BELGIAN DEBT AGENCY

info@debtagency.be
www.debtagency.be

METHODOLOGICAL ANNEX ON IMPACT ASSESSMENT

Green OLO Allocation & Impact report

2024

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METHODOLOGICAL ANNEX ON IMPACT ASSESSMENT

1 SUBSIDIES TO SNCB (CAPEX): PURCHASE OF M7 DOUBLE-DECK TRAINS

Following discussions with SNCB/NMBS and an analysis of the available data, the investment program for rolling stock has been refocused specifically on the M7 vehicles. This choice reflects the considerable share of M7 vehicles in total investments in "rolling stock".

The deployment of M7 vehicles will optimize energy consumption across the fleet, contributing to a measurable decrease in CO_2 emissions. More specifically, the M7's are expected to reduce energy consumption by 20 to 30% due to their higher efficiency compared to older trains nearing the end of their service life[1]. The new M7 trains enable an average saving of 8.5 kt[2] of CO2 per year over a period of 45 years. Additionally, deploying M7 trains on the most congested lines, particularly in Brussels, is anticipated to boost capacity on these routes.

Nonetheless, the primary objective of the M7 trains is to sustain the current railway capacity. In 2020, a subsequent order of **306 M7** trains (Order n°2) was made, supplementing the initial purchase of **445 M7** trains (Order n°1) aimed at replacing older models. The new M7 trains will constitute 20% of the total train capacity, effectively replacing one-fifth of the existing fleet. It should be noted that the capacity increases funded by the 2024 Green OLO for M7 vehicles were not considered in the evaluation; only the gains in energy efficiency were accounted for.

The impact study was conducted by comparing the emission factors per seat of the old trains and the new M7 vehicles, allowing for the estimation of greenhouse gas emissions avoided over the expected lifetime of the M7s, which is 45 years.

The calculation is based on the average number of trains per million euros, derived from the proportion of M7 units delivered in 2024 from orders 1 and 2 (76 trains from order 1 and 82 from order 2). It is noted that all remaining trains from order 1 are scheduled for delivery this year. This ratio is then applied to the total amount of Green OLO funds allocated in 2024 for the M7 procurement, to estimate the number of vehicles financed through Green OLO.

PURCHASE OF M7 DOUBLE-DECK TRAINS	OLO 86 – 2024	OLO 96 – 2024	2023 *(allocated in 2024)*
Allocated amounts of Green OLO to M7 2024[Meuros)	**16.5**	**77.4**	**219.5**

Additionally, the CO2 saved per vehicle is calculated by dividing 8.5 kt of CO2 per year by the number of M7 vehicles. Finally, the number of vehicles is multiplied by the CO2 saved per vehicle and by 45 years, resulting in a total of 84.56 ktCO2 avoided over the lifetime of the M7 trains financed by the Green OLO in 2024.

An underlying assumption of the calculations is a constant emission factor for electricity production during the lifetime of the M7 trains. However, the share of renewable energy in total electricity production is expected to increase over the coming years and decades in Europe and the federal government has decided to maintain a nuclear capacity of 4GW, so that the Belgian electricity production infrastructure will most likely have lower CO2 emissions in the coming years. Given the uncertainty surrounding the decarbonization trajectory of electricity production in Belgium and to simplify the assessment

[1] Source : SNCB, internal calculations. The new M7 trains enable an average saving of 8.5 kt of CO2 per year over a period of 45 years.

[2] Source : SNCB, internal calculations. The new M7 trains enable an average saving of 8.5 kt of CO2 per year over a period of 45 years.

while avoiding potential double counting (for instance, with support mechanisms for offshore wind production), changes in the emission factor were not incorporated into the impact assessment calculations. Our assumption of a constant emission factor is therefore a conservative one.

The methodology used to calculate the environmental impact of the purchase of M7s is summarized in **Appendix 5.1** of this methodological report.

The total avoided CO2 eq emissions financed by the Green OLO 2024 over the lifetime of the M7 (45 years) amounts to 84.8 kt CO2 eq.

PURCHASE OF M7 DOUBLE-DECK TRAINS	2024 expenditures (allocated in 2024)		2023 expenditures (allocated in 2024)
	OLO86	OLO96	Total (86+96)
Improvement in energy efficiency of M7 trains (per seat)	**25%**	**25%**	**25%**
Avoided CO2 eq emissions related to Green OLO over the lifetime of M7 trains [kt]	**4.5**	**20.9**	**59.4**

2 SUBSIDIES TO INFRABEL (CAPEX)

2.1 MAINTENANCE OF RAILWAY INFRASTRUCTURE

Regular maintenance of the railway network is crucial to supporting sustainable mobility and reducing the environmental impact of less eco-friendly transport alternatives.

The core of the methodology used to assess the environmental impact of the maintenance of railway infrastructure is inspired by a similar assessment made by SNCF Réseau[3]. It assumes that a lack of investment in the maintenance of a section of the railway network will affect the mean speed of trains on that section and that, consequently, areduction in the mean speed will decrease the attractiveness of rail transport along that part of the network. Therefore, passengers and freight operators will move to other means of transportation such as cars or buses for passengers and trucks or inlandnavigation for freight.

The assumption is that each segment of the railway network is renovated according to an annual renovation schedule. A lack of investment in any given section in a particular year will mean that the section will miss its maintenance opportunity, and its condition will not be addressed until it is its turn again, after all other sections have been renovated. This cycle is based on the technical lifetime of railway infrastructure components like tracks, catenaries, and signage, which is set at 40 years.

For the quantitative assessment, it is assumed that railway traffic in Belgium is evenly distributed across the network. Infrabel's annual maintenance budget is considered sufficient to maintain 1/40th of the total infrastructure each year, thus impacting an equivalent share of demand. No significant effects are expected during the first two years without maintenance; however, from the third year onward, infrastructure quality deteriorates, leading to a decline in service levels. As a result, traffic on the affected sections is projected to decrease progressively, disappearing entirely over a 20-year period—with a substantial modal shift to road transport: 82% for passenger traffic and 100% for freight.

[3] SNCF Réseau and Carbone 4, Carbon Impact of rail infrastructure Investments, 2017

Furthermore, traffic projections from the Federal Planning Bureau from 2019 to 2040 predict a 30% increase in freight transport via the Belgian railways, whereas passenger numbers are expected to decline by 3.3%[4], influenced by slower sociodemographic growth and the increasing prevalence of teleworking.

Results of the long-term outlook for passengertransportation under unchanged policy	2019	2030	2040
Billion passengers-kilometers per year – rail	**15.0**	**15.0**	**14.5**
Billion tons-kilometers per year – freight	**6.5**	**7.5**	**8.4**

Table 1 : Bureau Fédéral du Plan, Perspectives de la demande de transport à l'horizon 2040

These figures make it possible to estimate the total volume of passenger traffic (in passenger-kilometers) and freight traffic (in ton-kilometers) that shifts from rail to road—cars and trucks—as a result of insufficient maintenance investment.

The total amount of avoided emissions for the 2024–2063 period is calculated by multiplying the diverted passenger-kilometers (pkm) and ton-kilometers (tkm) by the difference in emission factors between rail and road transport (cars and trucks). These emission factors, presented in the table below, are those used by the Federal Planning Bureau (FPB)[5] to estimate CO_2 equivalent emissions across transport modes. The analysis considers tank-to-wheel emissions for fossil fuel-based transport, and for electric vehicles, it incorporates emissions based on the current Belgian electricity mix (assumed to remain constant through 2050).

Emission factors considered Emission factors / Years	2023	2024	2030	2040
Passenger car transport [g CO2 / pkm]	108.55	104.64	81.20	23.95
Passenger moto transport [g CO2 / pkm]	50.52	50.52	50.52	50.52
Passenger Bus transport [g CO2 / pkm]	41.06	41.06	41.06	41.06
Passenger Tram/ Metro transport [g CO2 / pkm]	34.00	34.00	34.00	34.00
Railways, passengers [g CO2 / pkm]	16.30	16.30	16.30	16.30
Railways, freight [g CO2 / tkm]	7.00	7.00	7.00	7.00
Freight road transport [g CO2 / tkm]	70.00	70.00	70.00	70.00

[4] Bureau Fédéral du Plan, Perspectives de la demande de transport à l'horizon 2040, Avril 2022, p.5

[5] Source : Bureau Fédéral du Plan

In this 2024 impact report, we maintain the same assumptions as in the 2023 edition to ensure consistency and comparability. More specifically, we continue to assume that, in the absence of rail transport, 82% of passengers would switch to cars, 3% to BTM (bus/tram/metro), 1% to motorcycles, and 1% to walking.

In 2024, Infrabel's network maintenance and renewal expenditure amounted to 770.01 million euros, compared to 688.2 million euros in 2023. Over the same period, the total length of the Infrabel network has slightly decreased from 6565 km in 2023 to 6551 km in 2024[6].

The methodology used to calculate the environmental impact of maintenance of the railway infrastructure is summarized in **Appendix 5.2** of this methodological report.

The total avoided CO2 eq emissions financed by the Green OLO 2024 over the lifetime of maintenance investment amounts to 303.7 kt CO2 eq.

MAINTENANCE OF RAILWAY INFRASTRUCTURE	
Allocated amounts of green OLO 2024 [Meuros]	424.6
Avoided CO_2 emissions related to Green OLO 86 2024 over the lifetime of maintenance investments [kt]	18.5
Avoided CO_2 emissions related to Green OLO 96 2024 over the lifetime of maintenance investments [kt]	86.8
Avoided CO_2 emissions related to Green OLO 2023 over the lifetime of maintenance investments [kt]	198.4
Total avoided CO_2 emissions related to Green OLO 2024 over the lifetime of maintenance investments [kt]	**303.7**

3 TAX EXEMPTIONS AND DEDUCTIONS TO PROMOTE CLEAN TRANSPORTATION

3.1 EXEMPTION FOR REIMBURSEMENT OF COMMUTING BY PUBLIC TRANSPORT

According to FPS Mobility figures, in 2023, the large majority (58%) of commuting between home and work was done by car[7].

This expenditure relates to the full exemption granted to taxpayers who declare their professional expenses on a lump-sum basis, for employer reimbursements covering commuting costs—provided the commute is made via public transportation.

[6] Infrabel, internal calculations

[7] SPF Mobilité et transports, BeMob - Les déplacements domicile-travail 2022-2023, (online), p. 3

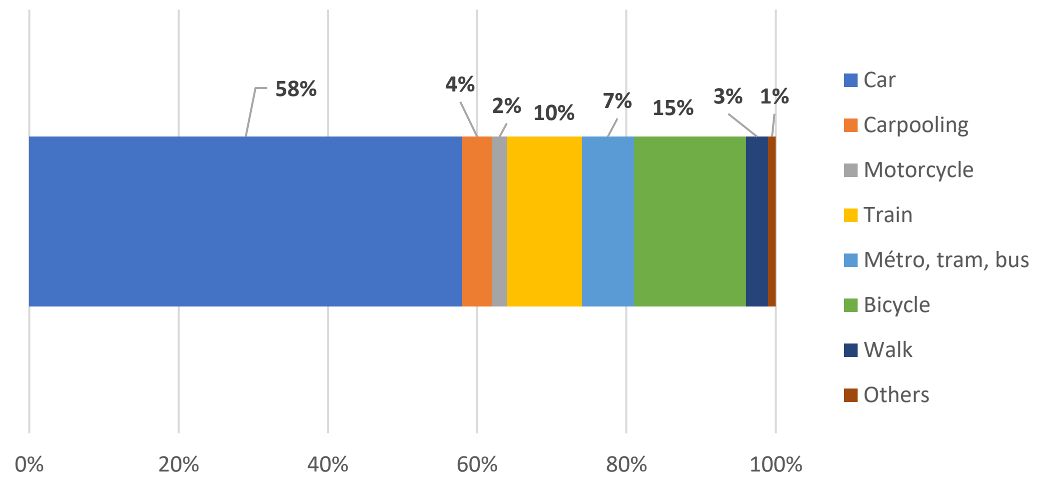


Figure 1: Modal split of home-work commutes in 2023, Belgium[8]

To estimate the environmental impact of this expenditure, an analysis of the current public transport commuting situation was conducted. The objective was to determine the total number of kilometers traveled by public transport due to the policy and to determine the alternative means of transportation that would have been used without this tax exemption.

The reference situation is defined by the current number of commuters using public transport. According to StatBel data[9], there were 4,981,145 workers in Belgium in 2024. By applying the modal split for home-to-work commutes estimated in the previously mentioned SPF Mobilité survey (10% using the train and 7% using BTM[10]), it was estimated that 498,115 workers commute daily by train and 348,680 by BTM.

Based on a study of OVG Vlaanderen[11] the average distances traveled daily by commuters using different transport modes were estimated. These distances were multiplied by 210 business days and, considering two round trips per day, the total passenger kilometers (PKM) were calculated as follows:

- Train: 9.335 million pkm (Mpkm)
- BTM: 1.804 million pkm (Mpkm)

The next step of the assessment aimed to determine the number of commuters who would not have used public transport without the reimbursement initiative. This calculation was based on the price elasticities from a computable model developed by the Federal Planning Bureau (FPB)[12].

Next, the assessment identified the alternative transportation modes commuters would choose in the absence of public incentives, using diversion factors from the same FPB's model. Diversion factors, in this context, represent the percentages indicating how commuters would redistribute among different transportation modes if they no longer used public transport due to the absence of the policy. These alternative modes include cars, motorcycles, walking, and biking (collectively referred

[8] https://mobilit.belgium.be/fr/publications/bemob-les-deplacements-domicile-travail-en-2022-et-en-2023

[9] Emploi et chômage - Plus de chiffres | Statbel (fgov.be)

[10] Bus – Tram - Metro

[11] K. Declercq, D. Janssens, G. Wets. 2018. « ONDERZOEK VERPLAATSINGSGEDRAG VLAANDEREN 5.3 (2017-2018) TABELLENRAPPORT ».

[12] Bureau fédéral du Plan - Publication - Description et utilisation du modèle PLANET p.8

to as "slow" modes). Diversion factors also account for changes in "total transportation demand", indicating that the overall demand for transportation decreases when there is a switch in transportation mode.

The diversion factors in this version of the report have not been updated from the previous report. The current diversion factors are shown in the table below:

Diversion factor	To trains	To cars	To BTM	To Moto	To "Slow"	To "Total Demand"
From trains	**0%**	**82%**	**3%**	**1%**	**1%**	**13%**
From BTM	**2%**	**50%**	**0%**	**0.1%**	**25%**	**23%**

Finally, the environmental impact is determined by multiplying the number of kilometers that would have been traveled without the policy for each mode of transportation by the specific emission factor for each mode, as outlined in point 2.1 of this methodological annex. This provides a comprehensive view of the total amount of avoided emissions for the 2024 period thanks to the policy.

The detailed methodology used to calculate the environmental impact of the tax exemption for public transport is summarized in **Appendix 5.3** of this methodological report.

The total avoided CO2 eq emissions financed by the Green OLO 2024 amounts to 138.5 kt of CO2 eq.

EXEMPTION FOR REIMBURSEMENT OF COMMUTING BY PUBLIC TRANSPORT	2024
Mpkm travelled by train due to policy	1975.7
Mpkm travelled by bus, tram and metro due to policy	735.8
Pkm travelled by bus, tram, metro due to policy from ex-car users [%]	50%
Avoided CO2 emissions related to Green OLO 86 – 2024 [kt]	8.1
Avoided CO2 emissions related to Green OLO 96 2024 [kt]	38.2
Avoided CO2 emissions related to Green OLO 2023 [kt]	92.2
Avoided CO2 emissions related to Green OLO [kt]	**138.5**

3.2 BICYCLE ALLOWANCE

The impact assessment of this policy was conducted through a structured three-step process. First, we estimated the total kilometers eligible for an allowance in 2024 by dividing the total amount of the allowance, estimated at 272.930.042 €[13], by the prevailing unit cost per kilometer for the year, which was €0.35/km at this time. This calculation provided an estimate of the total number of kilometers traveled by bicycle for commuting, totaling 779.8 Mpkm.

Second, we identified the percentage of these bicycle kilometers that were directly influenced by the policy, utilizing both elasticity and diversion factors provided by the Federal Planning Bureau (FPB). The elasticity factor allowed us to determine that 412.74 Mpkm were traveled due to the policy.

In this case, diversion factors indicate how commuters would redistribute among different transportation modes if they no longer used bicycles due to the absence of the policy. This step also involved analyzing alternative transportation methods that would have been used instead, including cars, motorcycles, trains, buses, trams, and the metro. By applying the diversion factors, we could estimate the proportion of commuters who would switch to each alternative mode of transport.

It is important to note that the factors in this version of the report have not been updated from last year's new model published by the BFP. The diversion factors are shown in the table below:

Diversion factor	To trains	To cars	To BTM	To Moto	To "Total Demand"
From Slow	**2%**	**40%**	**14%**	**0%**	**44%**

Finally, we compared the emission factors of these alternative transportation methods with those of bicycles to assess the net environmental impact. As in the 2023 report, the emission factors for the switch to public transport (BTM) and train, as reported along with the other emission factors in section 2.1 of this methodological annex, are also considered here. By calculating the difference in emissions between bicycle use and the alternative modes of transport, we could determine the total avoided emissions due to the policy.

The methodology used to calculate the environmental impact of the bicycle allowance is summarized in **Appendix 5.4** of this methodological report.

The total avoided CO2 eq emissions financed by the Green OLO 2024 amounts to 18.4 kt of CO2 eq.

BICYCLE ALLOWANCE	2024
Mpkm travelled by bicycle due to policy	412.7
Pkm travelled by bicycle due to policy from ex-car users [%]	40%
Avoided CO_2 emissions related to Green OLO 86 – 2024 [kt]	1.1

[13] Source MINFIN 2024

Avoided CO_2 emissions related to Green OLO 96 2024 [kt]	5.0
Avoided CO_2 emissions related to Green OLO 2023 [kt]	12.4
Total avoided CO_2 emissions related to Green OLO in 2024 [kt]	**18.4**

4 REDUCED PACKAGE CHARGE FOR USING INDIVIDUAL REUSABLE DRINK PACKAGES

The assessment of the reduced package charge focused on quantifying the environmental benefits in terms of avoided CO2 equivalent emissions and reduced extraction of materials. To achieve this, we calculated the volume of containers likely to be reused, estimated at a 1000 liters unit, by analyzing the charges applied to reusable containers versus those for non-reusable ones.

As a first step, a reference scenario was established where reuse is considered at zero: all beverage packaging is used only once. This implies that all the beverage containers are produced with primary and/or recycled materials according to the actual recycled content in new glass production. Then a reuse scenario was established, considering that glass packaging is used on average 25 times[14] (updated with new numbers since 2023 compared to 7 times before). However, it still needs to be produced before the first time it is used. Therefore, 1/25 of the beverage containers are assumed to be produced with primary or recycled material (according to the actual recycled content in new glass production).

For each scenario, we calculated the materials needed, emissions related to the production and re-use of glass as well as the glass waste that will end up in the environment. The impact on GHG emissions is assessed based on emission factors (kgCO2eq/1000l) linked to the type of production (new or recycling) and to the kind of collection (deposit system or collection point)[15]. For reused bottles, emissions are only linked to the collection (we assume a deposit system) and to the washing of the bottles. The emission factors considered for the washing of bottles have been updated with new numbers for 2024 calculations. Emission factor was estimated at 85 kgCO2/1000L and updated to 20 kgCO2/1000L[16].

The inputs in terms of materials and energy used considered recycling rates in Belgium as well as an upper limit for the use of recycled materials when producing new glass bottles. The estimation of glass waste ending-up in the environment is based on the collection system implemented in Belgium, where 98% of the waste is collected while the remaining 2% exits the loop and leads to environmental impact[17]. The amount of waste glass can be measured either in terms of weight (tons) or in terms of the number of items. In the latter case, an average weight is considered to estimate the number of containers that end up in the environment.

The final results only consider the share that is due to the allocated amount of the tax expenditure to Green OLO for the year in question.

[14] Reloop & Zero Waste Europe, Reusable VS single-use packaging, a review of environmental impacts, December 2020, available at Reusable VS single-use packaging.

[15] Reloop & Zero Waste Europe, Reusable VS single-use packaging, a review of environmental impacts, December 2020, available at Reusable VS single-use packaging.

[16] Source : Deroche Consultants, Bilan environnemental de la bouteille en verre consigné « 75 cl Alsace » commercialisée dans l'Est de la France par comparaison avec une bouteille en verre à usage unique (not translated), Table VII p. 24, available at LCA glass deposit

[17] Close the glass loop, available at https://closetheglassloop.eu/record-collection-of-glass-containers-for-recycling-hits-78-in-the-eu/

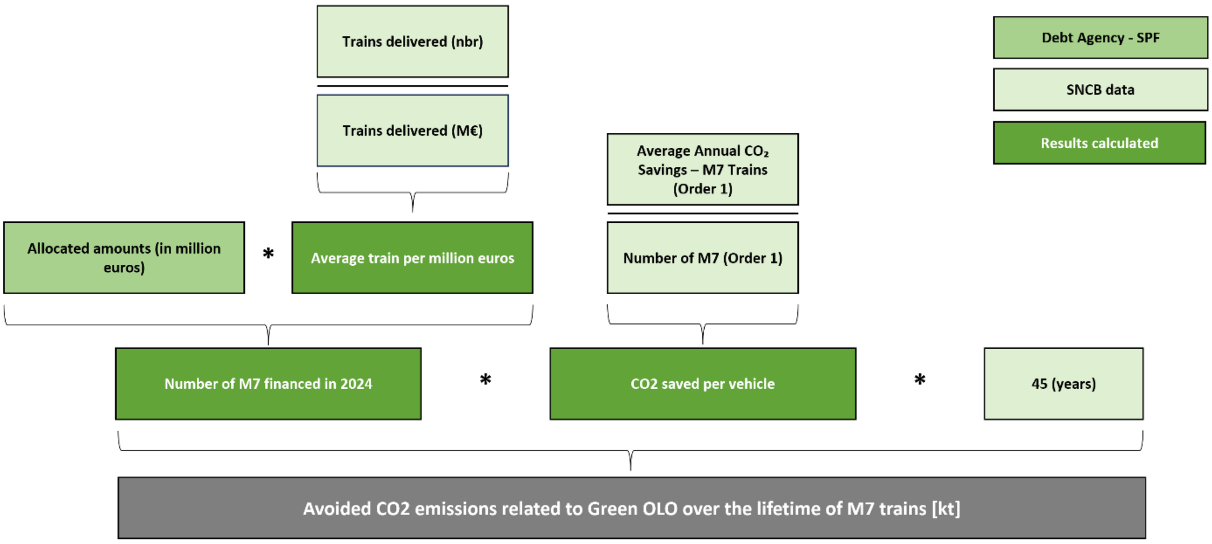
The methodology used to calculate the environmental impact of reduced packaging charge is summarized and available in **Appendix 5.5** of this methodological report.

This reduced packaging charge is estimated to have avoided 170.6 kt of CO2eq in 2024 as well as 121.4 kt of sand, 48.6 kt of lime and 39.9 kt of caustic soda along with 7.7 kt of glass released into the environment. In terms of quantity, this translates to approximately 30.7 million items being spared.

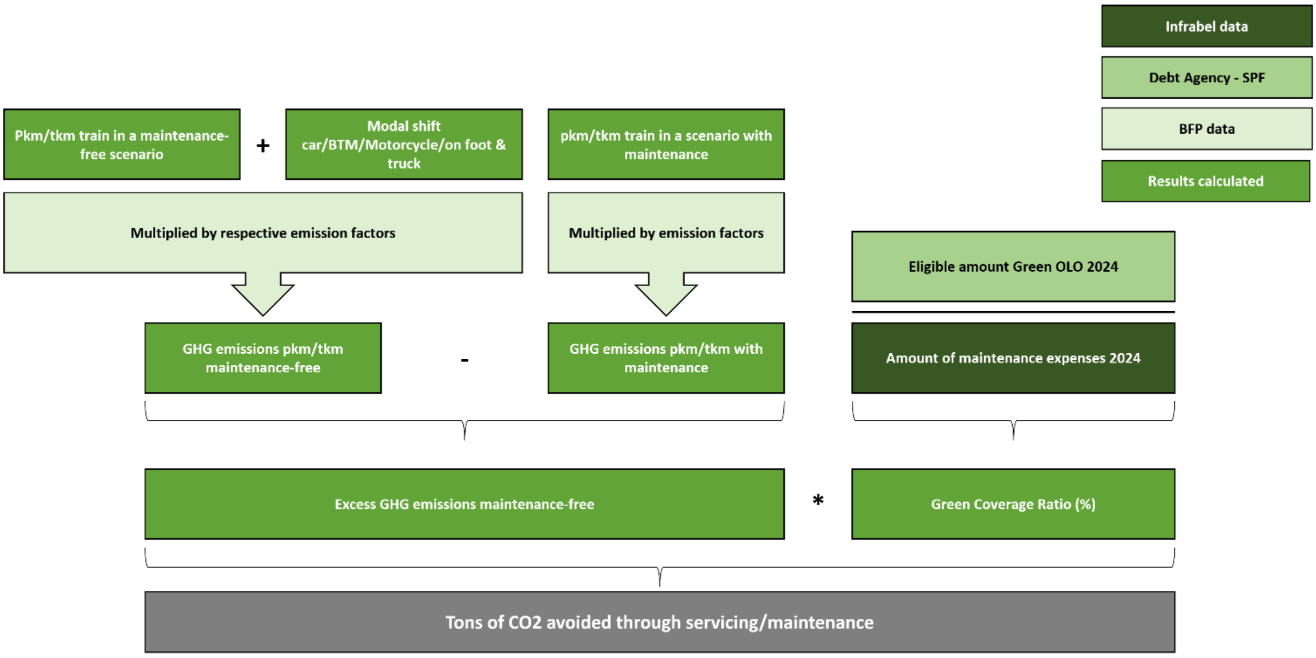
REDUCED PACKAGING CHARGE FOR USING INDIVIDUAL REUSABLE BEVERAGE CONTAINERS	OLO 86 – 2024	OLO 96 - 2024	2023 (allocated in 2024)
Allocated amounts of Green OLO [M€]	2.7	12.9	31.5
Avoided CO_2eq emissions related to Green OLO [kt]	9.9	46.7	114.0
Avoided use of materials related to Green OLO [kt]:			
• **Sand**	7.1	33.2	81.1
• **Lime**	2.8	13.3	32.5
• **Caustic soda**	2.3	10.9	26.7
Avoided glass in the environment [kt]	0.5	2.1	5.1
Avoided glass in the environment related to Green OLO [M number of items]	1.8	8.4	20.6

5 APPENDICES

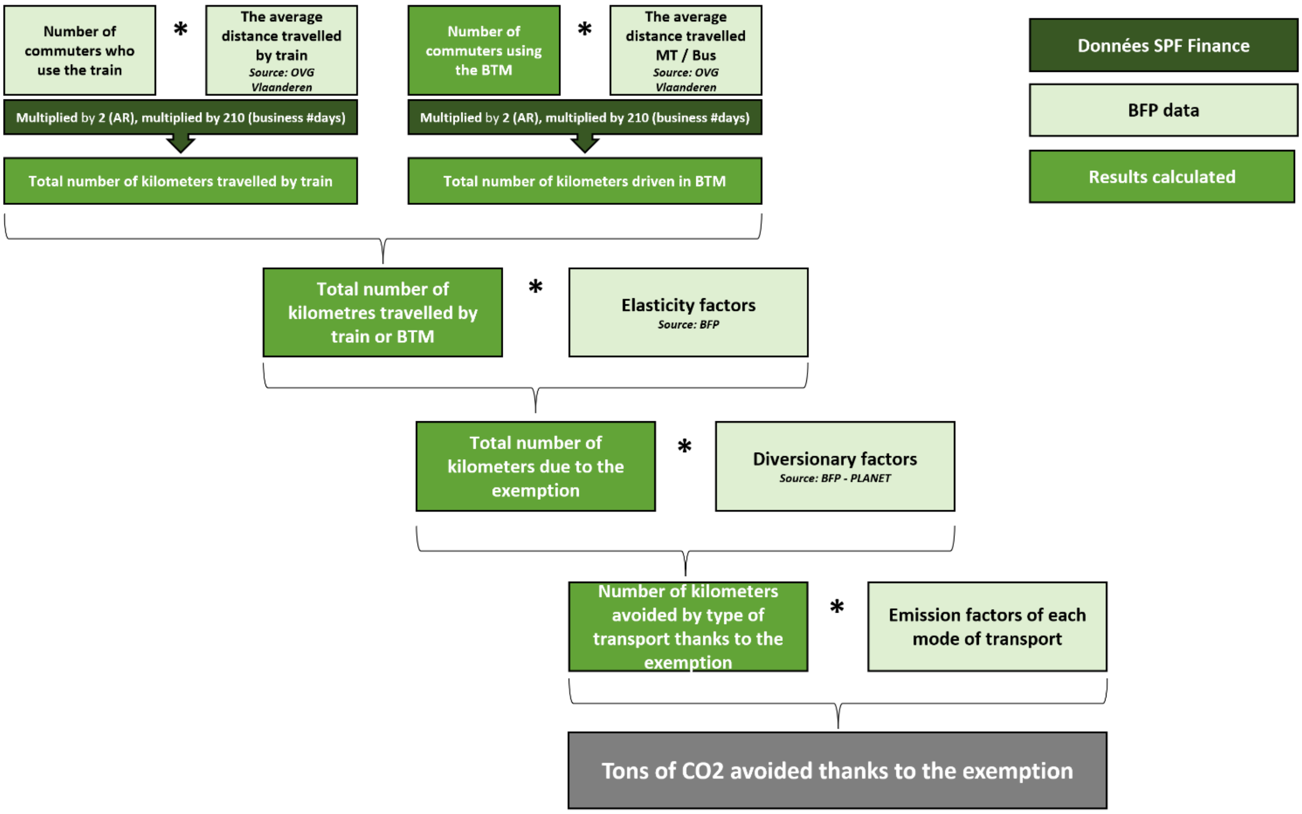
5.1 METHODOLOGICAL ANALYSIS: SUBSIDIES TO SNCB (CAPEX): PURCHASE OF M7 DOUBLE-DECK TRAINS



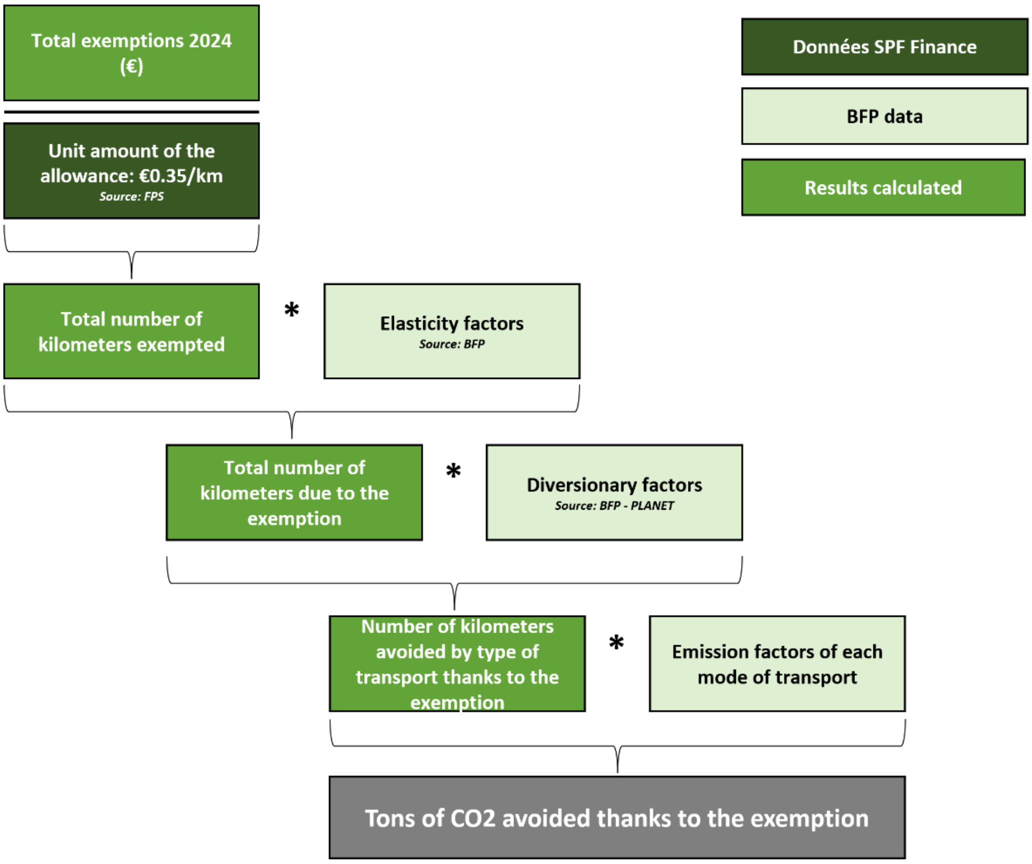
5.2 METHODOLOGICAL ANALYSIS: MAINTENANCE OF RAILWAY INFRASTRUCTURE



5.3 METHODOLOGICAL ANALYSIS: EXEMPTION FOR REIMBURSEMENT OF COMMUTING BY PUBLIC TRANSPORT



5.4 METHODOLOGICAL ANALYSIS: BIKE ALLOWANCE



5.5 METHODOLOGICAL ANALYSIS: REDUCE PACKAGE CHARGE