

Integrated Green Finance Allocation and Impact Report 2021–2023

As of December 31, 2023



HOCHBAHN

1 Purpose

Hamburger Hochbahn AG (HOCHBAHN) is one of the leading local transport companies in Germany. Owned by the City of Hamburg, it operates four metro lines and 117 bus routes in Hamburg, Germany, carrying around 1.3 million passengers a day to their destinations, providing around half of all local transport services in the Hamburg Transport Association (hvv). With over 6,600 employees HOCHBAHN is one of Hamburg’s largest employers.

With its vision of creating intelligent mobility for a future worth living in Hamburg, HOCHBAHN underlines its role as an important mobility partner for the city and aligns its daily activities with this vision. With innovative and sustainable solutions, it ensures simple and user-oriented mobility for all. The aim is to make a significant contribution to reducing greenhouse gas- (GHG-) emissions and support the mobility turnaround by reducing the use of private cars.

A sustainable and attractive range of mobility services with adequate capacity is a key factor to achieve a modal transportation shift towards more environmentally friendly modes of transport, and contributes to global efforts of climate change mitigation and helps to maintain the quality of life in a growing city like Hamburg. HOCHBAHN is committed to the targets set out by the climate action plan of the City of Hamburg, and as a result, is significantly expanding the range of services offered by metros and buses as well as the integration of on-demand services into public transport and the electrification of its bus fleet.

The HOCHBAHN Green Bond issuance is dedicated to the advancement of sustainable transport and will help to accelerate the achievement of the strategic objectives of HOCHBAHN.

With the issuance of the debut Green Bond in February 2021, HOCHBAHN published the “Green Bond Framework”. The “Green Bond Framework” was updated in 2023 and renamed to “[Green Finance Framework](#)”.

HOCHBAHN has commissioned CICERO Shades of Green to review the Green Bond Framework. The second opinion of CICERO Shades of Green confirms compliance with ICMA principles and rates HOCHBAHN’s Green Bond Framework with the highest rating of “Dark Green”.

Following the ICMA Green Bond Principles, HOCHBAHN has promised in its “Green Finance Framework” to publish an annual reporting on its efforts to promote sustainability with the funds provided by investors. With this document, HOCHBAHN intends to deliver on this promise and provide the investors with a comprehensive, transparent and understandable interated allocation and impact report.

Key figures of HOCHBAHN’s bus and metro operations

Bus	2023	2022	2021
Passengers (million)	223.5	189.4	139.0
Passenger kilometres (million)	746.4	626.0	477.5
Number of buses	1,096	1,073	1,106
Number of lines	117	115	116
Number of stations	1,466	1,421	1,452
Metro	2023	2022	2021
Passengers (million)	244.5	199.0	146.8
Passenger kilometres (million)	1,278.3	1,188.1	876.4
Number of carriages	1,007	1,037	995
Number of lines	4	4	4
Number of stations	93	93	93

2 Final Terms

Issuer	Hamburger Hochbahn AG
Issuer Rating	Fitch: AAA
Format	Bond; Senior, Unsecured, Reg S Bearer
Settlement Date	24.02.2021
Maturity	24.02.2031
Volume	€ 500,000,000
ISIN	XS2233088132
Denomination	€ 100,000
Use of Proceeds	Green projects in line with HOCHBAHN's Green Finance Framework
Listing	Luxembourg

Issuer	Hamburger Hochbahn AG
Issuer Rating	Fitch: AAA
Format	Schuldscheindarlehen
Settlement Date	26.04.2023
Maturity	26.04.2030
Volume	€ 6,500,000
ISIN	No. 16352
Denomination	€ 100,000
Use of Proceeds	Green projects in line with HOCHBAHN's Green Finance Framework
Listing	N/A

Issuer	Hamburger Hochbahn AG
Issuer Rating	Fitch: AAA
Format	Schuldscheindarlehen
Settlement Date	26.04.2023
Maturity	26.04.2033
Volume	€ 162,500,000
ISIN	No. 16353
Denomination	€ 100,000
Use of Proceeds	Green projects in line with HOCHBAHN's Green Finance Framework
Listing	N/A

Issuer	Hamburger Hochbahn AG
Issuer Rating	Fitch: AAA
Format	Namenschuldverschreibung
Settlement Date	26.04.2023
Maturity	26.04.2035
Volume	€ 101,500,000
ISIN	No. 16354
Denomination	€ 100,000
Use of Proceeds	Green projects in line with HOCHBAHN's Green Finance Framework
Listing	N/A

Issuer	Hamburger Hochbahn AG
Issuer Rating	Fitch: AAA
Format	Namenschuldverschreibung
Settlement Date	26.04.2023
Maturity	26.04.2038
Volume	€ 29,500,000
ISIN	No. 16355
Denomination	€ 100,000
Use of Proceeds	Green projects in line with HOCHBAHN's Green Finance Framework
Listing	N/A

3 Use of Proceeds

The net proceeds of HOCHBAHN’s Green Finance Portfolio, consisting of the Green Bond as well as the Namensschuldverschreibungen and Schuldscheindarlehen issued in 2023, will be used to finance in whole or in part, new or existing projects (“Eligible Projects”) from any of the Eligible Green Products/Project Categories as defined in HOCHBAHN’s Green Bond Finance Framework:

Green Bond Principles Category: Clean Transportation

Eligibility criteria	Examples of Impact KPI	Alignment with SDG
<p>Metro: Refurbishment of our existing metro network</p> <p>(such as acquisition of rolling stock, refurbishment of existing metro infrastructure (tracks and depots))</p>	<ul style="list-style-type: none"> Increased capacity (available seat km) Avoided emissions compared to cars (CO₂e, NO_x, SO₂)¹ 	<p>7 AFFORDABLE AND CLEAN ENERGY</p> 
<p>Bus: Expansion and refurbishment of our bus network; transformation to a zero-emission bus fleet</p> <p>(such as acquisition of electric buses (battery, fuel-cell), charging infrastructure, construction of new and refurbishment of existing bus depots for electric buses)</p>	<ul style="list-style-type: none"> Increased capacity (available seat km) Avoided emissions compared to cars (CO₂e, NO_x, SO₂)¹ Avoided emissions compared to diesel bus (CO₂e, NO_x, SO₂) 	<p>8 DECENT WORK AND ECONOMIC GROWTH</p>  <p>9 INDUSTRY, INNOVATION AND INFRASTRUCTURE</p> 
<p>Services: Refurbishment and improvements of stations, integration of new customer services and on-demand services contributing to increase the share of integrated public transport over individual car use</p> <p>(such as ticketing, traffic information, passenger guidance systems, ticketing-terminals, service centers, and digital ticketing and service solution; integration of on-demand services and construction of mobility hubs)</p>	<ul style="list-style-type: none"> energy savings (due to refurbishment of metro stations such as new lighting) number of new services and mobility hubs average number of users per day customer satisfaction surveys (qualitative assessment of the projects’ contribution to improve the overall usability and accessibility of the public transport system) 	<p>11 SUSTAINABLE CITIES AND COMMUNITIES</p>  <p>13 CLIMATE ACTION</p> 

¹Avoided carbon emissions = passenger km with public transport (km) x Modal transfer rate (%) (based on surveys) x emissionfactor cars (CO₂e/km)

4 Main Projects

4.1 Renewal of rolling stock

Rolling stock fleet modernization is key for attractive, efficient and sustainable mobility in urban areas. Our current metro vehicle generation DT5 has a consistent lightweight design and enables energy recovery during braking, which significantly reduces energy consumption. In addition, the metro vehicle has a high proportion of recyclable materials. With a wide entrance, a minimised boarding step and the stepless passageways between the carriages and the resulting redundant boarding and alighting options, the DT5 enables barrier-free travel. Transitions between the carriages improve the distribution of passengers throughout the vehicle. The air-conditioned passenger compartment, ergonomically designed seats and an enhanced information system via passenger screens ensure a comfortable journey.

The impact balance of new DT5 metro vehicles financed by Green Bond, SSD and NSV in 2021–2023 is estimated to:

- Number of new metro trains: 48
- Passenger-kilometres: about 270 Mio.
- Avoided-car-kilometres: about 160 Mio.
- Net reduction of GHG emissions by modal shift: about 30,900 t CO₂e
- Net reduction of air pollutants by modal shift:
 - Particulate matter: about 1.7 t PM
 - Nitrogen oxides: about 42.8 t NO_x
 - Sulphur oxide: about 8.5 t SO₂

Additional information can be found:

- Differentiation of impact KPIs by financing instrument (Chapter 5)
- Methodology of Impact assessment (Chapter 6)

7 AFFORDABLE AND CLEAN ENERGY



8 DECENT WORK AND ECONOMIC GROWTH



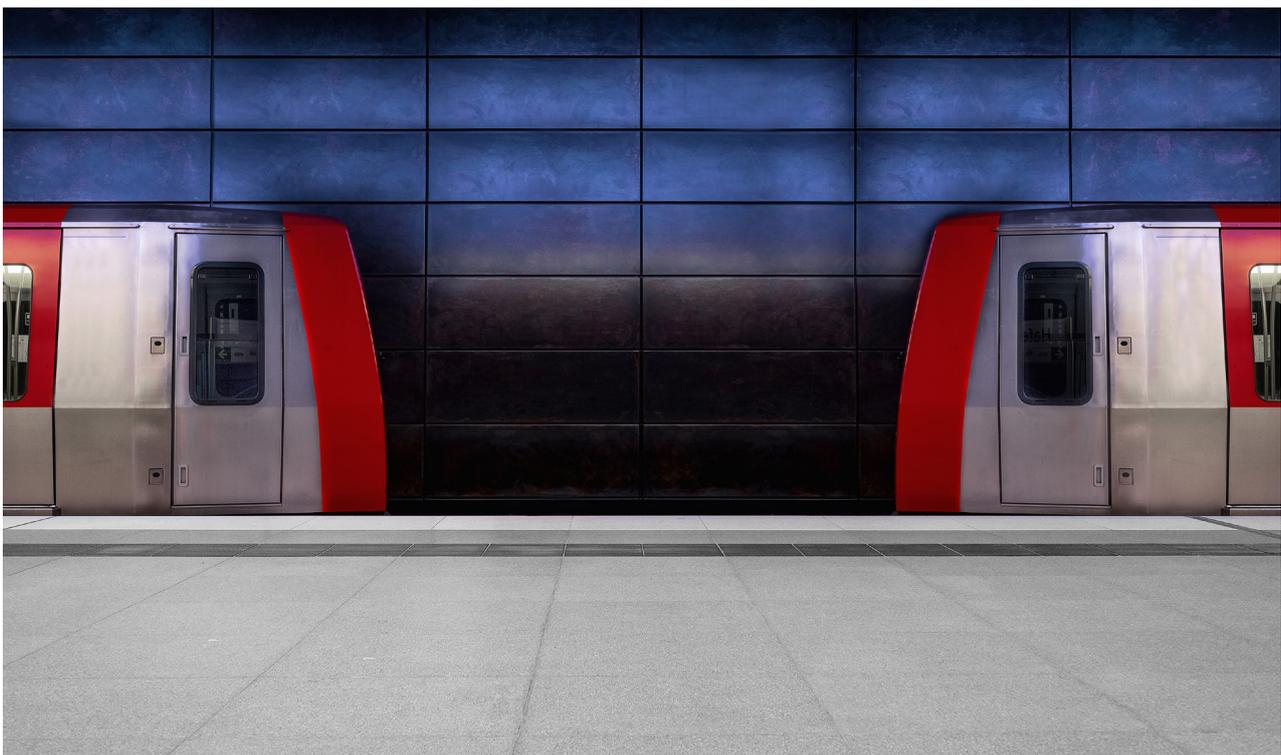
9 INDUSTRY, INNOVATION AND INFRASTRUCTURE



11 SUSTAINABLE CITIES AND COMMUNITIES



13 CLIMATE ACTION



4.2 Electrification bus system

The Clean Transportation category includes also the expansions and refurbishment of our bus network where the focus is the transition of HOCHBAHN's diesel bus fleet to a zero-emission bus network to reduce emissions of greenhouse gases and air pollutants. This includes the acquisition of electric buses with the corresponding charging infrastructure as well as the expansion and new construction of bus depots to fit the future needs of a growing electric bus fleet. New digital solutions for improvement of the bus operation are also part of the category.

The impact balance of electric buses financed by Green Bond, SSD and NSV in 2021–2023 is estimated to:

- Number of new electric buses: 119
- Passenger-kilometres: about 56 Mio.
- Avoided-car-kilometres: about 33 Mio.
- Net reduction of GHG emissions by modal shift and electrification: about 11,500 t CO₂e
- Net reduction of air pollutants by modal shift and electrification:
 - Particulate matter: about 0.8 t PM
 - Nitrogen oxides: about 26.4 t NO_x
 - Sulphur oxide: about 3.9 t SO₂

Additional information can be found:

- Differentiation of impact KPIs by financing instrument (Chapter 5)
- Methodology of Impact assessment (Chapter 6)

7 AFFORDABLE AND CLEAN ENERGY



8 DECENT WORK AND ECONOMIC GROWTH



9 INDUSTRY, INNOVATION AND INFRASTRUCTURE



11 SUSTAINABLE CITIES AND COMMUNITIES



13 CLIMATE ACTION



4.3 hvv switch app + service points (integrated mobility solutions)

The mobility transformation will only become a reality if the current public transport system is aligned very closely with new public mobility services. As a driver of sustainable mobility in Hamburg, HOCHBAHN is therefore expanding its core business to include complementary intuitive mobility services. HOCHBAHN plans to combine its regular public transport services with new mobility services to create a coherent product range that is easy and convenient to use.

The hvv switch platform offers passengers in Hamburg a multimodal service that adapts to their individual mobility needs and will therefore play a decisive role in the implementation of the mobility transformation. The aim of the hvv switch app is to provide users with easy and quick access to their favourite means of public transport services and new sharing services.

As well as being a key part of the digital mobility platform, the hvv switch concept is based on a network of mobility service points that bring together various complementary services, such as car and bike sharing, in one place.

The impact balance of hvv switch financed by Green Bond, SSD and NSV in 2021–2023 is estimated to:

- Number of new hvv mobility service points: 71
- Number of new hvv switch app registrations: about 800,000

Additional information can be found:

- Differentiation of impact KPIs by financing instrument (Chapter 5)

7 AFFORDABLE AND CLEAN ENERGY



8 DECENT WORK AND ECONOMIC GROWTH



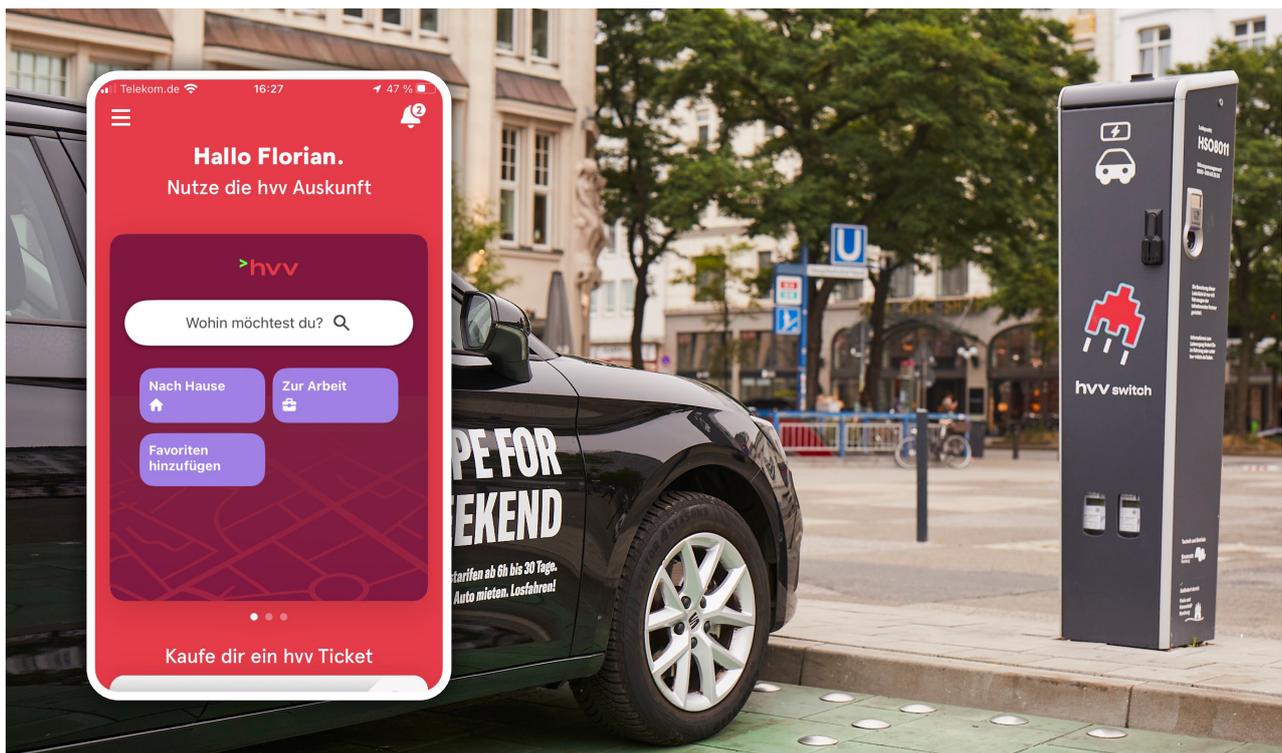
9 INDUSTRY, INNOVATION AND INFRASTRUCTURE



11 SUSTAINABLE CITIES AND COMMUNITIES



13 CLIMATE ACTION



5 Impact and Allocation of Proceeds 2021-2023

By the end of 2023, HOCHBAHN has allocated the proceeds from the Green Bond fully. An additional € 213.2 million has been allocated from proceeds of the new issued instruments. Thereof 100% was used to finance new projects. Pending full allocation, the balance was deposited on money market accounts of ESG-compliant banks.

5.1 Inst. Number XS2233088132 → p. 10

5.2 Inst. Number SSD, No. 16352 → p. 11

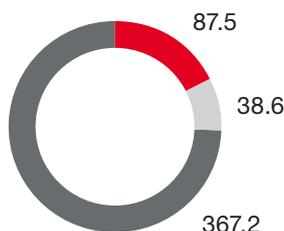
5.3 Inst. Number SSD, No. 16353 → p. 12

5.4 Inst. Number NSV, No. 16354 → p. 13

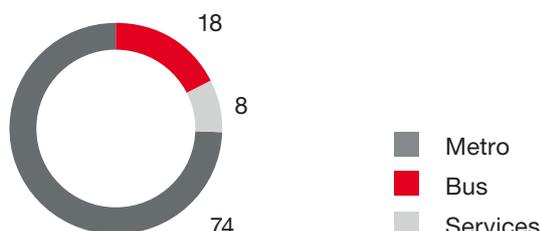
5.5 Inst. Number NSV, No. 16355 → p. 14

5.1 Inst. Number XS2233088132

Allocated amount (Mio. €)



Share of allocated amount (%)



The following table provides a detailed view on the use of proceeds

Clean Transportation Portfolio	Signed Amount (Mio. €)	Share of Total Project Financing	Eligibility for green bonds	Clean Transportation portfolio component	Allocated Amount (Mio. €)	Portfolio lifetime
Metro: Refurbishment of our existing metro network	7,357.2	100 %	100 %	100 %	367.2	+40Y
Bus: Expansion and refurbishment of our bus network; transformation to a zero-emission bus fleet	695.0	100 %	100 %	100 %	87.5	+40Y
Services: Refurbishment and improvements of stations, integration of new customer services and on-demand services contributing to increase the share of integrated public transport over individual car use	312.7	100 %	100 %	100 %	38.6	+15Y
Total	8,364.9	100 %	100 %	100 %	493.4	+40Y

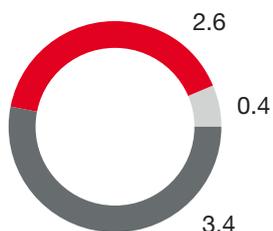
The following table provides a detailed view on the Impact of proceeds 2021–2023

Clean Transportation Portfolio	Passenger-kilometres (km)	GHG emissions net reduction (tCO ₂ e in 2021–2023) tCO ₂ e over depreciation period		Air pollutants net reduction (kg in 2021–2023) kg over depreciation period		Other Indicators in 2023 ²		
Metro: Refurbishment of our existing metro network	266,866,016.8	-30,619.8	-408,264.1	Particulate matter (kgPM)	-1,708.4	-22,779.3	Number of new metro trains:	44
				Nitrogen oxides (kgNO _x)	-42,405.9	-565,412.2	Avoided car-kilometres:	158,511,227
				Sulphur oxides (kgSO ₂)	-8,421.1	-112,281.6		
Bus: Expansion and refurbishment of our bus network; transformation to a zero-emission bus fleet	47,831,602.7	-9,900.4	-33,001.2	Particulate matter (kgPM)	-685.9	-2,286.4	Number of new electric buses:	73
				Nitrogen oxides (kgNO _x)	-22,618.5	-75,395.1	Avoided car-kilometres:	28,246,489
				Sulphur oxides (kgSO ₂)	-3,309.7	-11,032.3		
	314,697,619.5	-40,520.2	-441,265.3	Particulate matter (kgPM)	-2,394.4	-25,065.7		
				Nitrogen oxides (kgNO _x)	-65,024.4	-640,807.3		
				Sulphur oxides (kgSO ₂)	-11,730.8	-123,313.9		
Services: Refurbishment and improvements of stations, integration of new customer services and on-demand services contributing to increase the share of integrated public transport over individual car use							Number of new mobility hubs (hvv switch):	19
							Number of new hvv-switch app registrations:	255.080
							Energy savings through lighting refurbishment in metro trains [kWh]:	-560.490

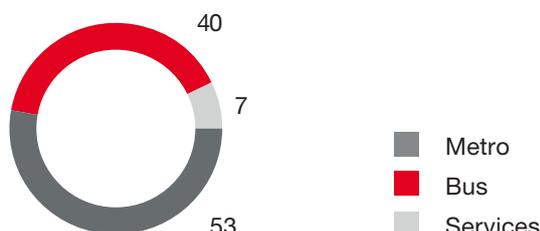
² Determination proportionally according to the allocation of the proceeds from the financial instruments and rounded up greater than 1.

5.2 Inst. Number SSD, No. 16352

Allocated amount (Mio. €)



Share of allocated amount (%)



The following table provides a detailed view on the use of proceeds

Clean Transportation Portfolio	Signed Amount (Mio. €)	Share of Total Project Financing	Eligibility for green bonds	Clean Transportation portfolio component	Allocated Amount (Mio. €)	Portfolio lifetime
Metro: Refurbishment of our existing metro network	4,397.3	100 %	100 %	100 %	3.4	+40Y
Bus: Expansion and refurbishment of our bus network; transformation to a zero-emission bus fleet	461.2	100 %	100 %	100 %	2.6	+40Y
Services: Refurbishment and improvements of stations, integration of new customer services and on-demand services contributing to increase the share of integrated public transport over individual car use	178.1	100 %	100 %	100 %	0.4	+15Y
Total	5,036.6	100 %	100 %	100 %	6.5	+40Y

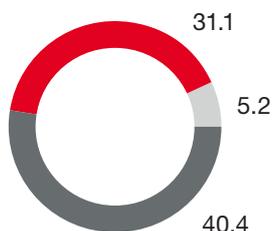
The following table provides a detailed view on the Impact of proceeds in 2023

Clean Transportation Portfolio	Passenger-kilometres (km)	GHG emissions net reduction (tCO ₂ e in 2023) over depreciation period		Air pollutants net reduction (kg in 2023) over depreciation period		Other Indicators in 2023 ²		
Metro: Refurbishment of our existing metro network	81,485.3	-9.1	-365.1	Particulate matter (kgPM)	-0.5	-20.3	Number of new metro trains:	1
				Nitrogen oxides (kgNO _x)	-12.5	-501.8	Avoided car-kilometres:	47,261
				Sulphur oxides (kgSO ₂)	-2.6	-102.5		
Bus: Expansion and refurbishment of our bus network; transformation to a zero-emission bus fleet	248,610.4	-50.8	-508.4	Particulate matter (kgPM)	-3.5	-35.2	Number of new electric buses:	1
				Nitrogen oxides (kgNO _x)	-116.2	-1,161.8	Avoided car-kilometres:	144,194
				Sulphur oxides (kgSO ₂)	-16.9	-169.2		
	330,095.7	-60.0	-873.5	Particulate matter (kgPM)	-4.0	-55.5		
				Nitrogen oxides (kgNO _x)	-128.7	-1,663.6		
				Sulphur oxides (kgSO ₂)	-19.5	-271.8		
Services: Refurbishment and improvements of stations, integration of new customer services and on-demand services contributing to increase the share of integrated public transport over individual car use				Number of new mobility hubs (hvv switch):			1	
				Number of new hvv switch app registrations:			16,532	
				Energy savings through lighting refurbishment in metro trains [kWh]:			-17,165	

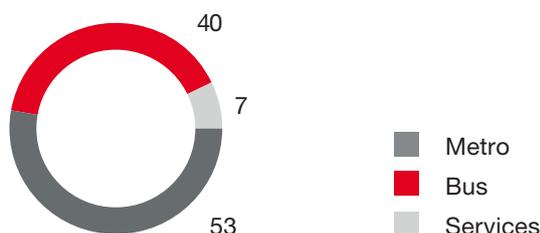
² Determination proportionally according to the allocation of the proceeds from the financial instruments and rounded up greater than 1.

5.3 Inst. Number SSD, No. 16353

Allocated amount (Mio. €)



Share of allocated amount (%)



The following table provides a detailed view on the use of proceeds

Clean Transportation Portfolio	Signed Amount (Mio. €)	Share of Total Project Financing	Eligibility for green bonds	Clean Transportation portfolio component	Allocated Amount (Mio. €)	Portfolio lifetime
Metro: Refurbishment of our existing metro network	4,397.3	100 %	100 %	100 %	40.4	+40Y
Bus: Expansion and refurbishment of our bus network; transformation to a zero-emission bus fleet	461.2	100 %	100 %	100 %	31.1	+40Y
Services: Refurbishment and improvements of stations, integration of new customer services and on-demand services contributing to increase the share of integrated public transport over individual car use	178.1	100 %	100 %	100 %	5.2	+15Y
Total	5,036.6	100 %	100 %	100 %	76.8	+40Y

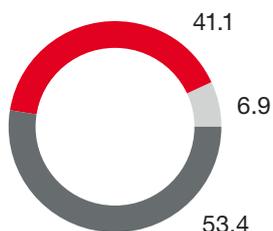
The following table provides a detailed view on the Impact of proceeds in 2023

Clean Transportation Portfolio	Passenger-kilometres (km)	GHG emissions net reduction (tCO ₂ e in 2023) over depreciation period		Air pollutants net reduction (kg in 2023) over depreciation period		Other Indicators in 2023 ²		
Metro: Refurbishment of our existing metro network	962,186.0	-107.8	-4,311.3	Particulate matter (kgPM)	-6.0	-239.6	Number of new metro trains:	1
				Nitrogen oxides (kgNO _x)	-148.1	-5,925.3	Avoided car-kilometres:	558,068
				Sulphur oxides (kgSO ₂)	-30.3	-1,210.8		
Bus: Expansion and refurbishment of our bus network; transformation to a zero-emission bus fleet	2,935,615.0	-600.3	-6,003.3	Particulate matter (kgPM)	-41.5	-415.3	Number of new electric buses:	17
				Nitrogen oxides (kgNO _x)	-1,371.9	-13,718.9	Avoided car-kilometres:	1,702,657
				Sulphur oxides (kgSO ₂)	-199.8	-1,998.1		
	3,897,801.0	-708.1	-10,314.5	Particulate matter (kgPM)	-47.5	-654.9		
				Nitrogen oxides (kgNO _x)	-1,520.0	-19,644.2		
				Sulphur oxides (kgSO ₂)	-199.8	-3,208.9		
Services: Refurbishment and improvements of stations, integration of new customer services and on-demand services contributing to increase the share of integrated public transport over individual car use				Number of new mobility hubs (hvv switch):			19	
				Number of new hvv switch app registrations:			195,209	
				Energy savings through lighting refurbishment in metro trains [kWh]:			-202,685	

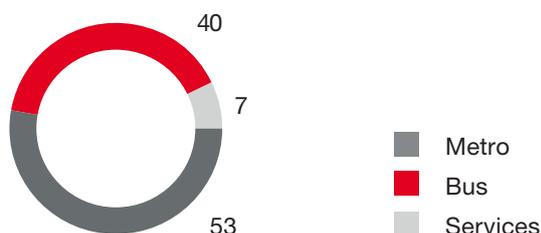
² Determination proportionally according to the allocation of the proceeds from the financial instruments and rounded up greater than 1.

5.4 Inst. Number NSV, No. 16354

Allocated amount (Mio. €)



Share of allocated amount (%)



The following table provides a detailed view on the use of proceeds

Clean Transportation Portfolio	Signed Amount (Mio. €)	Share of Total Project Financing	Eligibility for green bonds	Clean Transportation portfolio component	Allocated Amount (Mio. €)	Portfolio lifetime
Metro: Refurbishment of our existing metro network	4,397.3	100 %	100 %	100 %	53.4	+40Y
Bus: Expansion and refurbishment of our bus network; transformation to a zero-emission bus fleet	461.2	100 %	100 %	100 %	41.1	+40Y
Services: Refurbishment and improvements of stations, integration of new customer services and on-demand services contributing to increase the share of integrated public transport over individual car use	178.1	100 %	100 %	100 %	6.9	+15Y
Total	5,036.6	100 %	100 %	100 %	101.5	+40Y

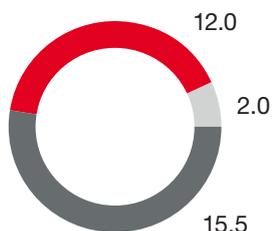
The following table provides a detailed view on the Impact of proceeds in 2023

Clean Transportation Portfolio	Passenger-kilometres (km)	GHG emissions net reduction (tCO ₂ e in 2023) tCO ₂ ekg over depreciation period		Air pollutants net reduction (kg in 2023) kg over depreciation period		Other Indicators in 2023 ²		
Metro: Refurbishment of our existing metro network	1,272,424.1	-142.5	-5,701.3	Particulate matter (kgPM)	-7.9	-316.9	Number of new metro trains:	1
				Nitrogen oxides (kgNO _x)	-195.9	-7,835.8	Avoided car-kilometres:	738,006
				Sulphur oxides (kgSO ₂)	-40.0	-1,601.1		
Bus: Expansion and refurbishment of our bus network; transformation to a zero-emission bus fleet	3,882,146.8	-793.9	-7,938.9	Particulate matter (kgPM)	-54.9	-549.2	Number of new electric buses:	22
				Nitrogen oxides (kgNO _x)	-1,814.2	-18,142.2	Avoided car-kilometres:	2,251,645
				Sulphur oxides (kgSO ₂)	-264.2	-2,642.4		
Total	5,154,571.0	-936.4	-13,640.3	Particulate matter (kgPM)	-62.8	-866.1		
				Nitrogen oxides (kgNO _x)	-2,010.1	-25,978.1		
				Sulphur oxides (kgSO ₂)	-304.3	-4,243.5		
Services: Refurbishment and improvements of stations, integration of new customer services and on-demand services contributing to increase the share of integrated public transport over individual car use				Number of new mobility hubs (hvv switch):			25	
				Number of new hvv-switch app registrations:			258,150	
				Energy savings through lighting refurbishment in metro trains [kWh]:			-268,037	

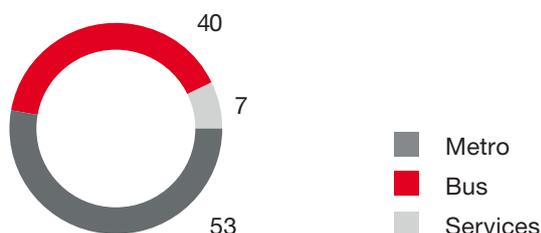
² Determination proportionally according to the allocation of the proceeds from the financial instruments and rounded up greater than 1.

5.5 Inst. Number NSV, No. 16355

Allocated amount (Mio. €)



Share of allocated amount (%)



The following table provides a detailed view on the use of proceeds

Clean Transportation Portfolio	Signed Amount (Mio. €)	Share of Total Project Financing	Eligibility for green bonds	Clean Transportation portfolio component	Allocated Amount (Mio. €)	Portfolio lifetime
Metro: Refurbishment of our existing metro network	4,397.3	100 %	100 %	100 %	15.5	+40Y
Bus: Expansion and refurbishment of our bus network; transformation to a zero-emission bus fleet	461.2	100 %	100 %	100 %	12.0	+40Y
Services: Refurbishment and improvements of stations, integration of new customer services and on-demand services contributing to increase the share of integrated public transport over individual car use	178.1	100 %	100 %	100 %	2.0	+15Y
Total	5,036.6	100 %	100 %	100 %	29.5	+40Y

The following table provides a detailed view on the Impact of proceeds in 2023

Clean Transportation Portfolio	Passenger-kilometres (km)	GHG emissions net reduction (tCO ₂ e in 2023) over depreciation period		Air pollutants net reduction (kg in 2023) over depreciation period		Other Indicators in 2023 ²		
Metro: Refurbishment of our existing metro network	369,817.8	-41.4	-1,657.0	Particulate matter (kgPM)	-2.3	-92.1	number of new metro trains:	1
				Nitrogen oxides (kgNO _x)	-56.9	-2,277.4	Avoided car-kilometres:	214,494
				Sulphur oxides (kgSO ₂)	-11.6	-465.4		
Bus: Expansion and refurbishment of our bus network; transformation to a zero-emission bus fleet	1,128,308.7	-230.7	-2,307.4	Particulate matter (kgPM)	-16.0	-159.6	Number of new electric buses:	6
				Nitrogen oxides (kgNO _x)	-527.3	-5,272.9	Avoided car-kilometres:	654,419
				Sulphur oxides (kgSO ₂)	-76.8	-768.0		
	1,498,126.5	-272.2	-3,964.4	Particulate matter (kgPM)	-18.3	-251.7		
				Nitrogen oxides (kgNO _x)	-584.2	-7,550.3		
				Sulphur oxides (kgSO ₂)	-88.4	-1,233.3		
Services: Refurbishment and improvements of stations, integration of new customer services and on-demand services contributing to increase the share of integrated public transport over individual car use				Number of new mobility hubs (hvv switch):			7	
				Number of new hvv-switch app registrations:			75,029	
				Energy savings through lighting refurbishment in metro trains [kWh]:			-77,902	

² Determination proportionally according to the allocation of the proceeds from the financial instruments and rounded up greater than 1.

6 Methodology of impact assessment

The main positive impacts are based on reduction and avoidance of greenhouse gas (GHG) emissions as well as air pollution due to

- Modal Shift (from private car use to public transport use) and
- Electrification (electric bus compared to diesel bus).

Therefore, the reduction and avoidance of GHG emissions and of air pollution has been estimated for the project categories “Metro: Refurbishment of our metro network” and “Bus: Expansion and refurbishment of our bus network; transformation to a zero-emission bus fleet”. When estimating the net reduced and avoided emissions, emissions caused by operating our own metro and bus services were taken into account (Well-to-Wheel).³

Net avoided emissions = Avoided emissions – Caused emissions

Details regarding the methodology can be found below (the numbers in brackets refer to the respective calculation factors found in 6.3).

6.1 Calculation of avoided emissions

6.1.1 Modal shift

Emissions	Calculation
Greenhouse gases (CO ₂ e)	passenger-km with financed e-buses resp. metro-vehicles (pkm) x Modal transfer rate (%) (1) x emission factor cars (CO ₂ e / passenger-km) (2)
Air pollutants (NO _x , PM, SO ₂)	passenger-km with financed e-buses resp. metro-vehicles (pkm) x Modal transfer rate (%) (1) x emission factor cars (NO _x (3) resp. PM (4) resp. SO ₂ (5) / passenger-km)

6.1.2 Electrification (bus fleet)

Emissions	Calculation
Greenhouse gases (CO ₂ e)	vehicle-km of financed e-buses x emission factor diesel-bus / vehicle-km (6)
Air pollutants (NO _x , PM, SO ₂)	passenger-km of financed e-buses x emission factor diesel-bus (NO _x (3) resp. PM (4) resp. SO ₂ (5) / passenger-km)

³ Well-to-Wheel includes both emissions from the production and distribution of the used energy (Well-to-Tank) and emissions generated during the vehicle's operation (Tank-to-Wheel)

6.2 Calculation of caused emissions

Emissions	Calculation
Greenhouse gases (CO ₂ e)	passenger-km with financed e-buses resp. metro-vehicles (pkm) x emission factor e-buses resp. metro-vehicles (CO ₂ e / passenger-km) (2)
Air pollutants (NO _x , PM, SO ₂)	passenger-km with financed e-buses resp. metro-vehicles (pkm) x emission factor e-buses resp. metro-vehicles (NO _x , PM, SO ₂ / passenger-km) (3, 4, 5)

6.3 Calculation factors

(1) Used modal transfer rate in %⁴

	2021	2022	2023	Data Base
Share of HOCHBAHN customers using their own private car, taxi or car sharing in Hamburg when public transport services are not available	61%	61%	58%	Customer surveys conducted every two years (here 2021 and 2023)

(2) Used GHG emission factors per passenger-km (Well-to-Wheel) in g CO₂e / passenger-km

	2021	2022	2023	Data Base
Metro	4.7	3.5	3.5	Own calculation (Fleet data)
Electric Bus	18.2	13.9	12.7	Own calculation (Fleet data)
Electric Bus (articulated)	18.2	14.0	12.7	Own calculation (Fleet data)
Diesel Bus	149.3	116.0	101.7	Own calculation (Fleet data)
Diesel Bus (articulated)	137,6	106,9	93,7	Own calculation (Fleet data)
Private Car (urban)⁵	200.7	199.1	199.1 ⁶	TREMOD 6.5.3

(3) Used Nitrogen oxides (NO_x) emission factors per passenger-km (Well-to-Wheel) in g NO_x / passenger-km

	2021	2022	2023 ⁶	Data Base
Metro	0.07	0.06	0.06	TREMOD 6.5.3
Electric Bus	0.11	0.09	0.09	TREMOD 6.5.3
Diesel Bus	0.46	0.35	0.35	TREMOD 6.5.3
Private Car (urban)⁵	0.39	0.36	0.36	TREMOD 6.5.3

⁴ Question in survey: Now please imagine that the last time you travelled by public transport there was no public transport, e.g. due to a strike. How would you have reacted then?

⁵ Identical emission factors are applied to both taxis and car sharing

⁶ The TREMOD 6.5.3 dataset includes values only up to the year 2022. Therefore, for the year 2023, the values from 2022 were applied.

(4) Used Partikel (PM) emission factors per passenger-km (Well-to-Wheel) in g PM / passenger-km

	2021	2022	2023 ⁶	Data Base
Metro	0.003	0.003	0.003	TREMOD 6.5.3
Electric Bus	0.005	0.004	0.004	TREMOD 6.5.3
Diesel Bus	0.012	0.010	0,010	TREMOD 6.5.3
Private Car (urban)⁵	0.016	0.015	0.015	TREMOD 6.5.3

(5) Used Partikel (SO₂) emission factors per passenger-km (Well-to-Wheel) in g SO₂ / passenger-km

	2021	2022	2023 ⁶	Data Base
Metro	0.042	0.027	0.027	TREMOD 6.5.3
Electric Bus	0.051	0.045	0.045	TREMOD 6.5.3
Diesel Bus	0.064	0.054	0.054	TREMOD 6.5.3
Private Car (urban)⁵	0.102	0.101	0.101	TREMOD 6.5.3

(6) Used GHG emission factors per vehicle-km (Well-to-Wheel) in g CO₂e / vehicle-km

	2021	2022	2023	Data Base
Electric Bus	154.0	152.2	158.0	Own calculation (Fleet data)
Electric Bus (articulated)	231.2	228.4	237.3	Own calculation (Fleet data)
Diesel Bus⁷	1,266.5	1,266.5	1,266.5	Own calculation (Fleet data)
Diesel Bus (articulated)⁷	1,750.5	1,750.5	1,750.5	Own calculation (Fleet data)

(7) Used Well-to-Wheel emission factors per energy unit

	2021	2022	2023	Data Base
Onshore wind energy in g CO₂e / kWh	36.3	35.4	38.4	UBA & DESNZ (formerly DEFRA)
Diesel in g CO₂e / l	3,142.8	3,142.8	3,142.8	DIN EN ISO 14083:2023
Heating oil in g CO₂e / l	3,142.8	3,142.8	3,142.8	DIN EN ISO 14083:2023

⁵ Identical emission factors are applied to both taxis and car sharing

⁶ The TREMOD 6.5.3 dataset includes values only up to the year 2022. Therefore, for the year 2023, the values from 2022 were applied.

⁷ Due to unchanged emission factors for diesel and heating oil, as well as constant specific consumption rates, the values for diesel buses remained consistent between 2021 and 2023

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