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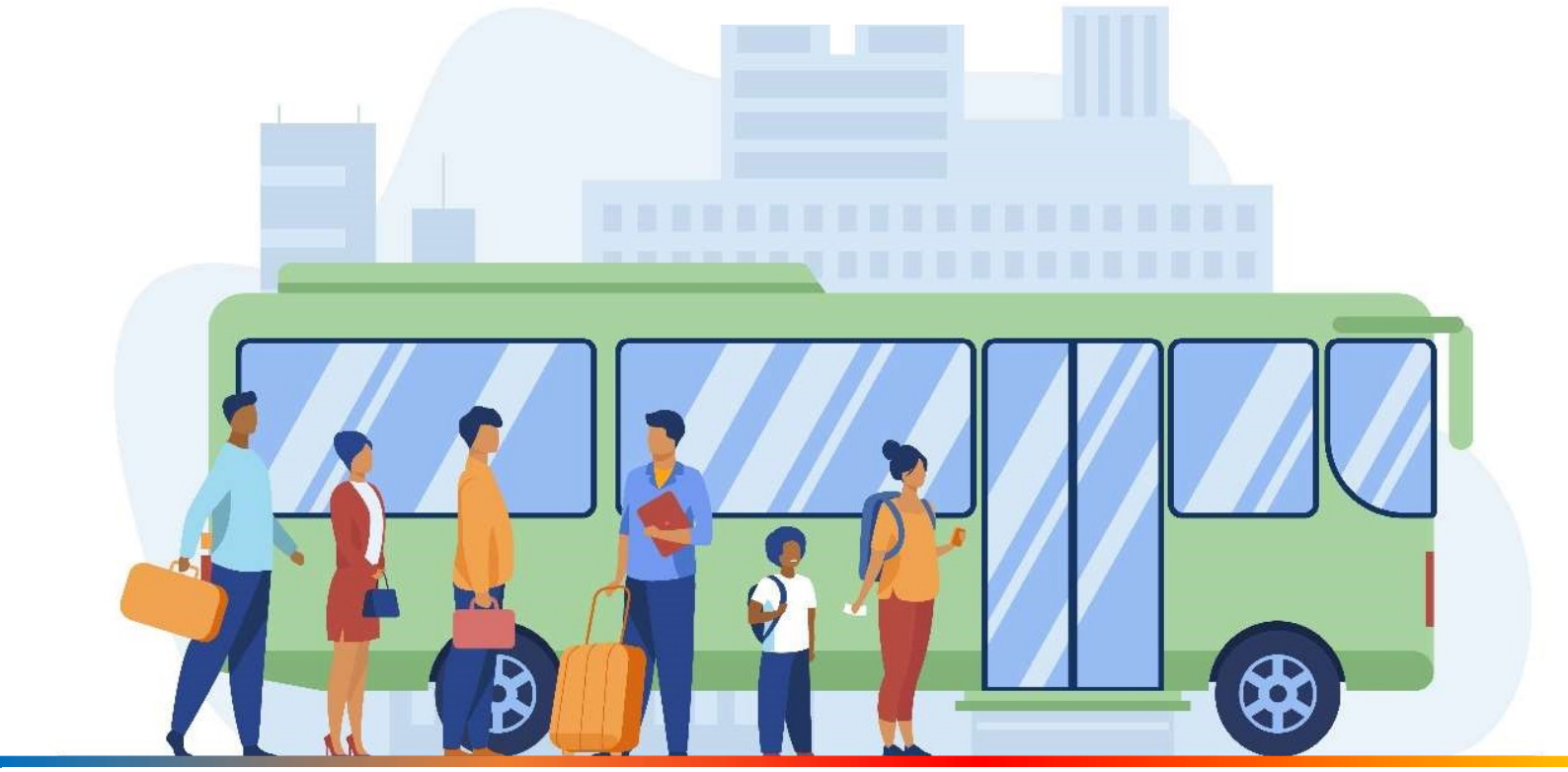

POLAND NET-ZERO 2050

THE ROLE OF PUBLIC TRANSPORT IN THE CONTEXT OF THE "FIT FOR 55" PACKAGE TO 2050

#Summary

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Main conclusions:

- The implementation of the scenario including the introduction of a ban on the sale of combustion engine passenger cars from 2035 (in line with the "Fit for 55" package) requires the introduction of a significant number of electric passenger cars. The additional cost of purchasing electric vehicles compared to the ambitious neutrality scenario will place a significant burden on consumers and businesses.
- The transformation of the passenger transport sector in Poland should assume a dynamic development of public transport. The quicker development **of public transport will reduce the demand for electric cars by 1 million in 2050** (compared to the NEU scenario) in favour of rail and bus travel. Such a substitution will be possible after lowering the costs of public transport: by - 17% for road transport and by - 13% for rail in 2030. In 2050, the reduction in cost will be -37% and -35%, respectively, compared to the scenario without promoting public transport. **Promoting public transport will require approx. EUR 7 billion in additional expenditure for rail and approx. EUR 40 billion for buses in the period 2025-2050.**
- **Zero-emission buses in Poland will constitute approx. 10% of the fleet in 2030 and over 70% in 2050.** In the initial phase, their use will be limited to cities and short-distance journeys.
- We will observe a decrease in passenger activity in aviation (domestic flights and short-distance flights) in favour of railways. In the analysed NEU_PUBLIC_55 scenario, approx. 35% of air transport in the territory of Poland is replaced by rail.
- The rise in passenger activity and the use of zero-emission technologies will result in a significant increase in the demand for electricity. In the NEU_PUBLIC_55 scenario the transport sector will use approx. 8TWh and 34TWh of electricity in 2030 and 2050 respectively.
- The use of hydrogen technologies in public transport will be important from 2030. It will primarily concern city buses. **In the NEU_PUBLIC_55 scenario, by 2050, the demand for hydrogen in Poland in passenger transport will reach the level of approx. 57 kt.**
- The introduction of a ban on the sale of combustion engine passenger cars from 2035 (according to the "Fit for 55" package) and the promotion of public transport will significantly reduce emissions. **In 2050, emissions from passenger transport will be reduced to approx. 8 Mt CO_2.**
- In the NEU_PUBLIC_55 scenario, the reduction of CO_2 emissions in passenger transport in Poland in 2050 compared to 2020 amounts to approx. 74%.
- Passenger cars and aviation will remain the main sources of emissions in domestic passenger transport in 2050 (3.1 Mt passenger cars, 3.8 Mt aviation).

Summary

1. In this report we analysed the possible directions of change in the transport sector, with special focus on the role of public transport. We simulated the effects of various scenarios which highlight the challenges that Poland faces in its effort to reduce emission targets in line with EU climate policy:

    - **NEU (neutrality scenario)** – in which we assume achieving the goals of the "Fit for 55" package by 2030. In the long term we assume a 90% reduction of emissions with respect to 1990 and, when taking into account land use, land use change and forestry (LULUCF), an overall net-zero emissions level. Furthermore, we assume that the transport sector is covered by the BRT ETS.
    - **NEU_55** – neutrality scenario (NEU) in which we ban the sale of new internal combustion engine (ICE) cars from 2035.
    - **NEU_PUBLIC** – neutrality scenario (NEU) which assumes the promotion of public transport. It does not assume a ban on the sale of new ICE cars.
    - **NEU_PUBLIC_55** – neutrality scenario (NEU) which assumes both a ban on the sale of new internal combustion engine (ICE) cars from 2035 and the simultaneous promotion of public transport.

2. The implementation of EU climate policy will lead to a **deep transformation of the polish transport sector**. Changes in the structure of the fleet of vehicles will be driven by rapidly rising costs of reducing emissions. The introduction of a new emissions trading scheme (BRT ETS) which will cover the transport sector (as is mandated by the "Fit for 55" package) and achieving a net-zero target by 2050 in the EU will result in an increase of the marginal emission reduction cost to 126 EUR'2015/tCO_2 in 2030, and 1655 EUR'2015/tCO_2 in 2050. The strongest cost increase will be observed in the period 2030-2040. This is a result of the fact, that in the beginning of this period internal combustion engine (ICE) cars are still dominating, compared to zero-emission vehicles (ZEV), which are currently under development.

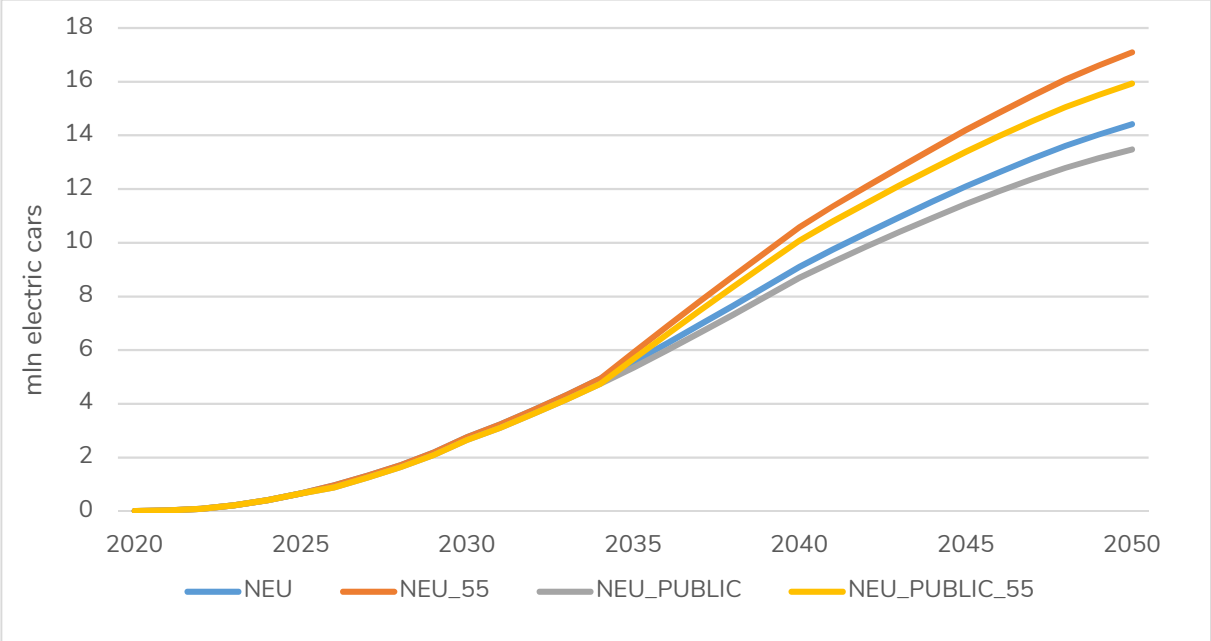
3. Achieving climate neutrality requires more ambitious emission reduction targets. The proposals put forth in the "Fit for 55" package assume that CO_2 emission norms in 2030 with respect to 2021 will be lowered by 55% for cars and 50% for light duty vehicles respectively. From the year 2035 the sale of new internal combustion engine cars will be banned[1], which means that only purchases of cars powered by hydrogen or electricity will be allowed.

[1] European Commision, Proposal for a REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL amending Regulation (EU) 2019/631 as regards strengthening the CO2 emission performance standards for new passenger cars and new light commercial vehicles in line with the Union's increased climate ambition: https://eur-lex.europa.eu/legal-content/en/ALL/?uri=CELEX:52021PC0556 [access 16.04.2022]

4. In the scenarios that we consider, the cost of travelling by rail are reduced by approx. 1.5% per year. For zero-emission urban transport (electric and hydrogen buses), these costs are reduced by approx. 60% by means of a free public transport scheme. Such a reduction in costs may be the result of subsidizing the purchase of zero-emission vehicles or lower operational costs due to the use of hydrogen or electricity. When faced with lower relative costs of public transport with respect to individual transport, passengers chose the former more often.

5. In all scenarios, by 2050 the dominant technology will be **zero-emission vehicles (ZEV)**. However, there are significant differences in the development of the transport sector between the scenarios. The introduction of the ban on new internal combustion engine cars in 2035 requires an additional 2.5 to 3 million new electric vehicles. This is a significant increases in the required number of cars, and even without the ban the level of zero-emission cars might be difficult to achieve – the average number of new cars that need to be produced in the period 2025-2050 is 0.5 million per year (NEU scenario).

Figure 1. The number of electric cars in Poland for different neutrality scenarios



Source: CAKE/KOBiZE

6. The transformation of passenger transport should involve the **dynamic development of public road and rail transport**. An increase in public passenger activity might reduce individual car transport by approximately 7% and reduce the number of electric vehicles in Poland by 1 million in 2050. Increasing collective transport, in particular rail, will help in reducing avation activity, which in the NEU scenario quadruples in the period 2020 – 2050. The number of **passenger-km in aviation** in 2050 in Poland might be lower by about 30 billion under the scenario which promotes public road and rail transport when compared to

the NEU and NEU_55 scenarios (this is a reduction of approx. 35%). This reduction is made possible by the substitution of domestic and short-distance flights by rail transport.

Table 1. Changes in passenger activity in Poland by scenarios [bln pkm]

Scenario	Mode of transport	2020	2030	2050
NEU_55	Passenger cars	200,4	242,3	303,8
	Buses	30,5	35,9	51,2
	Rail	25,0	31,9	36,0
	Aviation	25,4	45,2	93,6
	Total	**281,2**	**355,3**	**484,6**
NEU_PUBLIC_55	Passenger cars	200,4	237,2	284,0
	Buses	30,5	39,8	64,5
	Rail	25,0	42,6	79,6
	Aviation	25,4	36,9	60,9
	Total	**281,2**	**356,5**	**489,0**

Source: CAKE/KOBiZE

7. Another result of the transformation of road transport will be an increase in the number of zero-emission buses running on electricity and hydrogen. In the scenario promoting public transport the number of electric buses in Poland will reach 6 thousand in 2030 and approx. 7 thousand in 2050 (approx. 53% of the fleet). Initially, the number of hydrogen-powered buses will be relatively low, approx. 1.5 thousand in 2030. However, with developments in hydrogen technology their utilisation will be rising. The number of hydrogen buses in Poland in 2050 might reach 25 thousand (approx. 20% of the fleet).

Table 2. The number of buses in Poland by scenario [thous.]

Scenario	Mode of transport	2020	2030	2050
NEU_55	Electric	0,7	5,4	56,5
	Hydrogen	0,0	1,4	20,2
	ICE	67,6	73,2	28,6
	Total	**68,4**	**79,9**	**105,3**
NEU_PUBLIC_55	Electric	0,7	6,1	70,8
	Hydrogen	0,0	1,5	25,7
	ICE	67,6	80,8	36,1
	Total	**68,4**	**88,4**	**132,6**

Source: CAKE/KOBiZE

8. Until 2030, zero-emission buses will mainly operate in cities and on short-distance routes (approx. 10% of the fleet in 2030). However, the spread of zero-emission technologies will require significant amounts of electricity and hydrogen. In the NEU_PUBLIC_55 scenario the demand for electricity in passenger transport (passenger cars, buses and rail) will reach approx. **34 TWh in 2050**, which amounts to approx. 10% of total electricity demand in Poland. The demand for hydrogen in passenger transport will mainly come from hydrogen buses. In 2030 it will amount to approx. 1.6 kt. In 2050, this figure might reach approx. 56 kt and will cover the demand from both cars and buses.

Table 3. Demand for electricity in individual and collective transport in Poland [TWh]

Scenario	Mode of transport	2020	2030	2050
NEU_55	Passenger cars	0,0	4,4	28,1
	Buses	0,0	0,1	1,4
	Rail	2,1	2,6	2,7
	Total	**2,2**	**7,1**	**32,2**
NEU_PUBLIC_55	Passenger cars	0,0	4,2	26,2
	Buses	0,0	0,2	1,8
	Rail	2,1	3,5	6,0
	Total	**2,2**	**7,9**	**34,0**

Source: CAKE/KOBiZE

Table 4. Demand for hydrogen in road passenger transport in Poland [kt]

Scenario	Mode of transport	2020	2030	2050
NEU_55	Passenger cars	0,0	0,0	31,3
	Buses	0,0	1,5	21,8
	Total	**0,0**	**1,5**	**53,1**
NEU_PUBLIC_55	Passenger cars	0,0	0,0	28,6
	Buses	0,0	1,6	27,7
	Total	**0,0**	**1,7**	**56,3**

Source: CAKE/KOBiZE

9. The substitution of collective for individual transport will be made possible by an adequate decrease in the average cost of the former. In the scenario promoting public transport it is approx. -17% in 2030 and -37% in 2050 for road transport (buses) and approx. -13% in 2030 and -35% in 2050 for rail. In the period 2025 – 2050 promoting public transport will require an additional 47 bln EUR (of which 7 bln EUR for rail and 40 bln EUR for buses).

Table 5. Cumulative cost of promoting public transport in Poland in the period 2025 – 2050 in bln EUR [change in NEU_PUBLIC_55 vs. NEU_55]

	Cumulative cost (2025 – 2050) (billion EUR)	Yearly average cost (2025 – 2050) (billion EUR)
Scenario ➔	NEU_PUBLIC_55 vs. NEU_55	NEU_PUBLIC_55 vs. NEU_55
Rail	6,9	0,3
Buses (total)	39,6	1,6
Urban buses	4,4	0,2

Source: CAKE/KOBiZE

10. In the NEU_PUBLIC_55 scenario CO_2 emissions in Poland are **reduced by approx. 74%** in 2050 with respect to 2020 and are at the level of 8Mt CO_2. The reduction is achieved by replacing the internal combustion engine car fleet by zero-emission vehicles, increasing the role of public transport and by shifting from aviation activity to rail.

Table 6. The level and change in emissions in the analysed scenarios in 2030 and 2050 with respect to 2020 in Poland

		2030	2050
Emissions – passenger transport (Mt CO_2)	NEU_55	27,4	10,1
	NEU_PUBLIC_55	26,8	8,2
Change in the level of CO_2 emissions vs 2020 – passenger transport	NEU_55	-11%	-67%
	NEU_PUBLIC_55	-13%	-74%

Source: CAKE/KOBiZE