Centre for Climate and Energy Analyses

THE CO_2 EMISSION REDUCTION PATHS IN THE TRANSPORT SECTOR IN POLAND IN THE CONTEXT OF "THE EUROPEAN GREEN DEAL"

#SUMMARY

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Main conclusions:

- The different dynamics of historical emissions in the transport sector in Poland compared to the European Union will be important in emissions reduction and will undoubtedly affect the pace of these reduction.
- Baseline scenario (BAU) to be used as a reference for included simulations in this report is consistent with the PRIMES 2016 reference scenario. The average increase in transport activity adopted in BAU at 1.5% y / y translates into an increase of emissions from 61 Mt CO_2 in 2020 to 63 Mt CO_2 in 2030 and then a drop to 58 Mt CO_2 in 2050.
- The main analytical scenario (ProETSeq) introduces an additional tax depending on the intensity of the fuel consumption of the conventional vehicles and a gradual decline in the price of electric and hybrid vehicles, with the price per ton of CO_2 emissions converging up to EUR 350 in 2050.
- The increase in the operating costs of ICE-powered cars (levy on CO_2 emissions) and the decrease in the prices of low-emission vehicles (electric and hybrid) will result in a dynamic increase in the number of electric vehicles in Poland - around 350.000 vehicles per year.
- The structure of the passenger car fleet in Poland will change: 7% share of electric cars and 5% hybrid cars in 2030 and 54% electric cars and 10% hybrid cars in 2050.
- Changing consumer preferences regarding the purchase vehicles, as well as an increase in rail transport activity would lead to a decrease in emissions up to 52 Mt CO_2 in 2030 and 31 Mt CO_2 in 2050. The possibilities of significant emissions reduction by 2030 seem to be quite limited, if only due to the relatively expensive new low-emission vehicles. Hence, reductions of CO_2 emissions compared to the level in 2005 are only visible in the year 2050.
- The development of electromobility increases the total demand for electricity in 2050 by approximately 35 TWh, which would account for approximately 15% of the national electricity demand in that year[1] (additional CO_2 emissions from electricity production would represent 1.3% of emissions from the road transport sector).
- The freight sector, despite the significant increase of fuel prices caused by emission charges, is still responsible for a significant level of emissions - 25 Mt CO_2 in 2030 and 19 Mt CO_2 in 2050. Introduction of a fee based on emissions for vehicles with a payload above 3.5 tonnes may reduce the activity (and thus emissions) in this group of vehicles by 6% in 2030 and by 19% in 2050 compared to the baseline scenario - the activity will be replaced by rail transport.

[1] Assuming domestic electricity demand in 2050 at the level of 234 TWh.

Executive summary:

1. Implementation of the European Commission communication entitled "The European Green Deal" requires the reduction of greenhouse gas emissions in the entire European economy in order to achieve climate neutrality in 2050. The transport sector is the one of the most important sectors of the economy that will have to face this challenge[2]. The transport sector is a part of the non-ETS, the area which also covers agriculture, municipal and housing and some industrial sectors not covered by the EU ETS.

2. Contrary to the EU ETS system, in the non-ETS greenhouse gas emission reduction targets are assigned to each EU Member State individually. So far, Poland has been allowed to increase the GHG emissions by 14% between 2005 and 2020. For 2030, the legally binding target for Poland is set at -7% compared to the 2005 level.

3. The European Commission communication "The European Green Deal" assumes an increase in the EU emission reduction target for 2030 from the current 40% to 50-55% in relation to 1990. For the purposes of this analysis, a similar assumption to the current existing mechanism of allocating reduction targets between Member States in the non-ETS was adopted. The increased 55% emission reduction target at the EU level may translate into the increase of the target for Poland in the non-ETS even up to -16% in 2030 compared to the 2005 level.

4. The dynamics of historical CO_2 emissions from the transport sector in Poland compared to the average of the European Union is substantially different. In Poland, in the years 2005-2017, a significant increase in emissions was observed (by 76%), while in the EU a 3% decrease in emissions was visible in the same period. The trend of increasing emissions in this sector in Poland may continue in the coming years, what involves a significant impact on the future possibility of achievement of CO_2 emissions reductions.

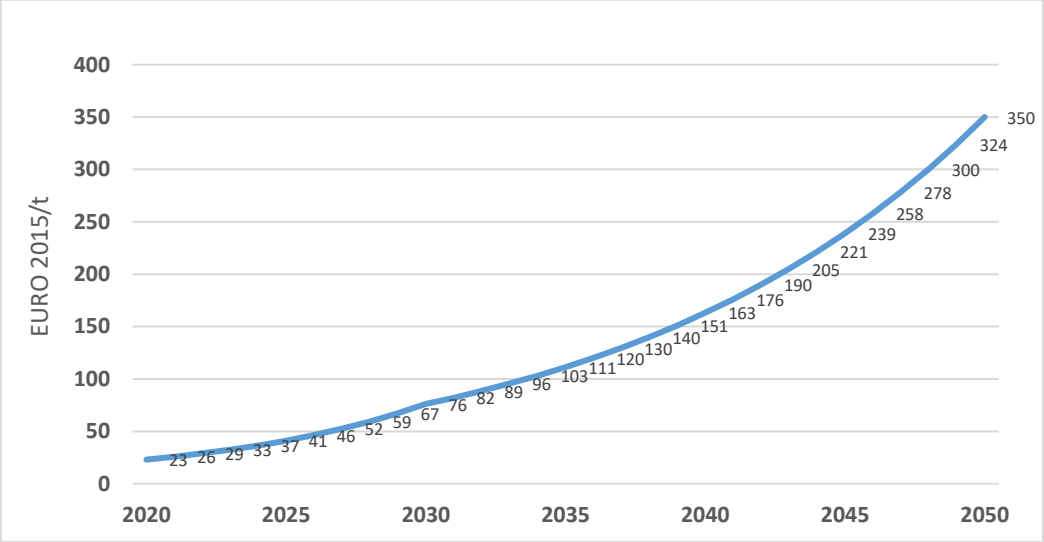
5. Analysis of the emissions reduction options in the transport sector in Poland has been made with application of the TR^3E partial equilibrium model. The TR^3E model has been created as part of the LIFE Climate CAKE PL project carried out at IOŚ/PIB-KOBiZE. One of the emission reduction mechanisms which has been analysed in the report is the introduction of additional charges (taxes) for CO_2 emissions in transport sector. This report provide the analysis which is focused on the extent to which environmental taxation of fuels affects the transport activity, fleet change and CO_2 emissions in this sector. For this purpose, an analytical scenario has been created assuming an increase in travel costs by the cost of CO_2 emissions (additional cost in the price of conventional fuels) - the **ETSeq scenario**.

6. For this purpose, an additional tax depending on the intensity of emissions of the fuel used by a given vehicle has been introduced. Based on the current data on the emissions of fuels consumed by vehicles, the assumed trends until 2050 and the prices for 1 tCO_2 emission,

[2] European Green Deal, https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1576150542719&uri=COM%3A2019%3A640%3AFIN

additional costs for vehicle users are calculated (fig. 1)[3]. We assumed the steady increase of the CO_2 tax from 23 euros in 2020, 67 euros in 2030 up to 350 euros in 2050. It should be emphasized that the ETSeq scenario does not examine the impact of the inclusion of the transport sector in the EU ETS, but only the impact of imposing additional taxes on this sector at the level of estimated EUA prices.

Fig. 1. The assumed path of increase in the rates of fees / tax for the emission of 1 t CO_2



Source: CAKE/KOBiZE own study based on the results of the CREAM model and the impact assessment to the EC document "A clean Planet for all" COM (2018) 773

7. The introduced tax rate depends on the level of emissions per 1 km from the fuel consumption of a given vehicle. Depending on the vehicle category, the introduction of a CO_2 "tax" will lead to the increase in operating costs in the passenger car sector by around 5% in 2030 and 15-20% in 2050.

8. As fuel prices and carbon dioxide emissions increase, low-carbon technologies (electric and hybrid vehicles) will become more and more popular, so their price gradually declines. Moreover, some state subsidies for the purchase of low-emission vehicles are possible, what may also make them attractive in relation to conventional – internal combustion vehicles (ICE). In order to analyze this phenomenon, a scenario of technological progress has been created - **TechPro**, assuming, among others, a decrease in the prices of alternative vehicles - electric and hybrid.

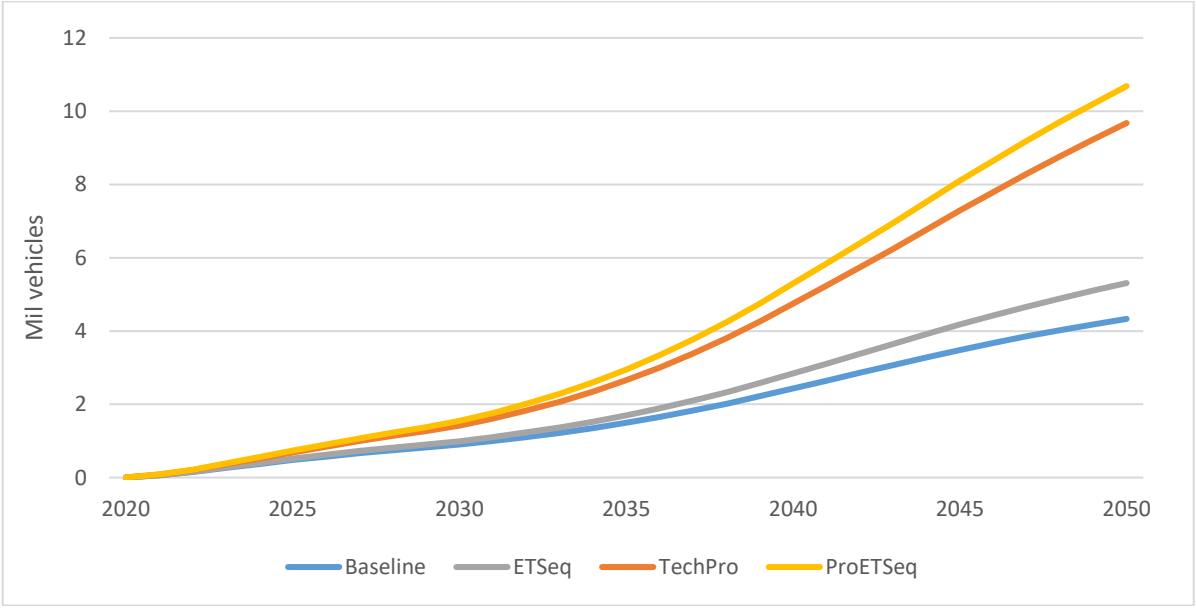
9. The third developed scenario include charges depending on carbon dioxide emissions which are included in the purchase price of fuels and as well as the ongoing technological progress -

[3] Adopted prices for emission of 1tCO_2 come from two sources. First, until 2030, the price for 1 tCO_2 is the result of the scenario prepared on the CREAM model. These prices are in line with the German proposal to create an emissions levy system in the transport sector: https://www.cleanenergywire.org/factsheets/germanys-planned-carbon-pricing-system-transport-and-buildings From 2030, allowance prices increase until they reach EUR 350 in 2050, according to the impact assessment of the EC document "A clean Planet for all" COM (2018) 773, scenario of achieving net zero emissions in 2050.

the **ProETSeq scenario**. It assumes a decrease in the prices of low-emission vehicles, an improvement in the intensity of emissions compared to that assumed in the baseline scenario and finally the introduction of a tax on CO_2 emissions.

10. One of the main results of the analysis is the estimated increase in the number of electric vehicles in Poland in 2020-2050. In the case of the ETSeq scenario, the number of electric cars until 2035 is growing at almost the same pace as in the baseline scenario (additional CO_2 emission charges do not significantly influence consumers decisions to purchase low-emission vehicles). In 2030 according to the ETSeq scenario there will be approx. 90 thousand (i.e. 9%) electric cars more than in the baseline scenario. On the other hand, in 2050 the emission carbon tax becomes so high that it causes the purchase of an additional 1 million electric vehicles. This gives a total of 5.3 million electric vehicles which is 23% more than in the baseline scenario (4.3 million vehicles).

Fig. 2. Number of electric vehicles in Poland in 2020-2050

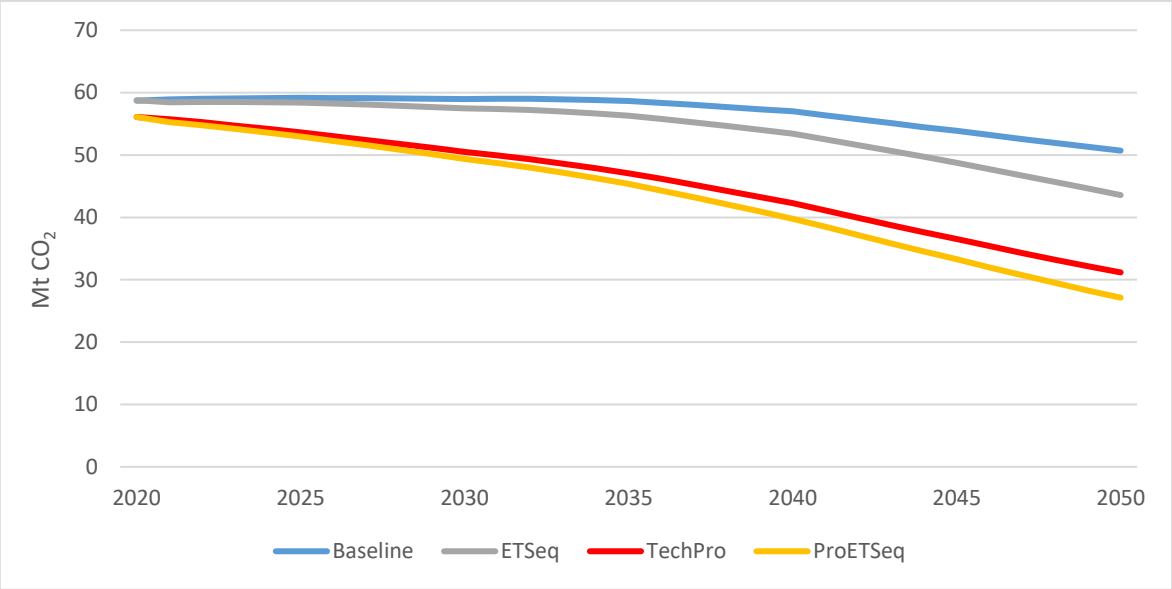


Source: CAKE/KOBiZE own study

11. In the ProETSeq scenario, the number of electric vehicles (EV) in Poland in 2050 will be at the level of 10.6 million (1.5 million in 2030), which means an average increase of approx. 350 thousand per year. The increase in the number of electric vehicles results from lower prices of electric cars in the TechPro scenario and changes in the consumer preferences resulting from the more expensive operation of the ICE vehicles (due to the purchase of fuels, charged with emission tax). The results of the analysis on CO_2 emissions from the transport sector indicate that there are quite limited possibilities to reduce emissions by 2030. The dynamics of the decline in emissions in the transport sector increases only after 2030, which is undoubtedly related to the significant decrease in prices of low emission vehicles observed after 2030 and the growing market share of these vehicles.

12. The largest drops in emissions in the entire transport sector in Poland are visible in the ProETSeq scenario - a decrease in CO_2 emissions to 31 Mt CO_2 in 2050 (27 Mt CO_2 in road transport). It should be noted that, as a part of the implementation of the TechPro and ProETSeq scenarios, it is necessary to provide financing that would allow to achieve the goal of the price drop of electric vehicles by 2050. It could be facilitated through innovation, economics of scale associated with increasing production, etc. It is worth emphasizing that the level of the 2050 CO_2 reduction is greater in the TechPro scenario than in the ETSeq scenario. This fact is related to the decline in the prices of low emission cars - the cost of purchasing a new car per km is much higher than the cost of fuel to run this vehicle, also taking into account the assumed rising cost of CO_2.

Fig. 3. CO_2 emissions in the road transport in Poland between 2020-2050



Source: CAKE/KOBiZE own study

13. In the TechPro scenario, the decline in the prices of electric vehicles makes a significant increase in the demand for this type of vehicles and at the same time would cause move away from conventional vehicles. In turn, under the ETSeq scenario, the reduction of emissions leads to an increase in the costs of using conventional vehicles as well as a decrease in transport activity in this segment of vehicles. Thus, the impact of this mechanism on the number of new electric vehicles on the market is smaller than in the TechPro scenario, which translates directly into the CO_2 emissions levels in these scenarios. In the ETSeq scenario, we observe the "shifting" of the costs of reducing emissions to vehicle users. This case involves the generation of significant state budget revenues from emission taxes. This income can, for example, be allocated to activities undertaken as part of the TechPro scenario. The implementation of the ProETSeq scenario, assuming both a decrease in the prices of low-emission vehicles and an increase in the operating costs of ICE vehicles, on the other hand, leads to a decrease in CO_2 emissions in road transport by 24 million tonnes in 2050 compared to the baseline scenario. Moreover, the development of electromobility increases the total demand for electricity in 2050 by

approximately 35 TWh, which would account for approximately 15% of the national electricity demand in that year. Additional CO_2 emissions from electricity production would represent 1.3% of emissions from the road transport sector.

14. According to the modeling results for CO_2 emissions from the entire transport sector, compared to 2005, lead to the conclusion that in 2030 in the most optimistic scenario, emissions are higher by almost 48% compared to 2005 levels (ProETSeq scenario). Depending on the analyzed scenario, the emissions can increase in the range of 48% to 74% (Table 1).

15. The only visible emission reductions in 2050 in comparison to 2005 can be achieved under the TechPro scenario (-2%) and at the highest level at ProETSeq scenario (-12%).

Table 1. Results of the analytical scenarios for Poland for 2030 and 2050

	2030				2050			
	Baseline	ETSeq	TechPro	ProETSeq	Baseline	ETSeq	TechPro	ProETSeq
% share of electric vehicles in the fleet	3,9%	4,2%	6,1%	6,6%	22%	28%	49%	54%
Emissions in the road transport (Mt CO_2)	59	58	51	49	51	44	31	27
Total emissions from transport sector (Mt CO_2)	63	61	53	52	58	51	35	31
Change in CO_2 emissions regarding 2005 r.	+78%	+74%	+51%	+48%	+65%	+46%	-2%	-12%

Source: CAKE/KOBiZE own study

16. Road transport is the most responsible for emissions in the transport sector, where the differences between Poland and the EU are at the level of 8 percent points (-52% in Poland and -60% in the EU-27 + UK in 2050 compared to 2020). In the case of passenger transport, emission reductions in Poland and the EU-27 + UK are on a similar level (-65% in Poland and -66% in the EU-27 + UK). In freight transport, the reduction of emissions in Poland is 5 percent points below the EU-27 + UK average (-24% in Poland vs. -29% in the EU-27 + UK) (see Table 2).

Table 2. Changes in emission levels in Poland and in the EU-27+UK in 2050 comparing to 2020 – scenario ProETSeq

	Poland	EU-27+UK
Total	-47%	-53%
Passenger	-65%	-66%
Freight	-24%	-29%
Road	-52%	-60%

Source: CAKE/KOBiZE own study

17. If it comes to the costs and benefits for private consumers and firms, results show that only in the TechPro scenario, users benefit from cheaper electric and hybrid cars (the price of conventional fuels does not include a tax based on vehicle emissions). In the scenarios with the introduced tax on CO_2 emissions (ETSeq and ProETSeq) costs are higher if there is no assumed technological progress and consumers switching to low-emission vehicles (there is no drop in the price of low-emission cars). The summary of costs and benefits for private consumers and firms for each scenario is presented in Table. 3.

Table 3. Overview of costs and benefits of introducing the CO_2 tax for ICE vehicles in Poland. Annual average data in billion EUR for the period 2020-2050.

Category:	Scenario (deviation from the baseline scenario)		
	ETSeq	TechPro	ProETSeq
Total costs / benefits for users (private consumers and firms)	-6,2	2,0	-2,2

Source: CAKE/KOBiZE own study

18. State budget revenues are proportional to the level of emissions, but in the TechPro scenario they do not exist - there is no tax on CO_2 emissions. Table 4. contains a summary data on average revenues to the state budget from the introduced emission tax according to the scenarios in the period 2020-2050.

Table 4. Summary of revenues to the state budget due to the introduction of the CO_2 tax for ICE vehicles in Poland. Annual average data in billion EUR for the period 2020-2050

Category:	Scenario		
	ETSeq	TechPro	ProETSeq
State budget revenues (profits)	6,9	0	5,1

Source: CAKE/KOBiZE own study

19. The introduction only of an emission taxation system in the transport sector has a limited impact on the level of emissions. This is an important conclusion from the point of view of the latest proposal of the European Commission concerning the increase of the reduction target and the inclusion of the transport sector into the EU ETS, or the creation of a separate trading system for this sector. The hybrid system (combining both emission taxes and subsidies for new low-emission vehicles) will need to provide adequate financing, to which the European Commission document does not sufficiently refers. This funding could have a significant impact on the speed of the market share gain for the new low-emission vehicles and as well the associated reduction of CO_2 emissions.