

Vehicle Cost Calculation for Commercial Vehicles for Agent-Based Simulations

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Date of this version: August 27, 2026

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1 Purpose and Scope

This vehicle cost calculation can be used for the commercial vehicles in transport scenarios for agent-based simulation. The calculation is based on the commercial net cost perspective, which is the relevant perspective for fleet operators. The cost rates are used when solving vehicle routing problems with jsprit and when representing vehicle operation in the Multi-Agent Transport Simulation (MATSim) software [11, 12]. The calculation follows the same structure as previous MATSim-based work on commercial electric vehicles and waste collection vehicles [7, 9]. Most conventional vehicle parameters are based on the updated cost and valuation report for the German Federal Transport Infrastructure Plan [19]; additional vehicle-specific assumptions and calculation steps are documented in the tables below.

All tables use the commercial net cost perspective without value-added tax. The values therefore represent commercial cost calculations from the operator perspective rather than consumer prices. Fleet management and other general overheads are included in the fixed cost component, and personnel costs are included through the time-dependent labor cost component. Unless noted otherwise, the reported simulation cost rates are final scenario input values at the 2024 price level. The price level harmonization and the subsequent aggregation into fixed, distance-dependent, and time-dependent cost rates are described in Section 2.

All battery capacity values shown in the overview and vehicle-specific tables are usable battery capacities in kWh. For tour planning it has to be decided if the full usable battery capacity can be used for driving or if a reserve has to be applied. For battery-electric waste collection vehicles, it has to be considered that the energy required for waste collection and compaction is not available for driving. For these vehicles, the energy consumption for waste collection and compaction is assumed to be 1.4 kWh/t of waste collected [7].

2 Cost Calculation

The calculation uses the 2021 price level as the common monetary reference because the main source, the updated cost and valuation report for the German Federal Transport Infrastructure Plan, reports its cost and valuation parameters at the 2021 price level [19]. All monetary components are therefore first converted from the price level of their source year to the 2021 price level using inflation factors derived from the German consumer price index published by Destatis [17]. After the component-specific costs have been assembled, the resulting cost parameters are transformed from the 2021 price level to the price level of the target year using the corresponding inflation factors from the same source.

Some parameters are excluded from this inflation adjustment: Statutory or administratively set nominal components, such as vehicle tax, energy taxes, and Carbon price components, are not inflated with the consumer price index because they are treated as fixed nominal rates or specified directly as values for the target year.

For each vehicle type, the cost model separates fixed daily costs, distance-dependent costs, and time-dependent costs. This mirrors the cost structure required by the vehicle routing model. The simulation cost parameters are calculated as

$$c_{\text{fix}} = C_{\text{ownership},d}, \quad (1)$$

$$c_{\text{dist}} = \frac{C_{\text{operation},100} + C_{\text{energy},100}}{100000}, \quad (2)$$

$$c_{\text{time}} = \frac{C_{\text{labor},h}}{3600}. \quad (3)$$

Here,

- c_{fix} is the fixed cost per vehicle day in EUR/d,
- c_{dist} is the distance-dependent cost in EUR/m, and
- c_{time} is the time-dependent cost in EUR/s.

For the usage in simulations like MATSim and jsprit, the distance-dependent cost is converted to EUR/m, and the time-dependent cost is converted to EUR/s.

The daily ownership cost component, $C_{\text{ownership},d}$, contains vehicle costs, depreciation, interest, insurance, vehicle tax, storage, fleet management overheads, and general costs. Vehicle tax values are documented separately in [Sec. 2.4](#). Annual values are converted to daily costs using the assumed operating days per year. In the calculation structure, insurance and vehicle tax are fixed ownership cost elements, whereas tire wear and repairs/maintenance are represented as distance-dependent operating cost elements.

The distance cost component combines the non-energy operating cost, $C_{\text{operation},100}$, which contains tire wear, repairs and maintenance, with the energy cost, $C_{\text{energy},100}$. These are given per 100 km; since the result is given per m, the sum needs to be divided by 100000. The energy component uses the vehicle-specific consumption and the energy price applicable in the target year. For diesel and gasoline vehicles, the final energy price includes fuel tax and carbon price assumptions. For Battery Electric Vehicles (BEVs), the final electricity price includes electricity taxes and charges. Fuel tax, electricity tax, and vehicle tax components that are defined as nominal statutory rates are carried forward nominally and are not adjusted for inflation with the consumer price index.

Labor costs, $C_{\text{labor},h}$ represent personnel costs and are treated as time-dependent costs, converted from EUR per vehicle-hour to EUR per second. Charging infrastructure is not included in the vehicle cost rates and has to be considered separately in the simulation if required.

2.1 Calculation of Fuel-Specific Carbon Price Components

For gasoline and diesel vehicles, the carbon content is reverse engineered from 2021 values as follows: The 2021 Carbon price components per liter, 0.0590 EUR/L for gasoline and 0.0660 EUR/L for diesel, and the 2021 carbon price of 25.00 EUR/t are taken from the TRIMODE vehicle cost source [19]. The fuel-specific carbon contents are then derived from these 2021 values. For gasoline, the factor is

$$\frac{0.0590 \text{ EUR/L}}{25.00 \text{ EUR/t}} = 0.002360 \text{ t/L} ;$$

for diesel, it is

$$\frac{0.0660 \text{ EUR/L}}{25.00 \text{ EUR/t}} = 0.002640 \text{ t/L} .$$

The 2024 gasoline Carbon price component used in the VW Golf example is therefore calculated as

$$45 \text{ EUR/t} \cdot 0.002360 \text{ t/L} = 0.1062 \text{ EUR/L} ,$$

using the fixed 2024 carbon price of 45 EUR/t from the German Fuel Emissions Trading Act (Brennstoffemissionshandelsgesetz) (BEHG) [6].

2.2 BEV Cost Calculation

For the BEV variants, depreciation and interest are calculated from the assumed purchase costs using the same depreciation and interest rate assumptions as for the corresponding conventional vehicles. All other cost parameters are transferred from the conventional reference vehicles where no BEV-specific value is available. The repair and maintenance component is adjusted for alternative powertrains: a 25% reduction relative to the conventional reference vehicle is applied because fewer vehicle components are assumed to be used in operation [19].

2.3 Passenger Car Insurance Costs

For passenger cars, the insurance component combines comprehensive insurance (“Kasko”) and liability insurance. The value is derived from the 2021 household budget statistics published by Destatis, which report monthly household expenditure of 40 EUR for motor vehicle insurance in Table Ü2.1, line 72 [16]. The monthly household value is annualized and allocated to the privately held passenger car fleet by combining the number of private households in Germany in 2021 [18] with the number of privately held passenger cars in the KBA *FZ 23* vehicle stock statistics [13]. The resulting annual passenger car insurance cost is shown in Table 1.

Table 1: Derivation of the passenger car insurance cost component at the 2021 price level.

Component	Calculation or source	Value
Monthly motor vehicle insurance expenditure per household	household budget statistics, Table Ü2.1, line 72 [16]	40.00 EUR/month
Annual motor vehicle insurance expenditure per household	40.00 EUR/month · 12 months/a	480.00 EUR/a
Private households in Germany	2021 value from household time series [18]	40,423,000
Privately held passenger cars	2021 value from KBA <i>FZ 23</i> [13]	43,063,503 vehicles
passenger car insurance cost, including insurance tax, 2021	$480.00 \cdot 40,423,000 / 43,063,503$	450.57 EUR/a
passenger car insurance cost, excluding insurance tax, 2021	$450.57 \text{ EUR/a} / 1.19$	378.63 EUR/a

2.4 Vehicle Tax

Vehicle tax is treated as a fixed ownership cost component. For conventional vehicles, the annual vehicle tax value is calculated with the official motor vehicle tax calculator of the German Federal Ministry of Finance [5]. For the calculation for the target year (i.e., 2024), pure BEVs are assigned zero vehicle tax because German rules exempt pure electric vehicles first registered by 31 December 2030 from motor vehicle tax for up to ten years, with the exemption limited to 31 December 2035. After the exemption period, the motor vehicle tax is reduced by 50% [5]. For tractor-trailer combinations, this exemption applies to the electric tractor unit; where the calculation models the trailer jointly, a separately calculated trailer tax component can remain in the vehicle tax row at the combination level.

2.5 Example Cost Calculation

The same calculation sequence is applied to all vehicle types. Table 2 shows the calculation for the VW Golf 1.0 TSI as an example of the vehicle cost calculation without charging infrastructure costs included in fixed costs. The remaining vehicle types are calculated analogously from their vehicle-specific component values.

Table 2: Example for deriving the simulation cost parameters of the VW Golf 1.0 TSI. The example follows the commercial net cost column of the calculation workbook and reports the component values used for the 2024 scenario input.

Component	Calculation/Source	Result
General assumptions and price level conversion		
Target year and operating days	Set for each scenario	2024; 260 d/a
Chassis price conversion	Source value is at the 2021 price level	16,104.00 EUR
Chassis price, 2021	$16,104.00 \cdot 1.0(\text{inflation})$	16,104.00 EUR
Fixed vehicle ownership cost		
Tires, 2021	[19]	346.00 EUR
Interest with 1.7%	$0.017 \cdot (16,104.00 + 346.00) \cdot 0.5$	139.83 EUR/a
Time-dependent depreciation	$16,104.00/12$	1,342.00 EUR/a
Garaging, 2021	[19]	436.00 EUR/a
Commercial vehicle overhead and fleet management component, 2021	[19]	6,278.00 EUR/a
Insurance, 2021	Comprehensive and liability insurance, including insurance tax; see Sec. 2.3	450.57 EUR/a
Vehicle tax, 2024	Calculated with tax calculator [5]	75.40 EUR/a
Ownership cost before insurance and tax	$139.83 + 1,342.00 + 436.00 + 6,278.00$	8,195.83 EUR/a
Fixed vehicle ownership cost, 2024	$((8,195.83 + 450.57) \cdot 1.157129(\text{inflation}) + 75.40)/260$	38.77 EUR/d
Distance-dependent operating cost excluding energy and labor		
Tire mileage	[19]	50,000 km
Tire wear, 2021	$346.00/50,000 \cdot 100$	0.692 EUR/100 km
Repair and maintenance, 2021	[19]	4.990 EUR/100 km
Operating cost, 2021	$0.692 + 4.990$	5.6820 EUR/100 km
Operating cost, 2024	$5.6820 \cdot 1.157129$	6.57 EUR/100 km
Energy cost		
Energy use	WLTP combined consumption [3]	5.40 L/100 km
Net energy price w/o taxes, 2024	Scenario energy price input from [10]	0.45680 EUR/L
Net energy price w/o taxes, 2021	$0.45680 \cdot 0.864208(\text{inflation})$	0.394770 EUR/L
Fuel tax, 2024	Nominal value carried forward w/o inflation [19]	0.6550 EUR/L
Carbon price factor, gasoline	see Sec. 2.1	0.002360 t/L
Carbon price, 2024	Fixed price for 2024 [6]	45.00 EUR/t
Carbon price component, 2024	$45.00 \cdot 0.002360$	0.1062 EUR/L
Fuel tax and carbon price, 2024	$0.6550 + 0.1062$	0.76120 EUR/L
Final energy cost, 2024	$5.40 \cdot (0.45680 + 0.6550 + 0.1062)$	6.58 EUR/100 km
Final energy price, 2024	$0.45680 + 0.6550 + 0.1062$	1.2180 EUR/L
Distance simulation input		
Distance cost	$6.5748 + 6.5772$	13.15 EUR/100 km
Distance costs for simulation	$13.15/100,000$	0.0001315 EUR/m
Time-dependent labor cost		
Labor cost, 2021	[19]	29.48 EUR/h
Labor cost, 2024	$29.48 \cdot 1.157129$	34.11 EUR/h
Time costs for simulation	$34.11/3,600$	0.009476 EUR/s

Note: Monetary values are commercial net costs without value-added tax unless explicitly stated otherwise. The fixed simulation cost shown here is the vehicle ownership cost and does not include charging infrastructure costs. The distance simulation input consists of non-energy operating costs and energy costs.

3 Vehicle Cost Rates

In the overview table, Passenger car, Light-Duty Vehicle (LDV), and Heavy Goods Vehicle (HGV) denote the respective vehicle classes. An overview of the vehicle cost rates used as simulation input at the 2024 price level is shown in [Table 3](#). Also, the payload and the battery capacity of BEV are shown in the overview table.

Table 3: Overview of the vehicle cost rates used as simulation input. Monetary values are final scenario inputs at the 2024 price level. Fixed costs are vehicle ownership costs and exclude charging infrastructure allocations. Distance costs are split into non-energy operating costs and final energy costs; labor enters through the time-dependent cost.

Vehicle class	Powertrain	Model	Fixed vehicle	Dist. operation	Dist. energy	Dist. total	Time	Payload	Battery
			EUR /d	EUR /100 km	EUR /100 km	EUR /100 km	EUR /h	kg	kWh
Passenger car	gasoline	VW Golf 1.0 TSI	38.77	6.57	6.58	13.20	34.13	-	-
Passenger car	BEV	VW ID.3 Pure	42.51	5.13	3.26	8.40	34.13	-	52
LDV to 2.8 t	diesel	VW T6 2.0 TDI BMT	50.97	10.43	13.51	23.90	34.13	985	-
LDV to 2.8 t	BEV	ID. Buzz Cargo Pro	56.13	8.23	4.03	12.30	34.13	753	79
LDV 2.8 to 3.5 t	diesel	Mercedes Sprinter 316 CDI	70.04	12.09	14.16	26.20	27.94	1,450	-
LDV 2.8 to 3.5 t	BEV	Mercedes eSprinter	71.79	9.47	6.03	15.50	27.94	1,393	81
HGV 7.5 t	diesel	Mercedes Atego 818 L	91.65	17.38	19.95	37.30	27.94	3,400	-
HGV 7.5 t	BEV	Mitsubishi Fuso eCanter 9C18	94.36	13.86	17.85	31.70	27.94	4,600	124
HGV 18 t	diesel	Mercedes Antos 1833 L	112.42	20.62	34.11	54.70	27.94	10,450	-
HGV 18 t	BEV	Renault D Z.E	158.70	16.45	21.00	37.40	27.94	9,000	300
Waste collection 25 t	diesel	Mercedes Econic	164.71	62.10	77.22	139.30	119.63	11,500	-
Waste collection 25 t	BEV	E-Force (large battery)	400.44	41.85	21.00	62.80	119.63	10,500	310
Waste collection 25 t	BEV	E-Force (small battery)	346.40	41.85	21.00	62.80	119.63	11,500	155
HGV 40 t	diesel	MAN TGX 18.520 FLS XLX	200.19	27.71	41.18	68.90	27.94	29,000	-
HGV 40 t	BEV	Scania BEV tractor	258.17	22.92	31.50	54.40	27.94	26,490	624

The following component-based tables report the main inputs and resulting vehicle cost rates by vehicle class (see [Tables 4 to 10](#)). Conventional reference vehicles and their BEV counterparts are grouped together. The displayed component values follow the cost components for the target year of the calculation table and exclude charging infrastructure costs. The final simulation distance costs are the rounded EUR/m values, because this unit is used in the simulation. For gasoline and diesel vehicles, the Carbon price component included in final energy costs is documented in [Section 2.1](#). Source columns report external references or internal section and table references where component values are taken from documented sources.

Table 4: Component-based vehicle cost parameters for **Passenger car: compact class**. The component structure follows the cost calculation example.

Component	VW Golf 1.0 TSI	Source	VW ID.3 Pure	Source
Powertrain	gasoline	-	BEV	-
General assumptions and price level conversion				
Target year and operating days	2024; 260 d/a	-	2024; 260 d/a	-
Chassis price source value (net)	16,104.00 EUR (2021)	[19]	30,697.00 EUR (2025)	[4]
Chassis price, 2021	16,104.00 EUR	-	25,963.00 EUR	-
Fixed vehicle ownership cost				
Tires, 2021	346.00 EUR	[19]	346.00 EUR	[19]
Interest with 1.7%	139.83 EUR/a	-	223.63 EUR/a	-
Time-dependent depreciation	1,342.00 EUR/a	-	2,163.58 EUR/a	-
Garaging, 2021	436.00 EUR/a	[19]	436.00 EUR/a	[19]
Commercial vehicle overhead and fleet management component, 2021	6,278.00 EUR/a	[19]	6,278.00 EUR/a	[19]
Insurance, 2021	450.57 EUR/a	Sec. 2.3	450.57 EUR/a	Sec. 2.3
Vehicle tax, 2024	75.40 EUR/a	[5]	0.00 EUR/a	[5]
Ownership cost before insurance and tax	8,195.83 EUR/a	-	9,101.21 EUR/a	-
Fixed vehicle ownership cost, 2024	38.77 EUR/d	-	42.51 EUR/d	-
Distance-dependent operating cost excluding energy and labor				
Tire mileage	50,000 km	[19]	50,000 km	[19]
Tire wear, 2021	0.692 EUR/100 km	-	0.692 EUR/100 km	-
Repair and maintenance, 2021	4.990 EUR/100 km	[19]	3.741 EUR/100 km	[19]
Operating cost, 2021	5.6820 EUR/100 km	-	4.4334 EUR/100 km	-
Operating cost, 2024	6.57 EUR/100 km	-	5.13 EUR/100 km	-
Energy cost				
Energy use	5.40 L/100 km	[3]	15.50 kWh/100 km	[4]
Net energy price w/o taxes, 2024	0.45680 EUR/L	[10]	0.12035 EUR/kWh	[10]
Net energy price w/o taxes, 2021	0.39477 EUR/L	-	0.10401 EUR/kWh	-
Fuel tax, 2024	0.6550 EUR/L	[19]	-	-
Electricity taxes and duties, 2024	-	-	0.08965 EUR/kWh	[19]
Carbon price, 2024	45.00 EUR/t	Sec. 2.1	-	-
Carbon price component, 2024	0.1062 EUR/L	Sec. 2.1	-	-
Fuel tax and carbon price, 2024	0.76120 EUR/L	-	-	-
Final energy cost, 2024	6.58 EUR/100 km	-	3.26 EUR/100 km	-
Final energy price, 2024	1.2180 EUR/L	-	0.2100 EUR/kWh	-
Distance simulation input				
Distance cost	13.15 EUR/100 km	-	8.40 EUR/100 km	-
Distance costs for simulation	0.0001315 EUR/m	-	0.0000840 EUR/m	-
Time-dependent labor cost				
Labor cost, 2021	29.48 EUR/h	[19]	29.48 EUR/h	[19]
Labor cost, 2024	34.11 EUR/h	-	34.11 EUR/h	-
Time costs for simulation	0.009476 EUR/s	-	0.009476 EUR/s	-

Note: All prices are net prices without VAT.

Table 5: Component-based vehicle cost parameters for **LDV up to 2.8 t**. The component structure follows the cost calculation example.

Component	VW T6 2.0 TDI BMT	Source	ID. Buzz Cargo Pro	Source
Powertrain	diesel	-	BEV	-
General assumptions and price level conversion				
Target year and operating days	2024; 260 d/a	-	2024; 260 d/a	-
Gross vehicle weight	2,800 kg	[19]	3,150 kg	[1]
Payload	985 kg	[19]	753 kg	[1]
Chassis price source value (net)	27,500 EUR (2021)	[19]	48,225.21 EUR (2024)	[1]
Chassis price, 2021	27,500 EUR	-	41,676.61 EUR	-
Fixed vehicle ownership cost				
Tires, 2021	768.00 EUR	[19]	768.00 EUR	[19]
Interest with 1.7%	240.28 EUR/a	-	360.78 EUR/a	-
Time-dependent depreciation	2,291.67 EUR/a	-	3,473.05 EUR/a	-
Garaging, 2021	584.00 EUR/a	[19]	584.00 EUR/a	[19]
Commercial vehicle overhead and fleet management component, 2021	6,278.00 EUR/a	[19]	6,278.00 EUR/a	[19]
Insurance, 2021	1,917.62 EUR/a	[14]	1,917.62 EUR/a	[14]
Vehicle tax, 2024	164.00 EUR/a	[14]	0.00 EUR/a	[5]
Ownership cost before insurance and tax	9,393.94 EUR/a	-	10,695.83 EUR/a	-
Fixed vehicle ownership cost, 2024	50.97 EUR/d	-	56.14 EUR/d	-
Distance-dependent operating cost excluding energy and labor				
Tire mileage	55,000 km	[19]	55,000 km	[19]
Tire wear, 2021	1.396 EUR/100 km	-	1.396 EUR/100 km	-
Repair and maintenance, 2021	7.620 EUR/100 km	[19]	5.715 EUR/100 km	Sec. 2.2
Operating cost, 2021	9.0164 EUR/100 km	-	7.1114 EUR/100 km	-
Operating cost, 2024	10.43 EUR/100 km	-	8.23 EUR/100 km	-
Energy cost				
Energy use	10.50 L/100 km	[19]	19.20 kWh/100 km	[1]
Net energy price w/o taxes, 2024	0.69780 EUR/L	[10]	0.12035 EUR/kWh	[10]
Net energy price w/o taxes, 2021	0.60304 EUR/L	-	0.10401 EUR/kWh	-
Fuel tax, 2024	0.4704 EUR/L	[19]	-	-
Electricity taxes and duties, 2024	-	-	0.08965 EUR/kWh	[19]
Carbon price, 2024	45.00 EUR/t	Sec. 2.1	-	-
Carbon price component, 2024	0.1188 EUR/L	Sec. 2.1	-	-
Fuel tax and carbon price, 2024	0.58920 EUR/L	-	-	-
Final energy cost, 2024	13.51 EUR/100 km	-	4.03 EUR/100 km	-
Final energy price, 2024	1.2870 EUR/L	-	0.2100 EUR/kWh	-
Distance simulation input				
Distance cost	23.90 EUR/100 km	-	12.30 EUR/100 km	-
Distance costs for simulation	0.000239 EUR/m	-	0.000123 EUR/m	-
Time-dependent labor cost				
Labor cost, 2021	29.50 EUR/h	[19]	29.50 EUR/h	[19]
Labor cost, 2024	34.13 EUR/h	-	34.13 EUR/h	-
Time costs for simulation	0.009480 EUR/s	-	0.009480 EUR/s	-

Note: All prices are net prices without VAT.

Table 6: Component-based vehicle cost parameters for **LDV 2.8 to 3.5 t**. The component structure follows the cost calculation example.

Component	Mercedes Sprinter 316 CDI diesel	Source	Mercedes eSprinter	Source
Powertrain		-	BEV	-
General assumptions and price level conversion				
Target year and operating days	2024; 260 d/a	-	2024; 260 d/a	-
Gross vehicle weight	3,500 kg	[19]	4,150 kg	[2]
Payload	1,450 kg	[19]	1,393 kg	[2]
Chassis price source value (net)	43,570 EUR (2021)	[19]	57,664.71 EUR (2024)	[2]
Chassis price, 2021	43,570 EUR	-	49,834.29 EUR	-
Fixed vehicle ownership cost				
Tires, 2021	900.00 EUR	[19]	900.00 EUR	[19]
Interest with 1.7%	378.00 EUR/a	-	431.24 EUR/a	-
Time-dependent depreciation	3,630.83 EUR/a	-	4,152.86 EUR/a	-
Garaging, 2021	584.00 EUR/a	[19]	584.00 EUR/a	[19]
Commercial vehicle overhead and fleet management component, 2021	6,278.00 EUR/a	[19]	6,278.00 EUR/a	[19]
Insurance, 2021	4,684.42 EUR/a	[14]	4,684.42 EUR/a	[14]
Vehicle tax, 2024	211.00 EUR/a	[14]	0.00 EUR/a	[5]
Ownership cost before insurance and tax	10,870.83 EUR/a	-	11,446.10 EUR/a	-
Fixed vehicle ownership cost, 2024	70.04 EUR/d	-	71.79 EUR/d	-
Distance-dependent operating cost excluding energy and labor				
Tire mileage	64,000 km	[19]	64,000 km	[19]
Tire wear, 2021	1.406 EUR/100 km	-	1.406 EUR/100 km	-
Repair and maintenance, 2021	9.040 EUR/100 km	[19]	6.780 EUR/100 km	Sec. 2.2
Operating cost, 2021	10.4463 EUR/100 km	-	8.1863 EUR/100 km	-
Operating cost, 2024	12.09 EUR/100 km	-	9.47 EUR/100 km	-
Energy cost				
Energy use	11.00 L/100 km	[19]	28.70 kWh/100 km	[2]
Net energy price w/o taxes, 2024	0.69780 EUR/L	[10]	0.12035 EUR/kWh	[10]
Net energy price w/o taxes, 2021	0.60304 EUR/L	-	0.10401 EUR/kWh	-
Fuel tax, 2024	0.4704 EUR/L	[19]	-	-
Electricity taxes and duties, 2024	-	-	0.08965 EUR/kWh	[19]
Carbon price, 2024	45.00 EUR/t	Sec. 2.1	-	-
Carbon price component, 2024	0.1188 EUR/L	Sec. 2.1	-	-
Fuel tax and carbon price, 2024	0.58920 EUR/L	-	-	-
Final energy cost, 2024	14.16 EUR/100 km	-	6.03 EUR/100 km	-
Final energy price, 2024	1.2870 EUR/L	-	0.2100 EUR/kWh	-
Distance simulation input				
Distance cost	26.20 EUR/100 km	-	15.50 EUR/100 km	-
Distance costs for simulation	0.000262 EUR/m	-	0.000155 EUR/m	-
Time-dependent labor cost				
Labor cost, 2021	24.15 EUR/h	[19]	24.15 EUR/h	[19]
Labor cost, 2024	27.94 EUR/h	-	27.94 EUR/h	-
Time costs for simulation	0.007760 EUR/s	-	0.007760 EUR/s	-

Note: All prices are net prices without VAT.

Table 7: Component-based vehicle cost parameters for **HGV up to 7.5 t**. The component structure follows the cost calculation example.

Component	Mercedes Atego 818 L	Source	Mitsubishi Fuso eCanter 9C18	Source
Powertrain	diesel	-	BEV	-
General assumptions and price level conversion				
Target year and operating days	2024; 260 d/a	-	2024; 260 d/a	-
Gross vehicle weight	7,490 kg	[19]	7,490 kg	[8]
Payload	3,400 kg	[19]	4,600 kg	[8]
Chassis price source value (net)	59,800 EUR (2021)	[19]	79,168.00 EUR (2024)	[8]
Chassis price, 2021	59,800 EUR	-	68,417.61 EUR	-
Fixed vehicle ownership cost				
Tires, 2021	1,686.00 EUR	[19]	1,686.00 EUR	[19]
Interest with 1.7%	522.63 EUR/a	-	595.88 EUR/a	-
Time-dependent depreciation	5,436.36 EUR/a	-	6,219.78 EUR/a	-
Garaging, 2021	944.00 EUR/a	[19]	944.00 EUR/a	[19]
Commercial vehicle overhead and fleet management component, 2021	8,433.00 EUR/a	[19]	8,433.00 EUR/a	[19]
Insurance, 2021	5,009.55 EUR/a	[14]	5,009.55 EUR/a	[14]
Vehicle tax, 2024	286.00 EUR/a	[14]	0.00 EUR/a	[5]
Ownership cost before insurance and tax	15,335.99 EUR/a	-	16,192.66 EUR/a	-
Fixed vehicle ownership cost, 2024	91.65 EUR/d	-	94.36 EUR/d	-
Distance-dependent operating cost excluding energy and labor				
Tire mileage	59,000 km	[19]	59,000 km	[19]
Tire wear, 2021	2.858 EUR/100 km	-	2.858 EUR/100 km	-
Repair and maintenance, 2021	12.160 EUR/100 km	[19]	9.120 EUR/100 km	Sec. 2.2
Operating cost, 2021	15.0176 EUR/100 km	-	11.9776 EUR/100 km	-
Operating cost, 2024	17.38 EUR/100 km	-	13.86 EUR/100 km	-
Energy cost				
Energy use	15.50 L/100 km	[19]	85.00 kWh/100 km	[8]
Net energy price w/o taxes, 2024	0.69780 EUR/L	[10]	0.12035 EUR/kWh	[10]
Net energy price w/o taxes, 2021	0.60304 EUR/L	-	0.10401 EUR/kWh	-
Fuel tax, 2024	0.4704 EUR/L	[19]	-	-
Electricity taxes and duties, 2024	-	-	0.08965 EUR/kWh	[19]
Carbon price, 2024	45.00 EUR/t	Sec. 2.1	-	-
Carbon price component, 2024	0.1188 EUR/L	Sec. 2.1	-	-
Fuel tax and carbon price, 2024	0.58920 EUR/L	-	-	-
Final energy cost, 2024	19.95 EUR/100 km	-	17.85 EUR/100 km	-
Final energy price, 2024	1.2870 EUR/L	-	0.2100 EUR/kWh	-
Distance simulation input				
Distance cost	37.30 EUR/100 km	-	31.70 EUR/100 km	-
Distance costs for simulation	0.000373 EUR/m	-	0.000317 EUR/m	-
Time-dependent labor cost				
Labor cost, 2021	24.15 EUR/h	[19]	24.15 EUR/h	[19]
Labor cost, 2024	27.94 EUR/h	-	27.94 EUR/h	-
Time costs for simulation	0.007760 EUR/s	-	0.007760 EUR/s	-

Note: All prices are net prices without VAT.

Table 8: Component-based vehicle cost parameters for **HGV up to 18 t**. The component structure follows the cost calculation example.

Component	Mercedes Antos 1833 L	Source	Renault D Z.E	Source
Powertrain	diesel	-	BEV	-
General assumptions and price level conversion				
Target year and operating days	2024; 260 d/a	-	2024; 260 d/a	-
Gross vehicle weight	18,000 kg	[19]	18,000 kg	[8]
Payload	10,450 kg	[19]	9,000 kg	[8]
Chassis price source value (net)	78,700 EUR (2021)	[19]	218,823.00 EUR (2024)	[8]
Chassis price, 2021	78,700 EUR	-	189,108.56 EUR	-
Fixed vehicle ownership cost				
Tires, 2021	3,654.00 EUR	[19]	3,654.00 EUR	[19]
Interest with 1.7%	700.01 EUR/a	-	1,638.48 EUR/a	-
Time-dependent depreciation	7,154.55 EUR/a	-	17,191.69 EUR/a	-
Garaging, 2021	1,209.00 EUR/a	[19]	1,209.00 EUR/a	[19]
Commercial vehicle overhead and fleet management component, 2021	9,575.00 EUR/a	[19]	9,575.00 EUR/a	[19]
Insurance, 2021	6,045.90 EUR/a	[14]	6,045.90 EUR/a	[14]
Vehicle tax, 2024	665.00 EUR/a	[14]	0.00 EUR/a	[5]
Ownership cost before insurance and tax	18,638.55 EUR/a	-	29,614.17 EUR/a	-
Fixed vehicle ownership cost, 2024	112.42 EUR/d	-	158.70 EUR/d	-
Distance-dependent operating cost excluding energy and labor				
Tire mileage	108,000 km	[19]	108,000 km	[19]
Tire wear, 2021	3.383 EUR/100 km	-	3.383 EUR/100 km	-
Repair and maintenance, 2021	14.440 EUR/100 km	[19]	10.830 EUR/100 km	Sec. 2.2
Operating cost, 2021	17.8233 EUR/100 km	-	14.2133 EUR/100 km	-
Operating cost, 2024	20.62 EUR/100 km	-	16.45 EUR/100 km	-
Energy cost				
Energy use	26.50 L/100 km	[19]	100.00 kWh/100 km	[8]
Net energy price w/o taxes, 2024	0.69780 EUR/L	[10]	0.12035 EUR/kWh	[10]
Net energy price w/o taxes, 2021	0.60304 EUR/L	-	0.10401 EUR/kWh	-
Fuel tax, 2024	0.4704 EUR/L	[19]	-	-
Electricity taxes and duties, 2024	-	-	0.08965 EUR/kWh	[19]
Carbon price, 2024	45.00 EUR/t	Sec. 2.1	-	-
Carbon price component, 2024	0.1188 EUR/L	Sec. 2.1	-	-
Fuel tax and carbon price, 2024	0.58920 EUR/L	-	-	-
Final energy cost, 2024	34.11 EUR/100 km	-	21.00 EUR/100 km	-
Final energy price, 2024	1.2870 EUR/L	-	0.2100 EUR/kWh	-
Distance simulation input				
Distance cost	54.70 EUR/100 km	-	37.40 EUR/100 km	-
Distance costs for simulation	0.000547 EUR/m	-	0.000374 EUR/m	-
Time-dependent labor cost				
Labor cost, 2021	24.15 EUR/h	[19]	24.15 EUR/h	[19]
Labor cost, 2024	27.94 EUR/h	-	27.94 EUR/h	-
Time costs for simulation	0.007760 EUR/s	-	0.007760 EUR/s	-

Note: All prices are net prices without VAT.

Table 9: Component-based vehicle cost parameters for **Waste collection vehicle up to 25 t**. The component structure follows the cost calculation example.

Component	Mercedes Econic Source diesel	E-Force large battery Source BEV	E-Force small battery Source BEV
General assumptions and price level conversion			
Target year and operating days	2024; 260 d/a -	2024; 260 d/a -	2024; 260 d/a -
Gross vehicle weight	26,000 kg [7]	26,000 kg [7]	26,000 kg [7]
Payload	11,500 kg [7]	10,500 kg [7]	11,500 kg [7]
Chassis price source value (net)	210,000 EUR (2019) [7]	452,250 EUR + 242,466 EUR [7]	452,250 EUR + 130,559 EUR [7]
Chassis price, 2021	217,597.99 EUR -	711,079.15 EUR -	599,171.61 EUR -
Fixed vehicle ownership cost			
Tires, 2021	4,872.00 EUR [19]	4,872.00 EUR [19]	4,872.00 EUR [19]
Interest with 1.7%	1,890.99 EUR/a -	6,085.58 EUR/a -	5,134.37 EUR/a -
Time-dependent depreciation	21,759.80 EUR/a -	71,107.91 EUR/a -	59,917.16 EUR/a -
Garaging, 2021	1,209.00 EUR/a [7]	1,209.00 EUR/a [7]	1,209.00 EUR/a [19]
Commercial vehicle overhead and fleet management component, 2021	9,575.00 EUR/a [7]	9,575.00 EUR/a [7]	9,575.00 EUR/a [7]
Insurance, 2021	2,000.00 EUR/a [15]	2,000.00 EUR/a [15]	2,000.00 EUR/a [15]
Vehicle tax, 2024	665.00 EUR/a [14]	0.00 EUR/a [5]	0.00 EUR/a [5]
Ownership cost before insurance and tax	34,434.79 EUR/a -	87,977.50 EUR/a -	75,835.53 EUR/a -
Fixed vehicle ownership cost, 2024	164.71 EUR/d -	400.44 EUR/d -	346.41 EUR/d -
Distance-dependent operating cost excluding energy and labor			
Tire mileage	133,000 km [19]	133,000 km [19]	133,000 km [19]
Tire wear, 2021	3.663 EUR/100 km -	3.663 EUR/100 km -	3.663 EUR/100 km -
Repair and maintenance, 2021	50.00 EUR/100 km [15]	32.50 EUR/100 km [15]	32.50 EUR/100 km [15]
Operating cost, 2021	53.6632 EUR/100 km -	36.1632 EUR/100 km -	36.1632 EUR/100 km -
Operating cost, 2024	62.10 EUR/100 km -	41.85 EUR/100 km -	41.85 EUR/100 km -
Energy cost			
Energy use	60.00 L/100 km [7]	100.00 kWh/100 km [7]	100.00 kWh/100 km [7]
Net energy price w/o taxes, 2024	0.69780 EUR/L [10]	0.12035 EUR/kWh [10]	0.12035 EUR/kWh [10]
Net energy price w/o taxes, 2021	0.60304 EUR/L -	0.10401 EUR/kWh -	0.10401 EUR/kWh -
Fuel tax, 2024	0.4704 EUR/L [19]	- -	- -
Electricity taxes and duties, 2024	- -	0.08965 EUR/kWh [19]	0.08965 EUR/kWh [19]
Carbon price, 2024	45.00 EUR/t Sec. 2.1	- -	- -
Carbon price component, 2024	0.1188 EUR/L Sec. 2.1	- -	- -
Fuel tax and carbon price, 2024	0.58920 EUR/L -	- -	- -
Final energy cost, 2024	77.22 EUR/100 km -	21.00 EUR/100 km -	21.00 EUR/100 km -
Final energy price, 2024	1.2870 EUR/L -	0.2100 EUR/kWh -	0.2100 EUR/kWh -
Distance simulation input			
Distance cost	139.30 EUR/100 km -	62.80 EUR/100 km -	62.80 EUR/100 km -
Distance costs for simulation	0.001393 EUR/m -	0.000628 EUR/m -	0.000628 EUR/m -
Time-dependent labor cost			
Labor cost, 2021	103.39 EUR/h [7]	103.39 EUR/h [7]	103.39 EUR/h [7]
Labor cost, 2024	119.63 EUR/h -	119.63 EUR/h -	119.63 EUR/h -
Time costs for simulation	0.033230 EUR/s -	0.033230 EUR/s -	0.033230 EUR/s -

Note: All prices are net prices without VAT.

Table 10: Component-based vehicle cost parameters for **HGV up to 40 t**. The component structure follows the cost calculation example.

Component	MAN TGX 18.520 FLS XLX	Source	Scania BEV tractor unit	Source
Powertrain	diesel	-	BEV	-
General assumptions and price level conversion				
Target year and operating days	2024; 260 d/a	-	2024; 260 d/a	-
Gross vehicle weight	40,000 kg	[19]	40,000 kg	[8]
Payload	29,000 kg	[19]	26,490 kg	[8]
Chassis price source value (net)	140,200 EUR (2021)	[19]	328,971.00 EUR (2024)	[8]
Chassis price, 2021	140,200 EUR	-	288,332.36 EUR	-
Fixed vehicle ownership cost				
Tires, 2021	7,044.00 EUR	[19]	7,044.00 EUR	[19]
Interest with 1.7%	1,251.57 EUR/a	-	2,510.70 EUR/a	-
Time-dependent depreciation	12,508.33 EUR/a	-	24,852.70 EUR/a	-
Garaging, 2021	2,418.00 EUR/a	[19]	2,418.00 EUR/a	[19]
Commercial vehicle overhead and fleet management component, 2021	19,008.00 EUR/a	[19]	19,008.00 EUR/a	[19]
Insurance, 2021	8,640.51 EUR/a	[14]	8,640.51 EUR/a	[14]
Vehicle tax, 2024	1,336.00 EUR/a	[14]	671.00 EUR/a	[5, 14]
Ownership cost before insurance and tax, 2021	35,185.91 EUR/a	-	48,789.40 EUR/a	-
Fixed vehicle ownership cost, 2024	200.19 EUR/d	-	258.17 EUR/d	-
Distance-dependent operating cost excluding energy and labor				
Tire mileage	133,000/173,000 km	[19]	133,000/173,000 km	[19]
Tire wear, 2021	4.707 EUR/100 km	-	4.707 EUR/100 km	-
Repair and maintenance, 2021	19.240 EUR/100 km	[19]	15.100 EUR/100 km	Sec. 2.2
Operating cost, 2021	23.9469 EUR/100 km	-	19.8069 EUR/100 km	-
Operating cost, 2024	27.71 EUR/100 km	-	22.92 EUR/100 km	-
Energy cost				
Energy use	32.00 L/100 km	[19]	150.00 kWh/100 km	[8]
Net energy price w/o taxes, 2024	0.69780 EUR/L	[10]	0.12035 EUR/kWh	[10]
Net energy price w/o taxes, 2021	0.60304 EUR/L	-	0.10401 EUR/kWh	-
Fuel tax, 2024	0.4704 EUR/L	[19]	-	-
Electricity taxes and duties, 2024	-	-	0.08965 EUR/kWh	[19]
Carbon price, 2024	45.00 EUR/t	Sec. 2.1	-	-
Carbon price component, 2024	0.1188 EUR/L	Sec. 2.1	-	-
Fuel tax and carbon price, 2024	0.58920 EUR/L	-	-	-
Final energy cost, 2024	41.18 EUR/100 km	-	31.50 EUR/100 km	-
Final energy price, 2024	1.2870 EUR/L	-	0.2100 EUR/kWh	-
Distance simulation input				
Distance cost	68.90 EUR/100 km	-	54.40 EUR/100 km	-
Distance costs for simulation	0.000689 EUR/m	-	0.000544 EUR/m	-
Time-dependent labor cost				
Labor cost, 2021	24.15 EUR/h	[19]	24.15 EUR/h	[19]
Labor cost, 2024	27.94 EUR/h	-	27.94 EUR/h	-
Time costs for simulation	0.007760 EUR/s	-	0.007760 EUR/s	-

Note: All prices are net prices without VAT. Both vehicles are assumed to be used with a semi-trailer. For the BEV the vehicle tax is not zero because the semi-trailer is not exempt from taxation.

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