. However, the cited examples indicate that the trends observed on the transport market contradict the assumptions of not only EU, but even limited national environmental policy. At the same time, failure to intervene means further systematic deterioration of the current situation. This entails the risk of penalties for non-compliance with emission targets, increased costs for health care, and even lawsuits and claims against the state made by residents of the most polluted areas.

In order to achieve a real effect of limiting the negative impact of transport on the environment and human health, the documents to be prepared should be developed in a reliable manner, taking into account the actual needs and possibilities as well as the links to other studies, especially foreign ones, and, above all, they should specify solutions with a real impact on the transport market. What is crucial here is to formulate recommendations which would allow the overall volume of transport to be reduced in the future and to transfer its largest possible portion from road to rail. Only then can electromobility and electromobility-related solutions be recommended. The key is that any recommendations or commitments should actually be implemented instead of remaining just on paper.

The presented analysis, similarly to the analysis carried out in the previous article in the series, was an introduction to further studies, which will show the results of research on the level of environmental negative externalities generated by road, rail and air passenger transport and their comparison with freight transport. Then, recommendations will be proposed for various stakeholder groups, which should contribute to a better implementation of pro-environmental activities, to which we are obliged, inter alia, The European Union and their proper monitoring and adaptation to future changes.

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