How to support the implementation of a future Extended Producer Responsibility for HD Vehicles

Final Report | Brussels, 26th November 2025

STRAT ANTICIPATION | *Be One Step Ahead*

Our retained scope covers 78% of the HDV fleet and all vehicles over 3.5 tons, but excludes trailers from the analysis, due to a lack of available data & time constraints

Project scope

GEOGRAPHIES :
8 COUNTRIES

78 % of the total HDV fleet in the EU

PRODUCTS :
5 SEGMENTS

M2 VEHICLES :
PASSENGER TRANSPORT
- BETWEEN 3.5 & 5T

M3 VEHICLES :
PASSENGER TRANSPORT
- MORE THAN 5T

N2 VEHICLES :
FREIGHT TRANSPORT
- BETWEEN 3.5 & 12T

N3 VEHICLES :
FREIGHT TRANSPORT -
MORE THAN 12T

SPECIAL PURPOSE VEHICLES

CATEGORY O :
TRAILERS & SEMI-TRAILERS

Segments covered by the study Segments not covered by the study

HDV : Heavy-Duty Vehicle

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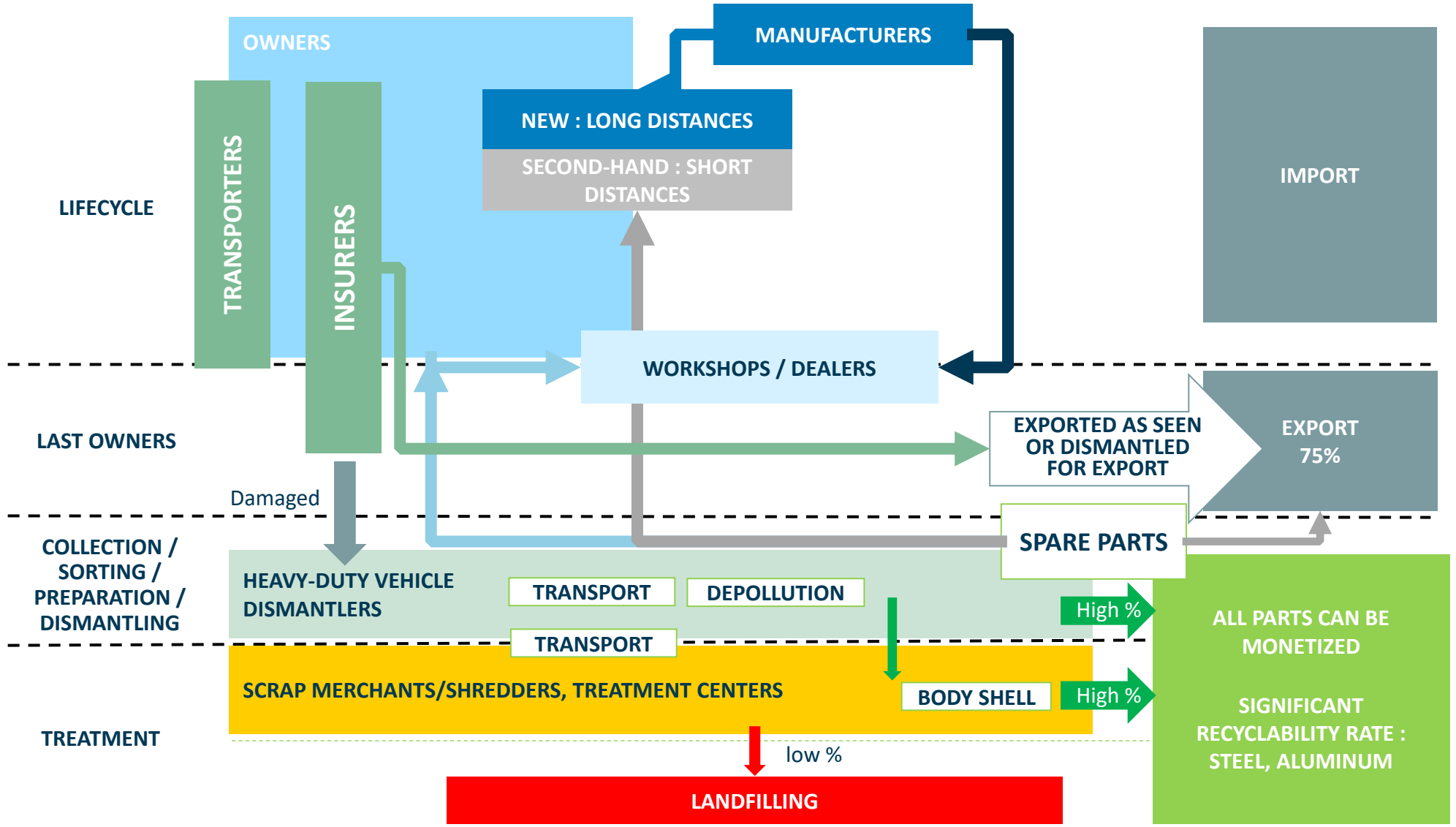
Trucks, which often have multiple owners, and 80% of them end their life being exported and/or dismantled to produce parts or materials (steel, aluminum)

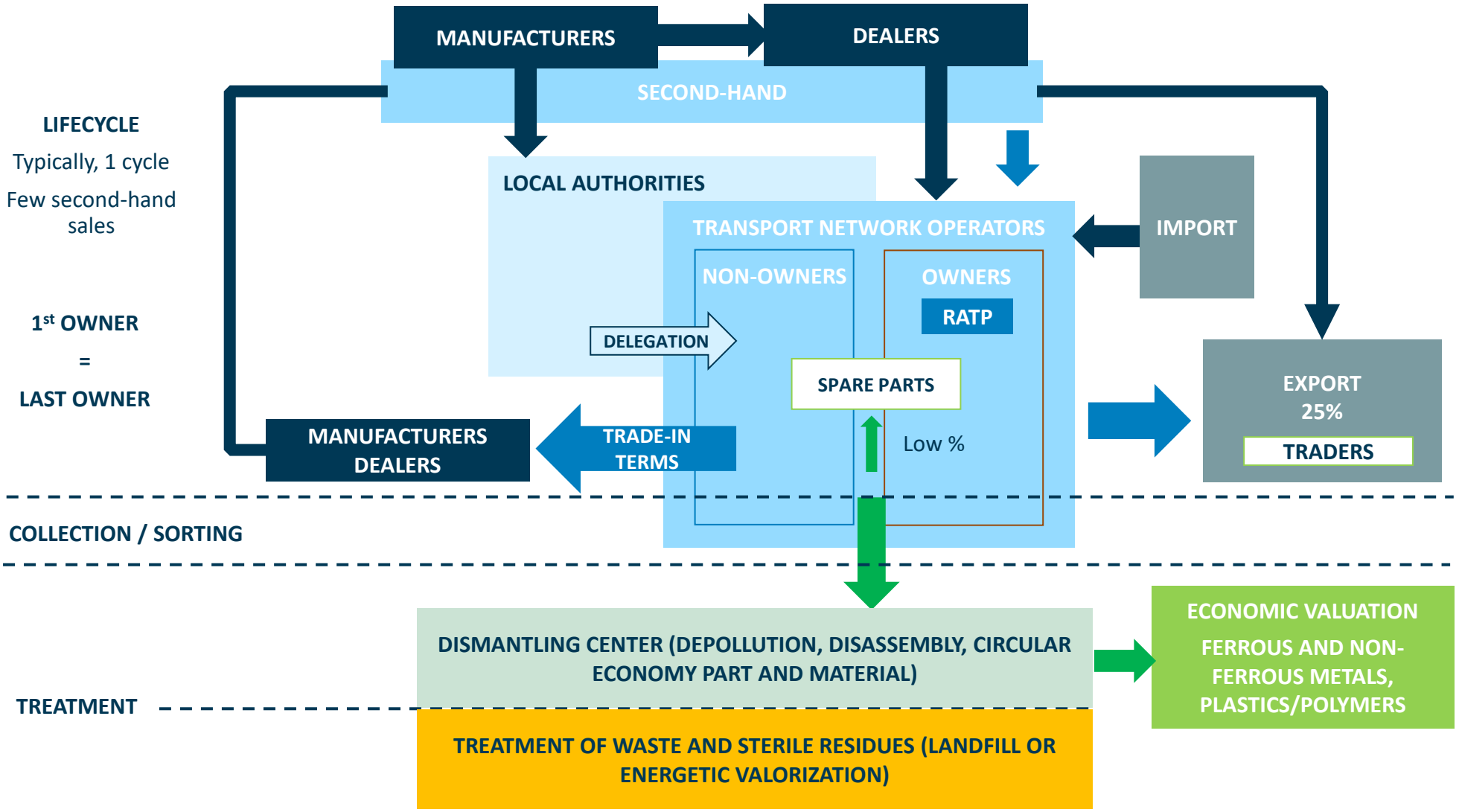
Value chain of trucks



Source : CIDER Engineering - Study End of life of out-of-service heavy materials, Strat Anticipation research & analysis

Buses typically have a single owner. With an export rate of 25%, they usually reach the end of their life in ELV centers, where they are dismantled for spare part resale

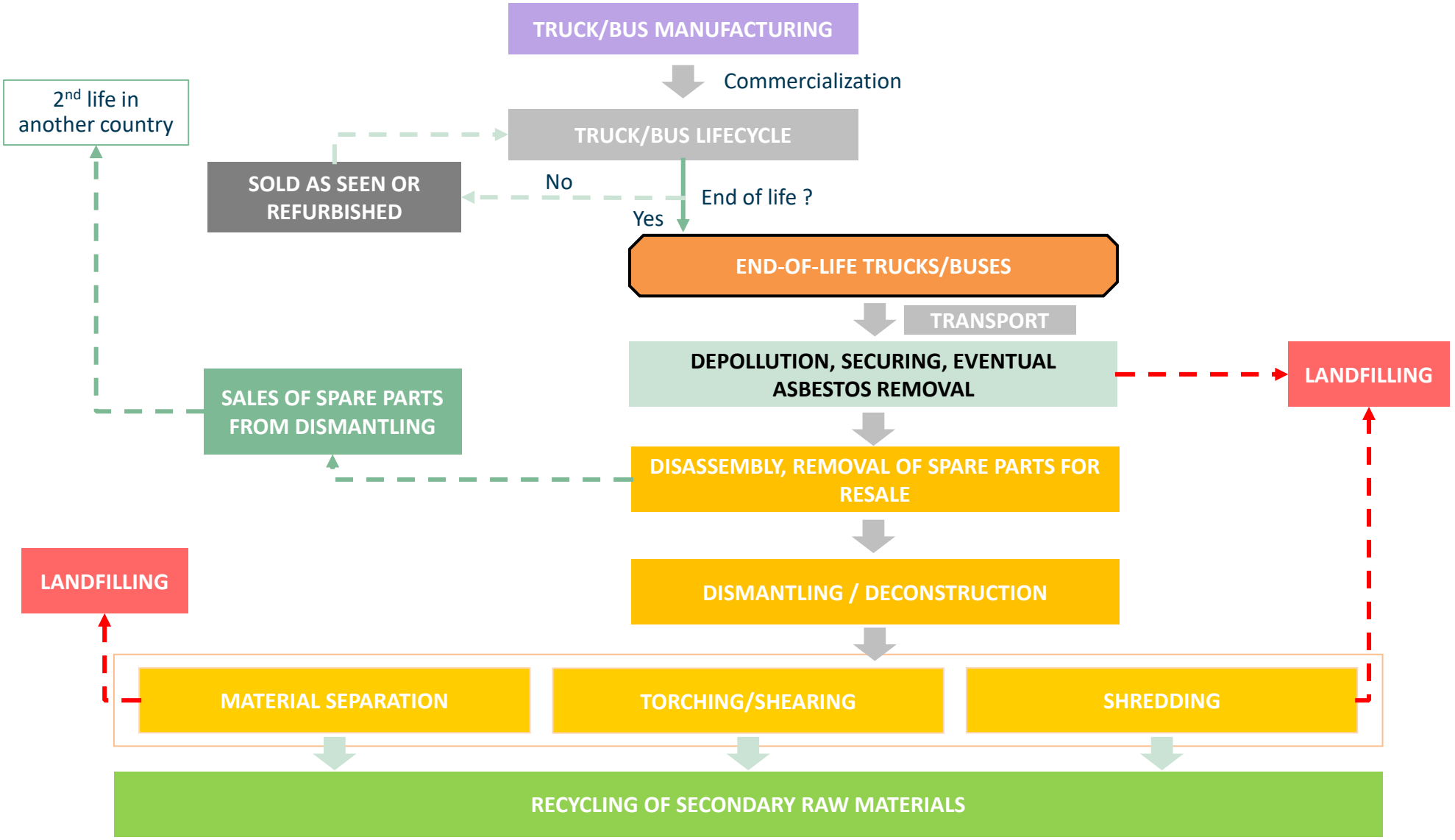
Value chain of buses



Source : CIDER Engineering - Study End of life of out-of-service heavy materials, Strat Anticipation research & analysis

Trucks and buses can be sold as-is or reconditioned, allowing them to be reused. Otherwise, they are depolluted, disassembled & shredded (parts and materials flows)

Treatment process for damaged/end-of-life trucks & buses



Source : CIDER Engineering - Study End of life of out-of-service heavy materials, Strat Anticipation research & analysis

Around half of vehicles above 3.5 tons are multi-stage approved, resulting in two different products from two different manufacturers : a base vehicle & a body

Multi-stage vehicles - Importance in the HDV sector & typical process

This is a very rare case for passenger cars, but a common one for trucks & buses

40-50%

50-60%

Base vehicle (chassis) – incomplete vehicle

- Manufacturer : automotive OEM
- Chassis type approval
- Own warranty
- **EPR : Vehicle manufacturer**

Bodywork – separate product, not a vehicle component

- Manufacturer: bodywork OEM
- Bodywork type approval
- Own warranty
- May be difficult to treat (e.g. cooling boxes)
- **EPR : No one is responsible in the case of a SME**

Completed vehicle

- Manufacturer : Automotive OEM + bodywork OEM (in most cases)
- Completed vehicle type approval
- 2 warranties : chassis + bodywork
- **EPR : Who is responsible ?**

HDV : Heavy-Duty Vehicle
EPR : Extended Producer Responsibility
Source : MAN Truck & Bus

Some challenges have been clearly identified in the context of extending the EPR regulation to HDVs

Key challenges for HDVs

LOWER VOLUMES THAN LIGHT VEHICLES	MUCH HIGHER DIVERSITY, ESPECIALLY ON RIGID TRUCKS WITH BODIES
LONGER LIFETIME DURATION	OLDER HDVs TEND TO LEAVE THE EU
NOT ALL HDVs ARE SENT TO ATFs WHEN STAYING IN THE EU (Cannibalization or unofficial channels)	IT IS QUITE COSTLY TO TRANSPORT EOL HDVs
THERE ARE FEW HDV SPECIALIZED DISMANTLING CENTERS	HDV-SPECIALIZED DISMANTLING CENTERS NEED SCALE & VOLUME TO BE COMPETITIVE
SOME USED MATERIALS WILL BE COMPLEX TO RECYCLE, SUCH AS COMPOSITES	MATERIALS REGULATION LIKE REACH CAN BE A ROADBLOCK
THE ONGOING ELECTRIFICATION TREND WILL INDUCE MORE COMPLEX & HAZARDOUS MATERIALS TO RECOVER	UPCOMING EU REGULATIONS COULD INTRODUCE A COMPLIANCE RISK

Challenges specific to HDVs Challenges that go beyond the case of HDVs

HDV : Heavy-Duty Vehicle
EPR : Extended Producer Responsibility

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As indicated during Workshop #1, we have used the following methodology to perform a fleet analysis & to calculate scrappage HDVs

Fleet analysis methodology - For each year n (**2010 – 2050**)* and age m (0-50)

$$Scrapped^{n,m} = Stock^{n,m} - Stock^{n+1,m+1} + new\ registrations^{n+1,m=0} + Import\ second\ hand^{n+1,m+1} - Export\ second\ hand^{n,m}$$

EMISIA database

- Data from: ACEA, Eurostat, EC Statistical Pocketbook, CO2 monitoring database, EAFO, national databases
- **Granularity**: Category/Powertrain/Segment/Euro-standard/age
  - HDVs → Articulated/Rigid & 14 total GVW categories
  - Buses → Urban buses/Coaches & 3 total GVW categories

Eurostat database (COMEXT)

- **Granularity**: Category/Powertrain
  - HDVs → Articulated/Rigid with 2 GVW categories >20t and <20t (only for Rigid)
  - Buses → **No categorization**
- Review with national statistics where available

To derive the final **scrapped vehicles**, we must couple the 2 databases → inconsistencies arise → assumptions made

Level of detail for HDVs → per segment and per age

Segments according to EMISIA database

- HDVs → Articulated and Rigid (14 total GVW categories)
- Buses → Urban buses and Coaches

Western countries

Eastern countries

Note : 2010-2024 statistical, 2025-2050 projections utilizing SIBYL methodology
Disclaimer:
1) Stock, new registrations and average age are from statistics (Source: EMISIA database)
2) Imports/Exports (not per age) are from statistics correcting outliers (Source: Eurostat, national databases)
3) Scrappage is calculated from the coupling of the above databases (through EMISIA interviews & experience)

EMISIA identified inconsistencies & gaps in the used raw data and applied the corrections needed, resulting in different confidence levels for the various parameters

Quality of modeling data, gaps & inconsistencies identified, and corrections applied

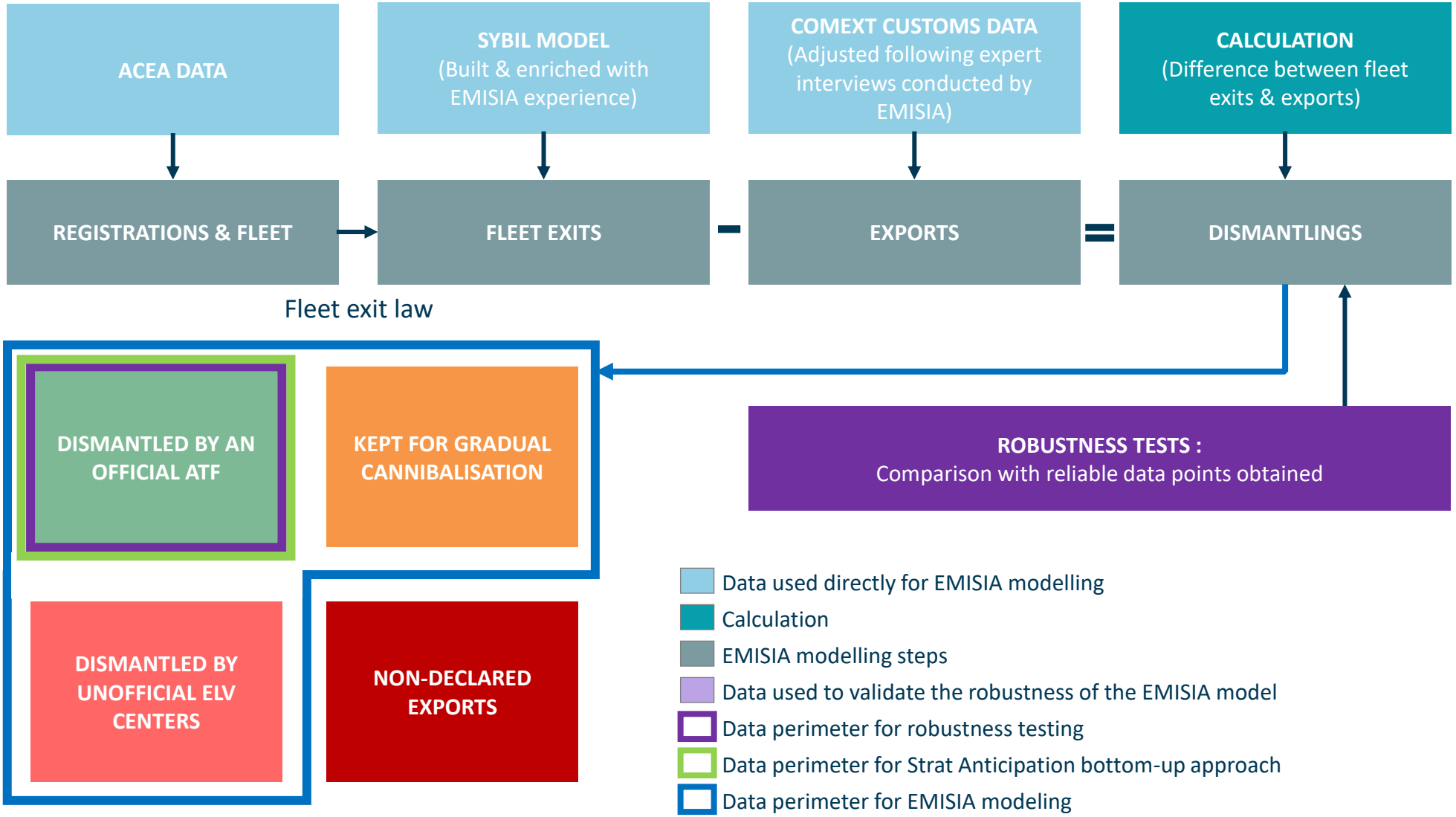
PARAMETER	SOURCES	INCONSISTENCIES FOUND	GAPS	CORRECTIONS APPLIED	DATA QUALITY*
NEW REGISTERED HDVs	ACEA, Eurostat, EC Pocketbook, EEA, EAFO, national databases	• Small differences among sources	• Differentiation of HDVs based on GVW & rigid/articulated not in desired level of detail	• Prioritization of sources • extrapolation & assumptions to treat gaps	Excellent
HDVs IN OPERATION	ACEA, Eurostat, EC Pocketbook, EEA, EAFO, national databases	• Differences among sources • Inconsistencies compared to new registered HDVs	• Same gap with new registered HDVs • No data for differentiation by age	• Prioritization of sources • Corrections based on new registered HDVs & avg fleet age & avg deregistration rates	Good
DEREGISTRATIONS HDVs	Model output based on new registered HDVs, 2nd hand imported & HDVs in operations	• Often great discrepancy over time (mainly eastern countries) • Inconsistencies originating from incorporating data from multiple sources	• Initially SIBYL did not consider imported 2nd hand vehicles	• Corrections based on new registered HDVs & avg fleet age & avg deregistration rates • Include imported 2nd hand HDVs from Eurostat • Extrapolation to treat gaps	Quite good
IMPORTS & EXPORTS HDVs	Eurostat, national databases, research & interviews	• Unrealistic spikes in exported/imported 2nd hand HDVs • Deviation between Eurostat & other sources • Great problem with NL/BE/DE due to 2nd hand HDVs exported to third countries via NL/BE/DE ports	• Eurostat data do not provide the desired level of detail • No data for differentiation by age • Gaps exist in some vehicle types between new/used exported/imported HDVs	• Validated with national sources, where possible • Corrected number of imported/ exported HDVs based on avg weight extracted from Eurostat & deregistrations • Imported vehicles similar age distribution to fleet • Exports follow a similar age distribution with deregistrations	Moderate
SCRAPPED HDVs	Model output as the difference between total deregistrations and exported	• Often great discrepancy over time (mainly in eastern countries) • Inconsistencies originating from incorporating data from multiple sources	• Very limited data for number of scrapped vehicles	• Treatment of number of imported/exported HDVs based on reported HDVs' weight by Eurostat & deregistrations from SIBYL	Moderate

$$Scrapped^{n,m} = Stock^{n,m} - Stock^{n+1,m+1} + new\ registrations^{n+1,m=0} + Import\ second\ hand^{n+1,m+1} - Export\ second\ hand^{n,m}$$

* Data quality varies among different countries, vehicle types and years

EMISIA modeling & Strat Anticipation bottom-up approach enable us to cover a different scope of dismantlings carried out in each country

Reminder of the EMISIA methodology & scope covered by our two approaches



Source : Strat Anticipation research & analysis

For trucks, there is a significant contrast between Western countries, which are more export-oriented, and Eastern countries, which are more import-oriented

8 EU Countries - Truck fleet - Summary

NUMBER OF TRUCKS IN THE FLEET | In k units, 2024

	1 015 k
	952 k
	745 k
	648 k
	684 k
	220 k
	232 k
	195 k

YEARLY IMPORTS/EXPORTS OF TRUCKS | In k units & % of the 2023 fleet, 2021-2023 Average

	Imports	Exports
	8 k (0.9%)	**53 k** (5.4%)
	5 k (0.5%)	**7 k** (0.8%)
	17 k (2.3%)	**14 k** (1.9%)
	1 k (0.2%)	**20 k** (3.1%)
	5 k (0.8%)	**6 k** (0.9%)
	2 k (1.1%)	**0.2 k** (2.0%)
	1 k (0.5%)	**5 k** (2.1%)
	4 k (2.0%)	**3 k** (1.6%)

YEARLY SCRAPPAGE OF TRUCKS | In k units & % of the 2023 fleet, 2021-2023 Average

	19 k (2.0%)
	23 k (2.4%)
	16 k (2.3%)
	18 k (2.7%)
	5 k (0.8%)
	5 k (2.1%)
	4 k (1.5%)
	5 k (2.6%)

FOR TRUCKS, DEPENDING ON THE COUNTRY CONSIDERED, THE SCRAPPAGE RATE RANGES FROM 0.8% TO 2.7% OF THE FLEET

Source : Sybil model - EMISIA, Strat Anticipation research & analysis

For buses, the West/East contrast for imports/exports also applies, but there are greater disparities than for trucks in terms of the % of the fleet scrapped

8 EU Countries - Bus fleet - Summary

NUMBER OF BUSES IN THE FLEET | In k units, 2024

	84 k
	100 k
	117 k
	91 k
	63 k
	24 k
	22 k
	48 k

YEARLY IMPORTS/EXPORTS OF BUSES | In k units & % of the 2023 fleet, 2021-2023 Average

	Imports	Exports
	2 k (2.8%)	**4 k** (4.9%)
	4 k (3.7%)	**3 k** (3.2%)
	0.5 k (0.5%)	**0.8 k** (0.7%)
	0.7 k (0.8%)	**2 k** (1.7%)
	5 k (7.9%)	**0.3 k** (0.5%)
	0.8 k (3.5%)	**0.1 k** (0.6%)
	0.2 k (1.1%)	**0.5 k** (2.4%)
	1 k (2.9%)	**0.2 k** (0.4%)

YEARLY SCRAPPAGE OF BUSES | In k units & % of the 2023 fleet, 2021-2023 Average

	2 k (2.2%)
	3 k (3.6%)
	2 k (1.5%)
	6 k (6.4%)
	7 k (10.8%)
	1 k (5.5%)
	0.5 k (2.5%)
	2 k (3.2%)

FOR BUSES, DEPENDING ON THE COUNTRY CONSIDERED, THE SCRAPPAGE RATE RANGES FROM 1.5% TO 10.8% OF THE FLEET

Source : Sybil model - EMISIA, Strat Anticipation research & analysis

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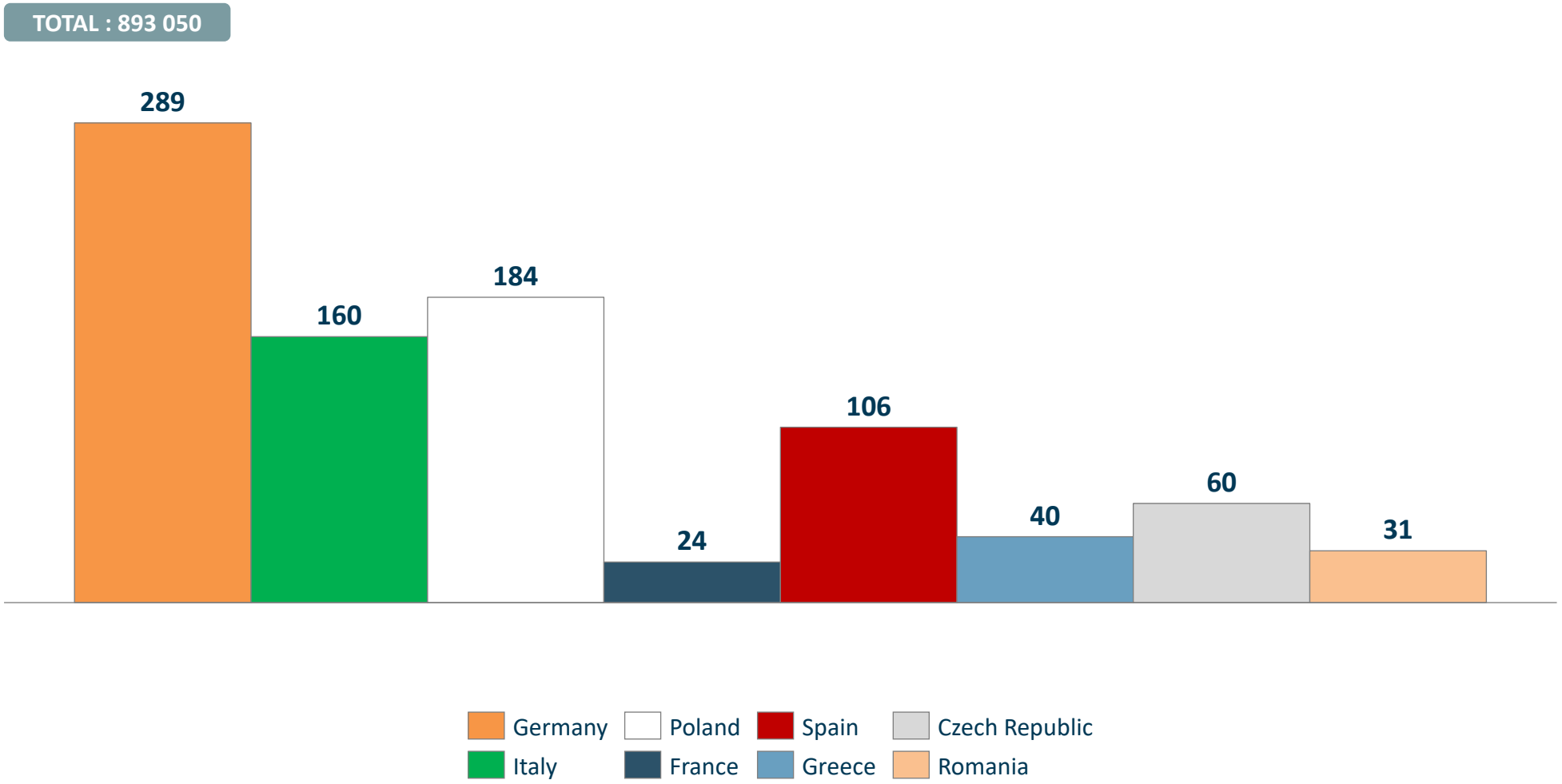
There are 289k rigid trucks under 7,5t in Germany. Rigid trucks under 7,5t share in the truck fleet is the lowest in France

8 EU Countries - Rigid trucks under 7.5 t - Fleet characteristics (1/2)

TOTAL NUMBER OF RIGID TRUCKS UNDER 7,5T IN THE FLEET |
In k units, 8 Countries, 2024



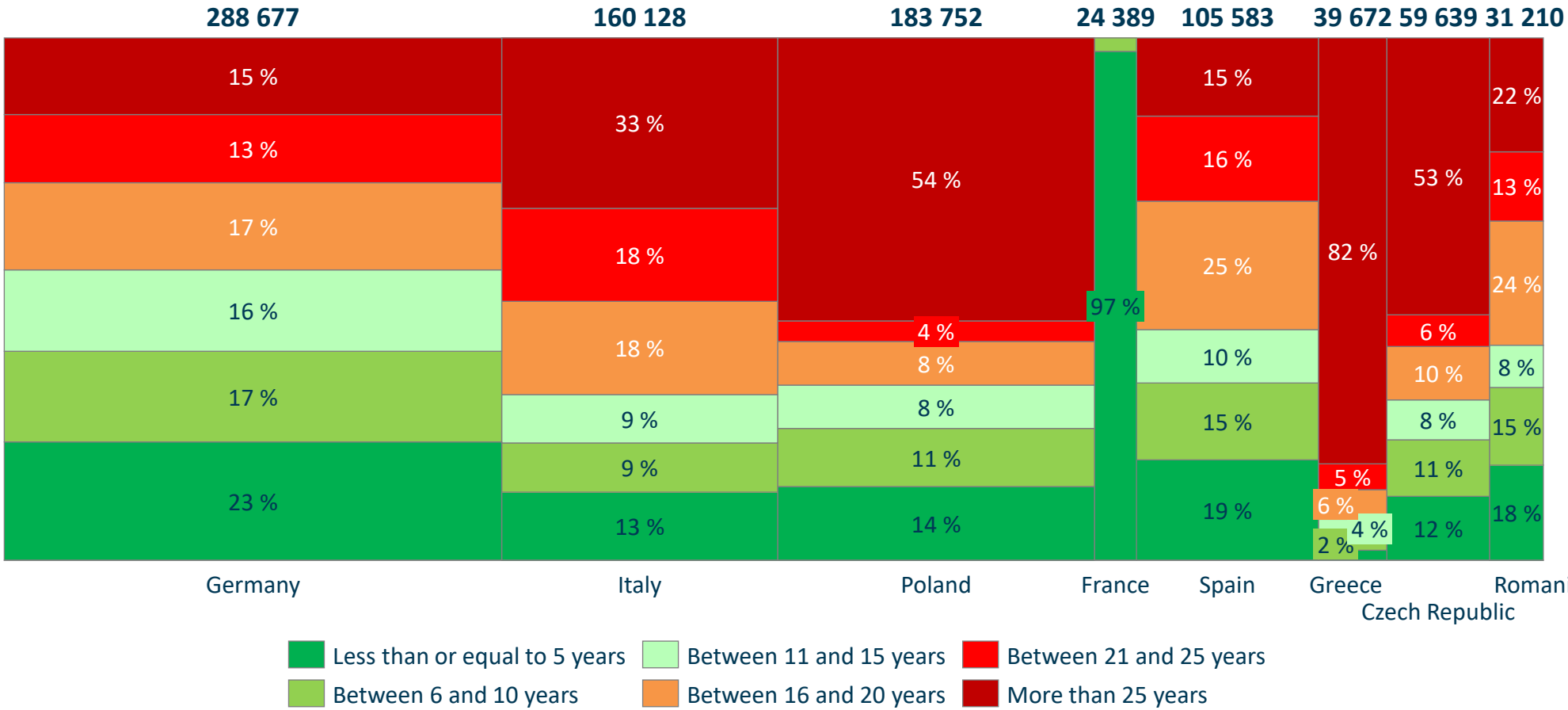
Source : Sybil model - EMISIA, Strat Anticipation research & analysis

For rigid trucks under 7,5t, the German fleet age distribution is balanced, while the Greek, Czech & Polish fleets are heavily dominated by older trucks

8 EU Countries - Rigid trucks under 7.5 t - Fleet characteristics (2/2)

RIGID TRUCK UNDER 7,5T FLEET BY SUBSEGMENT & AGE CATEGORY | In % and number of vehicles, 8 countries, 2024

TOTAL : 893 050



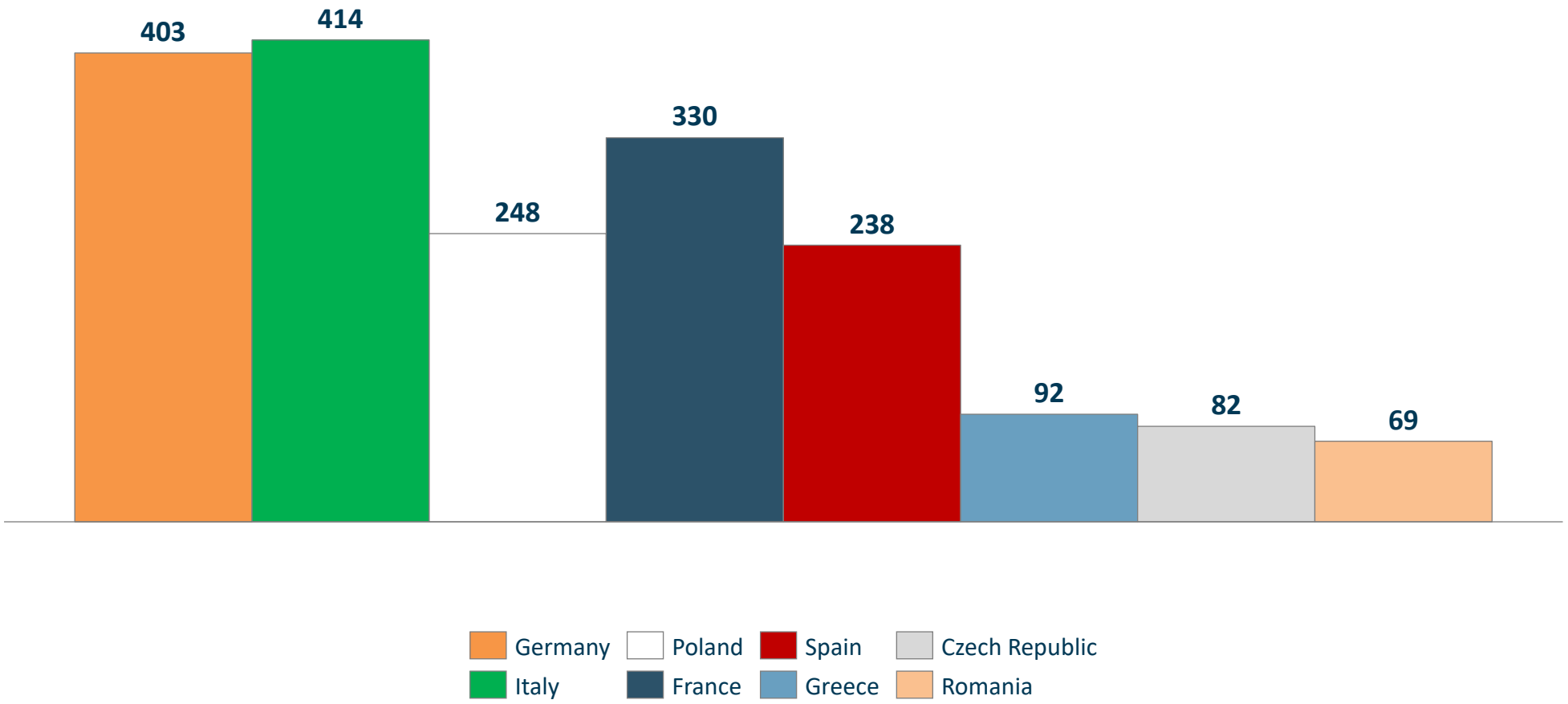
Source : Sybil model - EMISIA, Strat Anticipation research & analysis

There are 414k rigid trucks over 7,5t in Italy and 403k in Italy. Greece has the oldest fleet, whereas Germany has the youngest one

8 EU Countries - Rigid trucks over 7.5 t - Fleet characteristics (1/2)

TOTAL NUMBER OF RIGID TRUCKS OVER 7,5T IN THE FLEET |
In k units, 8 Countries, 2024

TOTAL : 1 875 799



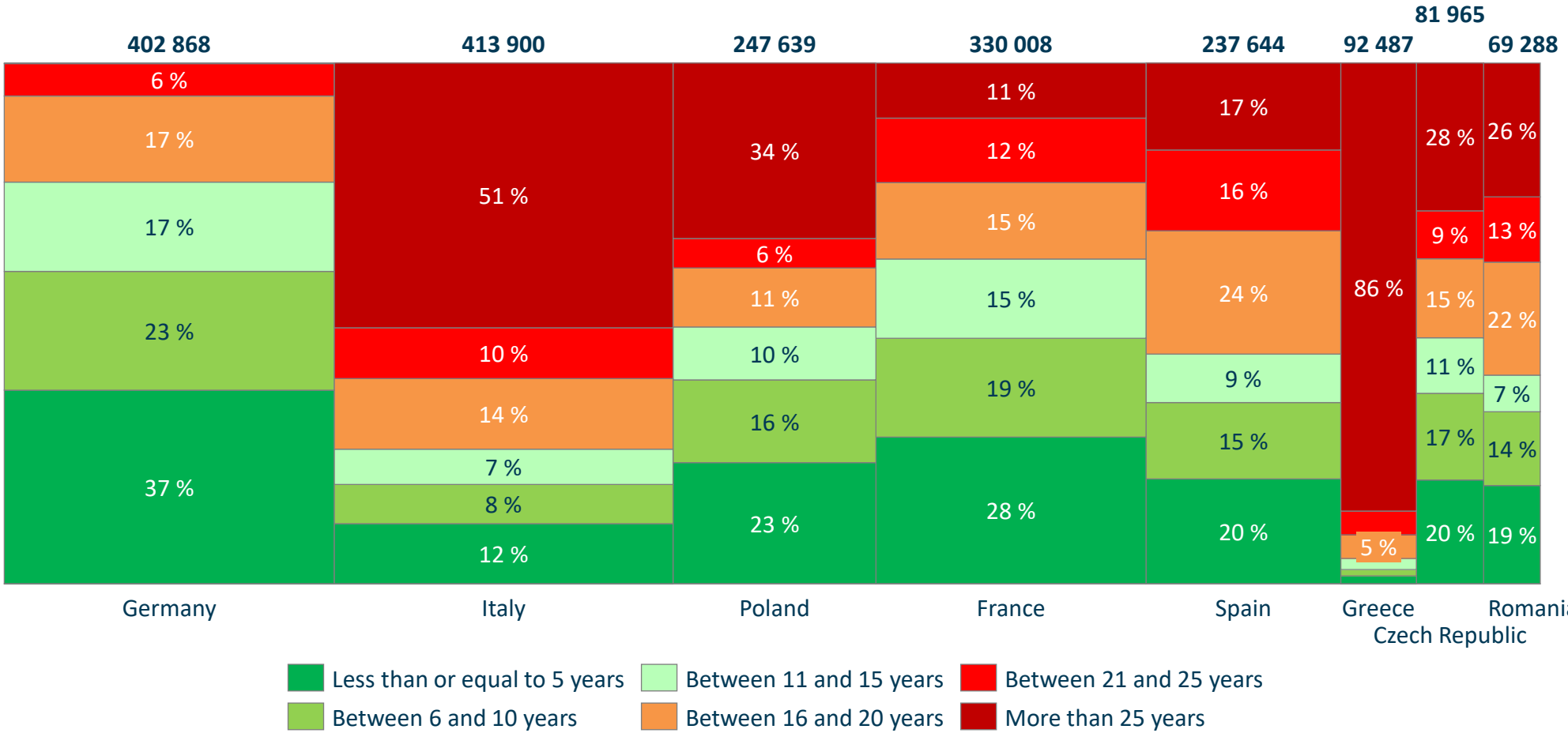
Source : Sybil model - EMISIA, Strat Anticipation research & analysis

Among the 8 countries, for rigids over 7.5 t, France has the most balanced age distribution, while Greece has the most unbalanced with 86% aged over 25 years

8 EU Countries - Rigid trucks over 7.5 t - Fleet characteristics (2/2)

RIGID TRUCK OVER 7,5T FLEET BY SUBSEGMENT & AGE CATEGORY | In % and number of vehicles, 8 countries, 2024

TOTAL : 1 875 799



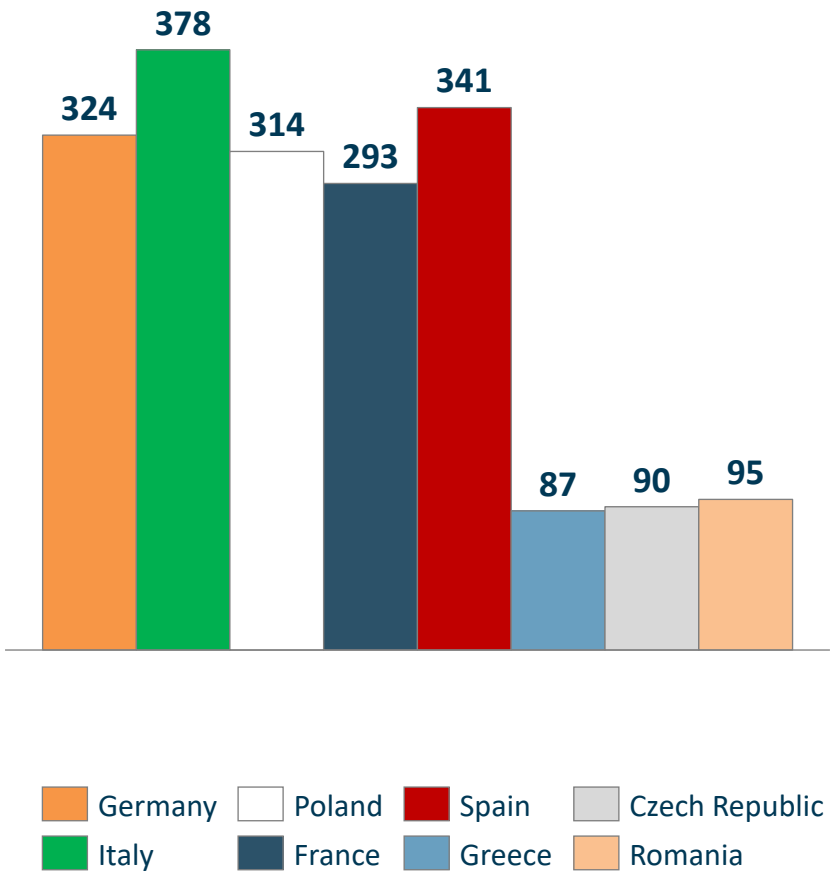
Source : Sybil model - EMISIA, Strat Anticipation research & analysis

Italy and Spain have the largest articulated truck fleets with respectively over 378k and 341k units. Germany and France have the youngest fleets

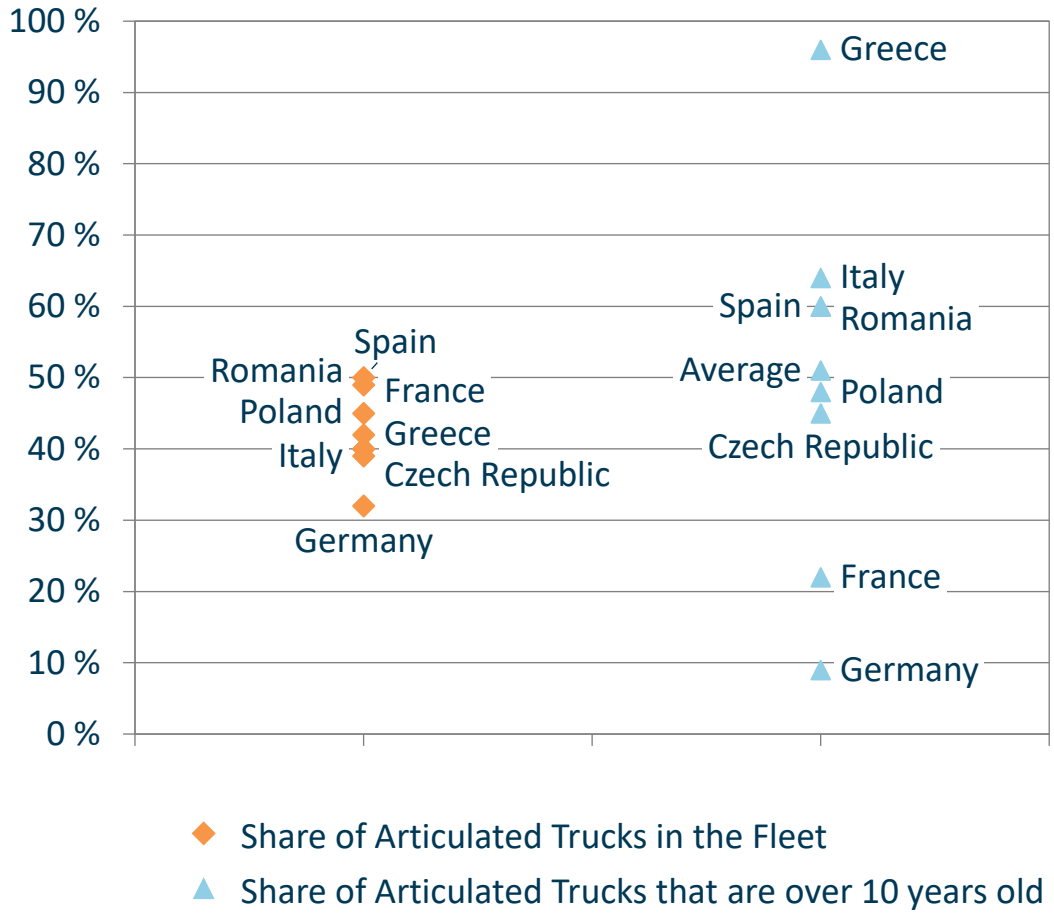
8 EU Countries - Articulated trucks - Fleet characteristics (1/2)

TOTAL NUMBER OF ARTICULATED TRUCKS IN THE FLEET | In k units, 8 Countries, 2024

TOTAL : 1 922 133



SHARE OF ARTICULATED TRUCKS & PERCENTAGE OF THE TRUCKS OVER 10 YEARS OLD | In %, 8 Countries, 2024



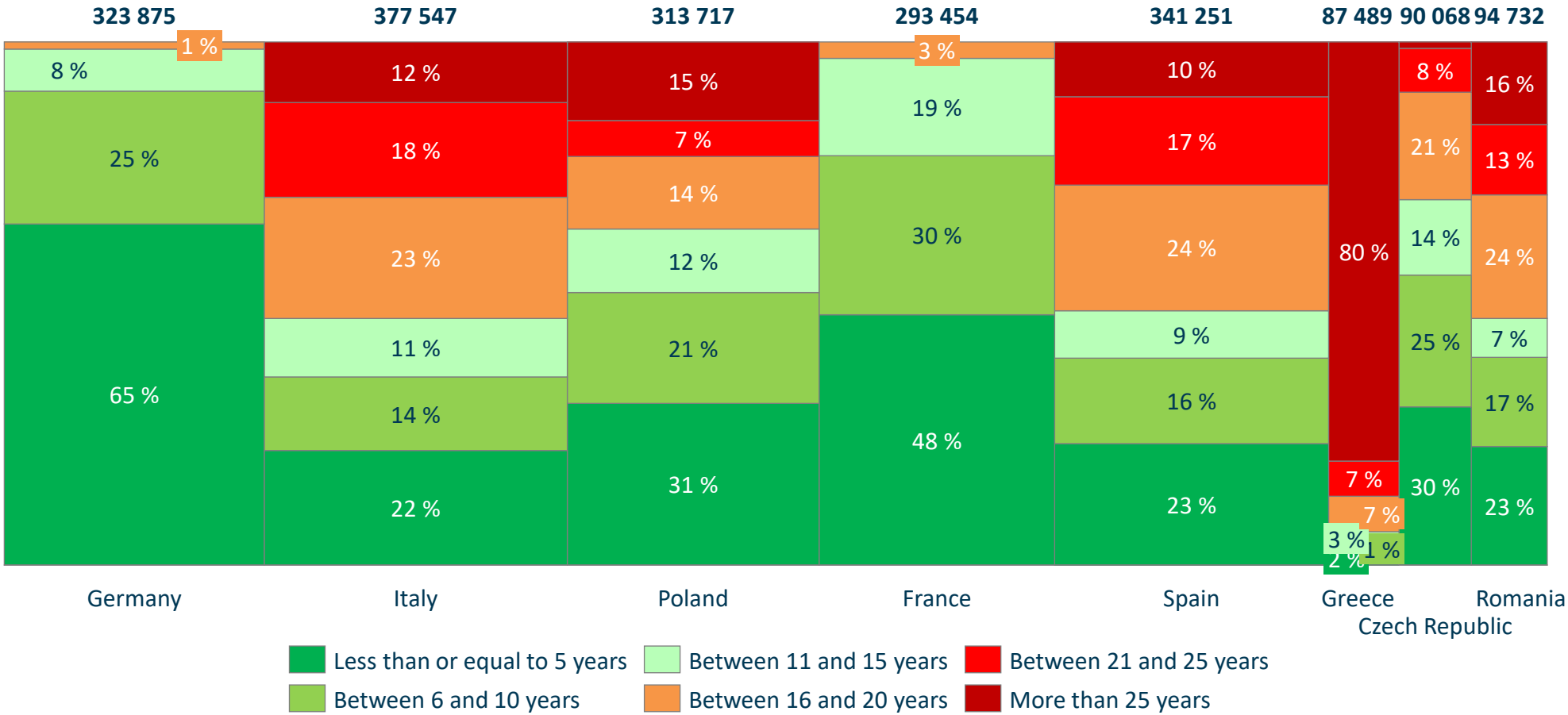
Source : Sybil model - EMISIA, Strat Anticipation research & analysis

The German articulated truck fleet is the youngest with 65% of it being under 10 years, whereas the Greek fleet is the oldest with 80% of it being over 25 years

8 EU Countries - Articulated trucks - Fleet characteristics (2/2)

ARTICULATED TRUCK FLEET BY SUBSEGMENT & AGE CATEGORY | In % and number of vehicles, 8 countries, 2024

TOTAL : 1 922 133



Source : Sybil model - EMISIA, Strat Anticipation research & analysis

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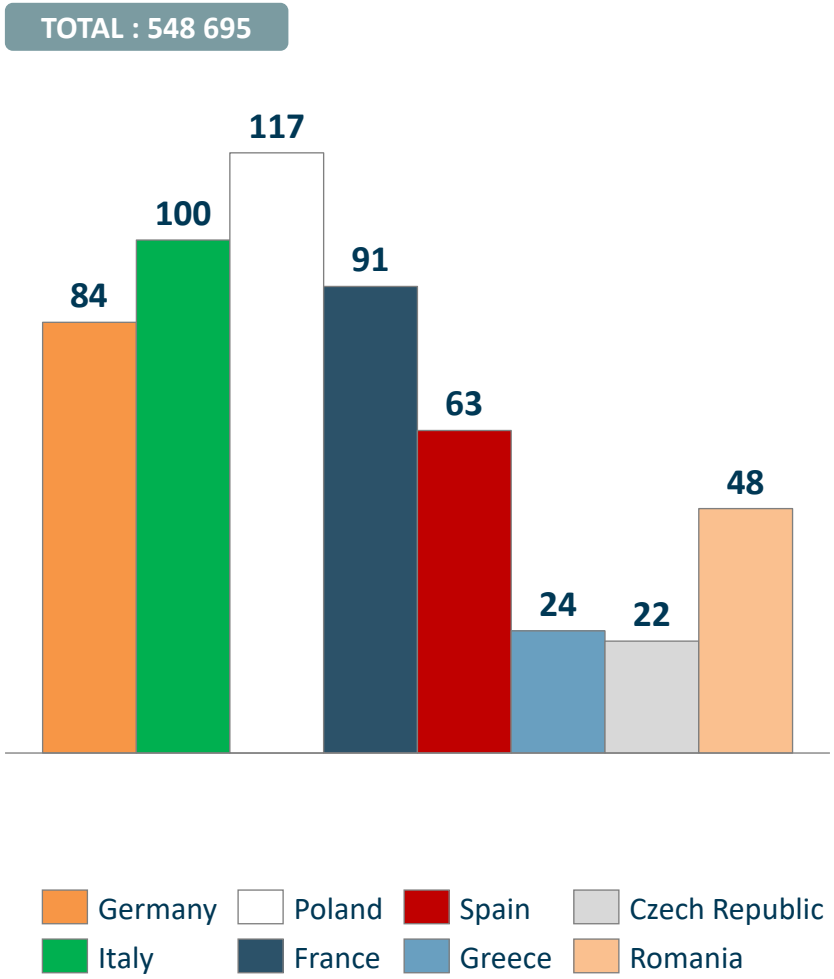
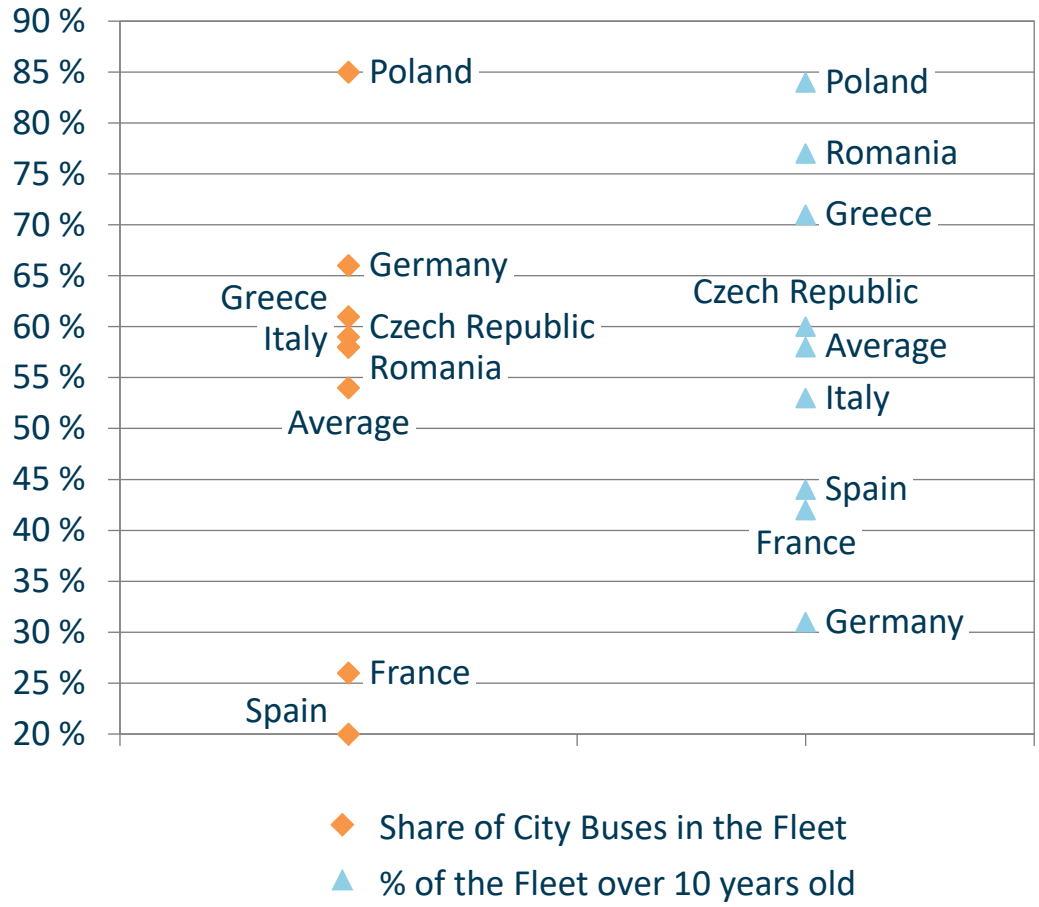
4 countries each have more than 80k buses in operation : Germany, France & Spain with a high share of coaches, and Poland with a predominance of buses

8 EU Countries Bus Fleet characteristics (1/3)

TOTAL NUMBER OF BUS IN THE FLEET IN 8 COUNTRIES | In k units, 8 Countries, 2024



SHARE OF CITY BUSES & PERCENTAGE OF THE BUSES OVER 10 YEARS OLD | In %, 8 Countries, 2024

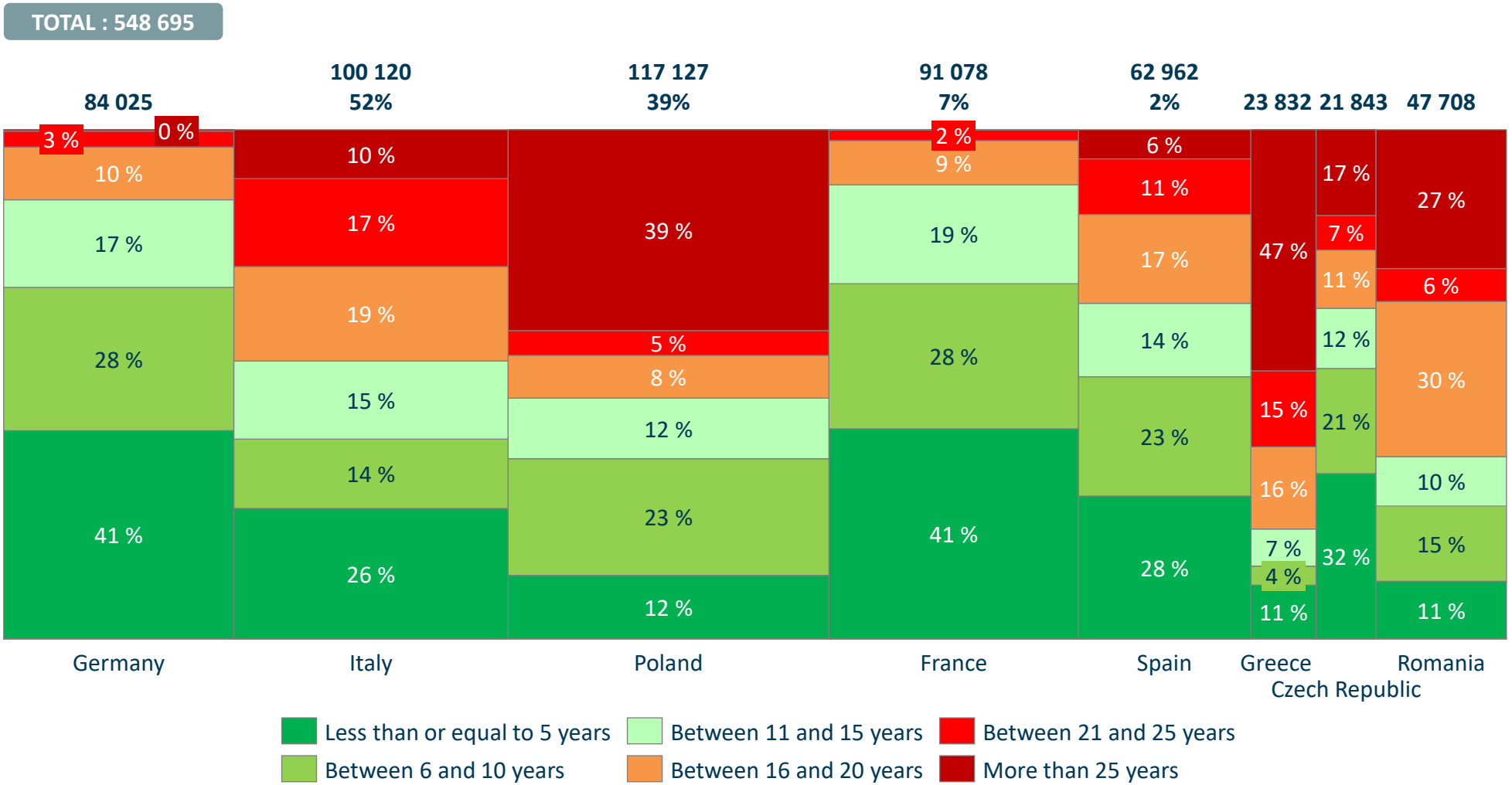


Source : Sybil model - EMISIA, Strat Anticipation research & analysis

Bus age patterns differ in the 8 countries, like in Poland where 39% of buses are over 25 years old, compared to less than 1% in Germany & France

8 EU Countries Bus Fleet characteristics (3/3)

8 COUNTRIES BUS HD FLEET BY SUBSEGMENT & AGE CATEGORY | In % and number of vehicles, 8 countries, 2024



Source : Sybil model - EMISIA, Strat Anticipation research & analysis

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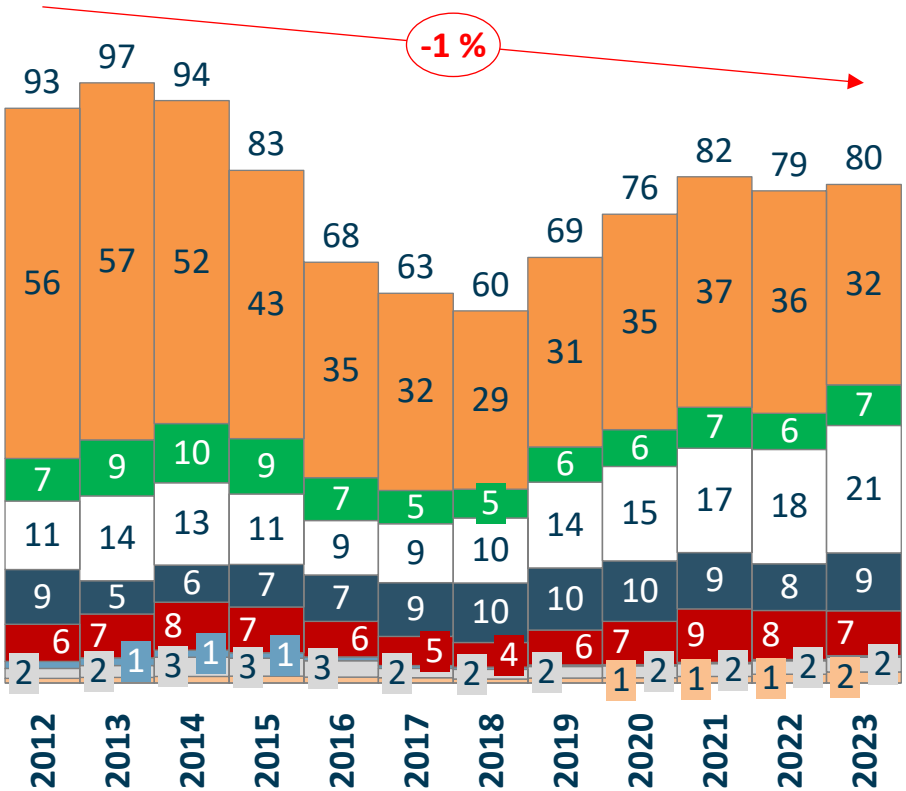
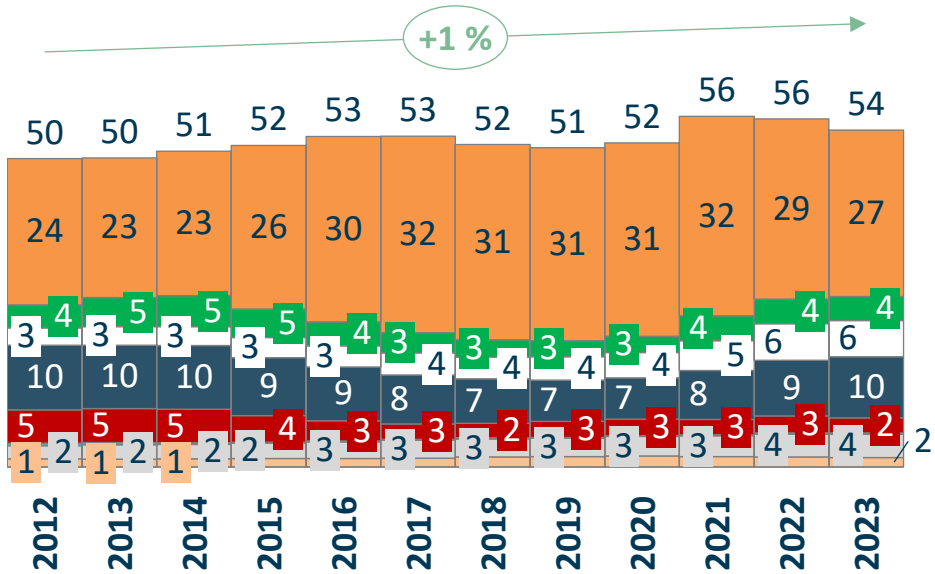
Extra-EU HDV export flows are reducing by 1% yearly on average, while intra-EU HDV export flows are slowly growing at 1% per year

Trucks Extra and Intra EU export in 8 countries

EXTRA EU - TOTAL NUMBER OF HDVs EXPORTED FROM 8 COUNTRIES – AVERAGE ON THE LAST 3 YEARS | In k units, 8 Countries, 2012-2023



INTRA EU - TOTAL NUMBER OF HDVs EXPORTED FROM 8 COUNTRIES – AVERAGE ON THE LAST 3 YEARS | In k units, 8 Countries, 2012-2023



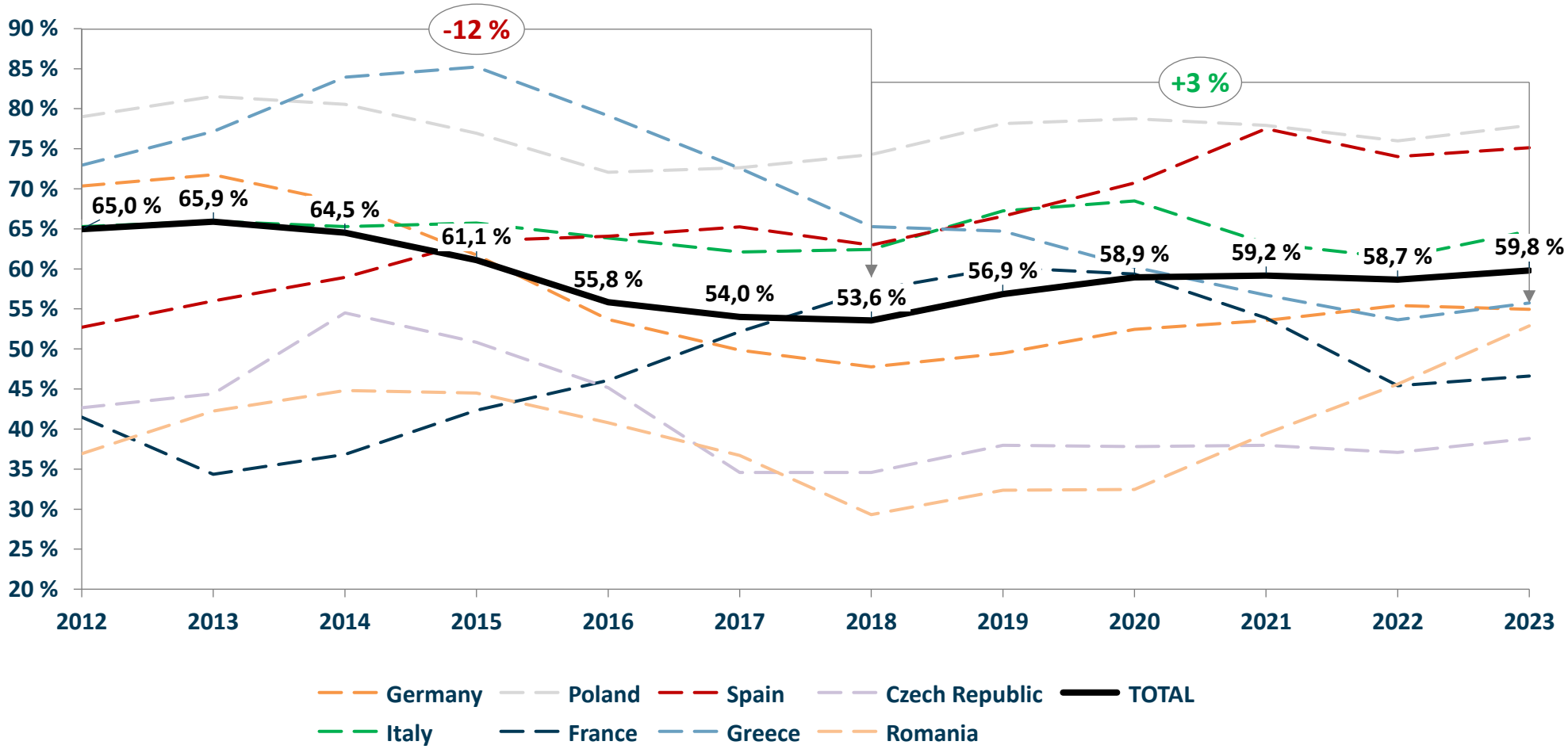
Germany | Poland | Spain | Czech Republic
Italy | France | Greece | Romania

HDV : Heavy-Duty Vehicle
Source : Sybil model - EMISIA, Strat Anticipation research & analysis

Among exports, the share of extra-EU HDV exports went down from 65% to 60% in 11 years and seems to have stabilized post-Covid

Export destination trend - Heavy-Duty Vehicles

PERCENTAGE OF EXTRA EU EXPORT FOR HEAVY DUTY VEHICLES PER YEAR – AVERAGE ON THE LAST 3 YEARS* | 8 European Countries, in percentage of exports, 2012-2023

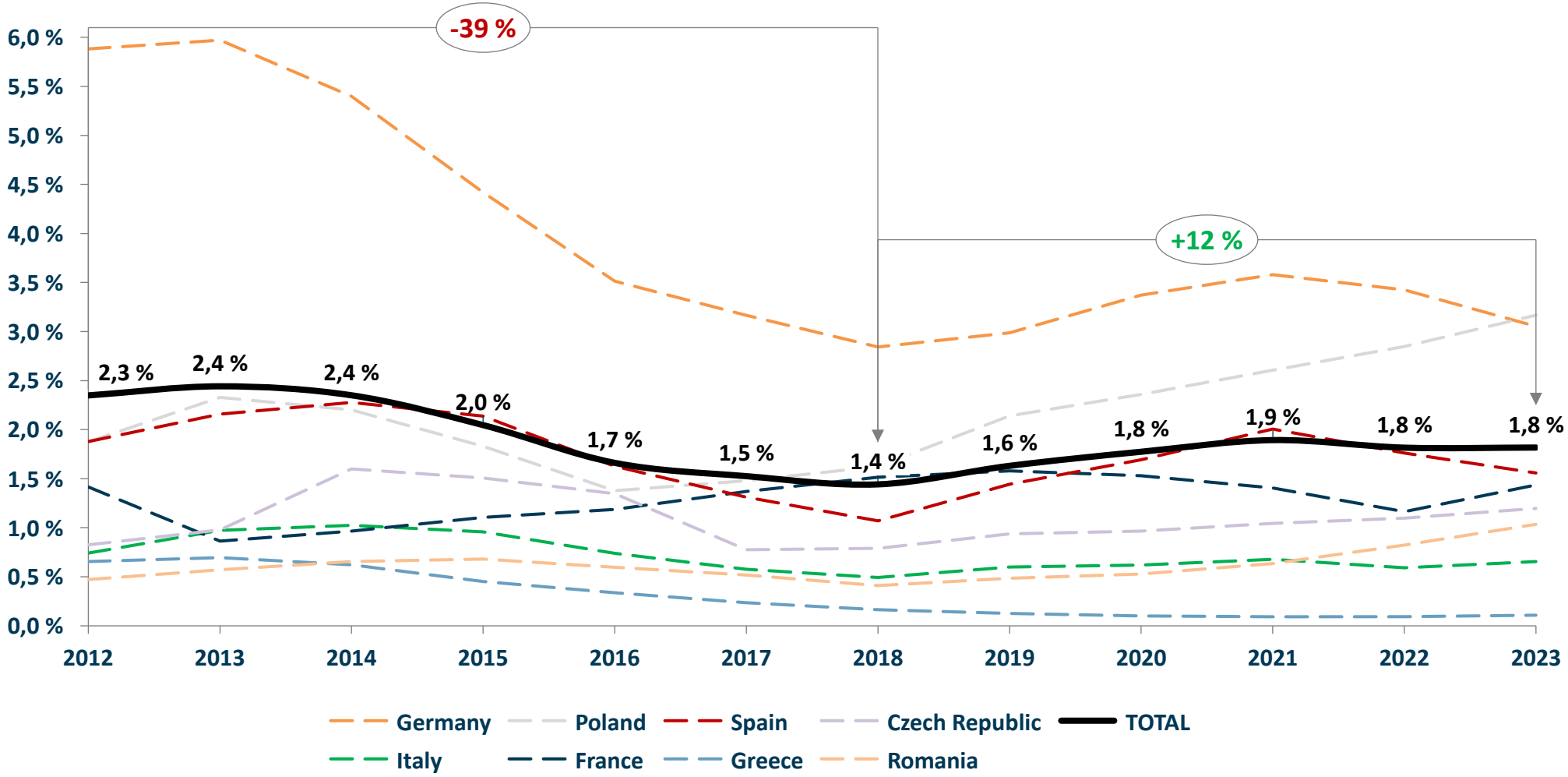


*Taking the average over the last three years allows us to smoothen the curves to see trends emerging, see appendix
Source : EMISIA, Eurostat, Strat Anticipation analysis

There is a similar trend for the percentage of the HDV fleet exported outside the EU, which went from 2.3% to 1.8% between 2012 & 2023

Export destination trend - Heavy-Duty Vehicles

EXTRA EU EXPORT FOR HEAVY DUTY VEHICLES PER YEAR FOR 8 COUNTRIES AND FOR THE CONSOLIDATED FLEET – AVERAGE ON THE LAST 3 YEARS, IN % OF THE FLEET | 8 European Countries, in percentage of fleet, 2012-2023



HDV : Heavy-Duty Vehicle
*Taking the average over the last three years allows us to smoothen the curves to see trends emerging, see appendix
Source : EMISIA, Eurostat, Strat Anticipation analysis

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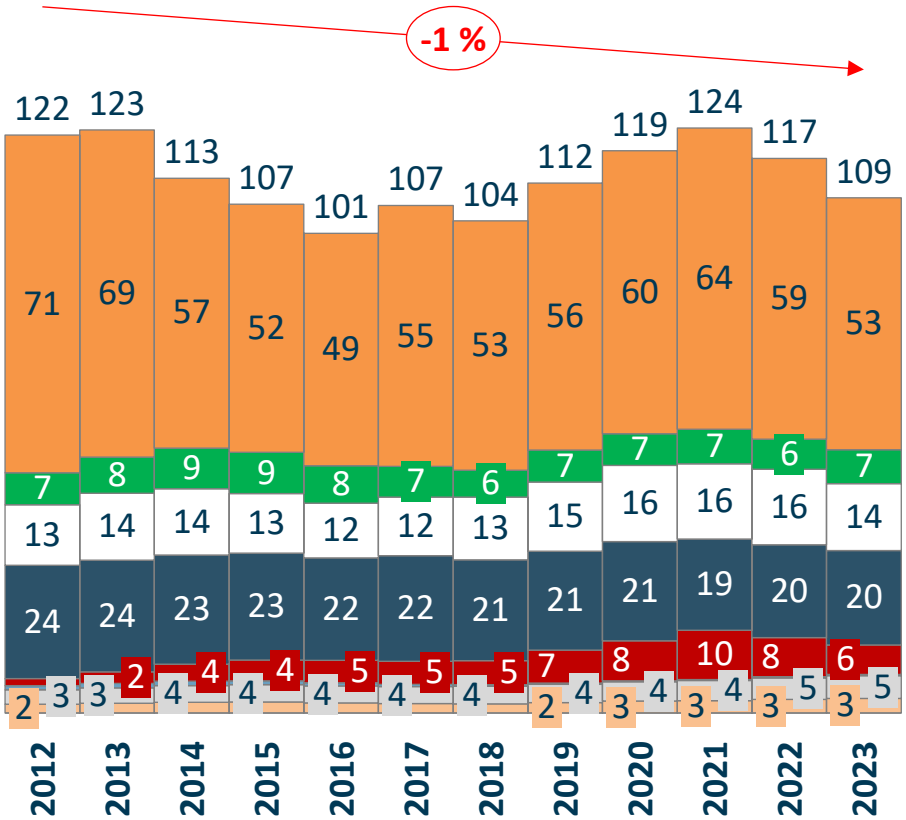
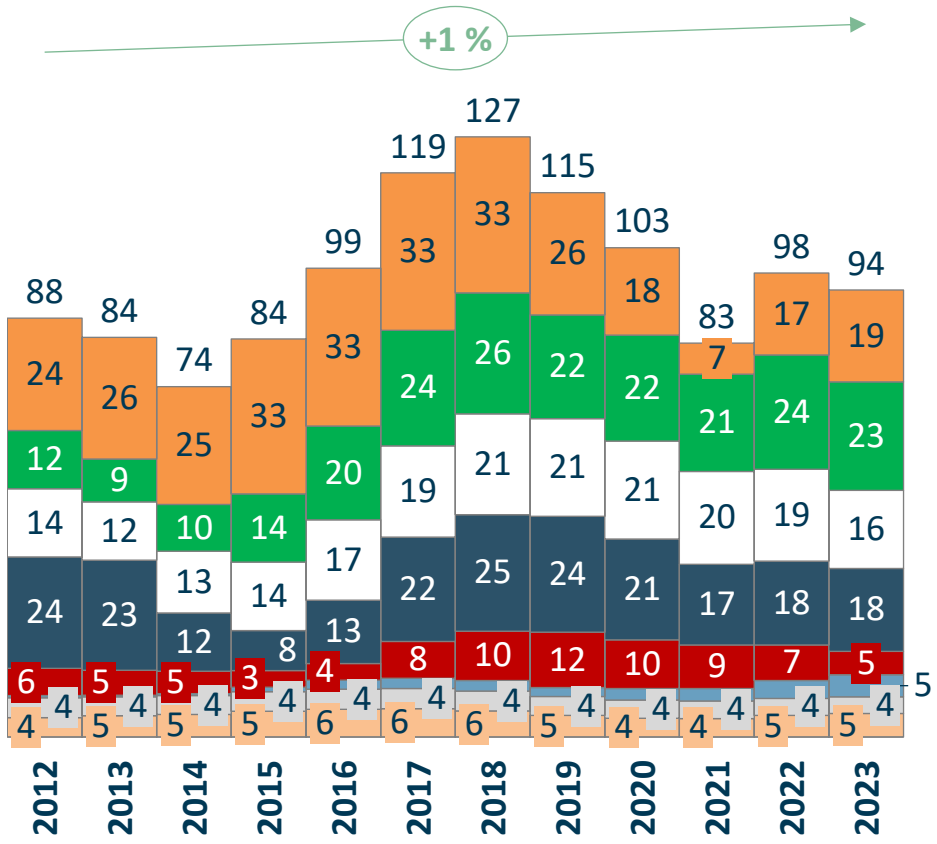
Overall, there is a slight decline (-1%) in truck export, whereas truck scrap is slightly growing by 1% in average

Trucks Scrapped and exported in 8 European countries

TOTAL NUMBER OF TRUCKS EXPORTED IN 8 COUNTRIES – AVERAGE ON THE LAST 3 YEARS | In k units, 8 EU Countries, 2012-2023



TOTAL NUMBER OF TRUCKS SCRAPPED IN 8 COUNTRIES – AVERAGE ON THE LAST 3 YEARS | In k units, 8 EU Countries, 2012-2023

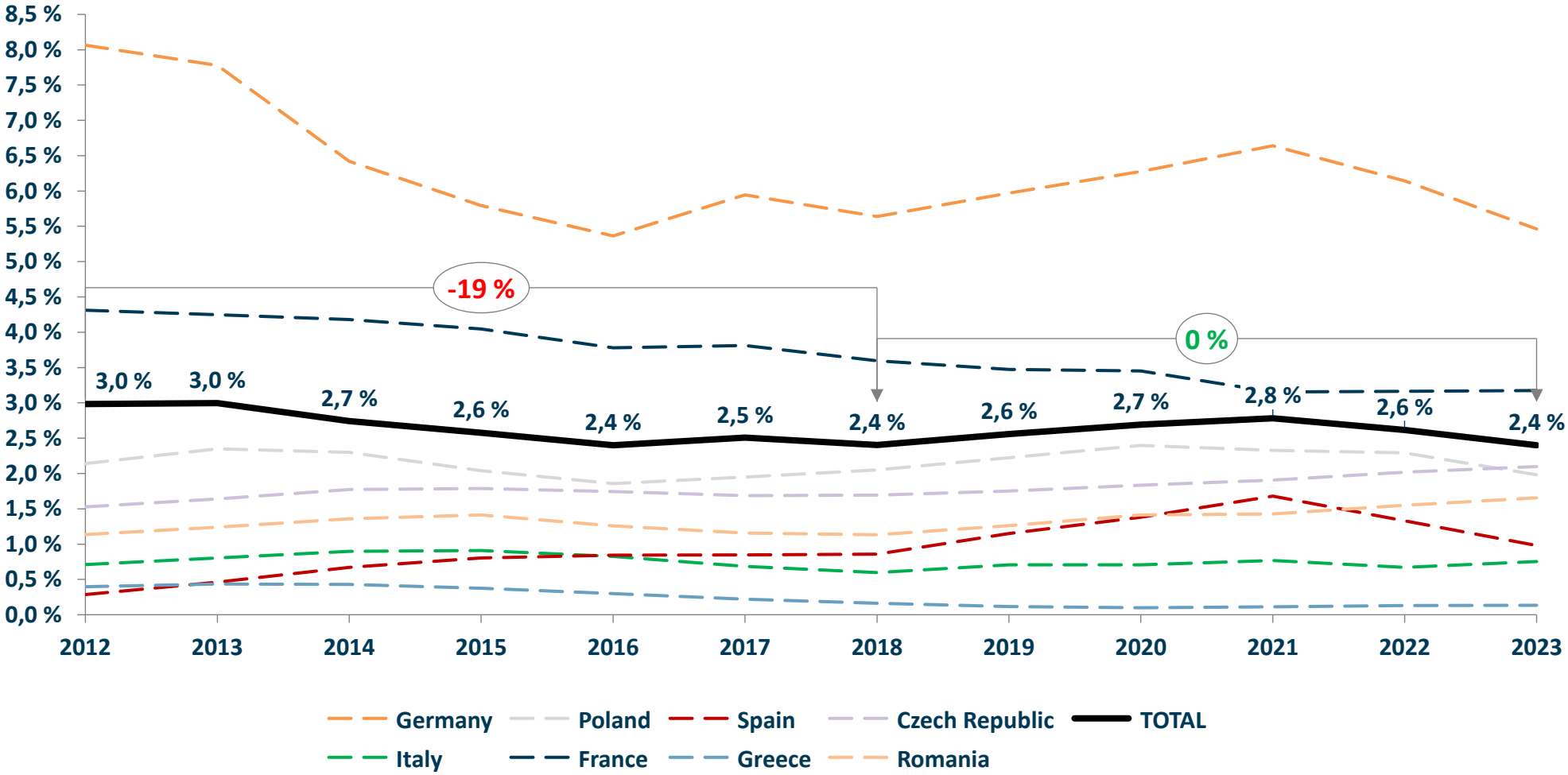


Source : Sybil model - EMISIA, Strat Anticipation research & analysis

Over the years, some fluctuations in truck exports were observed, but now the percentage has been mostly decreasing since 2021

Annual Truck Exports by Country - Percentage

PERCENTAGE OF THE TRUCK FLEET EXPORTED PER YEAR – AVERAGE ON THE LAST 3 YEARS | 8 EU Countries, in percentage of the fleet , 2012-2023

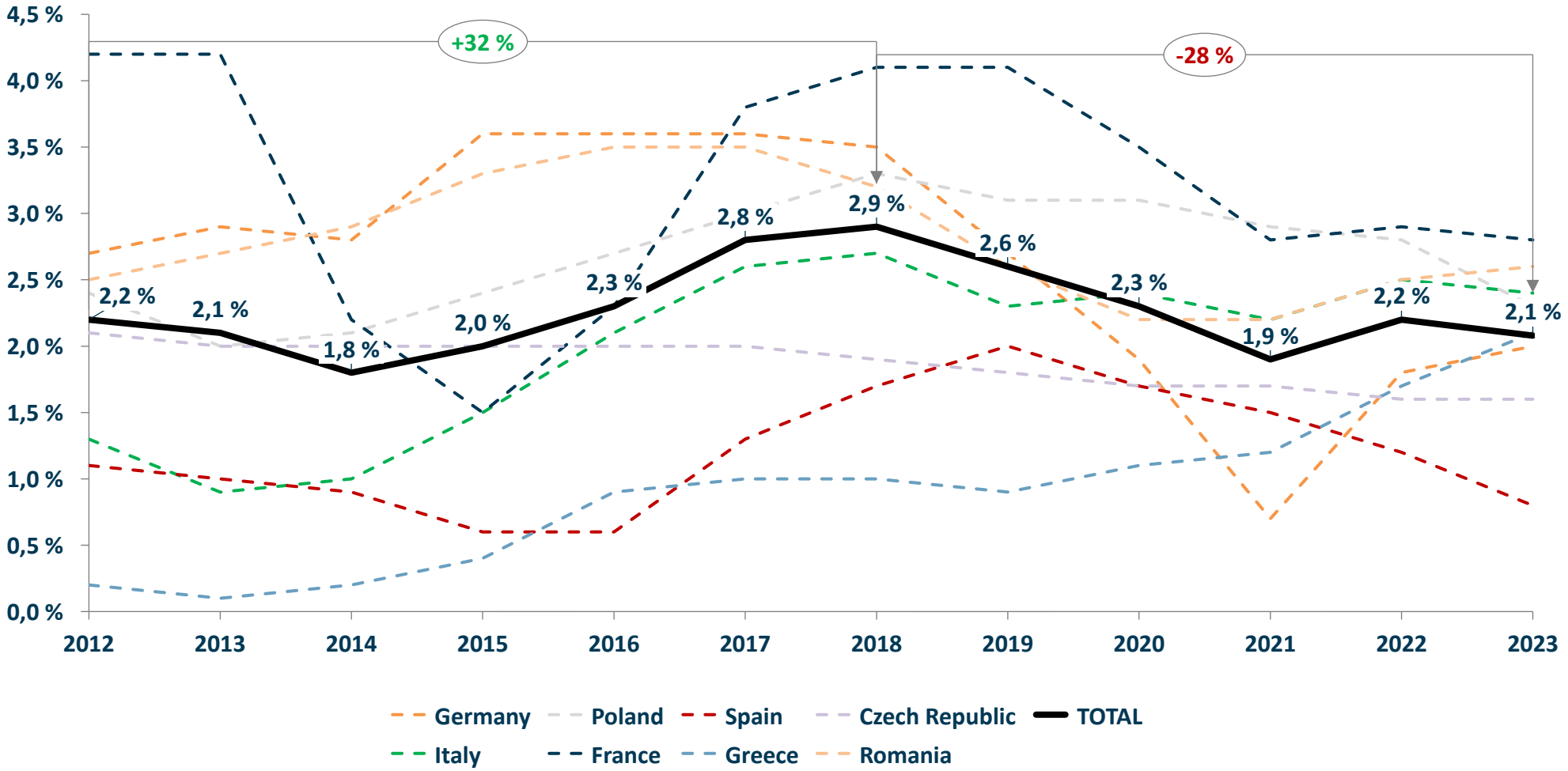


Source : EMISIA, Strat Anticipation analysis

The scrappage distribution is not following a similar trend; we're seeing lot of fluctuations over the years. It has started to decrease since 2018

Annual Truck Scrappage by Country - Percentage

PERCENTAGE OF THE TRUCK FLEET SCRAPPED PER YEAR – AVERAGE ON THE LAST 3 YEARS | 8 EU Countries, in percentage of the fleet, 2012-2023



Source : EMISIA, Strat Anticipation analysis

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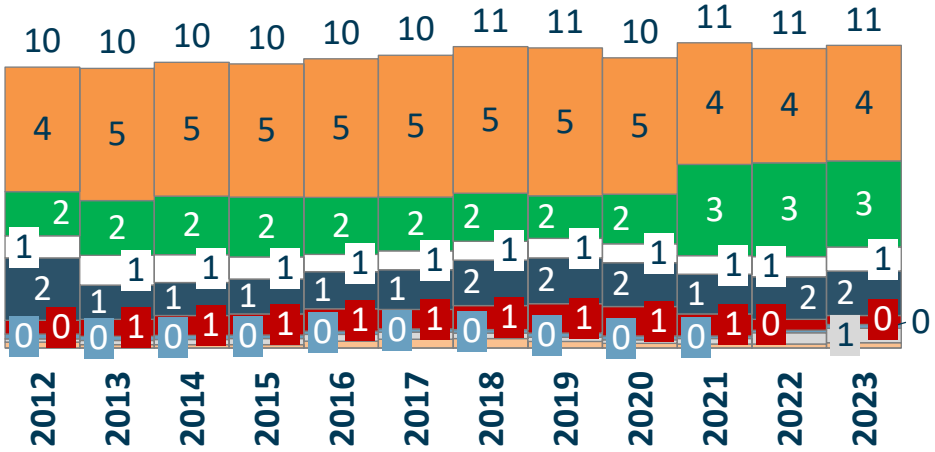
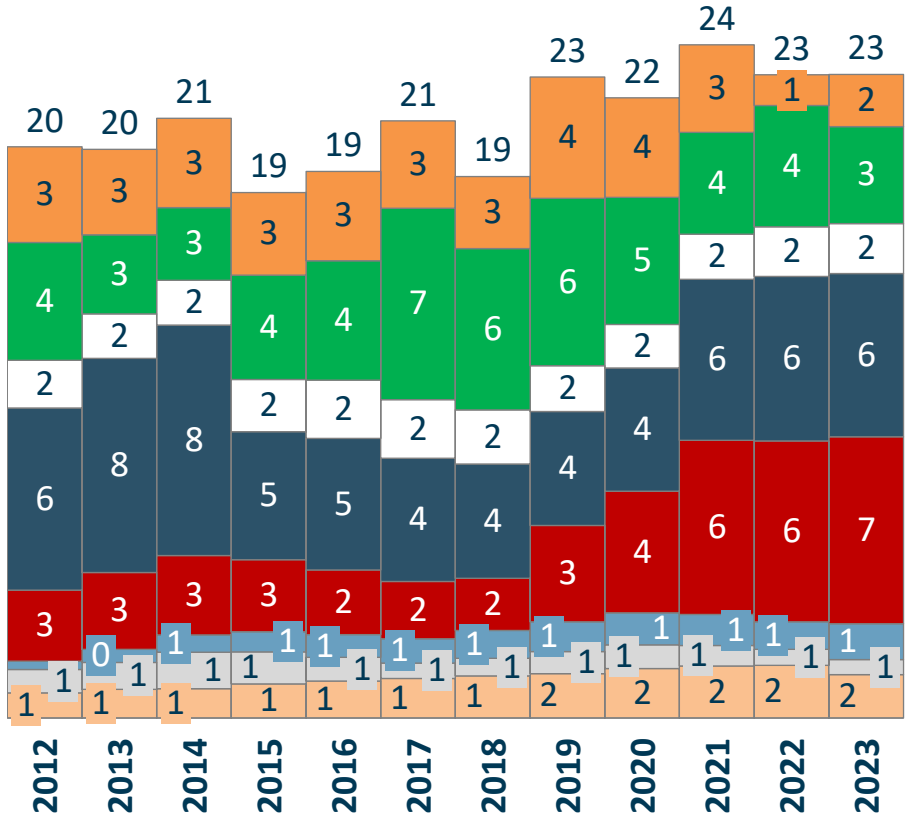
Since 2012, bus exports have remained stable around 11k units per year, while scrappage volume has grown slowly from 20 to 23k units annually

Scrappage and Exports of Buses in 8 European countries

TOTAL NUMBER OF BUSES EXPORTED IN 8 COUNTRIES – AVERAGE ON THE LAST 3 YEARS | In k units, 8 EU Countries, 2012-2023



TOTAL NUMBER OF BUSES SCRAPPED IN 8 COUNTRIES – AVERAGE ON THE LAST 3 YEARS | In k units, 8 EU Countries, 2012-2023



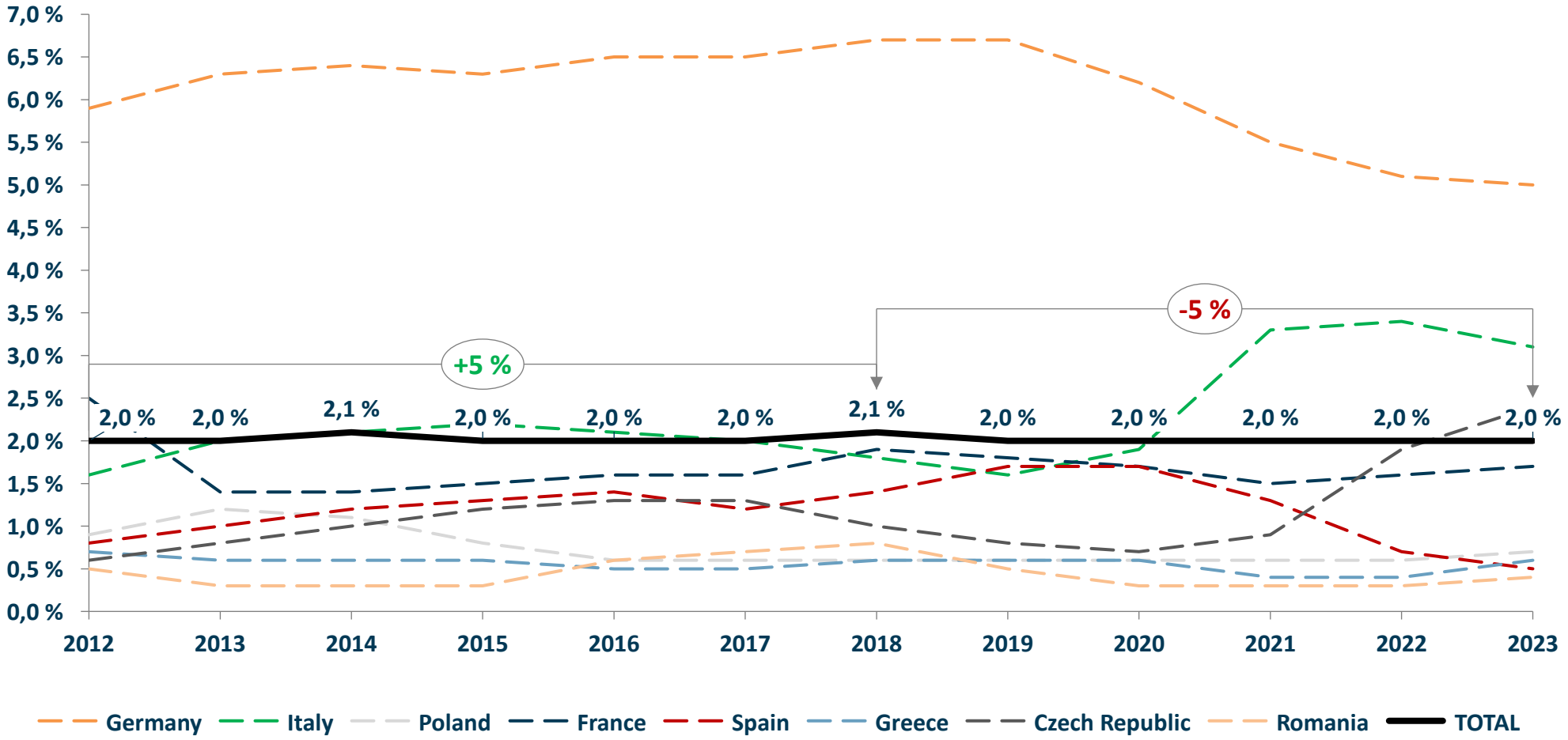
Germany | Poland | Spain | Czech Republic
Italy | France | Greece | Romania

Source : Sybil model - EMISIA, Strat Anticipation research & analysis

Germany exports around 6% of its bus fleet every year, nearly three times as much as the average percentage. The other 7 countries export no more than 3,0%

Annual Bus Exports by Country - Percentage

PERCENTAGE OF THE BUS FLEET EXPORTED PER YEAR – AVERAGE ON THE LAST 3 YEARS | 8 EU Countries, in percentage of the fleet , 2012-2023

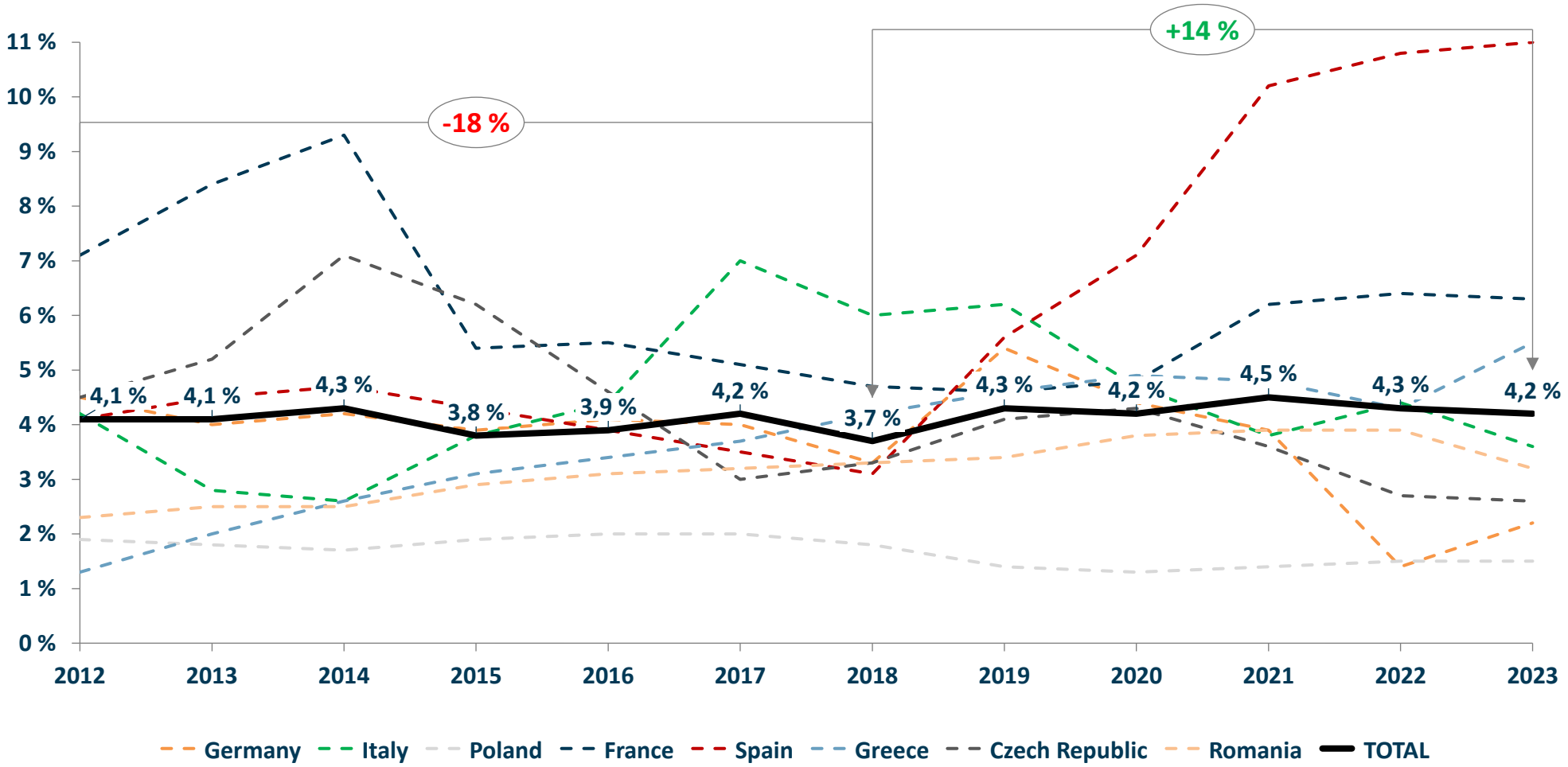


Source : CBC, Strat Anticipation analysis

Over the years, Spain is the country with the highest percentage of scrap, now above 10%, while other countries have converged towards a similar percentage around 4%

Annual Bus Scrappage by Country - Percentage

PERCENTAGE OF THE BUS FLEET SCRAPPED PER YEAR – AVERAGE ON THE LAST 3 YEARS | 8 EU Countries, in percentage of the fleet, 2012-2023



Source : CBC, Strat Anticipation analysis

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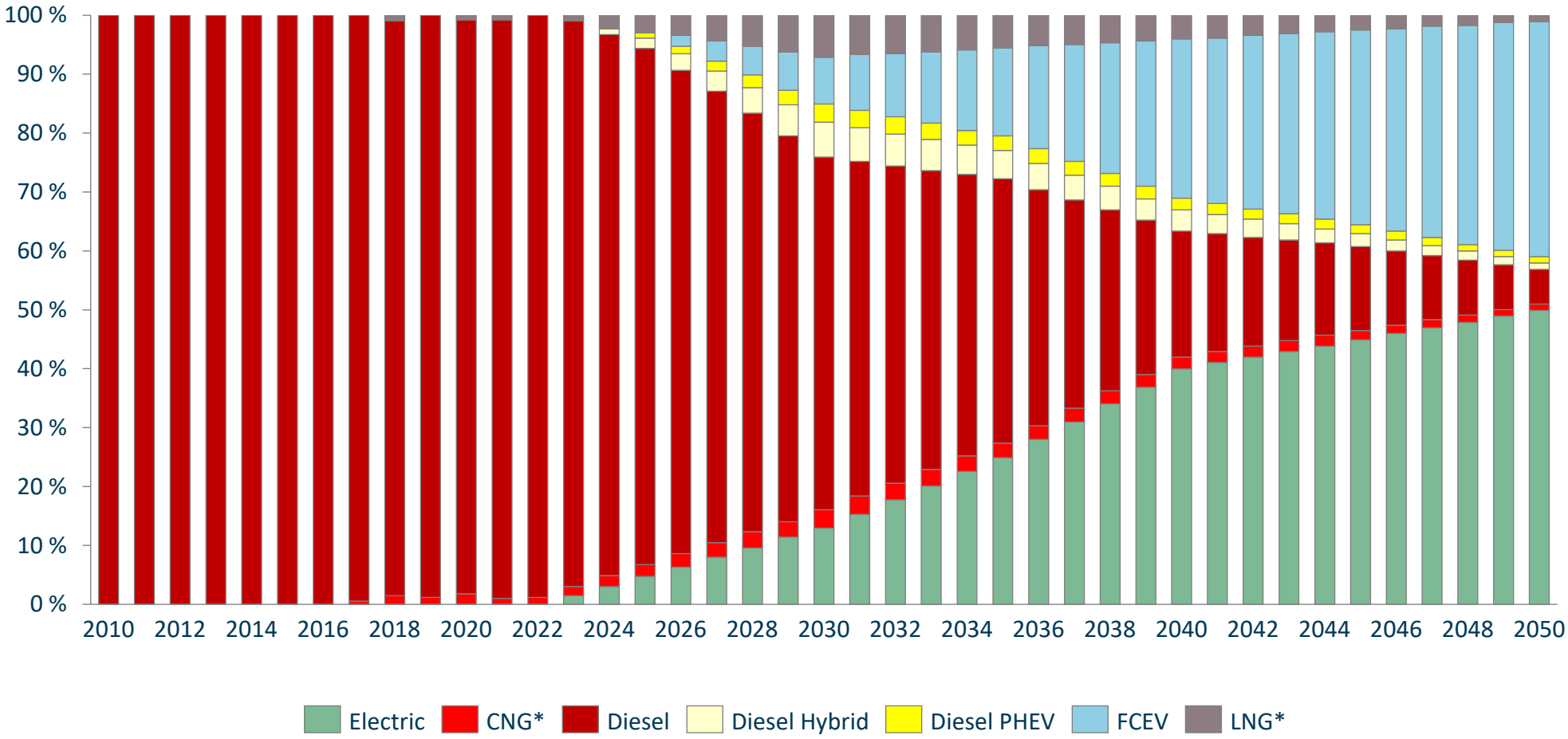
E:MISIA has made some forecasts of powertrain market share for trucks up to 2050, for the European Union & according to 2040 climate targets

Evolution of the powertrain mix within new truck registrations in the EU (1/2)

EU NEW TRUCK REGISTRATIONS BY POWERTRAIN | In %, EU, 2010-2050

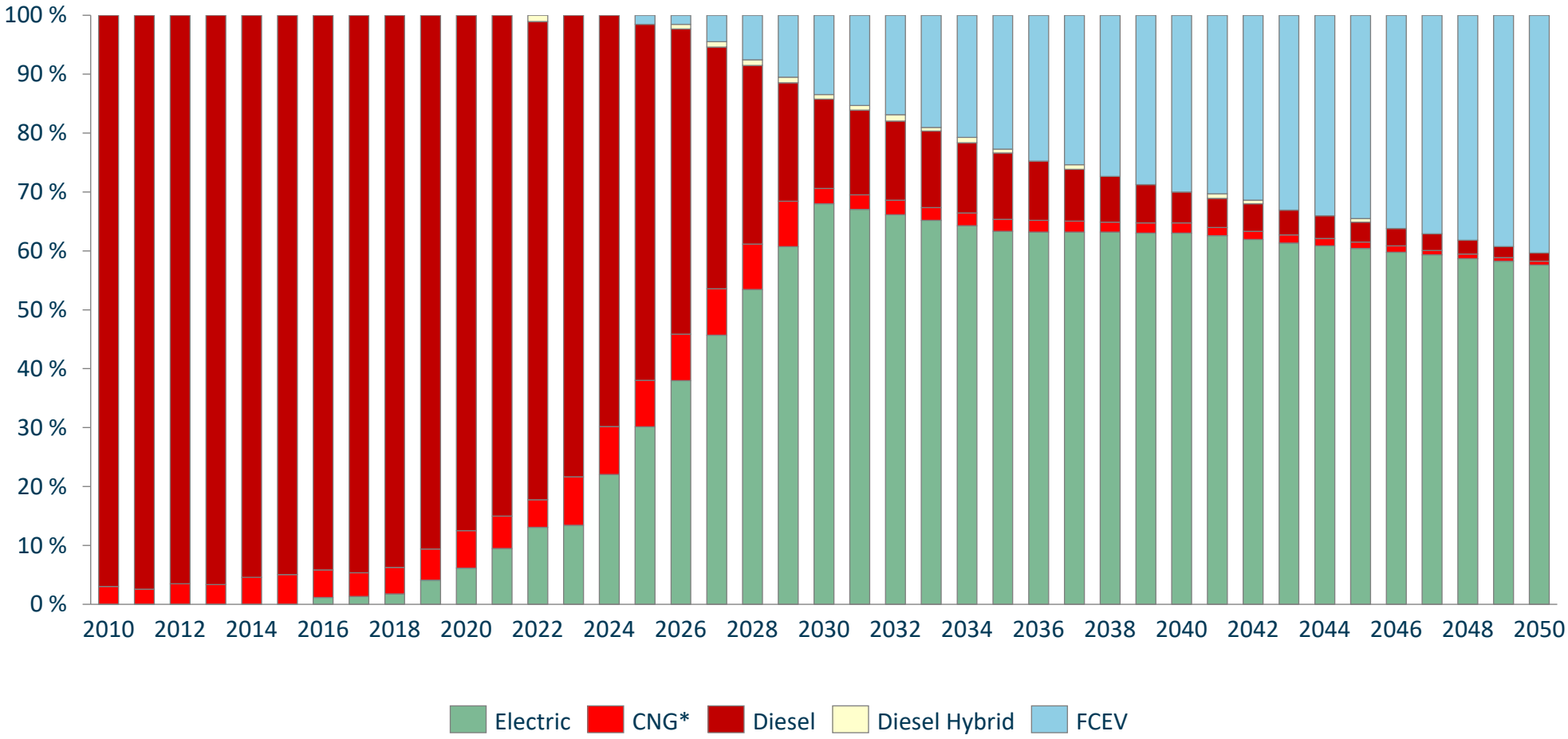


CNG : Compressed Natural Gas, LNG : Liquid Natural Gas
Source : Sybil model - EMISIA, Strat Anticipation research & analysis

E:MISIA has made some forecasts of powertrain market share for buses & coaches up to 2050, for the European Union & according to 2040 climate targets

Evolution of the powertrain mix within new bus & coach registrations in the EU (2/2)

EU NEW BUS REGISTRATIONS BY POWERTRAIN | In %, EU, 2010-2050

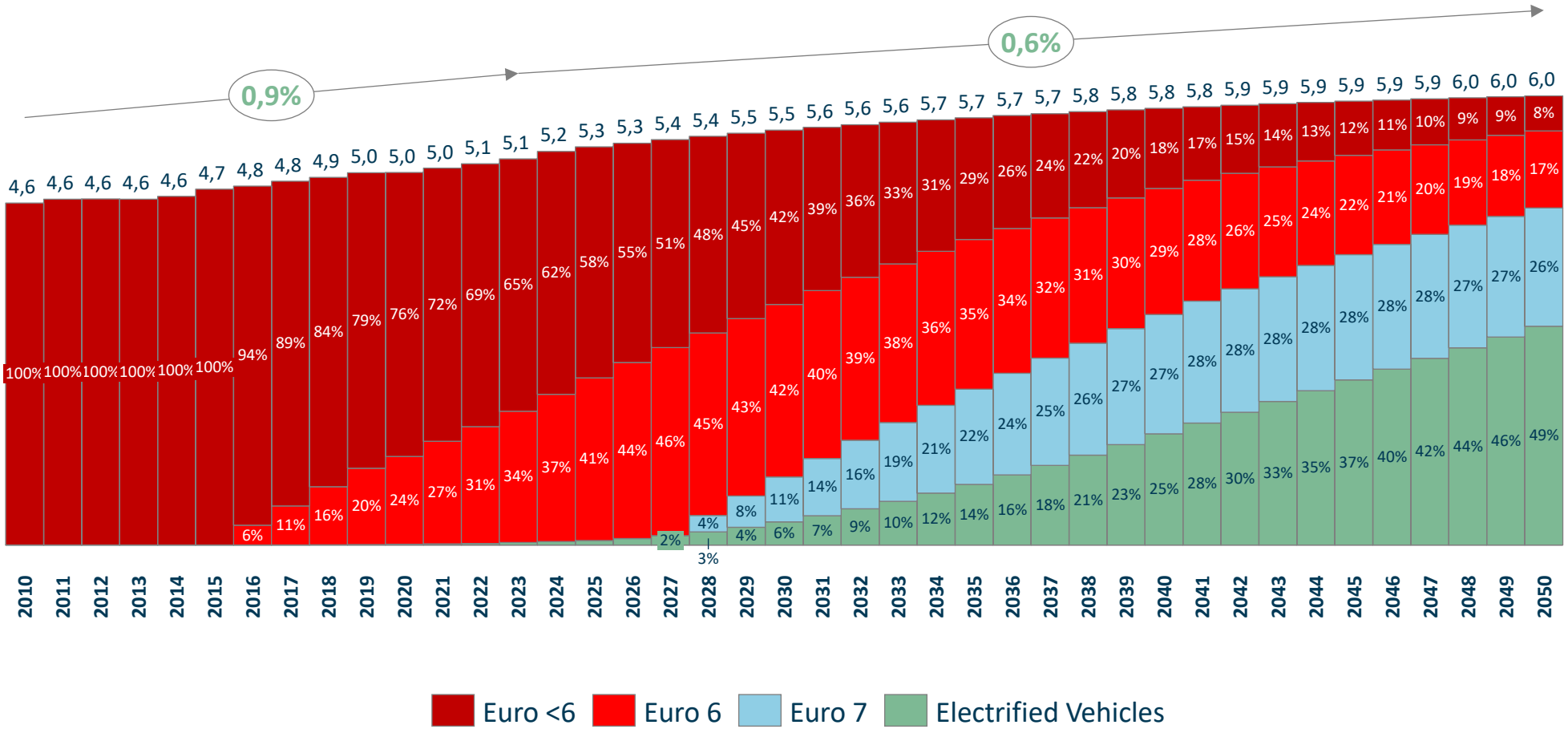


CNG : Compressed Natural Gas
Source : Sybil model - EMISIA, Strat Anticipation research & analysis

The HDV fleet should grow from 5,2 million in 2024 up to 6,0 in 2050, with a 49% share of electrified HDVs vs 6% in 2030

HDV Fleet by Category

HDV FLEET BY CATEGORY | In M units and %, 8 EU Countries, 2010-2050



HDV : Heavy-Duty Vehicle
Note : Electrified vehicles correspond to BEV, PHEV and FCEV
Source : EMISIA, Strat Anticipation analysis

3 scenarios were built : one is the baseline, sticking to the historical trend, one where exports decrease due to new trucks, & one with strong export limitations

Scenario Description

BASELINE

- In this baseline scenario, each country continues its historical patterns for managing Heavy Duty Vehicles (HDVs). The overall vehicle fleet (park) may vary due to factors like new registrations, but the proportion of HDVs that are scrapped or exported remains consistent with past trends, expressed as a percentage of the total fleet.
- For instance, older trucks are retired or exported at rates similar to previous years, with no significant policy changes or disruptions. This scenario assumes stability.

Base Scenario used in the rest of the document

LOWER EXPORT

- In this intermediate scenario, there's a partial shift in how HDVs are handled across countries. A portion of Euro 6 and Euro 7 trucks—those meeting stricter EU emission standards—are downgraded (e.g., modified to comply with lower emission requirements) and exported to markets outside the EU.
- Electrified vehicles, such as battery-electric or hybrid trucks, are also exported, but only to countries equipped with sufficient recharging infrastructure to support their operation.
- Globally, **truck exports outside Europe decrease: Euro 6 trucks exports are reduced by 20%, Euro 7 trucks by 50%, and Battery Electric Vehicles (BEVs) by 70% compared to historical trends. These trucks are instead scrapped within the country.**

NO EXPORTS OF RECENT TRUCKS

- In the no-exports scenario, all Euro 6, Euro 7, and electrified HDVs remain within the European Union for their entire end-of-life cycle, with no exports permitted. These vehicles are either scrapped or recycled domestically, aligning with EU regulations on waste management, emissions reduction, and circular economy goals.
- Globally, **truck exports outside Europe strongly decrease: Euro 6 trucks exports are reduced by 40%, and both Euro 7 trucks and Battery Electric Vehicles (BEVs) are set to 0. These trucks are instead scrapped within the country.**

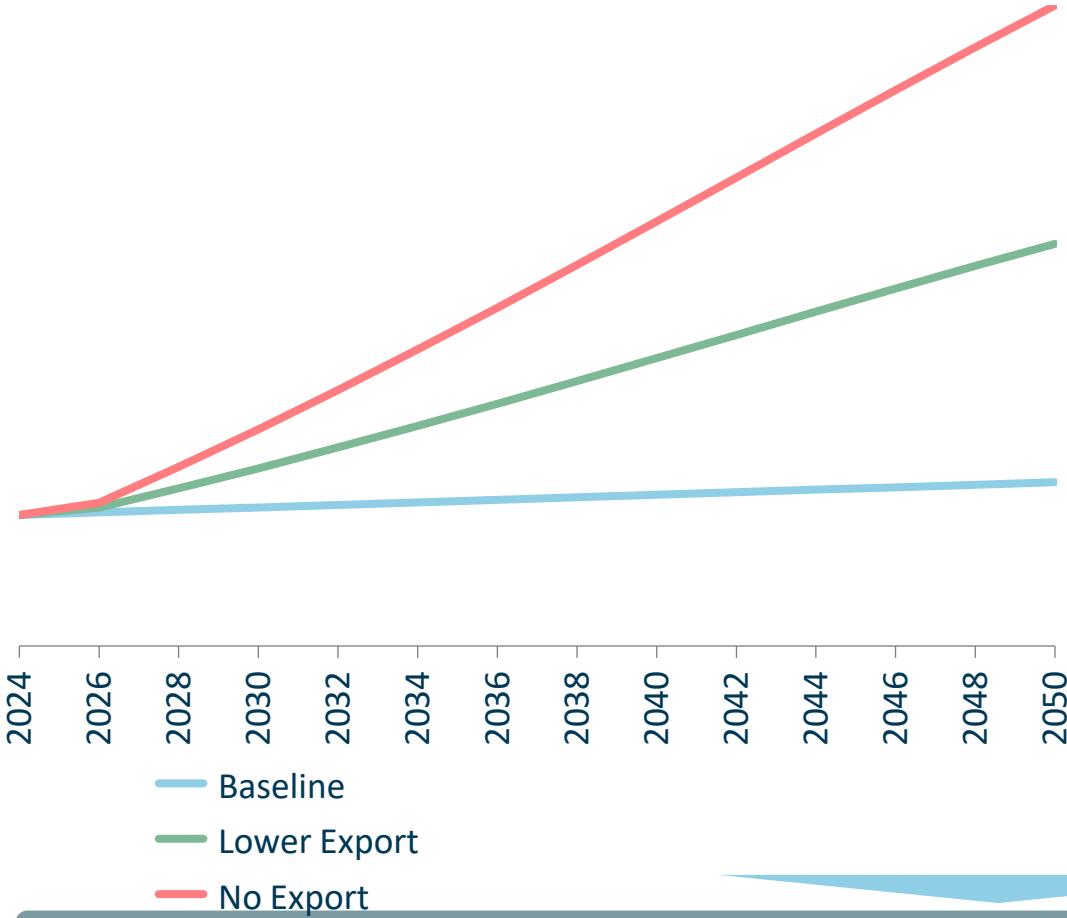
OUR GOAL IS TO ASSESS THE FUTURE NUMBER OF SCRAPPED TRUCKS & MATERIALS TO BE RECYCLED PER YEAR IN EACH OF THE SCENARIOS

Source : Strat Anticipation analysis

The goal of the scenarios is to illustrate the possible outcomes, that should be between the Baseline & the “No Export” Scenarios.

Scenario Description – Illustrative Objectives

ILLUSTRATIVE – SCENARIO RESULTS – NUMBER OF SCRAPPED TRUCKS IN THE 3 SCENARIOS | , 2024-2050, 8 Countries



CONSIDERING MARKET DYNAMICS (EURO 7 STANDARDS AND ELECTRIFICATION REDUCING EXPORTS) AND EVOLVING REGULATIONS (ELV DIRECTIVE FOR TRUCKS AND RESTRICTIONS ON IMPORTING OLDER TRUCKS IN VARIOUS COUNTRIES), WE EXPECT THE NUMBER OF END-OF-LIFE HEAVY-DUTY VEHICLES (HDVS) TO BE SCRAPPED IN OUR EIGHT COUNTRIES TO RANGE BETWEEN THE BASELINE AND NO-EXPORT SCENARIOS. WE AIM TO QUANTITATIVELY ASSESS THE VOLUME IMPACT OF THESE MARKET CHANGES.

OUR GOAL IS TO ASSESS THE VOLUME RANGE OF SCRAPPED TRUCKS AND BUSES IN OUR EIGHT COUNTRIES

Source : Strat Anticipation analysis

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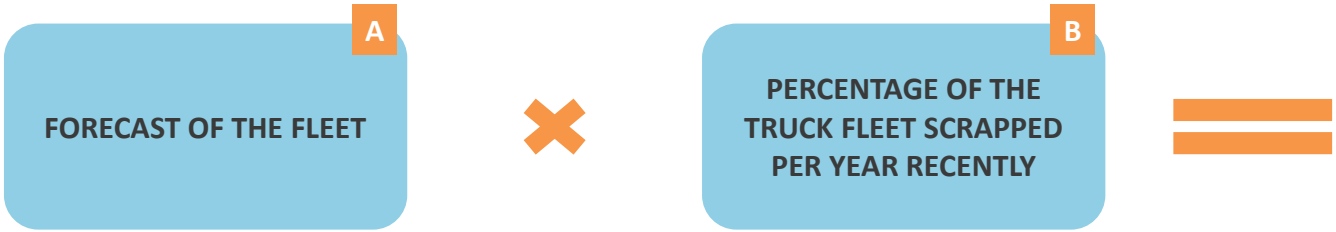
The Baseline Scenario for scrapped vehicles assumes that the current scrappage rate of the truck fleet will remain unchanged

Baseline Scenario Methodology

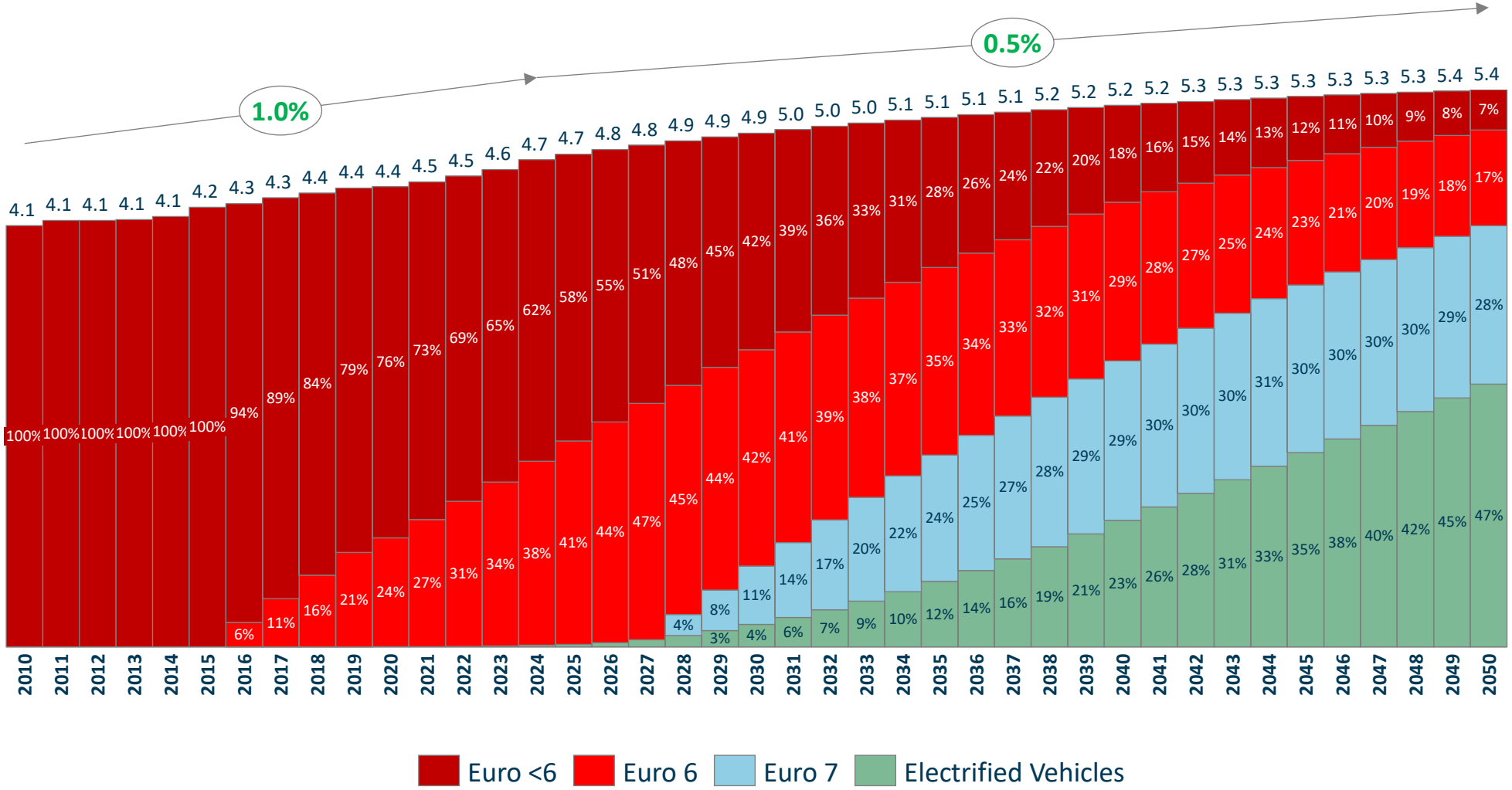


Source : Strat Anticipation analysis, EMISIA

We start with the truck fleet, which will grow from 4,7 million in 2024 up to 5,4 in 2050, with a 47% share of electrified trucks vs 4% in 2030

EU Truck Fleet by Category

A **8 COUNTRIES TRUCK FLEET BY CATEGORY |** In M units and %, 8 Countries, 2010-2050

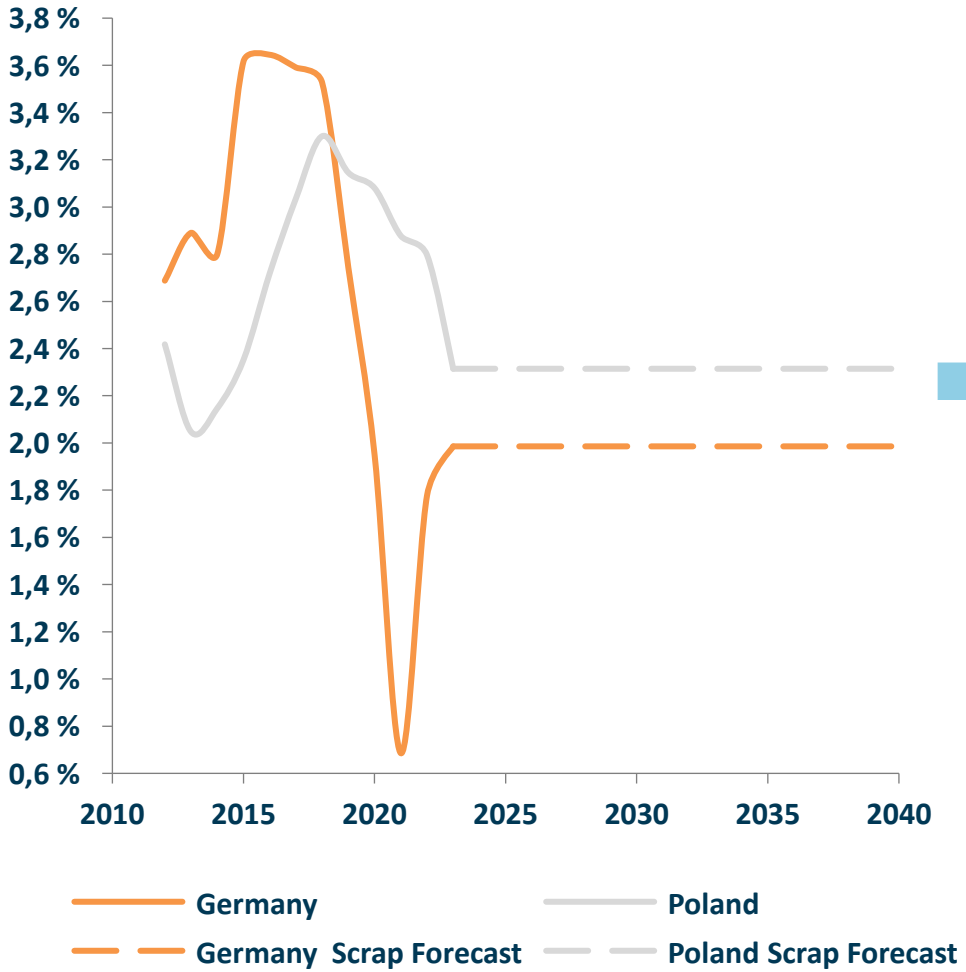


Source : Sybil model - EMISIA, Strat Anticipation research & analysis

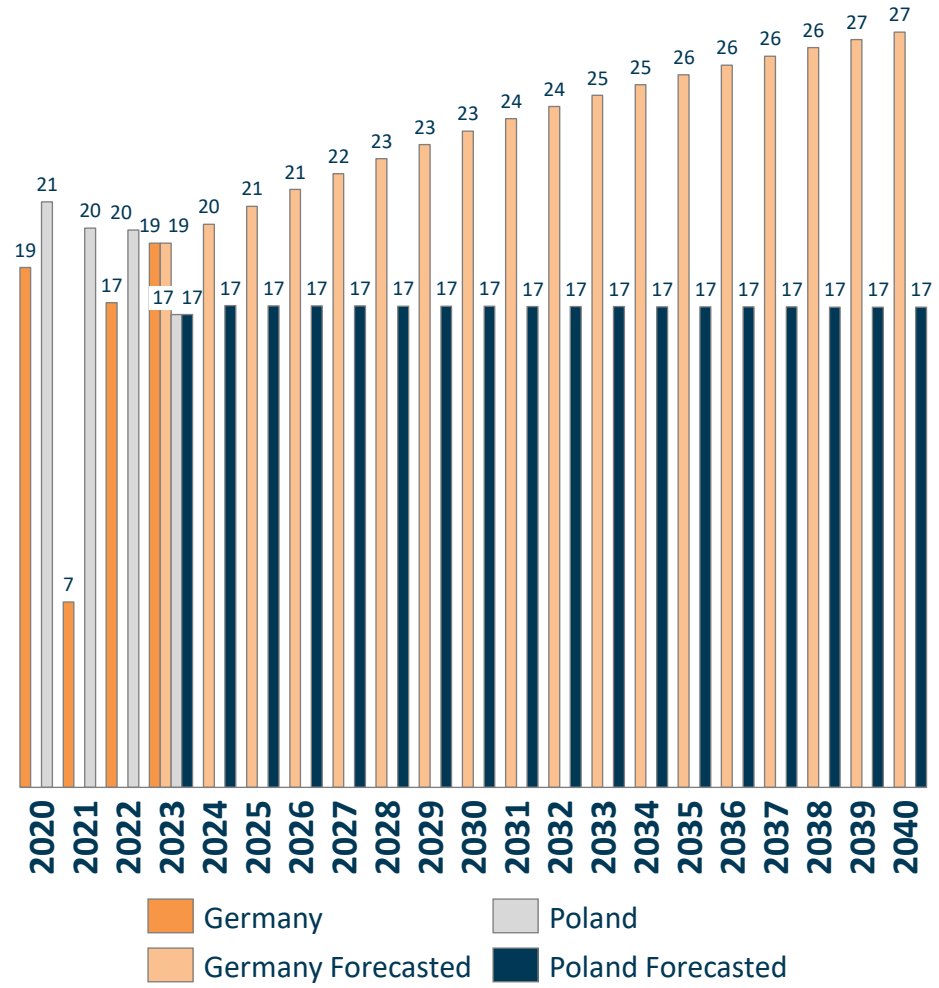
... and apply to it a percentage that corresponds to the share of the truck fleet scrapped between 2021 and 2023, for each of our 8 countries in scope

Baseline Scenario - Example of two countries

B **PERCENTAGE OF THE TRUCK FLEET SCRAPPED PER YEAR - 3-YEAR AVERAGE |** In % of the fleet, Germany & Poland, 2010-2040f



C **FORECAST OF TOTAL TRUCKS SCRAPPED |** In k units, Germany & Poland, 2020-2040f

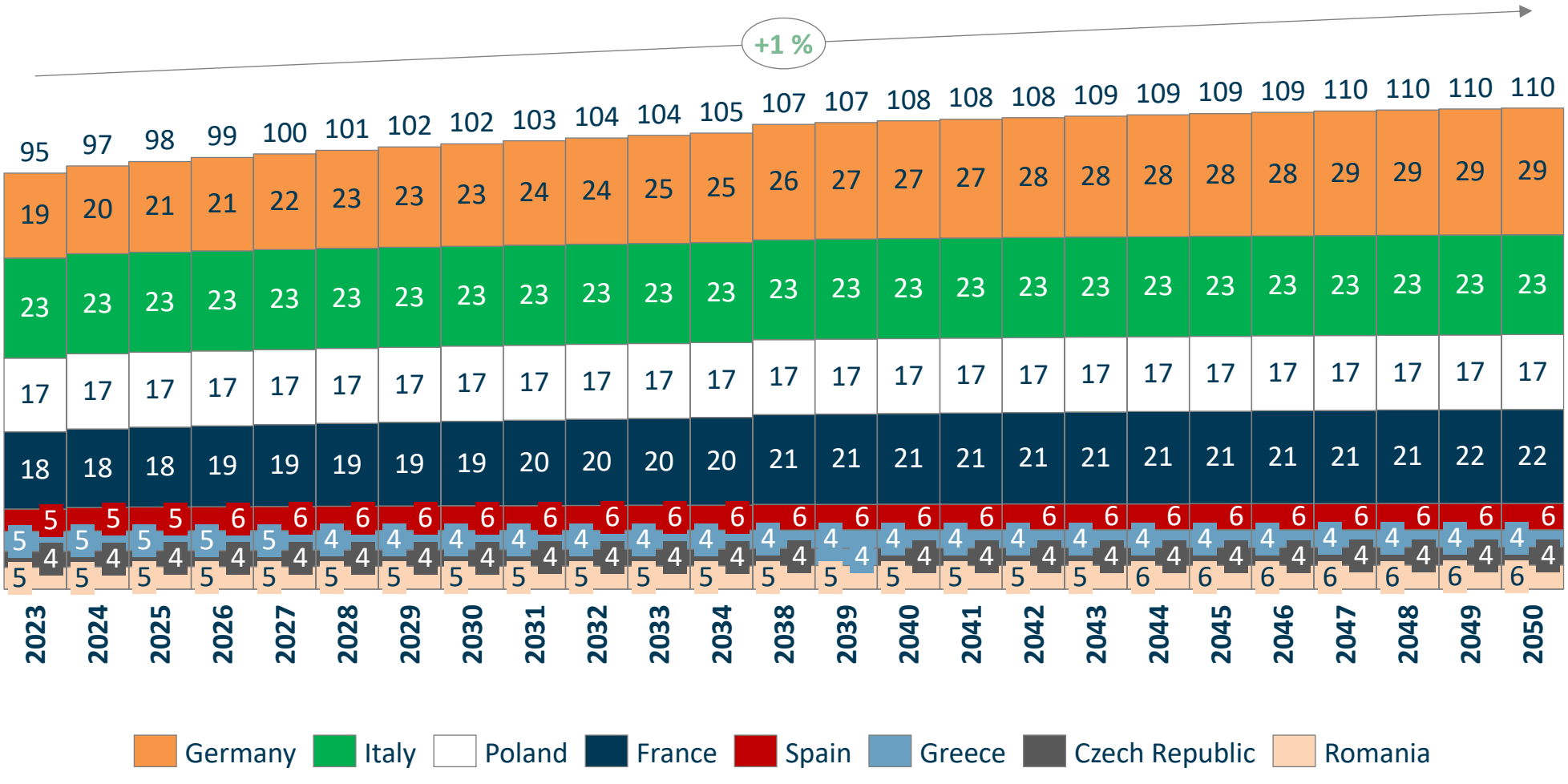


Source : Sybil model - EMISIA, Strat Anticipation research & analysis

In this Baseline Scenario, the total number of trucks to be scrapped across the 8 countries is approximately 95,000 units in 2023, with an annual growth rate of 1%

Trucks Scrapped in 8 EU countries

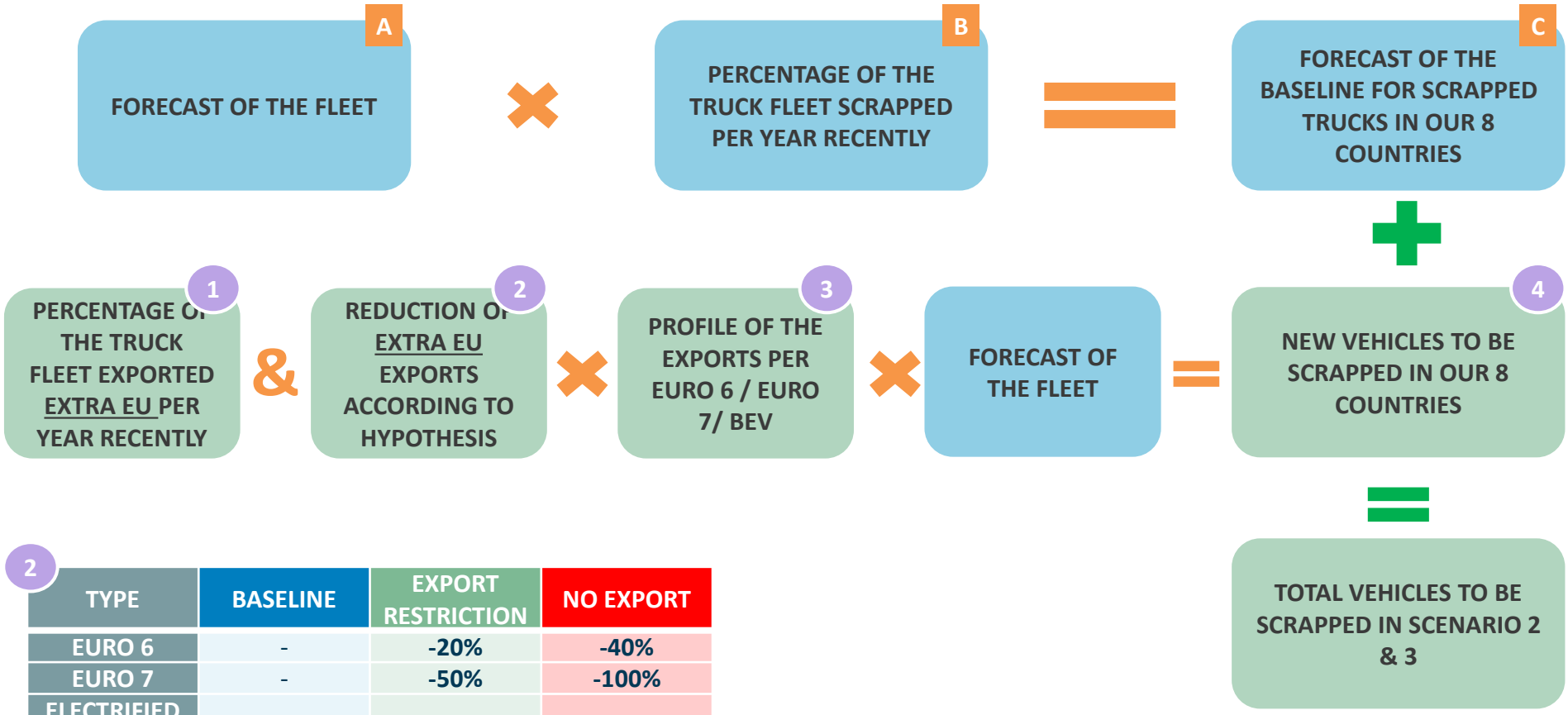
C **BASELINE SCENARIO - TOTAL NUMBER OF SCRAPPED TRUCKS IN OUR 8 COUNTRIES |** In k units, 8 EU Countries, 2023-2050f



Source : Sybil model - EMISIA, Strat Anticipation research & analysis

For the other scenarios, we calculate the impact of reduced extra-EU exports and assume that these trucks will now be scrapped within a European country

Export restriction Scenario - Methodology



2

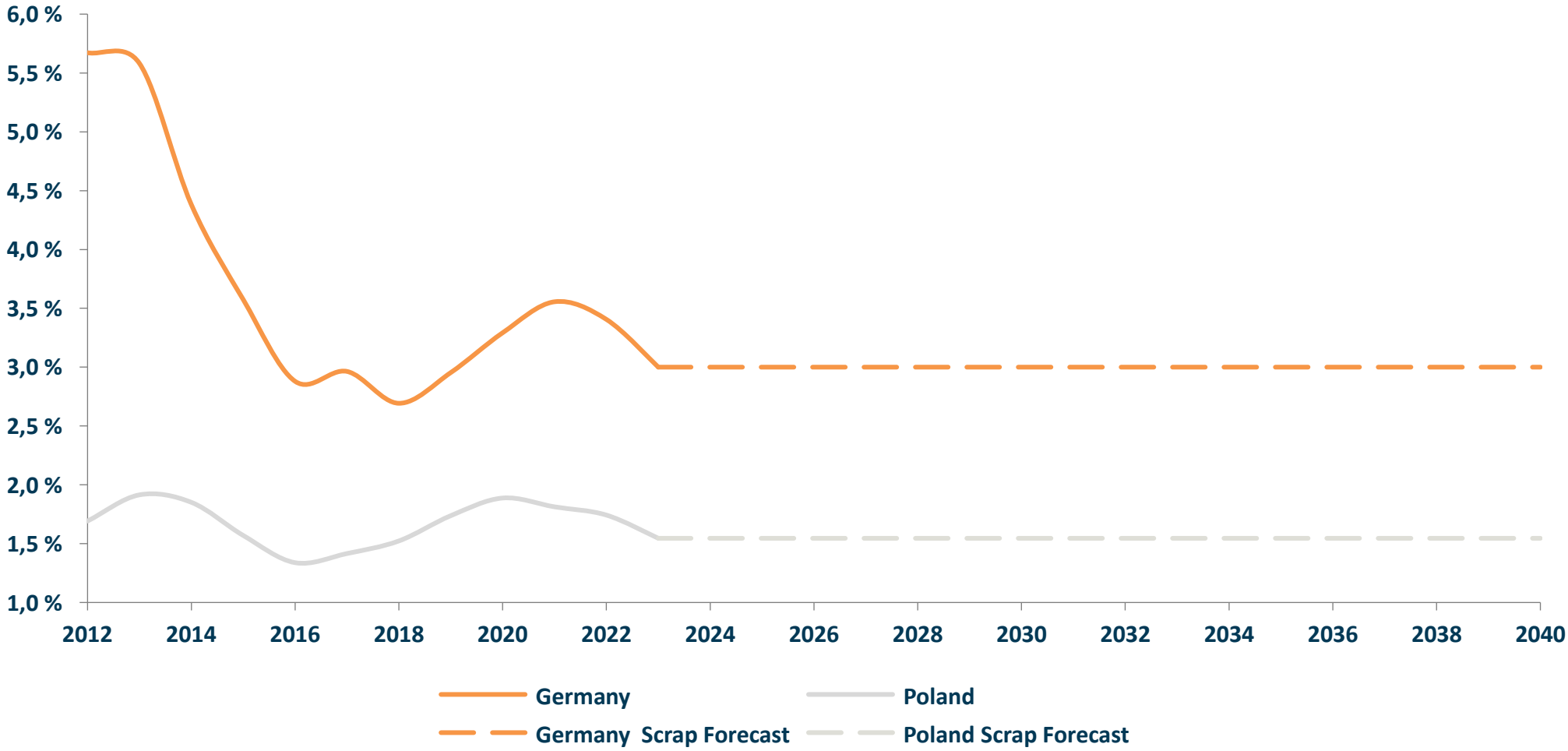
TYPE	BASELINE	EXPORT RESTRICTION	NO EXPORT
EURO 6	-	-20%	-40%
EURO 7	-	-50%	-100%
ELECTRIFIED VEHICLES	-	-70%	-100%

Source : Strat Anticipation analysis, EMISIA

To estimate exported trucks, we assume that the percentage of the HDV fleet exported outside the EU matches with the previous year values

Export restriction scenario – Methodology - Case of Germany & Poland

1 **PERCENTAGE OF THE HDV FLEET EXPORTED OUTSIDE EU PER YEAR*** | In % of the fleet, Germany & Poland, 2010-2040f

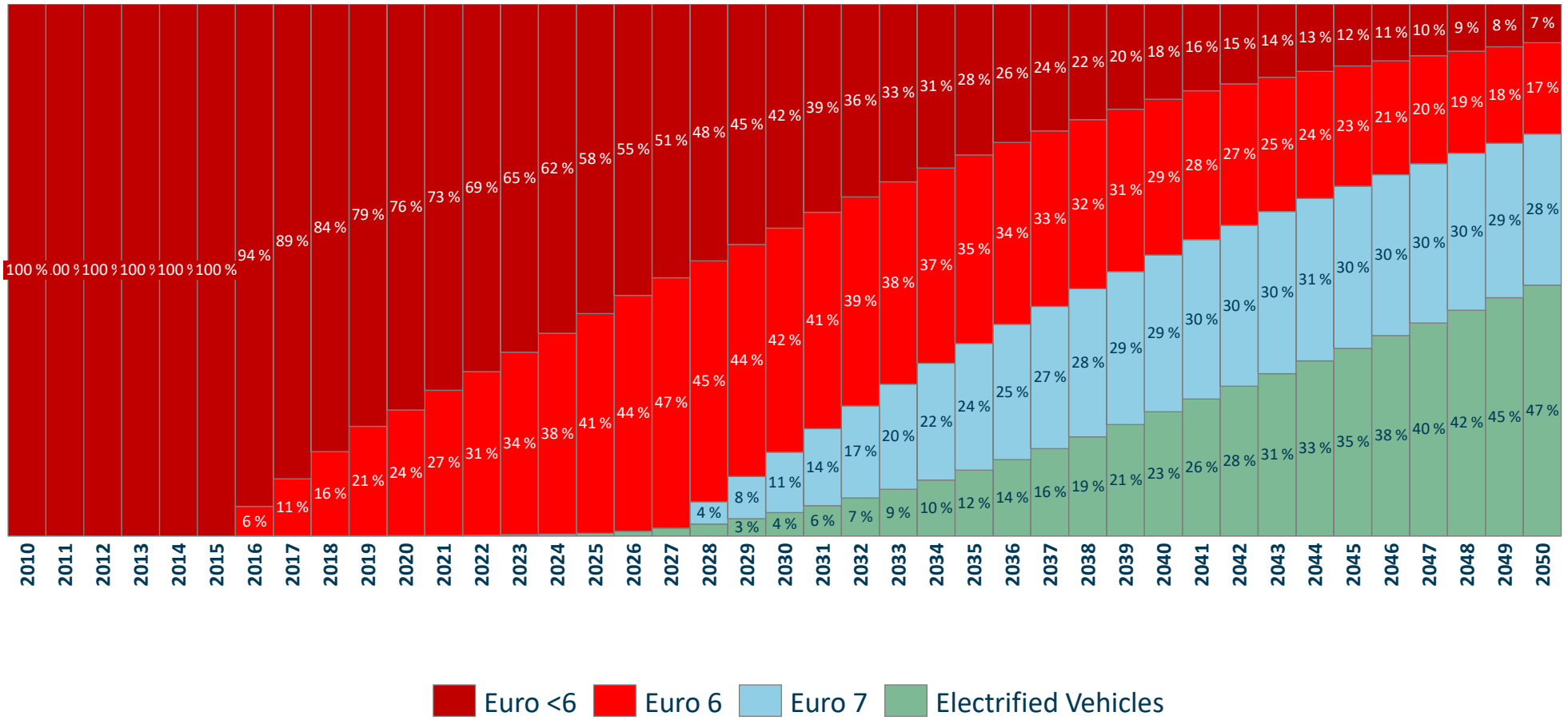


HDV : Heavy-Duty Vehicle
*Average On The Last 3 Years
Source : CBC, Strat Anticipation analysis

Then, we determine the types of vehicles (categorized by Euro 6, Euro 7, etc.) that will be exported from our 8 countries in scope

Extra-EU Truck Export by Category

2 **EXTRA EU TRUCK EXPORT SHARE BY EURO CATEGORY** | In %, 8 Countries, 2010-2050

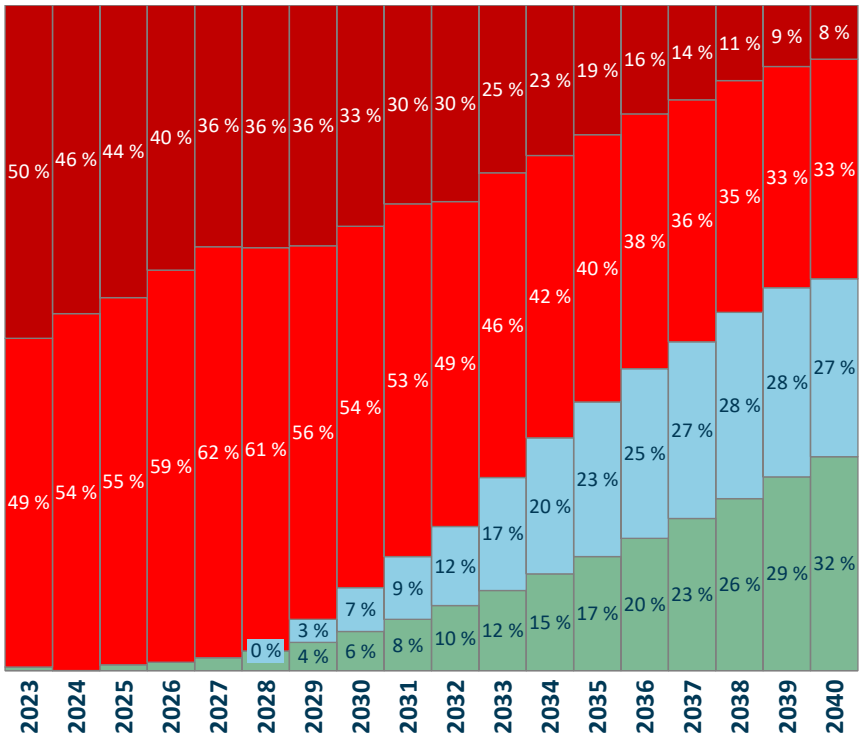


Source : EMISIA, Strat Anticipation analysis

And we apply the reduction in exports… We assume that this results in a portion of vehicles previously exported that will now be scrapped within the country

Lower export Scenario - Methodology - Case of Germany

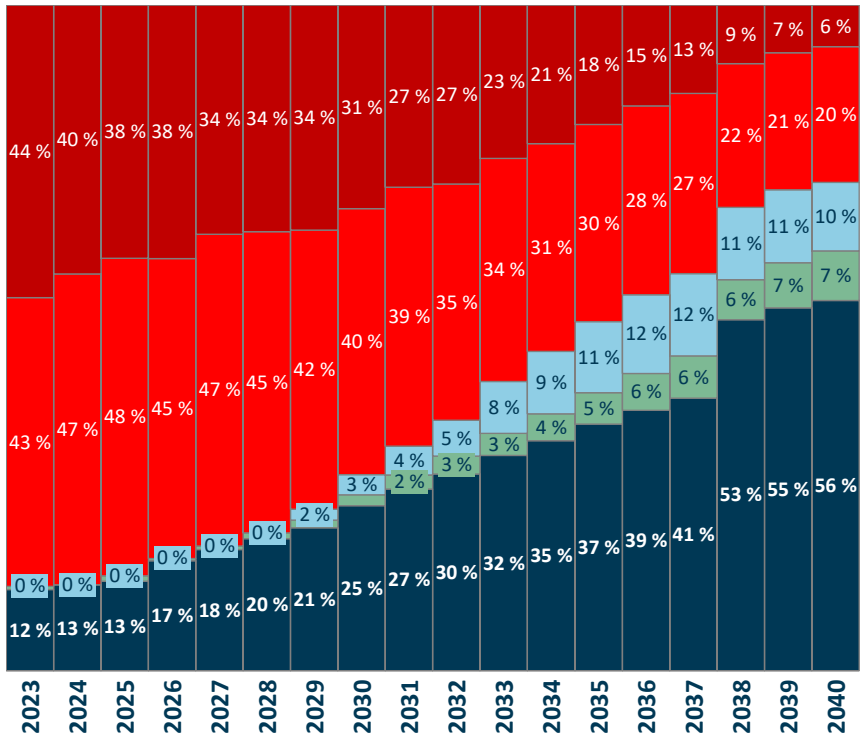
2 **GERMANY TRUCK EXTRA-EU EXPORT SHARE BY EURO CATEGORY |** In %, Germany, 2023-2040



TYPE	BASELINE	EXPORT RESTRICTION	NO EXPORT
EURO 6	-	-20%	-40%
EURO 7	-	-50%	-100%
ELECTRIFIED VEHICLES	-	-70%	-100%

Source : EMISIA, Strat Anticipation analysis

3 **Lower EXPORT SCENARIO - TRUCKS TO BE SCRAPPED INSTEAD OF BEING EXTRA-EU EXPORTED |** In %, Germany, 2023-2040

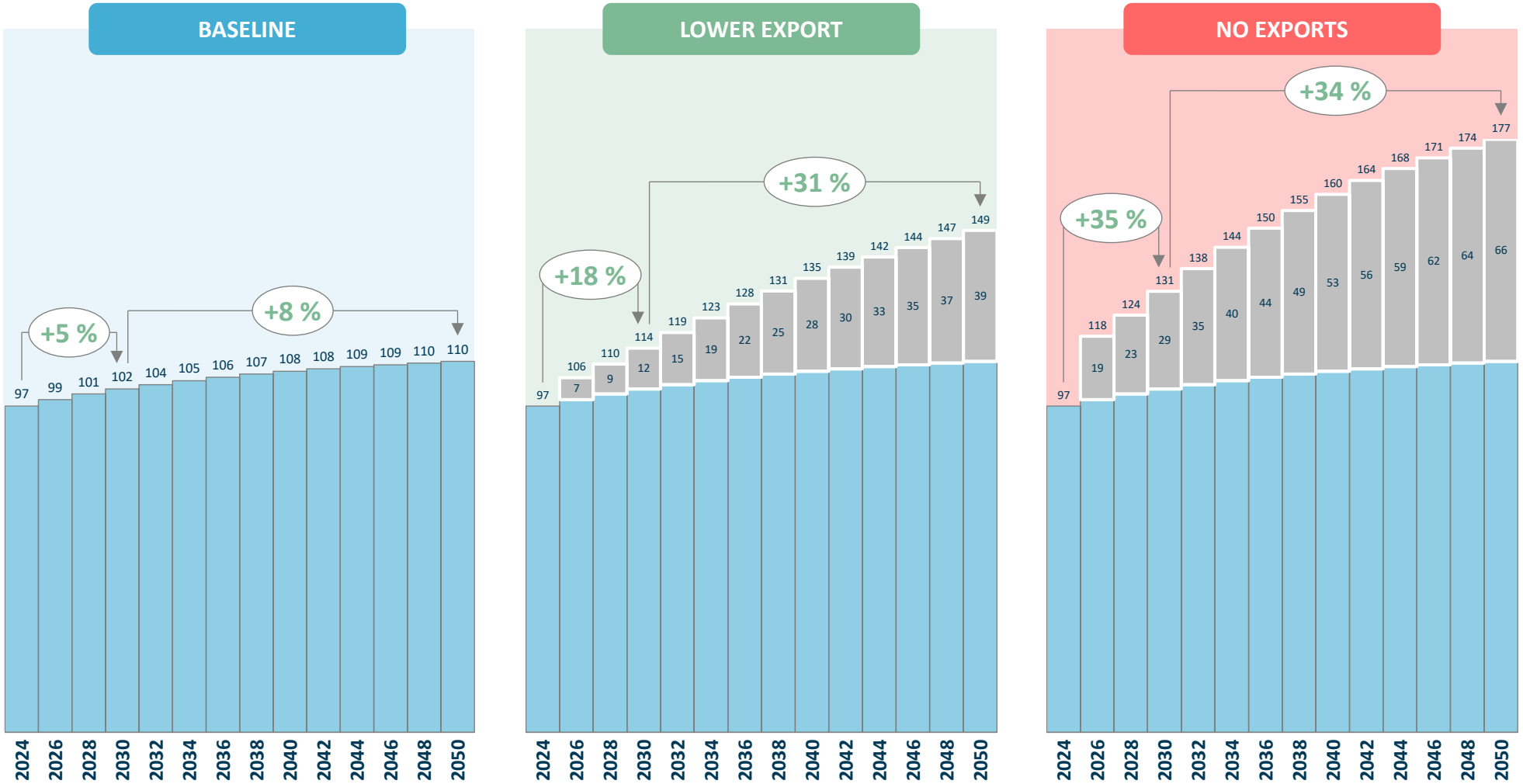


Euro 6 | Electrified Vehicles
Euro 7 | To be now Scrapped

Between 2024 & 2030, the truck volume to be scrapped is expected to grow by 5% in the baseline scenario, by 18% under Lower export, and by 35% without exports

Trucks - Scenario Comparison

SCRAPPED TRUCKS IN 8 COUNTRIES FOR THE 3 SCENARIOS | In k units, 8 Countries, 2024-2050f

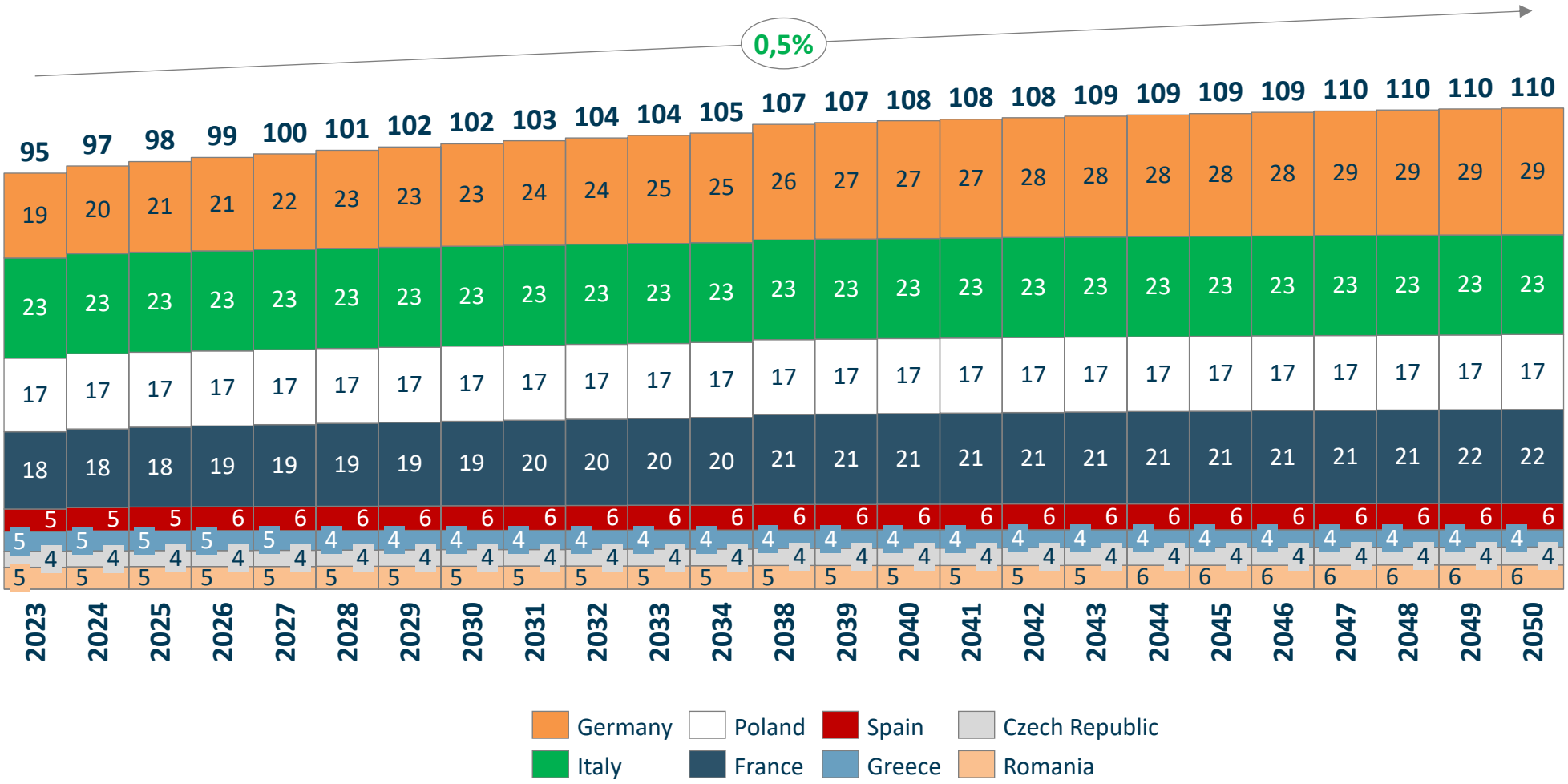


Source : Strat Anticipation analysis

In the Baseline Scenario, the total number of trucks to be scrapped across the 8 countries would be approximately 95k units in 2023, growing annually at 1%

Trucks Scrapped in 8 EU countries

BASELINE SCENARIO – TOTAL NUMBER OF SCRAPPED TRUCKS IN OUR 8 COUNTRIES | In k units, 8 EU Countries, 2023-2050f

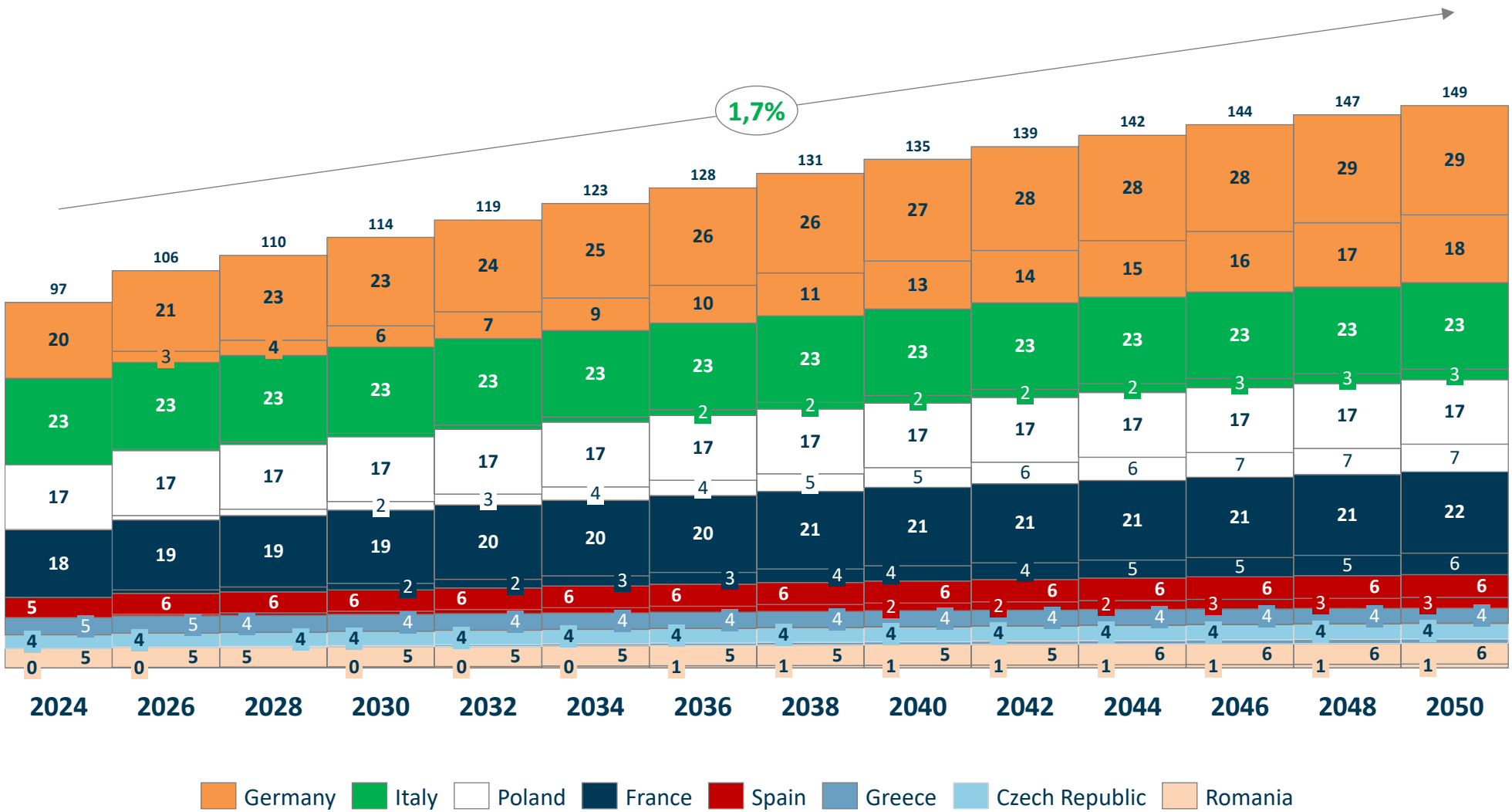


Source : Sybil model - EMISIA, Strat Anticipation research & analysis

In the “Export Restrictions” Scenario, all countries face more truck scrapping, with Germany, Poland & France most impacted by 2030, handling 2-6k more trucks

Lower Export Scenario - Trucks Scrapped in 8 EU countries

LOWER EXPORT SCENARIO - TOTAL NUMBER OF SCRAPPED TRUCKS IN OUR 8 COUNTRIES | In k units, 8 EU Countries, 2023-2050f

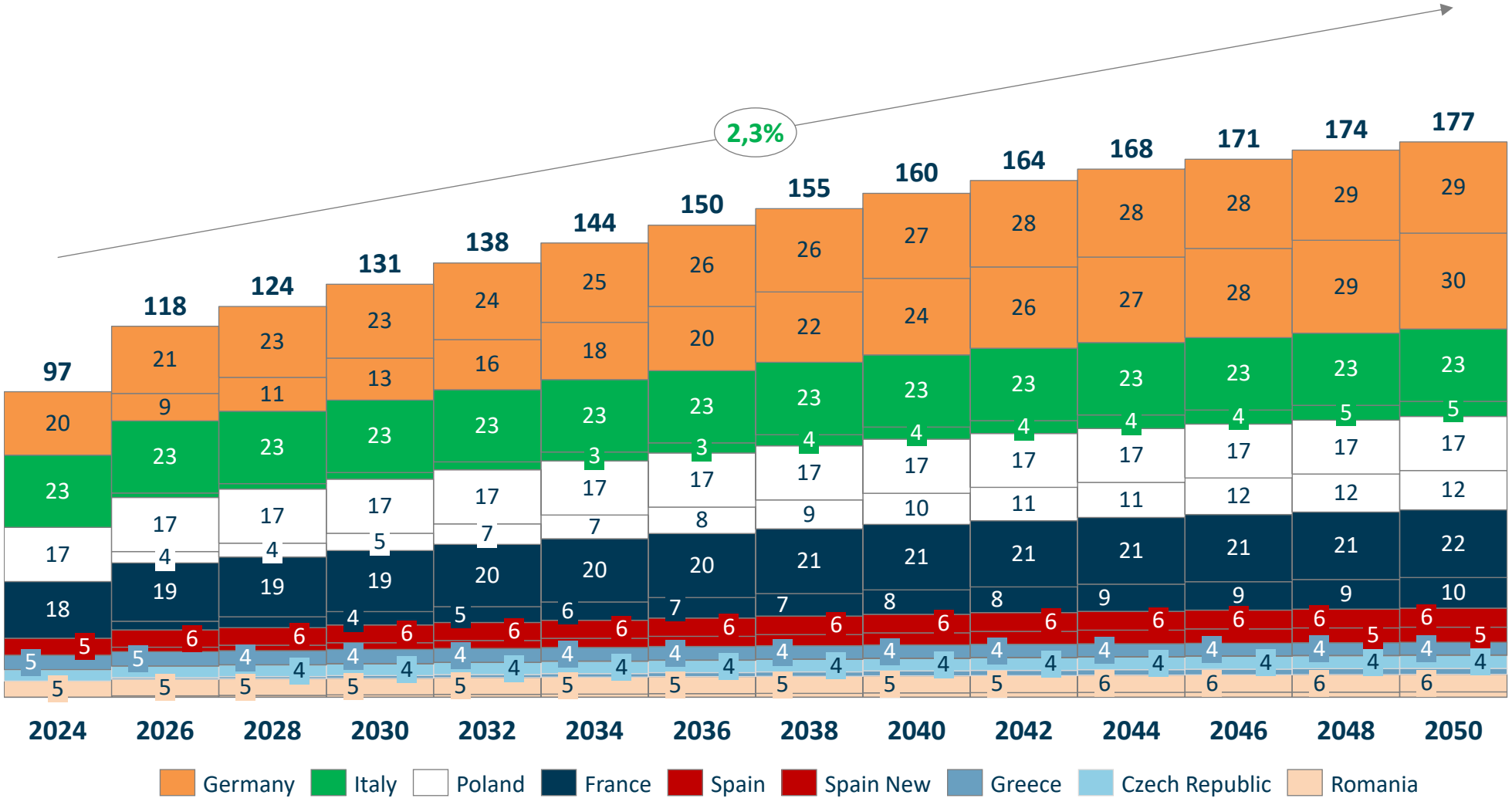


Source : Sybil model - EMISIA, Strat Anticipation research & analysis

In the "No Export" Scenario, all countries would have more trucks to scrap. Germany, as the biggest exporter, would have the most with 13k more in 2030

No Export Scenario - Trucks Scrapped in 8 EU countries

NO EXPORT SCENARIO - TOTAL NUMBER OF SCRAPPED TRUCKS IN OUR 8 COUNTRIES | In k units, 8 EU Countries, 2023-2050f



Source : Sybil model - EMISIA, Strat Anticipation research & analysis

We expect that if extra EU exports are not possible, 30% of the trucks concerned will need to be scrapped within the initial country & 70% will be exported within the EU

Destination Export – Methodology for Trucks

In the previous slides, we hypothesized that trucks exported outside the EU would be scrapped within the destination country. However, these trucks are likely to be re-exported within the EU to new destination countries, where they will ultimately be scrapped. This reformulation provides a more accurate representation of the export and scrapping process for these trucks.

Revised Hypothesis

Contrary to the initial assumption that trucks exported outside the EU will be scrapped in their initial destination countries, a significant portion of these trucks will be re-exported within the EU to secondary destinations before being scrapped. This necessitates a revised methodology to account for both local scrapping and intra-EU re-export patterns.

Methodology

To assess the movement and scrapping of trucks previously exported outside the EU, the following approach is proposed:

Local Scrapping Assessment

Estimate that approximately **30% of trucks** originally exported outside the EU will be scrapped locally in the initial export country.

A **Intra-EU Export Destination Analysis**

Identify and map the intra-EU export destinations for trucks that are exported within the EU.

B **Re-Export and Scrapping of Remaining Trucks**

Assume that the remaining **70% of trucks**, which can no longer be exported outside the EU due to regulatory & market constraints, are redirected to intra-EU destinations.

These trucks will follow established intra-EU export patterns, except exports to Belgium and the Netherlands.

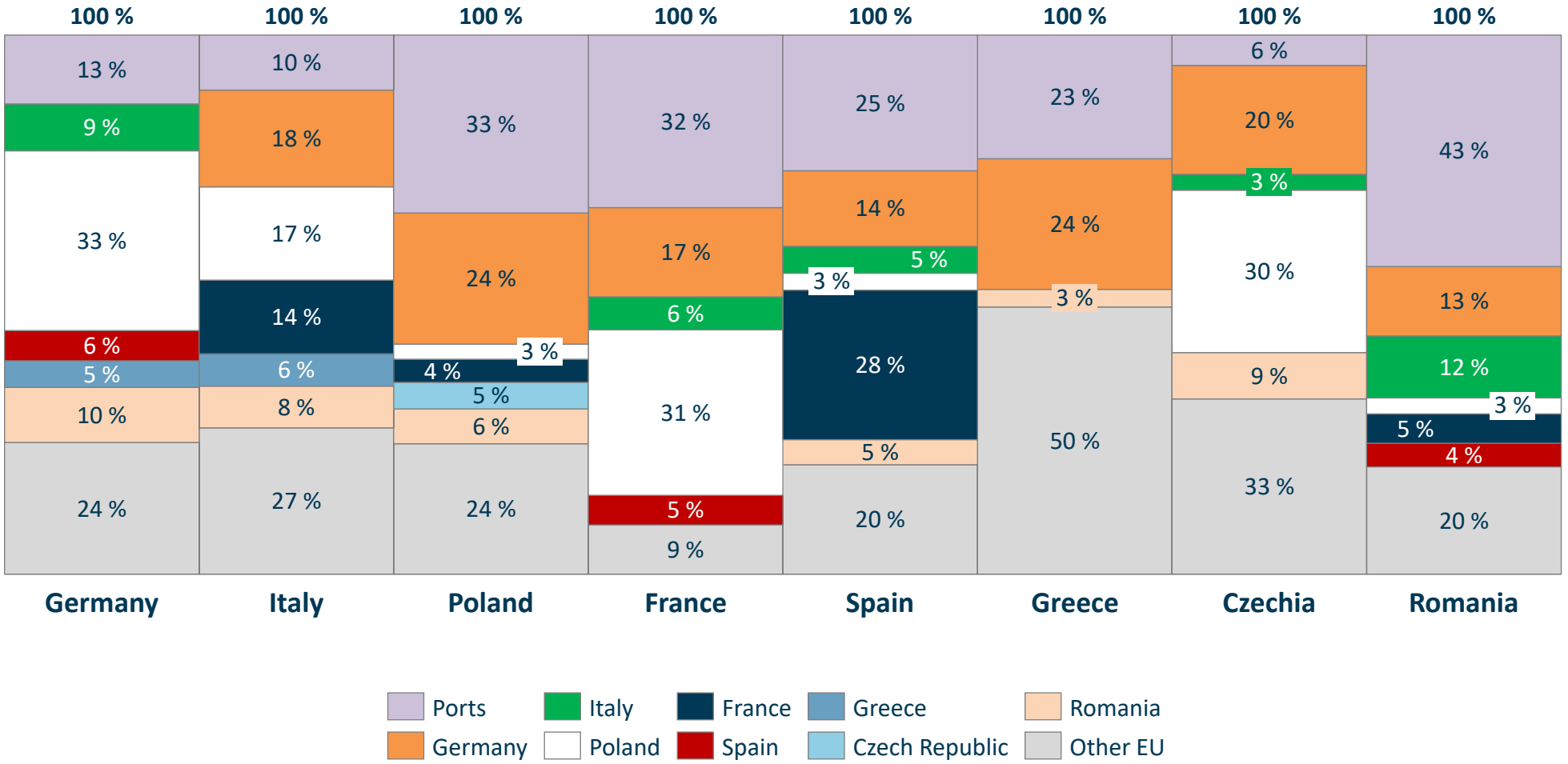
Note : Ports correspond to Belgium & The Netherlands
Source : EMISIA, Strat Anticipation analysis

Poland and Germany are the largest intra-EU truck importers, with Belgium and the Netherlands also playing significant roles

Intra-EU Export Destination Analysis

INTRA EU EXPORT DESTINATION FOR 8 EU COUNTRIES – HEAVY DUTY VEHICLES | In k units, 8 EU Countries, 2023-2050f

A



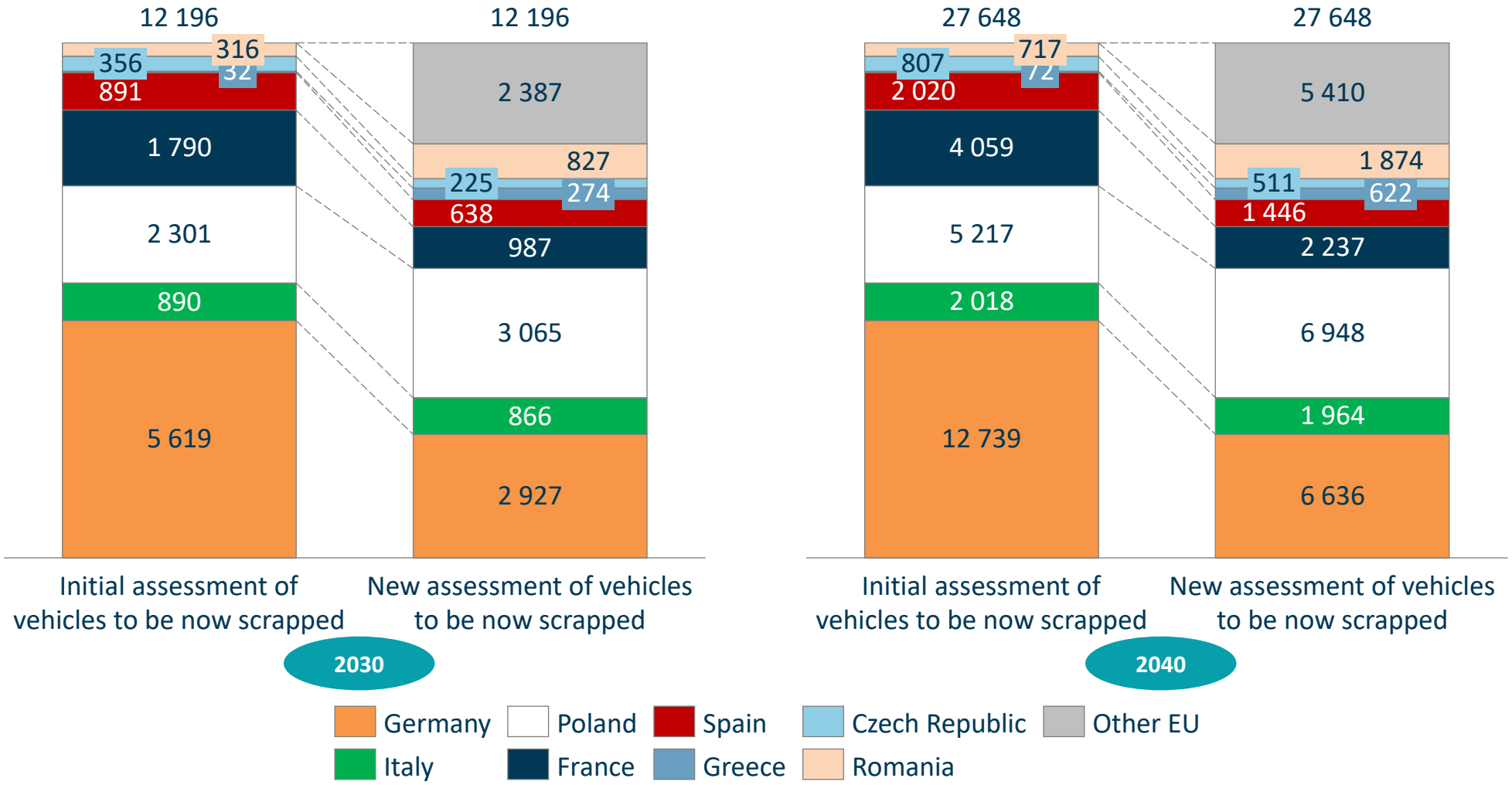
Note : Ports correspond to Belgium & The Netherlands
Source : EMISIA, Strat Anticipation analysis

Under this new methodology, Germany's truck scrapping surplus decreases by 48%, while Poland's increases by 33%

"Lower Export" Scenario – Trucks Scrapped in 8 countries changes – 2030 & 2040

LOWER EXPORT SCENARIO TRUCKS TO BE SCRAPPED AFTER TAKING INTO ACCOUNT NEW INTRA EU EXPORTS |
In k units, 8 Countries, 2030 & 2040

B



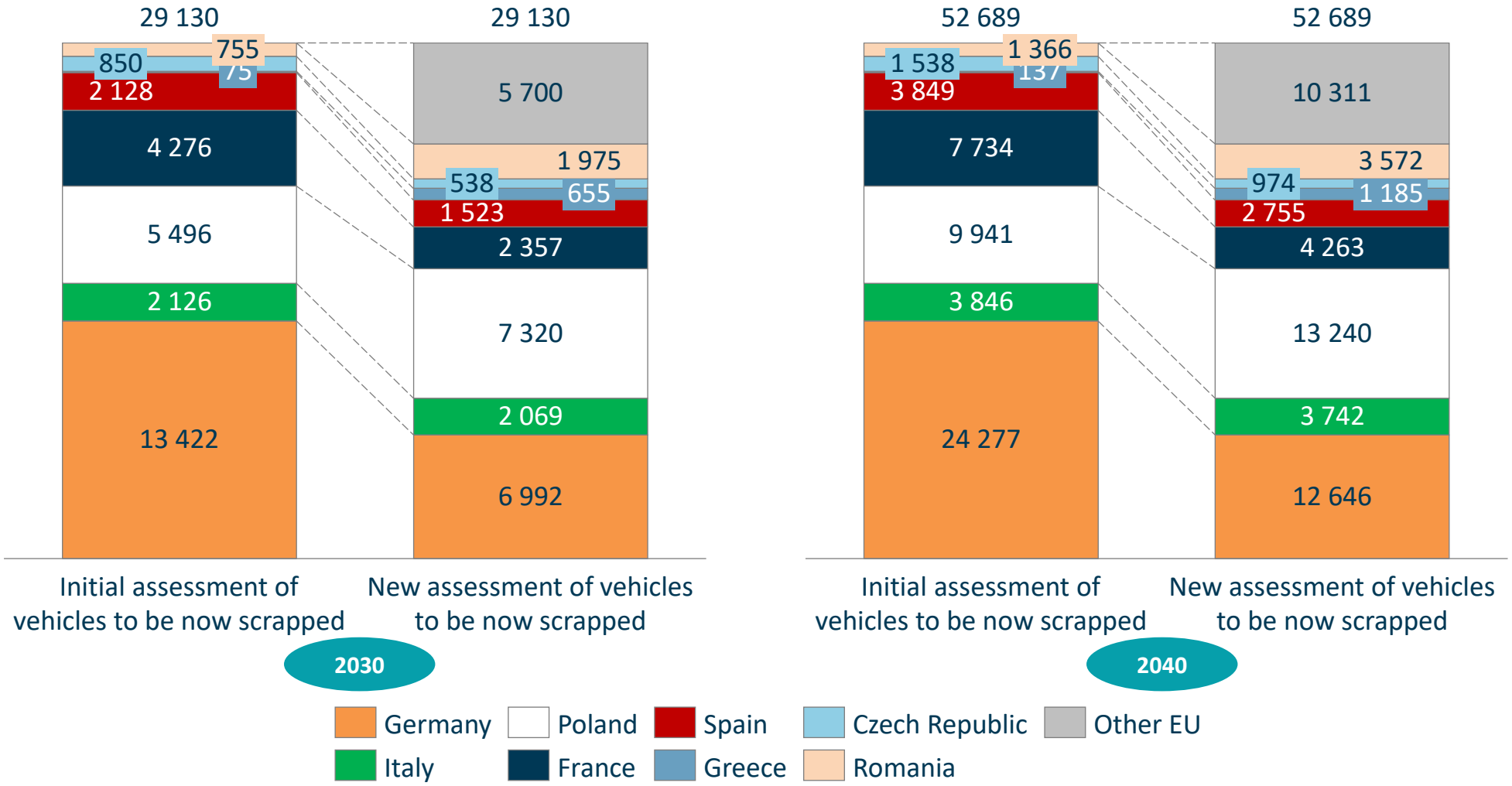
Source : EMISIA, Strat Anticipation analysis

With this new methodology, Greece, Romania, Poland, and the rest of the EU will see an increase in trucks to be scrapped, while other countries will see a decrease

"No Export" Scenario – Trucks Scrapped in 8 countries changes – 2030 & 2040

NO EXPORT SCENARIO TRUCKS TO BE SCRAPPED AFTER TAKING INTO ACCOUNT NEW INTRA EU EXPORTS |
In k units, 8 Countries, 2030 & 2040

B



Source : EMISIA, Strat Anticipation analysis

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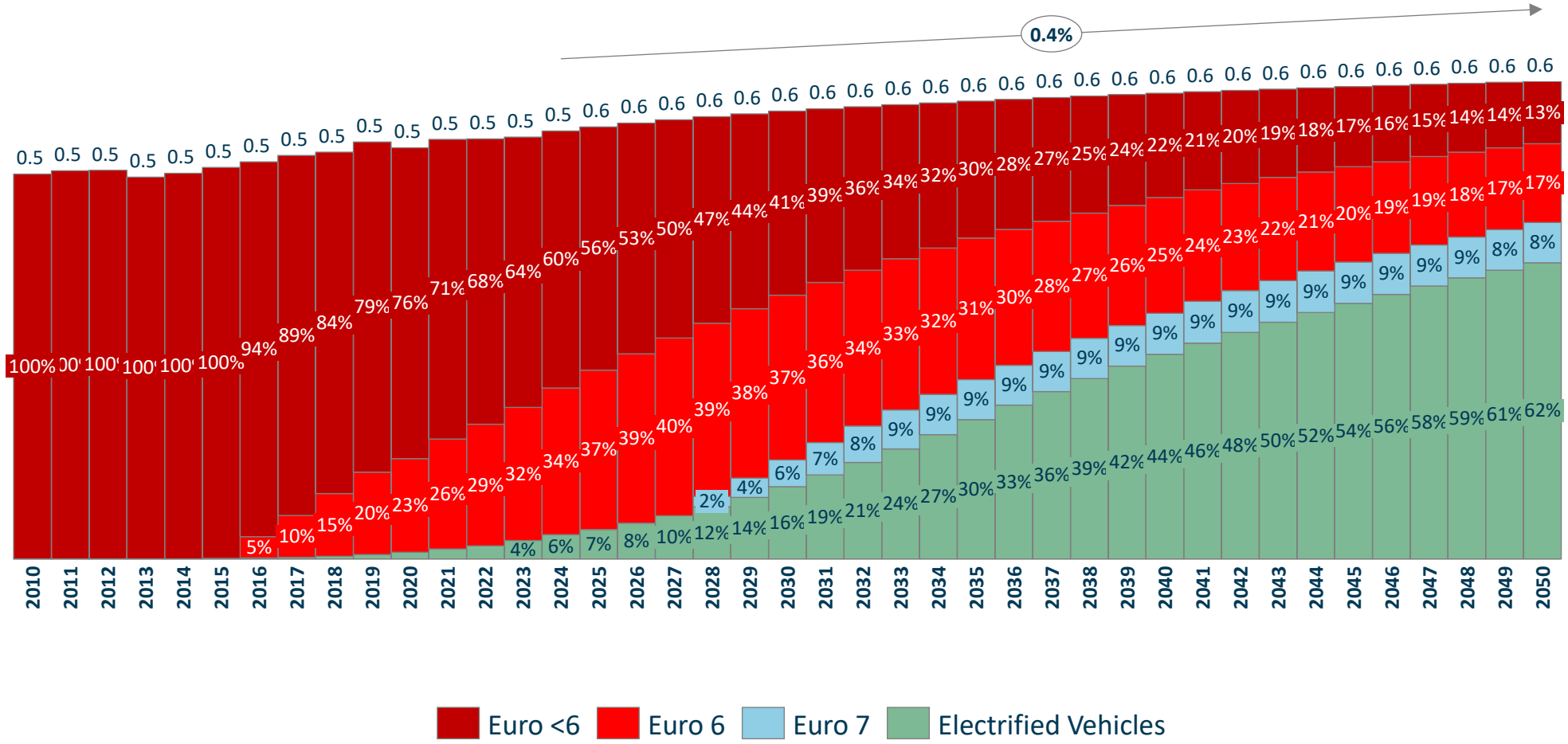
Total Bus Fleet will experience an overall modest electrification from 4% in 2030, 10% in 2040 & up to 24% in 2050

8 Countries Bus Fleet by Category

8 EU COUNTRIES BUS FLEET BY CATEGORY | In M units and %, 8 EU Countries, 2010-2050

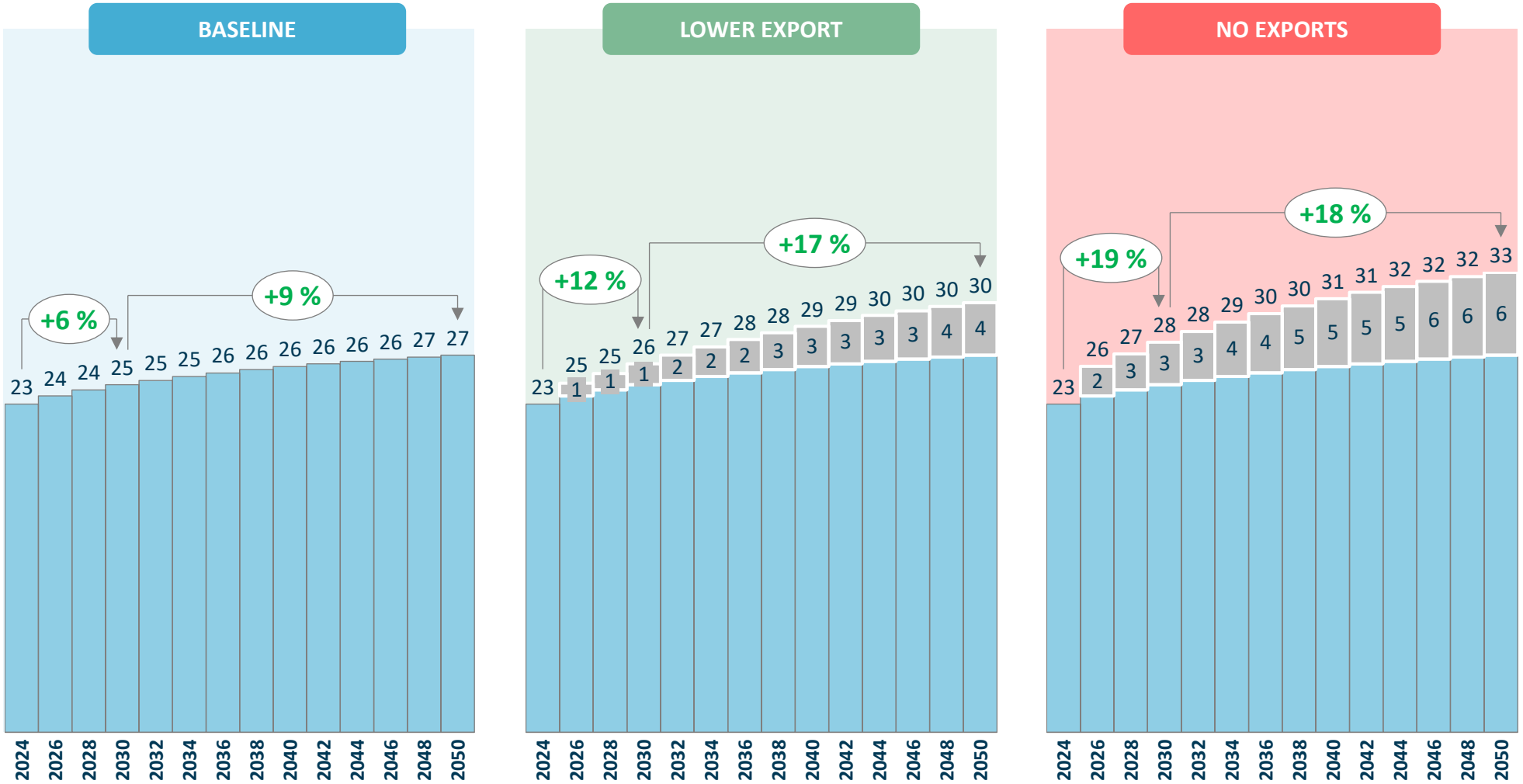


Source : EMISIA, Strat Anticipation analysis

In the Baseline Scenario, the bus volume to be scrapped would increase slightly, while in the other two, it would increase by 12% & 19% respectively, up to 2030

Buses & Coaches - Scenario Comparison

SCRAPPED BUSES & COACHES IN 8 EU COUNTRIES FOR THE THREE SCENARIO | # k Units, 8 EU Countries, 2024-2050

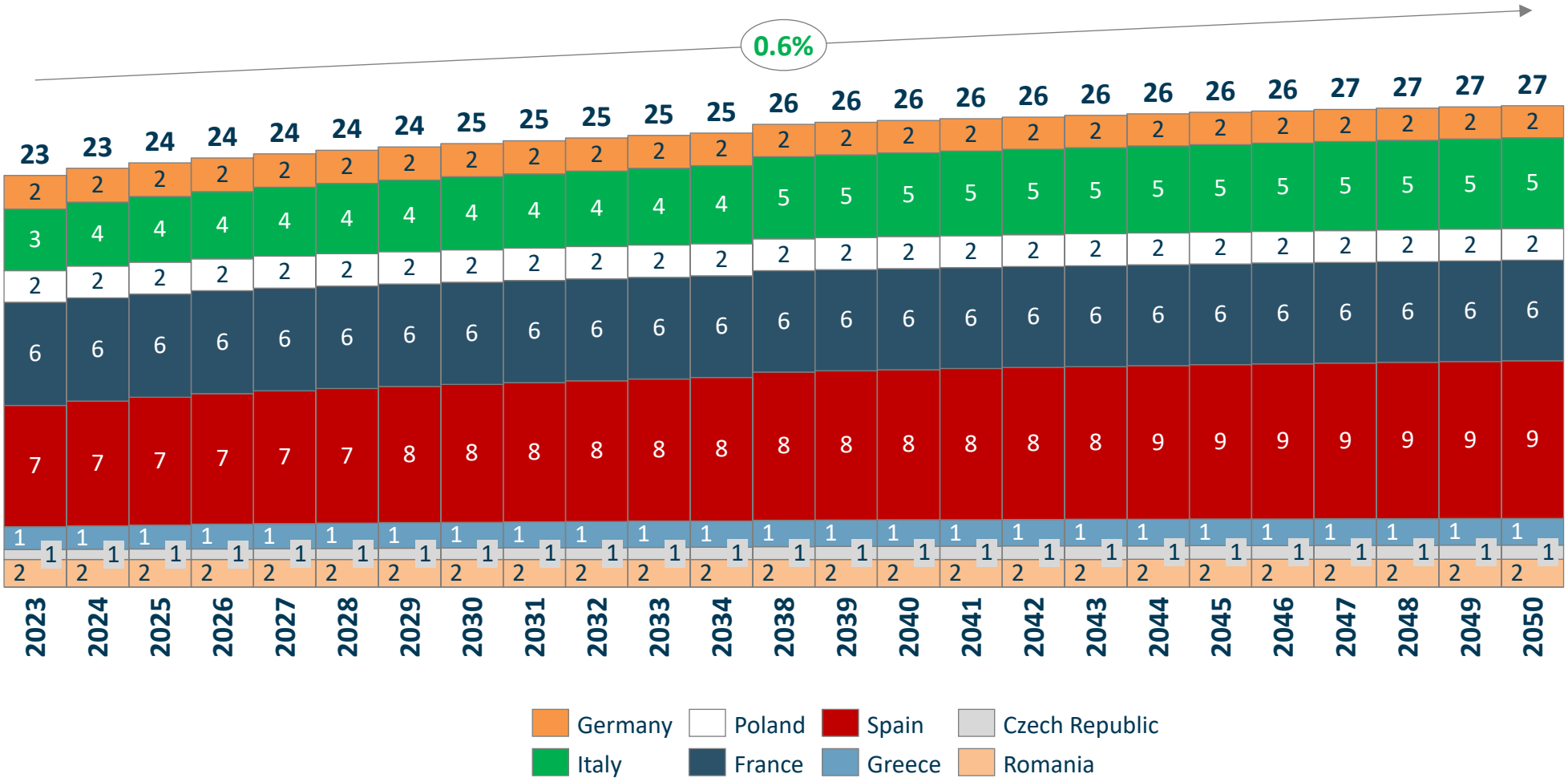


Source : Strat Anticipation analysis

In the Baseline Scenario, the total number of buses to be scrapped across the 8 countries is approximately 23k units in 2023, with an annual growth rate of 1%

Buses & Coaches Scrapped in 8 EU countries

BASELINE SCENARIO – TOTAL NUMBER OF SCRAPPED BUSES & COACHES IN OUR 8 EU COUNTRIES | In k units, 8 EU Countries, 2023-2050f

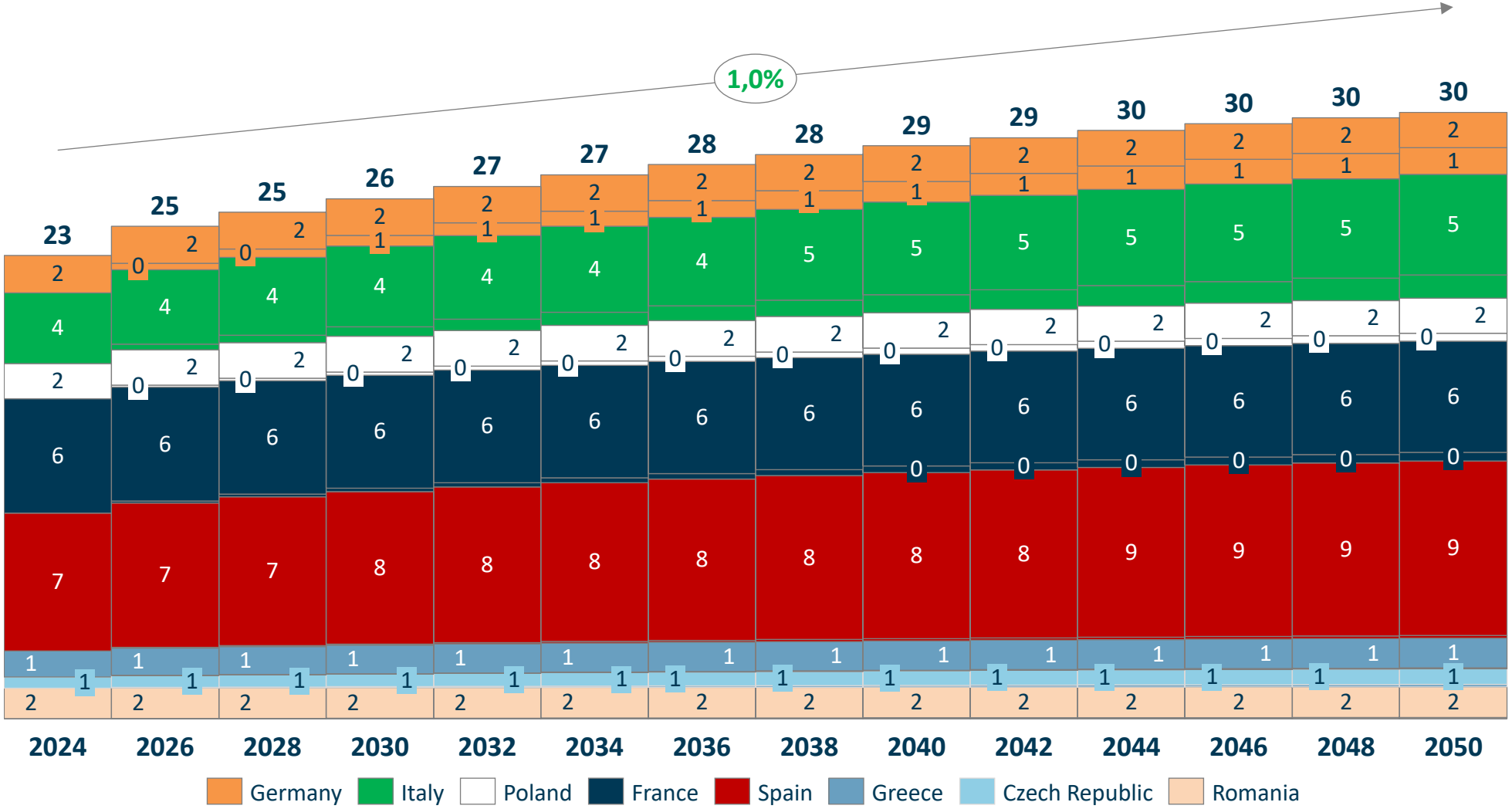


Source : Sybil model - EMISIA, Strat Anticipation research & analysis

In the “Lower Export” Scenario, the number of buses to be scrapped is 4k units higher than in the baseline scenario by 2030

“Lower Export” Scenario - Buses & Coaches Scrapped in 8 EU countries

LOWER EXPORT **SCENARIO – TOTAL NUMBER OF SCRAPPED BUSES & COACHES IN OUR 8 COUNTRIES|** In k units, 8 Countries, 2023-2050f

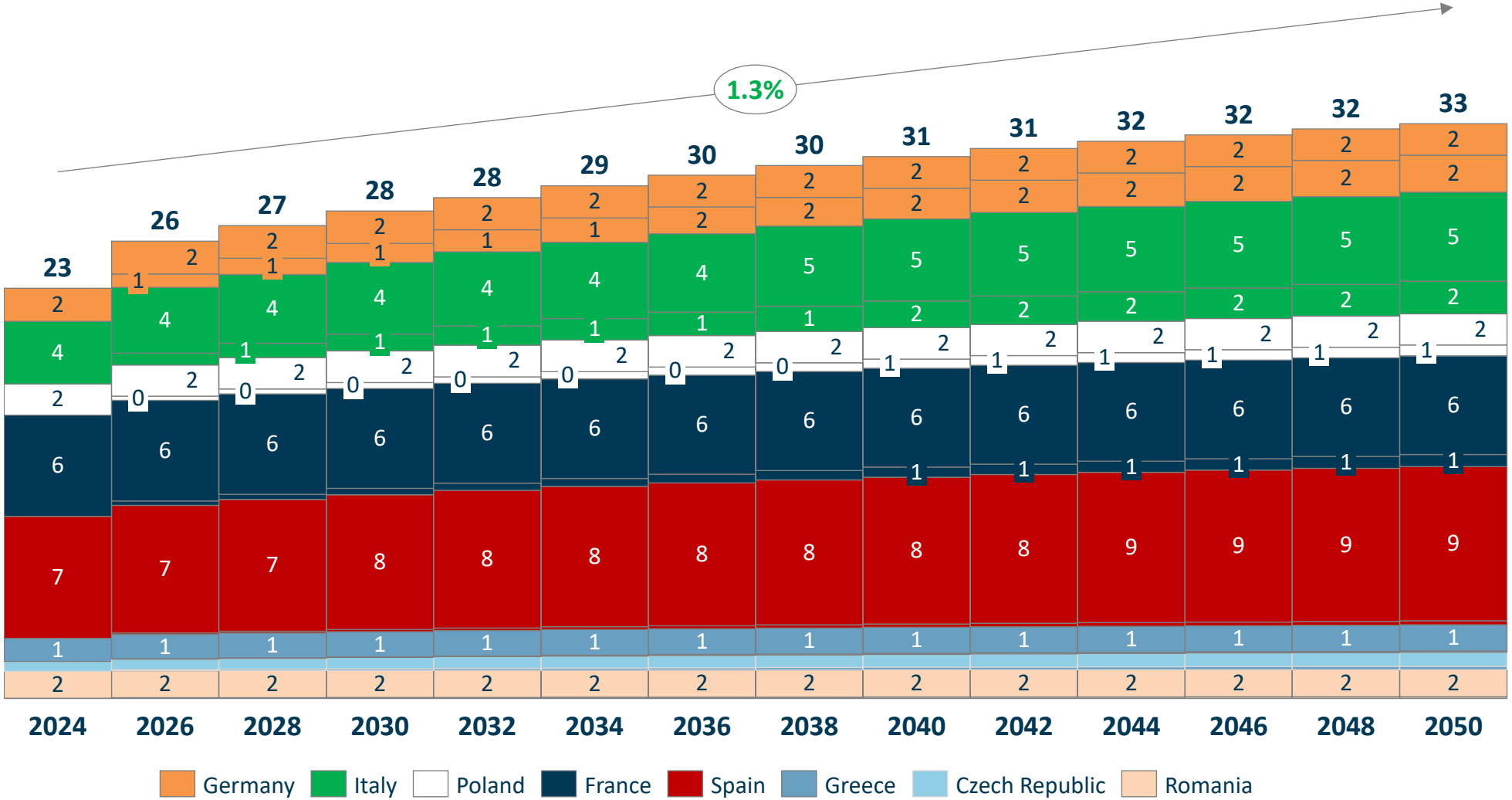


Source : Sybil model - EMISIA, Strat Anticipation research & analysis

In the “No Export” Scenario, the number of buses to be scrapped is 8k units higher than in the baseline scenario by 2030

“No Export” Scenario - Buses & Coaches Scrapped in 8 European countries

NO EXPORT SCENARIO – TOTAL NUMBER OF SCRAPPED BUSES & COACHES IN OUR 8 EUROPEAN COUNTRIES| In k units, 8 Countries, 2023-2050f



Source : Sybil model - EMISIA, Strat Anticipation research & analysis

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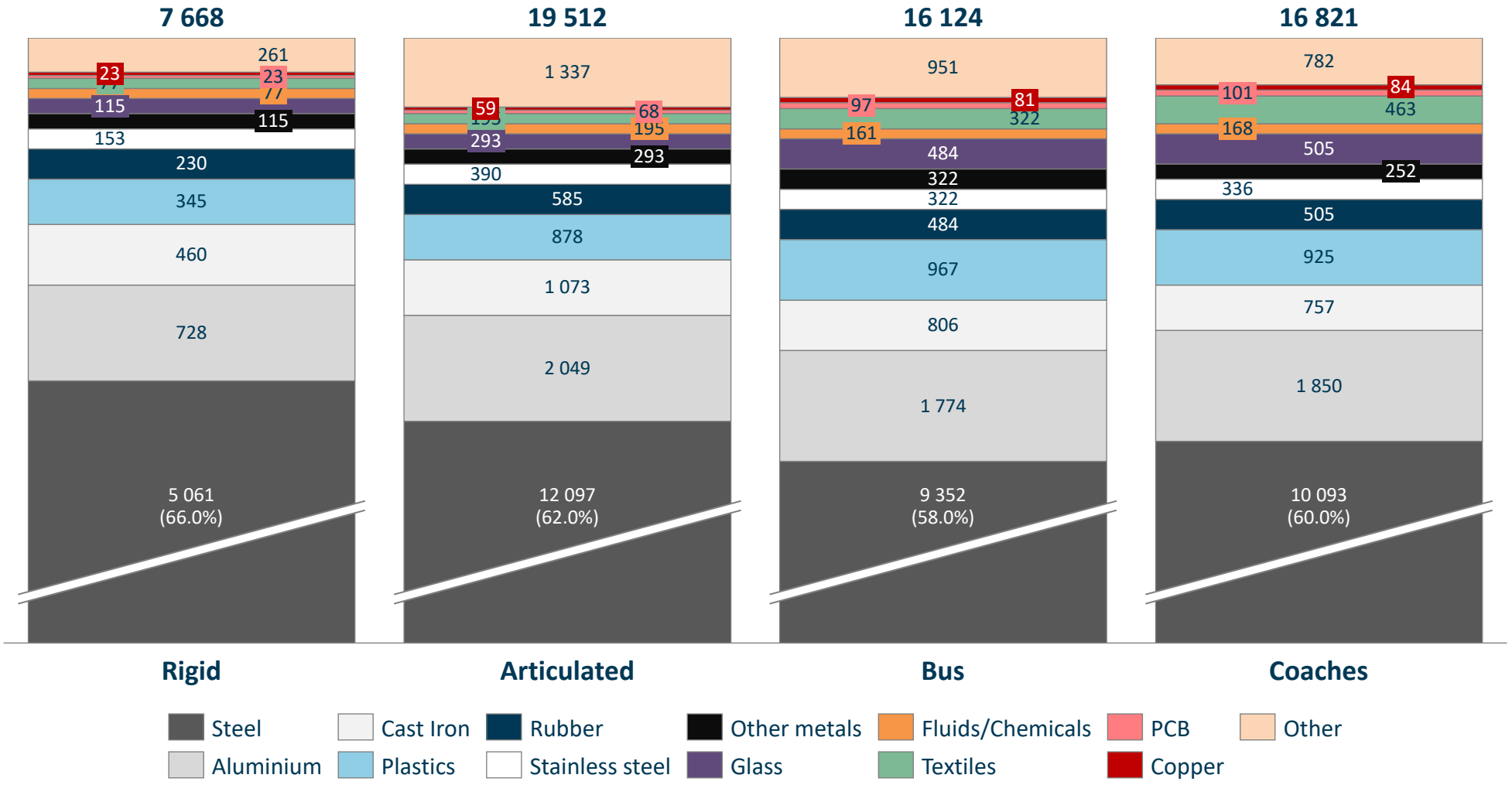
On average, a rigid truck weighs around 7,700 kg and is made up of approximately 66% steel, 730 kg of aluminum, 23 kg of copper, and 115 kg of glass

HDVs - Materials contained in HDV vehicles

MATERIALS CONTAINED IN A HDV VEHICLE AND TOTAL WEIGHT PER VEHICLE CATEGORY| In kg per vehicle, average in Europe, for ICE Vehicle



HDV : Heavy-Duty Vehicle
Source : Strat Anticipation analysis

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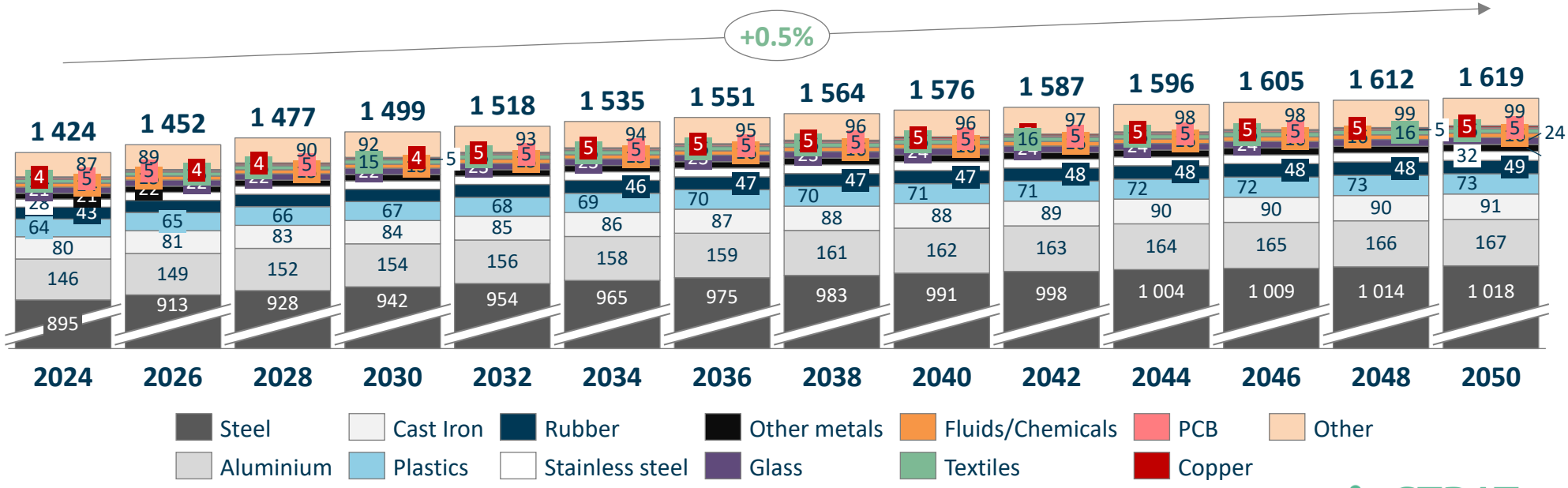
In the baseline Scenario, materials in scrapped trucks sum up to 1499 ktons, with 942 ktons of steel, 154 ktons of aluminum & 4 ktons of copper by 2030

Trucks - Materials contained in Scrapped Truck

MATERIALS CONTAINED IN SCRAPPED TRUCKS AND AVAILABLE FOR RECYCLING | In thousands of tons, 8 EU countries, 2024-2050f

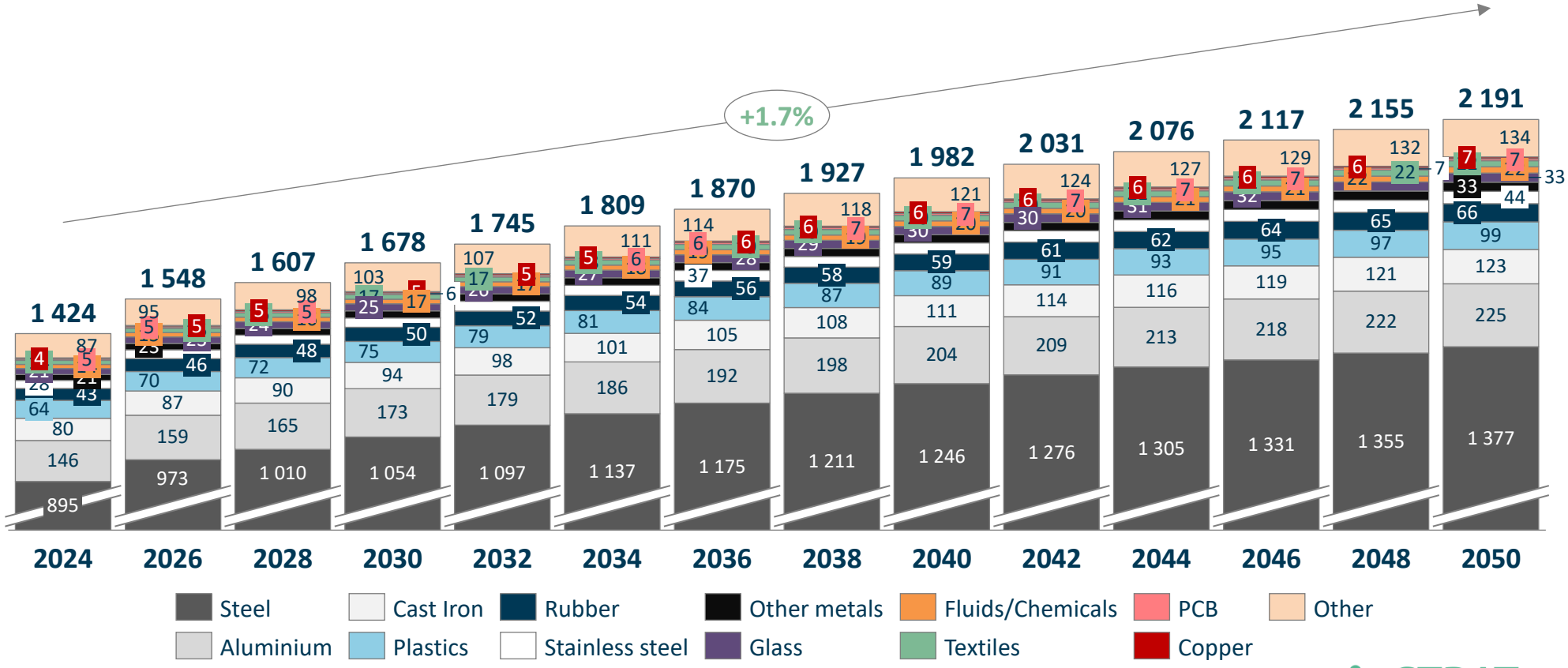


Source : Strat Anticipation analysis

In the “Export Restrictions” Scenario, materials in scrapped trucks sum up to 1678 ktons, with 1054 ktons of steel, 173 ktons of aluminum & 5 ktons of copper by 2030

“Export Restrictions” Trucks - Materials contained in Scrapped Truck

EXPORT RESTRICTIONS SCENARIO - MATERIALS CONTAINED IN SCRAPPED TRUCKS AND AVAILABLE FOR RECYCLING |
In thousands of tons, 8 countries, 2024-2050f

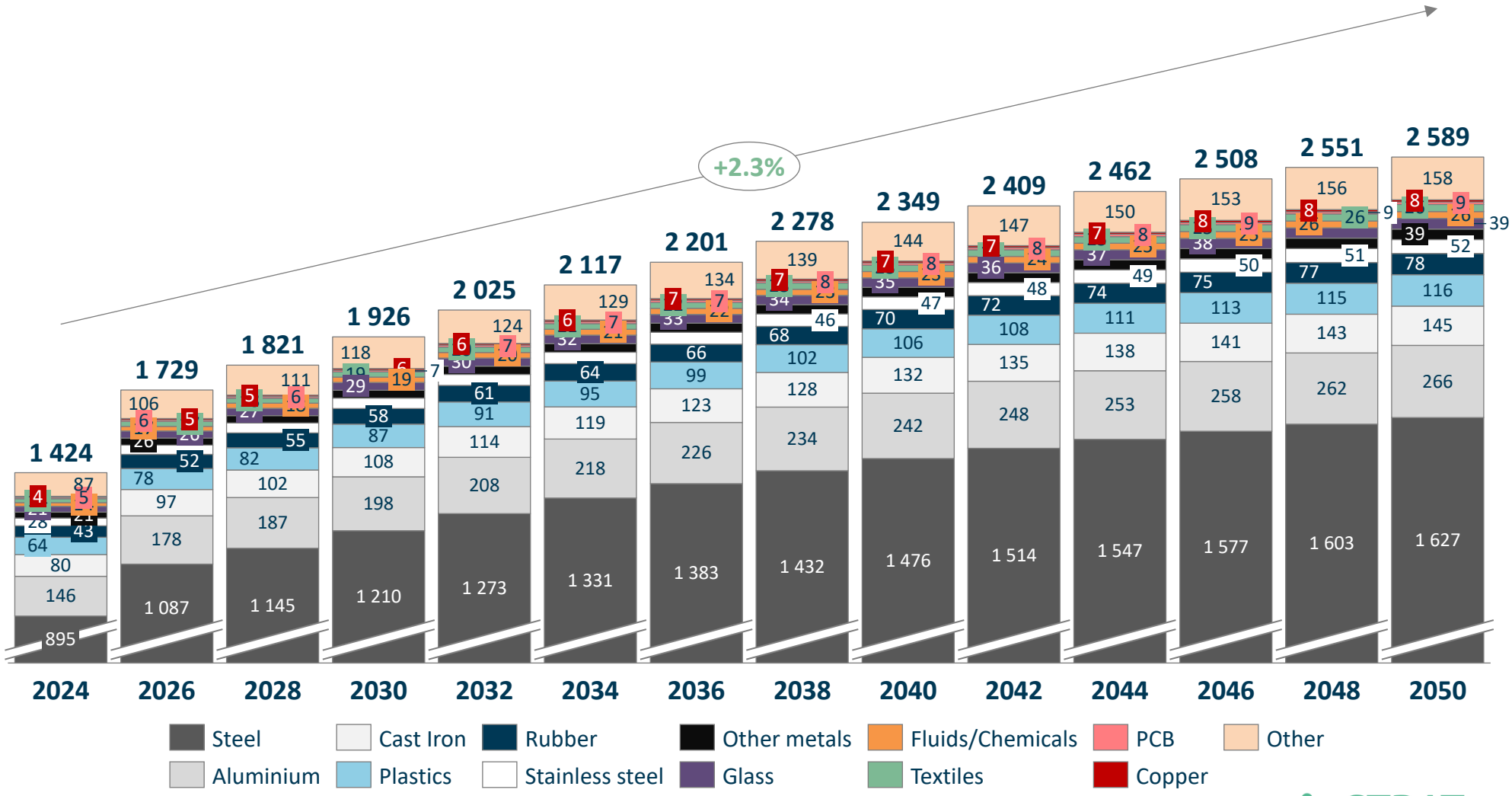


Source : Strat Anticipation analysis

In the “No Export” Scenario, materials in scrapped trucks sum up to 1926 ktons, with 1210 ktons of steel, 198 ktons of aluminum & 6 ktons of copper by 2030

“No Export” Scenario Trucks - Materials contained in Scrapped Truck

NO EXPORT SCENARIO - MATERIALS CONTAINED IN SCRAPPED TRUCKS AND AVAILABLE FOR RECYCLING |
In thousands of tons, 8 countries, 2024-2050f



Source : Strat Anticipation analysis

CONTENTS

Truck dismantling often has 3 stages : vehicle preparation, cabin removal & disassembly & chassis disassembly. For rigids, a body dismantling step is added

Truck dismantling process - Overview

I VEHICLE PREPARATION

Obtaining vehicle information to optimize dismantling, washing the vehicle, and de-polluting it

Share of EOL value in a typical HDV 5%

Average share of dismantling time 10%

Dismantling and reuse of the starter battery & various tanks, fluid recycling

Average CAPEX intensity

Average Labor intensity

II BODYWORK REMOVAL & DISASSEMBLY

Separation of the bodywork from the rest of the rigid truck by unbolting or unwelding the subframe

Share of EOL value in a typical HDV 25%

Average share of dismantling time 20%

Dismantling and reuse of bodywork after overhaul, recycling of materials

Average CAPEX intensity

Average Labor intensity

III CABIN REMOVAL & DISASSEMBLY

Separation of the cabin from the chassis and removal of various interior & exterior components prior to shredding

Share of EOL value in a typical HDV 15%

Average share of dismantling time 25%

Removal of various interior & exterior components for reuse or recycling, sending the rest of the cabin for shredding

Average CAPEX intensity

Average Labor intensity

IV CHASSIS & POWERTRAIN DISASSEMBLY

Removal of various modules & components, especially related to powertrain, before shredding

Share of EOL value in a typical HDV 55%

Average share of dismantling time 45%

Removal of tyres for recycling or retreading, removal of the powertrain modules for reuse, reman or recycling, removal of various other components for reuse or recycle, sending the remaining chassis for shredding

Average CAPEX intensity

Average Labor intensity

Specific step for rigid trucks

HDV : Heavy-Duty Vehicle
Source : OEM dismantling guides, Expert interviews, Dismantling site visits, Strat Anticipation research & analysis

The shredder sorts the most easily separable elements upstream of the shredding process, to avoid unnecessarily burdening its post-shredding sorting lines

HDV shredding process - Main flow overview

CABIN

- **The cabin integrates a wider flow of light automotive scrap, whose main output will be E40 steel,** in addition to many other materials

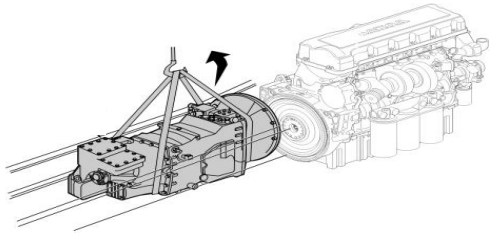
CHASSIS

- **The chassis is cut & sheared to produce Plate & Structural steel scrap**

ENGINE

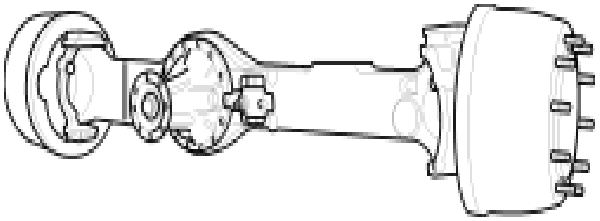
- **Engines** are handled through a **dedicated stream,** that **produces high-value E40 and non-ferrous metals**
- **E-motors** are dealt with by a dedicated stream

GEARBOX



- **Gearboxes** are handled through a **dedicated stream,** that **produces high-value E40 and non-ferrous metals**

AXLE



- Axles are processed in a dedicated flow, with a process similar to the chassis one

BODY

- Treatment varies greatly depending on the type of bodywork

HDV : Heavy-Duty Vehicle
Source : Expert interviews, Strat Anticipation research & analysis

There are many different options for the collection, pre-treatment & shredding of dismantling scrap, depending on players involved and their degree of advancement

HDV shredding process - Potential options for the collection & pre-treatment of scrap from dismantling

• DEALERSHIPS • FLEET OWNER INTEGRATED IN MAINTENANCE • LOW-VOLUME ELV CENTER	SCRAP DEALER	SHREDDER
▸ **Depollution & Basic chassis cutting***	▸ **Deep chassis cutting & Cabin compacting**	▸ **Shearing & Shredding**
Or (for most players)		
▸ **Depollution & Full chassis cutting**	▸ **Cabin compacting**	▸ **Shearing & Shredding**
	Or (for advanced players)	
	▸ **Cabin compacting & Shearing**	▸ **Shredding**

HIGH-VOLUME ELV CENTER	SHREDDER
▸ **Depollution & Full chassis cutting**	▸ **Cabin compacting & Shearing & Shredding**
Or (for advanced players)	
▸ **Depollution & Full chassis cutting & Cabin compacting**	▸ **Shearing & Shredding**
Or (planned by some advanced players)	
▸ **Depollution & Full chassis cutting & Cabin compacting & Shearing**	▸ **Shredding**

SHREDDER INTEGRATED IN ELV CENTERS

▸ **Full process**

HDV : Heavy-Duty Vehicle
Note : For example, simply cut the chassis in half to fit into a container
Source : Expert interviews, Strat Anticipation research & analysis

While flotation is a widespread technique among shredders, advanced technologies such as LIBS are far less common (0 lines in France, ≈10 in Germany for instance)

HDV shredding process – Detailed presentation of some key post-shredding sorting techniques

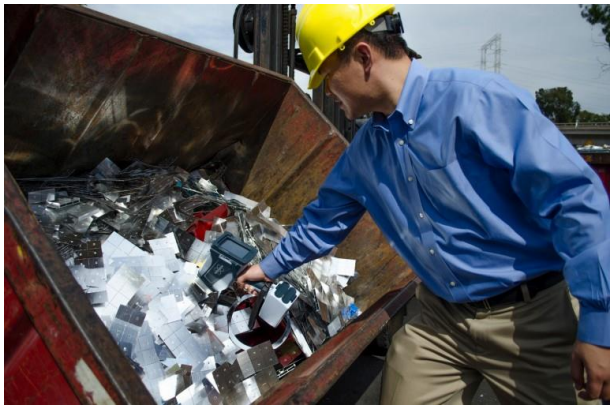
	FLOTATION	SORTING BY XRF SPECTROSCOPY	SORTING BY LIBS SPECTROSCOPY	OPTICAL SORTING WITH HYPER-SPECTRAL CAMERAS
OPERATING PRINCIPLE	• Uses density differences between materials to separate them in dense liquids or aqueous mixtures • Light metals, such as aluminum, float while denser metals, such as copper, sink	• X-rays excite the atoms in the material, producing a characteristic fluorescence that can be used to identify the chemical elements present	• A laser strikes the surface of a material, generating a plasma whose emitted light is analyzed to identify the chemical elements present	• Analyzes light reflected from material surfaces over a wide range of wavelengths (visible, near infrared, mid infrared) • Each material has a unique spectral signature, used to identify it
APPLICATIONS	• **Separation of aluminum from heavier metals** • **Preparation of homogeneous streams prior to chemical sorting steps**	• **Identification of non-ferrous metals such as aluminum, copper, zinc or their alloys** • **Sorting of materials even if oxidized or contaminated**	• **Distinguishes between various aluminum series according to their chemical composition** • **Ideal for sorting high-value mixed alloys**	• **Sorting of alloys according to surface composition** • **Identification of non-ferrous metals in complex flows**
TRL	9	8-9	7-8	7
ADVANTAGES	• **Proven, robust technology** • **Excellent solution for high-volume flows**	• **Operates on materials with impurities** • **High reliability**	• **Highly accurate chemical resolution** • **Suitable for streams containing multiple alloys**	• **Works with a wide variety of materials** • **Identifies metals despite variations in fragment size**
DRAWBACKS	• **Does not differentiate between alloys with similar densities** • **Requires specific consumables**	• **Less accurate for distinguishing complex alloys** • **Requires X-ray safety measures**	• **Sensitive to surface condition** (e.g. oxidation or dirt) • **Requires stable infrastructure to operate**	• **Sensitive to dust and contaminants on surfaces** • **Requires advanced algorithms to interpret data**

HDV : Heavy-Duty Vehicle
Source : Expert interviews, Strat Anticipation research & analysis

New emerging technologies for improving post-shredding sorting will be documented and their maturity assessed

New technologies to improve materials sorting post shredding

X-RAY FLUORESCENCE ANALYZER (XRF)

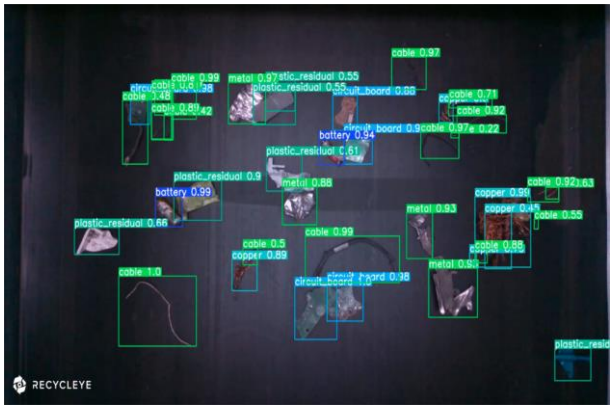


- The XRF analyzer enables shredders to detect the chemical composition of a metal in just a few moments, using a projected X-ray. Ideal for PMI*, quality control and non-ferrous metal analysis
- **Advantages :**
  - Lightweight, easy-to-use pistol format
  - Instant analysis results
  - Reliable analysis of all surfaces, including dirty or oxidized ones

LASER INDUCED BREAKDOWN SPECTROSCOPY (LIBS)

- Complementary to XRF, LIBS uses laser projection to generate a plasma from which the carbon composition of waste can be read. An ideal tool for distinguishing between different types of aluminum and mixed alloys
- **Advantages :**
  - Lightweight, easy-to-use pistol format
  - Instant analysis results
  - Accurate analysis of multi-alloy scrap

ARTIFICIAL INTELLIGENCE



- Post-shredding sorting AIs, still in the experimental stage, would automatically analyze and categorize waste according to its nature, composition and economic recovery potential. This would optimize the management of recycling flows
- **Advantages :**
  - Accurate and rapid identification
  - Reduced errors
  - Improved sorting line efficiency and reduced operating costs

* PMI : Positive Material Identification
Source : Recycling Product News, United Recyclers Group, Strat Anticipation research & analysis

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There are 3 different business models in the automotive circular economy (apart from recycling)

Reman & Repair definitions

	REMAN	BATCH REPAIR	ONE TO ONE REPAIR
DEFINTION	Remanufacturing is a standardized industrial process that takes place within industrial or factory settings, in which products are restored to same-as-new condition and performance or better, typically placed on the market with a commercial guarantee	Repair is the process of returning a faulty product to a condition where it can fulfil its intended use, either as a service (**One to One Repair**), or with a view to the subsequent resale of the repaired product (**Batch Repair**)	
CORE COLLECTION	• B2B • A volume of damaged products is given to the repairer/remanufacturer • Logistic (RAS)		• B2B2C • End user (car owner or Garage) bring their damaged product to repairer/ remanufacturer • Logistic constraint is High (24h/72h)
OPERATIONS	1. Cores selection 2. Selected cores are dismantled & cleaned 3. Components from cores are reprocessed 4. Reprocessed components (may include next ones) are reassembled to make a complete product as « New » 5. Product is tested and validated	1. A damaged product is used as a core 2. Diagnostic is performed to identify damage(s) root cause 3. Operations are performed to make non-working functions functional again (Software & Hardware) 4. Full product is tested	
STAKES	• Cores collection is key • Industrial process which requires square meters • Retro-engineering is need • Labor intensive process • Flexible remanufacturing equipment	• Diagnosis skill is key • Functional repair requires specific Software & Electronic expertise • Capex required for diagnosis equipment and end of line test (electronic product)	

THESE DEFINITIONS ARE ESPECIALLY TRUE IN EUROPE, WHEREAS IN USA & CHINA SOME PARTS CALLED REMAN ARE NOT

Source : Strat Anticipation analysis

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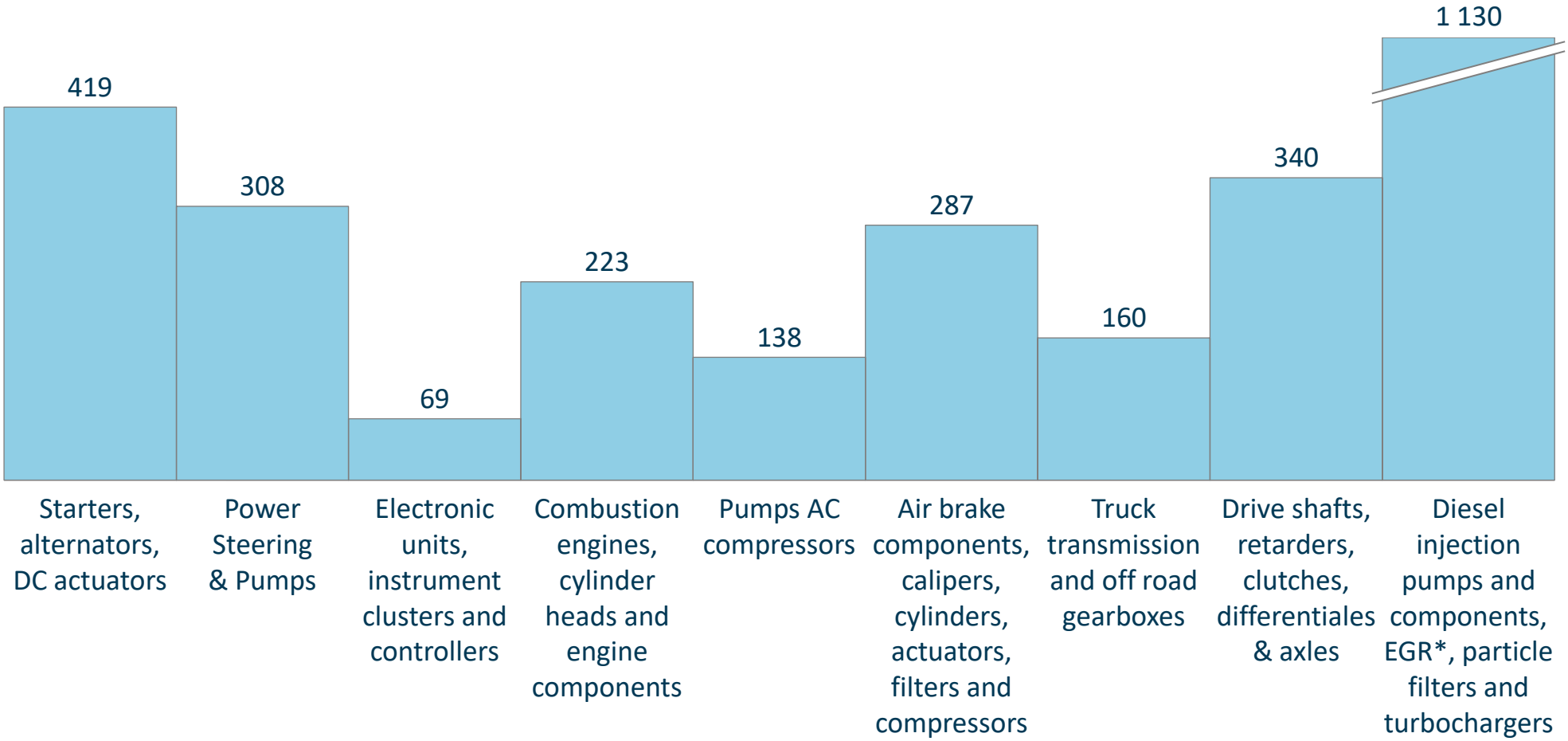
Reman is well developed for trucks, with several kind of parts having large volumes per year

Reman Market - Volumes

REMAN MARKET - VOLUMES | K UNITS, 2025



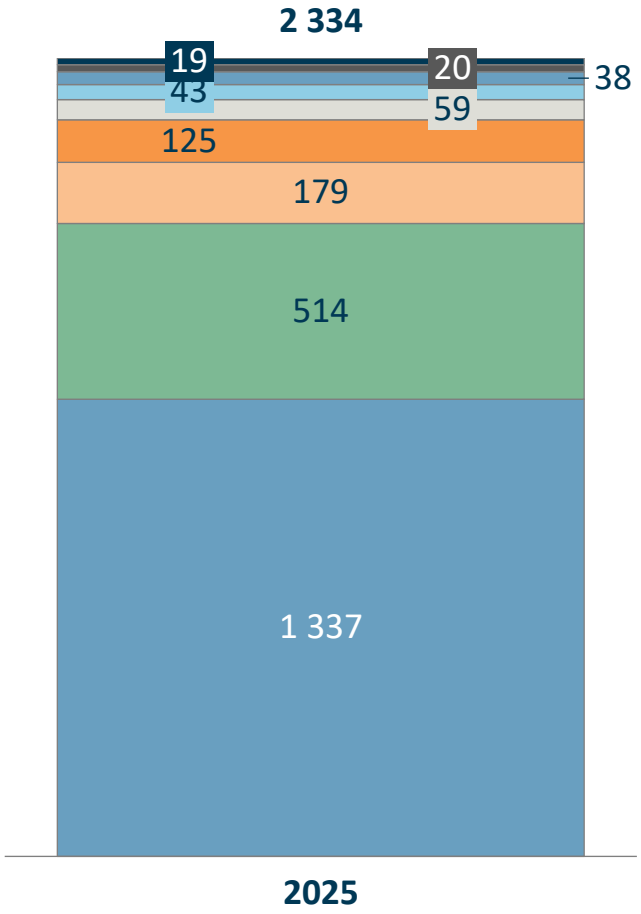
EGR : Exhaust Gas Recirculation
Source : CLEPA, Interviews and HIS Markit, Strat Anticipation research & analysis

In 2025, the European reman market for Heavy Duty Vehicles is focused on engines and engine components, gearboxes and transmissions as well as injectors & turbos

European Heavy Duty reman market analysis by main module - Supplier level

TOP-DOWN APPROACH - EUROPEAN REMAN MARKET BY TECHNOLOGY | In M€, 2021

TOTAL 2 334 M€



- Pumps AC compressors
- Air brake components, calipers, cylinders, actuators, filters and compressors
- Electronic units, instrument clusters and controllers
- Power Steering & Pumps
- Starters, alternators, DC actuators
- Diesel injection pumps and components, egr, particle filters and turbochargers
- Drive shafts, retarders, clutches, differentiales & axles
- Truck transmission & gearboxes
- Combustion engines, cylinder heads and engine components

STRONG REPAIR MARKET ALREADY EXISTS

Source : CLEPA, Global Data, Strat Anticipation Analysis

Repairable or remanufacturable parts fall into six categories: Engine, Drivetrain & Steering, Electrical, Air/Brake, Fuel, and Exhaust/Cooling.

List of Main parts used for Reman & Repair

ENGINE	DRIVETRAIN & STEERING	ELECTRICAL SYSTEM	AIR/BRAKE	FUEL SYSTEM	EXHAUST/COOLING SYSTEM
Turbocharger	Auto/manual transmission ★	Starter	Brake caliper	CRI injector ★	EGR module
Crankshaft	Clutch parts	Alternator	Brake cylinder	Distributor injection pump	Diesel particulate filter
Engine Block ★	Transfer case	Control units	A/C or air compressor	Nozzle holder combination	Exhaust silencer
Flywheel	Differential gear	Engine control units	Air brake compressor	High-pressure pump	Catalytic converter
Cylinder head	Axle drive ★			Supply module	Intercooler
Throttle valve actuator	Steering gear				Coolant pump
Rotating electrical	Propshaft				
Radiator					

★ Key products

Source : Company Reports

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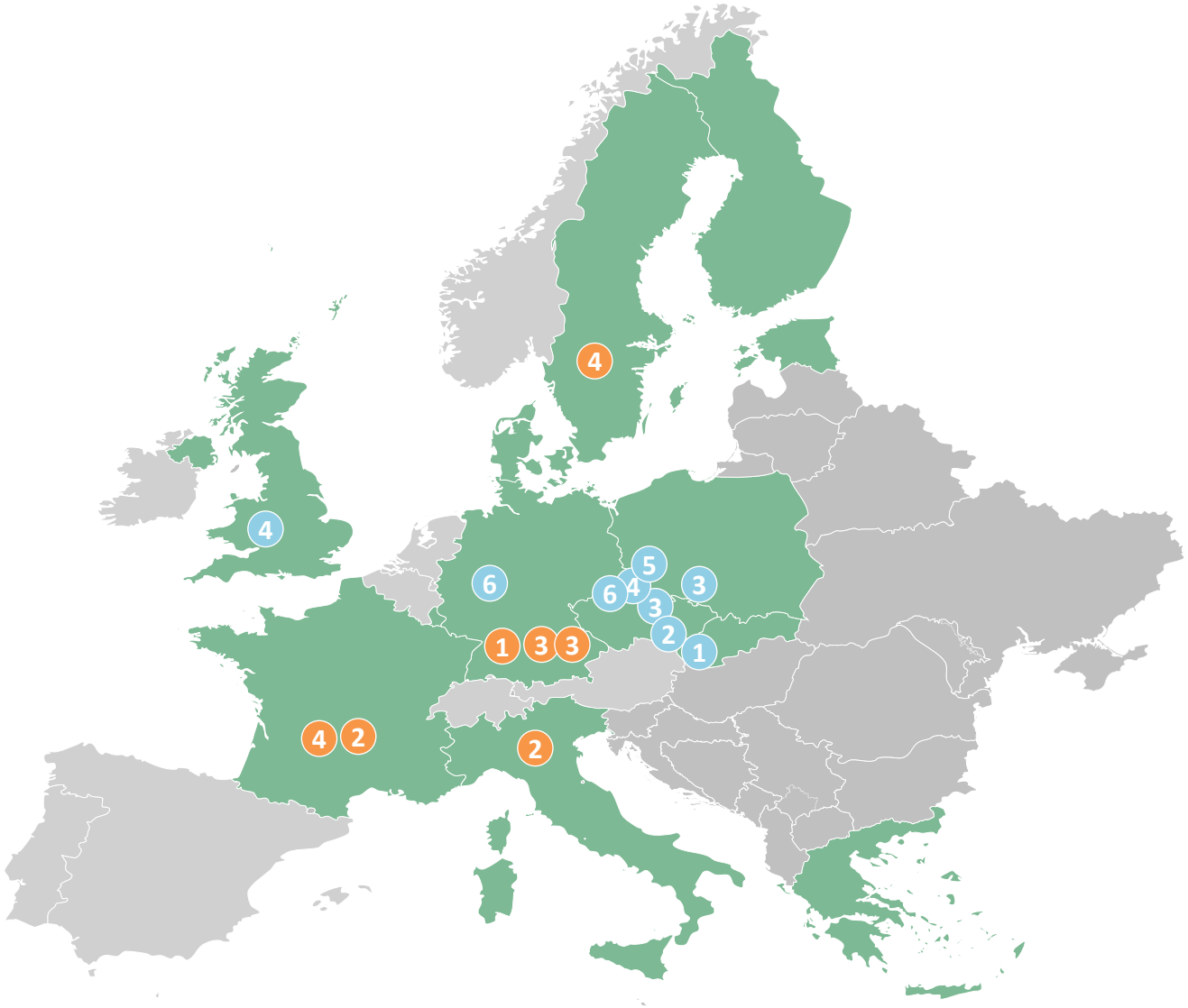
The main remanufacturing industrial sites are located in Eastern Europe. Among OES, most of them are between Poland and the Czech Republic.

Heavy-Duty Reman Players - Mapping

NON-EXHAUSTIVE

MAIN DEDICATED REMANUFACTURING FACTORIES IN EUROPE

1 DAIMLER TRUCK	1 BOSCH
2 IVECO	2 Garrett ADVANCING MOTION
3 MAN	3 Cummins
4 VOLVO	4 KNORR-BREMSE
	5 Valeo
	6 ZF



Source : Company Information, Expert interviews, Strat Anticipation research & analysis

Some HD OEM have dedicated factories to reman parts notably engines & transmissions. There is a lot of projects on remanufacturing of electric buses batteries

Heavy-Duty Reman Players - OEMs

OEM	DAIMLER TRUCK	IVECO	MAN	SCANIA	VOLVO TRUCKS	*RENAULT TRUCKS*
HQ						
REMAN ACTIVITIES	Reman parts for engines, transmissions Remanufacturing electric bus batteries (e.g., eCitaro)	Engines, transmissions, axles, and components (often via supplier partnerships) Project on electric bus battery reman	Engines and components under "MAN ecoline" label. Expansion to battery reman and repair for electric trucks/buses.	Gearboxes, engines, and component.	Broad range including injectors, control units, clutch kits, engines, turbochargers, and powertrain components; emphasis on circular business models for near-zero emissions parts.	Reman of engines, gearboxes and components
FOOTPRINT	Site for transmissions/axles & Remanufactured Parts program is **Gaggenau, Germany**	Production with partners from FPT Industrial in **Garchizy, France** & **Turin, Italy**	Production footprint include **Aldersbach, Germany** (truck plant with REMAN integration) and **Nuremberg, Germany** (new battery manufacturing and reman from April 2025)	N/A - Primarily integrated into non-specific factories	Dedicated reman facility at **Flen, Sweden** (expected to be largest in Europe for engines and components)	Dedicated reman factory at Limoges, France. Activity in Vénissieux & Bourg-en-Bresse, France

Source : Company Information, Expert interviews, Strat Anticipation research & analysis

OES have strong presence on truck reman in Czechia, Slovakia & Poland. Small players with diverse activities also play a key role

Heavy-Duty Reman Players - OES

	BOSCH	Cummins	Garrett ADVANCING MOTION	KNORR-BREMSE (INCL. ECONX)	Valeo	VOITH	ZF (INCL. WABCO)	*Others actors with main activities related to Light Vehicles*
HQ								
REMAN ACTIVITIES	Remanufactures diesel injection systems, starters, alternators, and other engine/vehicle components for HD trucks and buses.	Engine remanufacturing and *Cummins-Meritor* axles and brakes remanufacturing	Provides remanufactured turbochargers for HD trucks and buses under Original Reman.	Remanufactures braking systems including air compressors, calipers, and ABS components for HD trucks and buses.	Regenerates alternators, starters, dual-mass flywheels, A/C compressors, and other electrical/thermal components.	Remanufactures bus automatic transmissions and provides service/exchange for HD buses.	Remanufactures steering systems, transmissions, and braking components for trucks and buses under ZF REMAN and CV aftermarket programs.	COMMERCIAL GEARBOX & DIFF BORG AUTOMOTIVE HISMITH TRANSMISSIONS LTD TVH BUDWEG BETTER BE SAFE LKQ
FOOTPRINT	**Bernolákovo, Slovakia**	**Kraków, Poland** (engines); **Vrchlabí, Czech Republic & Cwmbran, UK** (brakes)	N/A	**Liberec, Czech Republic**	**Czechowice-Dziedzice, Poland**	N/A - Primarily integrated into non-specific factories	**Frydlant, Czech Republic** (CV reman); **Bielefeld, Germany** (steering reman)	

Source : Company Information, Expert interviews, Strat Anticipation research & analysis

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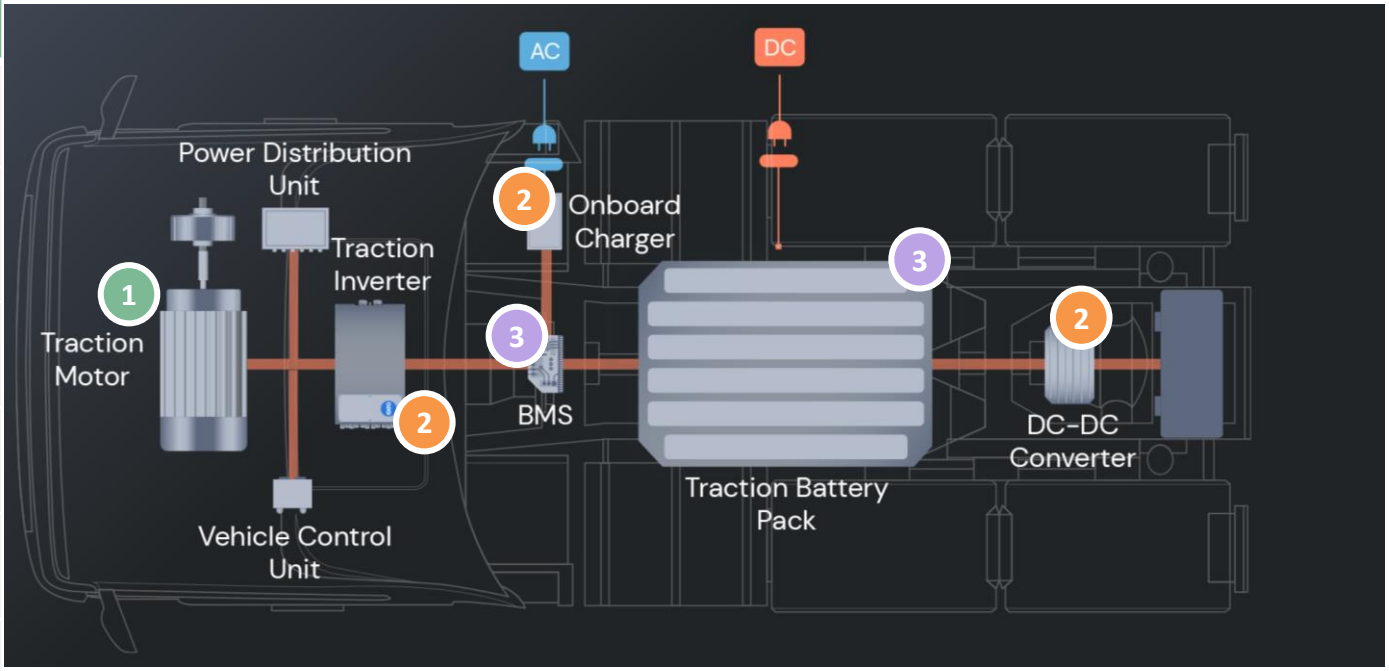
This section aims to explore remanufacturing market of the three primary new modules : electric motors, power electronics, and battery packs

New modules presentation

MAIN MODULES	
1 **E-Motors**	The traction motor
2 **Power Electronics**	Traction Inverter (often integrated with the E-motor)
	Onboard Charger
	DC-DC Converter
3 **Battery Pack**	Battery Pack
	BMS



WE WILL DIVE INTO EACH OF THESE 3 MODULES TO PRESENT A REMANUFACTURING MARKET OVERVIEW. THE E-MOTORS OF BEVs ARE SIMILAR TO THE ONES FOR HYDROGEN-POWERED VEHICLES

Source : Company Information, Strat Anticipation analysis

To evaluate the power of electric motors and battery capacity relative to truck size, we conducted a benchmark study on several models

Mapping - Size & Power of Electrified Trucks Motors

TRUCK MODEL	SIZE (GVWR)	EMPTY WEIGHT (KG)	GROSS VEHICLE WEIGHT RATING	BATTERY CAPACITY (KWH)	E MOTOR POWER (KW)
Mitsubishi Fuso eCanter (L-battery variant)	<14	4 500	7 500	124	129 (peak)
Freightliner eM2 (Class 6)	14-28	5 879	13 000 - 16 500	194	145 (peak)
Volvo VNR Electric (6x4 tractor, 6-battery)	28-40	10 192	24 500/37 195	565	340 (continuous)
Freightliner eCascadia (6x4, long-range)	28-40	9 875	37 195	438	350
Kenworth T680E (6x4 tractor, 4-string battery)	28-40	10 192	37 195	500	450 (peak)
Nikola Tre BEV (9-pack battery)	28-40	13 271	37 195	613	480 (continuous; 797 peak)
Mercedes-Benz eActros 600	40+	12 800	44 000	590	400 (continuous; 600 peak)

Source : Company Information, Strat Anticipation analysis

There are a few European players positioned on the Reman of e-motors & power electronics most of them coming from the LDV industry

Players positioned - E-Motors & Power Electronics

PLAYERS POSITIONNED – REPAIR & REMAN OF E MOTORS AND POWER ELECTRONICS						
COMPANY / PROGRAM	EU BASE / KEY SITES	E-MOTOR	INVERTER	OBC	DC-DC CONVERTER	NOTES
THE REMAKERS		✓	✓ (Valeo partnership)		✓ (Continental partnership)	>1,000 e-motors remanufactured; power electronics program launched 2025
VALEO		X	✓ (with The Remakers)	✓ (OE combo OBC+DC-DC;)	✓ (48V DC-DC for IAM, 2025)	Expanding EU aftermarket electrified range
CONTINENTAL		X	X	X	✓ (with The Remakers)	Converter reman in EU
ACTRONICS		X	✓	✓	X	Independent IAM reman of inverters & OBCs
ATC DRIVETRAIN		-	✓	In dev.	In dev.	Reman programs for EV e-powertrain parts
BORG AUTOMOTIVE REMAN		In dev.	In dev.	In dev.	In dev.	300+ EV PN in dev., “thousands” already available
MERCEDES-BENZ TRUCKS		In dev.	In dev.	In dev.	In dev.	Covers electronic components; check per VIN

WHILE THESE PLAYERS MOSTLY WORK ON EVs SINCE VOLUMES ARE STILL LOW, THEY ARE THE MOST LIKELY TO POSITION ON TRUCKS

Source : Company Information, Strat Anticipation analysis

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The HDV industry uses various e-motor configurations, such as integrated e-motors within an e-axle, and HDVs often utilize multiple e-motors

E-Motors for HDVs - Used technologies

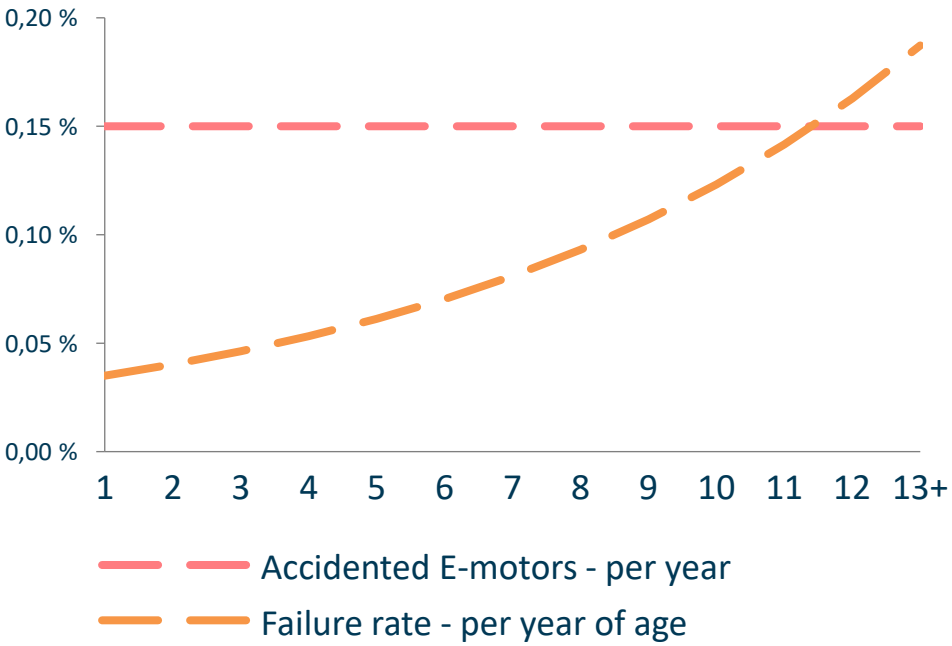
CONFIGURATION	DESCRIPTION	PROS/CONS	EXAMPLES
A **INTEGRATED MOTOR + TRANSMISSION + INVERTER**	- Motor, inverter, gearbox in one unit called **e-axle**. The setup is often on axle, no driveshaft.	- **Pros**: Compact, efficient (95%+), light, easy install - **Cons**: Hard to repair, axle weight affects handling.	- Dana TM4 SUMO HD (heavy truck e-axle). - Mercedes-Benz eActros (dual-motor e-axle, 400 kW peak). - Freightliner eCascadia (Detroit ePowertrain, 1-3 motors). - Volvo FL Electric (single-motor e-axle).
B **SEPARATED MOTOR, INVERTER & TRANSMISSION**	- Central motor, separate inverter, gearbox. - Driveshaft to axle (direct drive style).	- **Pros**: Easy maintenance, flexible, suits diesel conversions - **Cons**: Heavier, less efficient, more space needed.	- BYD 8TT (central motor, ~360 kW, driveshaft for Class 8 drayage). - Brogen port trucks (direct drive for short hauls). - Early Nikola Tre (central motor pre-integrated).
MULTIPLE E-MOTORS	- 2+ motors (either motors per axle or per wheel) - Can be integrated or separated setups	- **Pros**: High power (500+ kW), redundancy, AWD, better traction - **Cons**: Complex, costly, heavier, needs cooling.	- Tesla Semi (tri-motor, ~746 kW, integrated axles). - Volvo VNR Electric (dual motors, 340 kW). - Rivian EDV (quad-motor, 615 kW). - Brogen e-axle (4 motors, 720 kW, mining).

HDV : Heavy-Duty Vehicle
Source : Company Information, Strat Anticipation analysis

E-motors can be remanufactured in three ways: at the end of a truck's first life, from damaged e-motors due to accidents, or from e-motors with defects

E-Motors for HDVs - Replacement from accidentology, failure & for second life

E-MOTORS TO REPLACE FROM ACCIDENTOLOGY AND FAILURE PER AGE OF THE VEHICLE | In %



BOTH THE ACCIDENTED E MOTORS AND FAILED E MOTORS WILL BE REMANUFACTURED

	ESTIMATED LIFETIME
Source 1: DOE - Electrification Technologies Sector Team Roadmap	800-1200 k km
Source 2: DOE – An Action Plan for Medium & Heavy-Duty vehicle energy & emissions innovation	1 300- 1 500 k km

Retained Hypothesis – E-Motor Second Life:

- **Rigid trucks:** At 12 years of age, the E-Motor(s) of a truck has a 50% probability of being repaired at workshop/dealership (bearing replacement and/or rewinding at a workshop or factory) and a 20% probability of undergoing complete remanufacturing at the factory.
- **Articulated trucks:** At 8 years of age, the E-Motor(s) of a truck has a 40% probability of being repaired at workshop/dealership and a 30% probability of a complete factory remanufacturing

Source : DOE - *Electrification Technologies Sector Team Roadmap,* DOE - *An Action Plan for Medium & Heavy-Duty vehicle energy & emissions innovation,* Strat Anticipation analysis

E-motors can be fully remanufactured in a factory, involving bearing replacement, rewinding, joint and insulation replacement, and thorough cleaning

E-Motors for HDVs - Remanufacturing processes

E-MOTOR REMANUFACTURING STEPS	
INSPECTION Motors are logged, tagged, and visually checked for cracks, corrosion, or housing damage. Electrical insulation measured with megohmmeters, vibration/noise tested, and sensor data reviewed.	1
DISASSEMBLY External cleaning followed by systematic dismantling. Covers, fans, cooling jackets, and sensors removed with hand tools. Rotor and stator separated using presses/pullers.	2
CLEANING & PREPARATION **Shafts, housings, and stators** cleaned in washing/ultrasonic machines. Old varnish/insulation removed with thermal stripping ovens, scrapers, brushes. Surfaces polished or blasted.	3
MECHANICAL RESTORATION **Bearings removed** with induction heaters and pullers. **Shafts inspected** with micrometers, re-machined or metal-sprayed if worn. Housings, and flanges repaired, machined. **Cooling fans and seals** replaced if needed.	4
ELECTRICAL RESTORATION **Faulty windings stripped**. **New copper coils** wound with winding machines, insulated, and impregnated using VPI/dipping tanks. Sensors, and **thermal protection devices** tested and replaced if required.	5
REASSEMBLY Rotor, stator, and housing reassembled with alignment tools. Bearings pressed on with arbor presses and greased. Rotors balanced on dynamic balancing machines. New joints are used.	6
TESTING & CERTIFICATION Motors run on test benches under load to measure torque, efficiency, vibration, and temperature rise. High-voltage motors tested for partial discharge. Electrical safety checked.	7
FINISHING & PACKAGING Housings repainted or coated for corrosion protection. Labels and serials applied. Motors packaged for shipment or recycled if beyond repair.	8

FOR INTEGRATED E-AXLE, ELECTRONIC CAPABILITIES ARE NEEDED IF OPERATIONS MUST BE DONE REGARDING INVERTERS

Source : Industrial Service Solution - Electric Motor Bearing Maintenance, us.emotorsdirect.ca, swelectric - Electric Motor Repair: 6 Basic Steps & Best Practices

Maintenance operations are also viable for repairing e-trucks and can be conducted at well-equipped workshops or dealerships

E-Motors for HDVs - Repair processes

E-MOTOR REPAIR STEPS

1

BEARING REPLACEMENT
Motor is disconnected, covers removed, and rotor extracted. Seized bearings are expanded with an **induction heater** and removed using a **puller or press**. Shaft tolerances are checked with **micrometers**; machining if required. New bearings are heated, pressed on with an **arbor press**, and greased.
Tools: induction heater, puller/press, micrometer, arbor press, cleaning solvent.

2

WINDING REPAIR (IF NEEDED)
Faulty windings are stripped with a **coil stripping tool**, and slots cleaned with **brushes/scrapers**. New copper wire is wound with a **winding machine**, insulated, and impregnated using **varnish/VPI systems**. Final checks done with a **megohmmeter** and **a multimeter.**
Tools: coil stripper, winding machine, brushes, varnish/VPI setup, megohmmeter, multimeter.

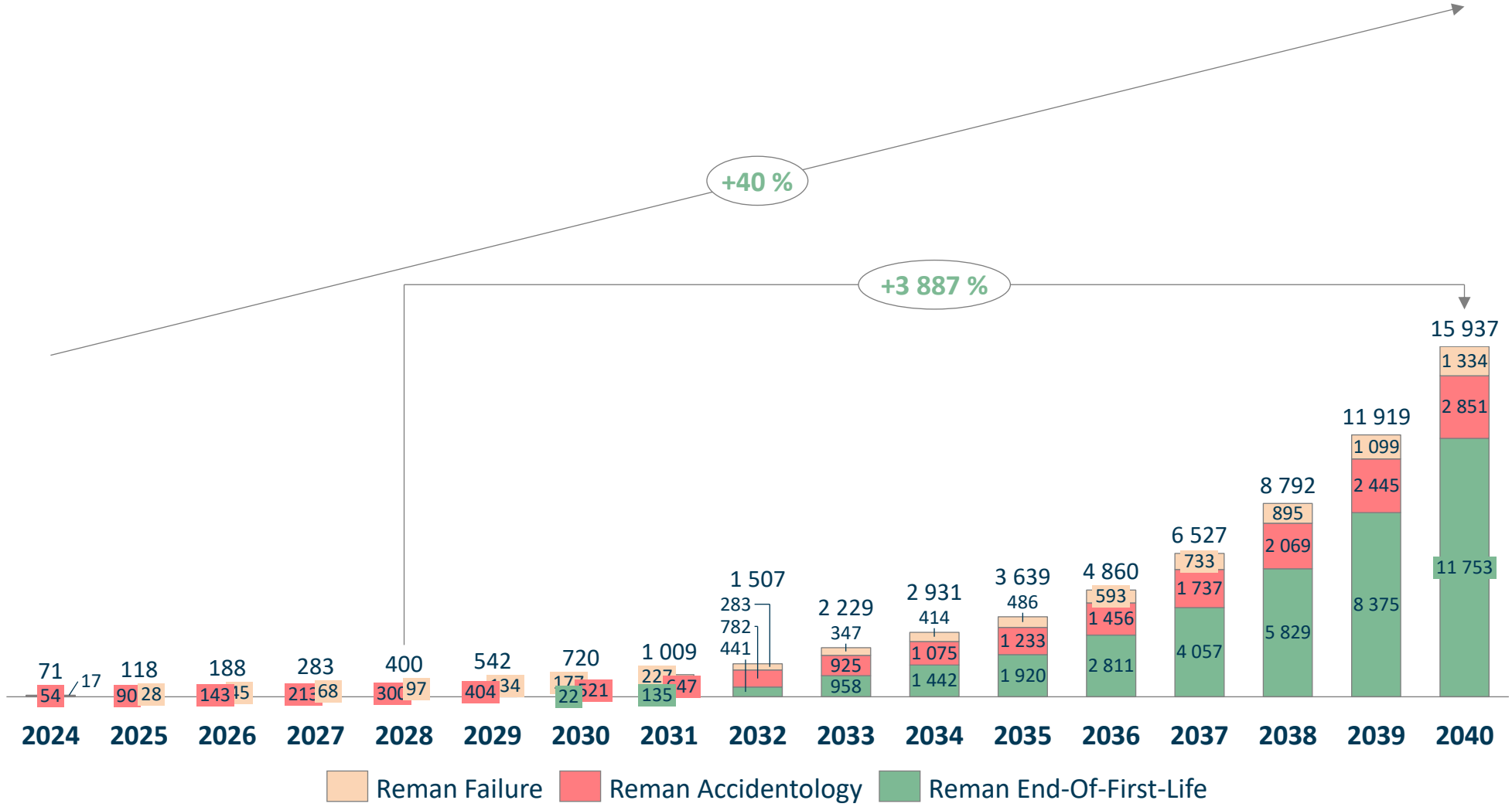
AN EQUIPPED WORKSHOP CAN ALSO ASSURE REPAIR AND MAINTENANCE SERVICE FOR E-MOTORS

Source : Industrial Service Solution - Electric Motor Bearing Maintenance, us.emotorsdirect.ca, swelectric - Electric Motor Repair: 6 Basic Steps & Best Practices

With the increasing adoption of electrified HDVs, the baseline scenario projects a remanufacturing volume of approximately 3,600 e-motors by 2035

E-Motors for HDVs - Volume to be remanufactured in units

TOTAL E-MOTORS TO BE REMANUFACTURED PER SOURCE IN EUROPE | In Units, 2024-2040, 8 Countries selected in scope

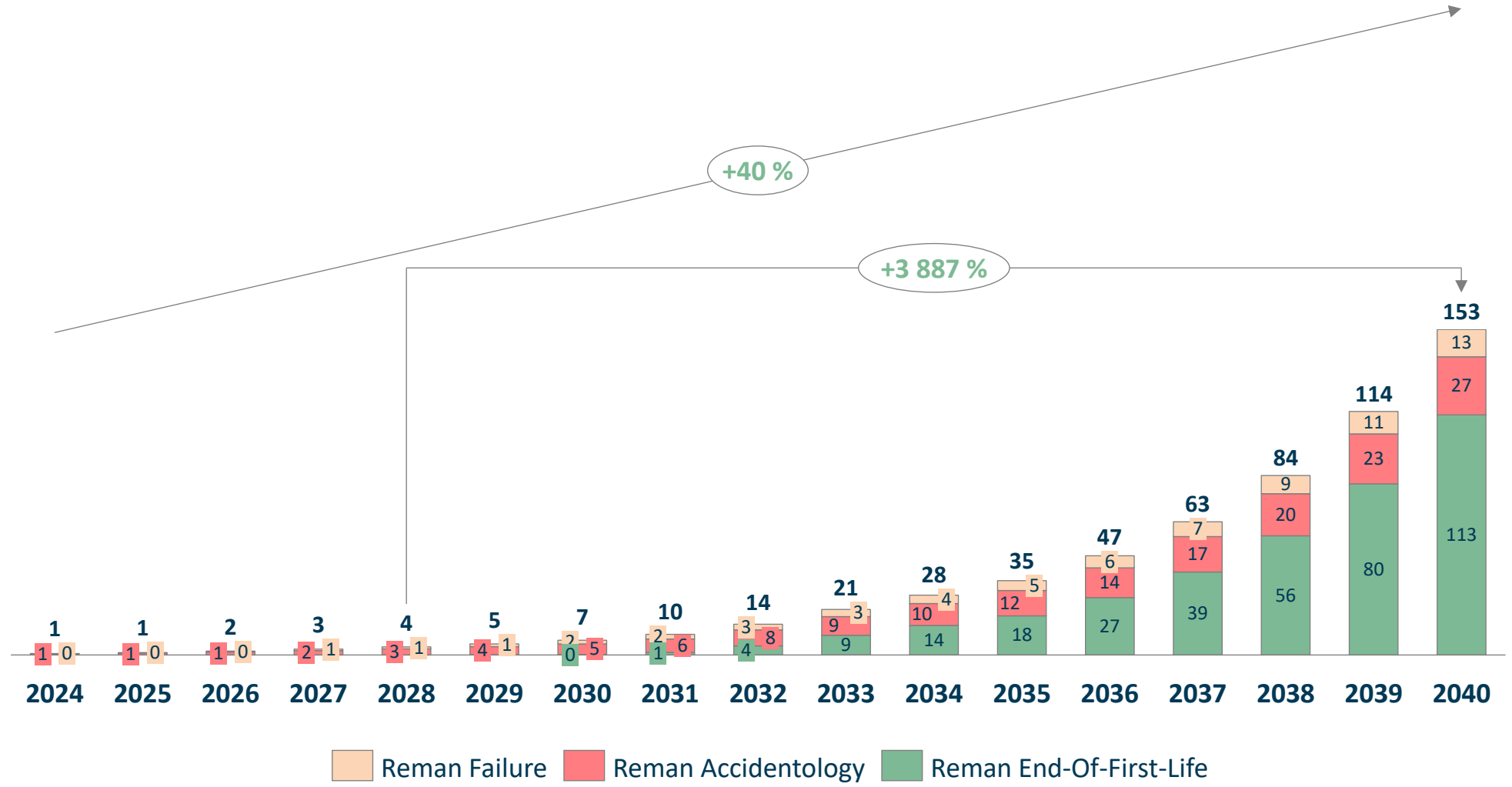


Source : EMISIA, Strat Anticipation Model

The market for the sale of remanufactured E-Motors is estimated at 35 M€ by 2035 & 153 M€ by 2040

E-Motors for HDVs - Volume to be remanufactured in value

TOTAL VALUE IN E-MOTORS TO BE REMANUFACTURED PER SOURCE IN EUROPE | In M €, 2024-2040, 8 Countries selected in scope



Note : Remanufactured E-Motor is sold at 60% of new price here. E-Axle are not considered
Source : EMISIA, Strat Anticipation Model

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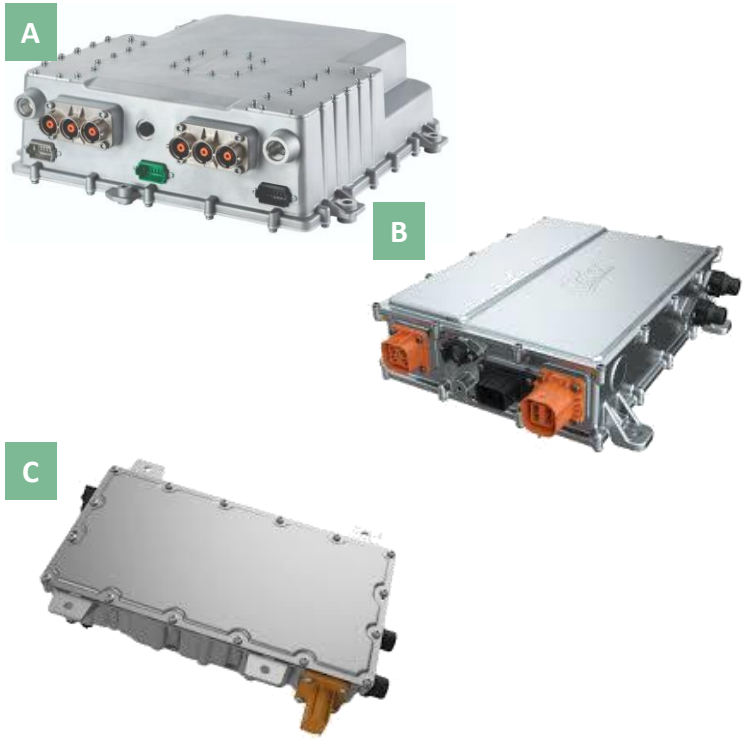
The HDV industry is using different modules for power electronics : Inverter, On-Board Charger, DC/DC Converter

Power Electronics for HDVs - Used technologies

POWER ELECTRONICS MODULES



Electric powertrains in trucks focus on three key modules, optimized for heavy-duty performance:

A **Inverter**: Converts battery DC to AC for motors. Key characteristics: high power output (300+ kW), robust cooling, and efficiency for heavy loads.

B **On-Board Charger (OBC)**: Manages AC charging to the battery. Key characteristics: high power (22–150 kW), fast charging support, and compatibility with megawatt charging.

C **DC/DC Converter**: Steps down high voltage (600–1000 V) for auxiliary systems (12 V/24 V). Key characteristics: high reliability, supports heavy auxiliary loads, and compact design.

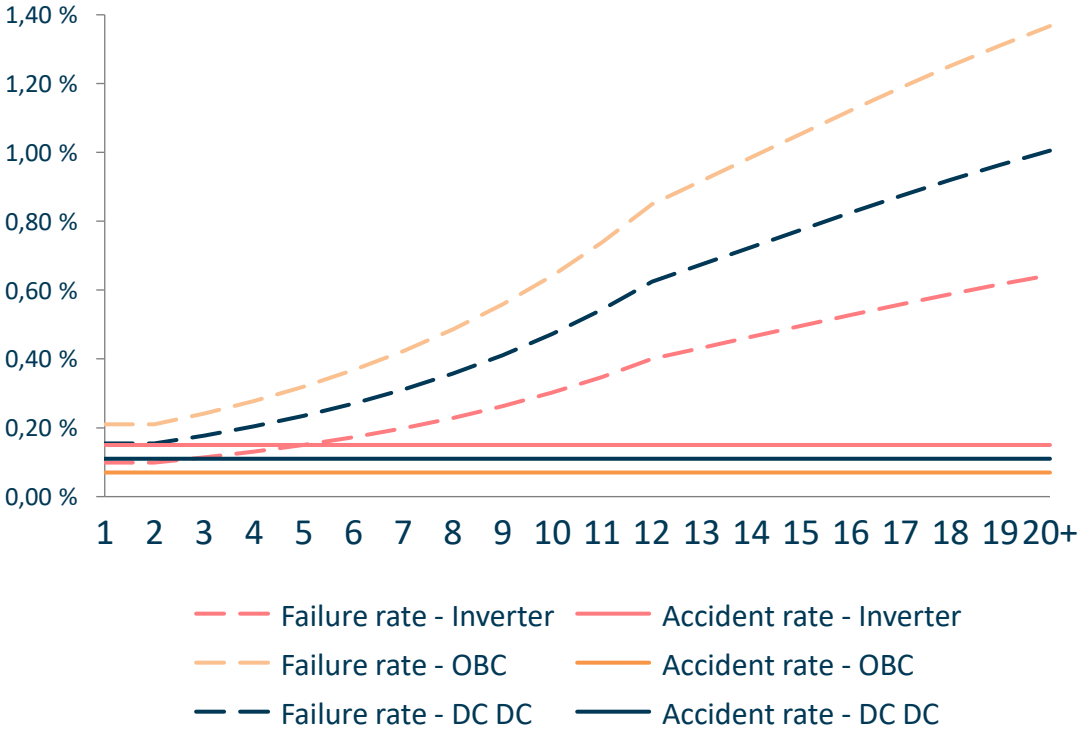
These are often integrated into an e-axle or distributed in the chassis, operating at 600–1000 V

HDV : Heavy-Duty Vehicle
Source : Strat Anticipation analysis

Power electronics in trucks are generally not refurbished, except for inverters integrated with the e-motor, meaning no true second-life strategy exists

Power Electronics for HDVs - Replacement from accidentology, failure & for second life

POWER ELECTRONICS TO REPLACE FROM ACCIDENTOLOGY AND FAILURE PER AGE OF THE VEHICLE | In %



RETAINED HYPOTHESIS – POWER ELECTRONICS SECOND LIFE

Once a truck reaches the end of its typical service life, **power electronics are generally not replaced**. Power electronics in trucks lack a second life because very few parts are reused or refurbished. Components are not wear-parts, are not designed for reuse, and face high remanufacturing costs.

In practice, **power electronics do not have a true second life**.
Inverters may only be remanufactured if they are **integrated with the E-motor**.
Otherwise, **no components of the power electronics are reused or refurbished**, and **no second-life strategy is applied**.

POWER ELECTRONICS REMANUFACTURING WILL COME FROM DEFECTIVE AND ACCIDENTED MODULES

Source : DOE - *Electrification Technologies Sector Team Roadmap,* DOE - *An Action Plan for Medium & Heavy-Duty vehicle energy & emissions innovation,* Strat Anticipation analysis

Performing remanufacturing of Power Electronics requires strong electronics capabilities. Some seals can also be changed

Power Electronics for HDVs - Remanufacturing processes

REMANUFACTURING STEPS

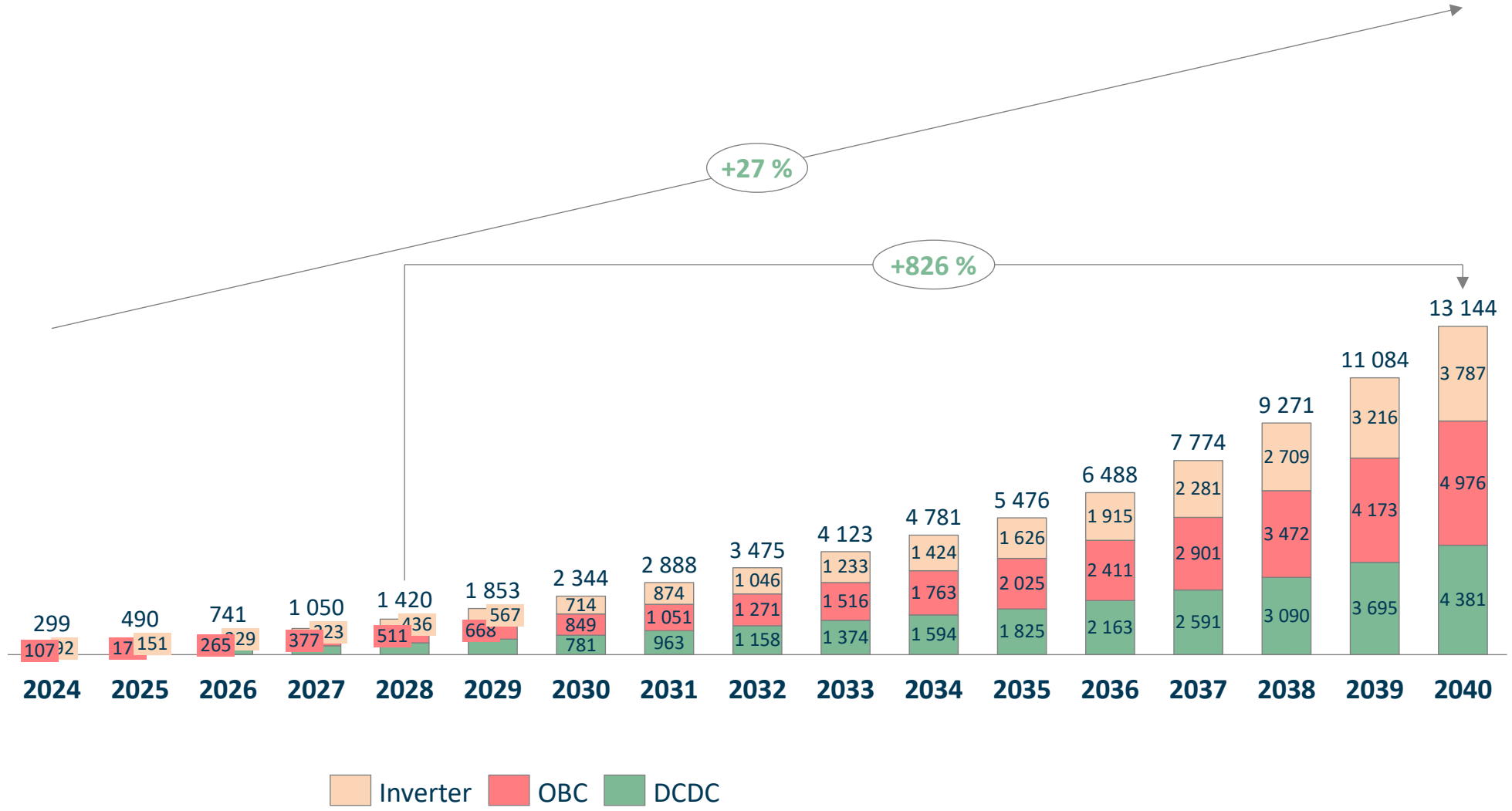
INVERTER	ON-BOARD-CHARGER	DC/DC CONVERTER
▪ Power Modules are tested for thermal fatigue, replaced. ▪ Capacitors are checked for leakage/ESR, replaced if faulty. ▪ Circuit Boards and Gate Drivers: Repaired or swapped. ▪ Cooling Systems (Heatsinks, Fans): Cleaned, regreased. ▪ Inductors and Transformers: Inspected for winding/core damage. ▪ Housings and Seals: Coated, replaced for environmental protection.	▪ Circuit Boards and Power Electronics: Inspected, repaired or replaced. ▪ Connectors and Contactors: Tested for conductivity, swapped if worn. ▪ Capacitors and Inductors: Checked for capacitance/ESR, replaced if degraded. ▪ Transformers and Converters: Rewound or replaced if damaged. ▪ Cooling Systems (Fans, Heatsinks): Cleaned, regreased. ▪ Seals, Housings: Replaced, coated for protection.	▪ Switches : Tested for resistance/speed, replaced. ▪ Inductors and Transformers: Rewound if necessary. ▪ Capacitors: Checked for current, replaced if degraded. ▪ Diodes and Rectifiers: Tested for voltage drop/leakage, replaced if needed. ▪ Control Circuits and PCBs: Repaired for regulation.

Source : Industrial Service Solution - Electric Motor Bearing Maintenance, us.emotorsdirect.ca, swelectric - Electric Motor Repair: 6 Basic Steps & Best Practices

With the increasing adoption of electrified HDVs, the baseline scenario projects a remanufacturing volume of approximately 5500 units by 2035

Power Electronics for HDVs - Volume to be remanufactured in units

TOTAL POWER ELECTRONICS MODULES TO BE REMANUFACTURED PER SOURCE IN EUROPE | In Units, 2024-2040, 8 Countries selected in scope

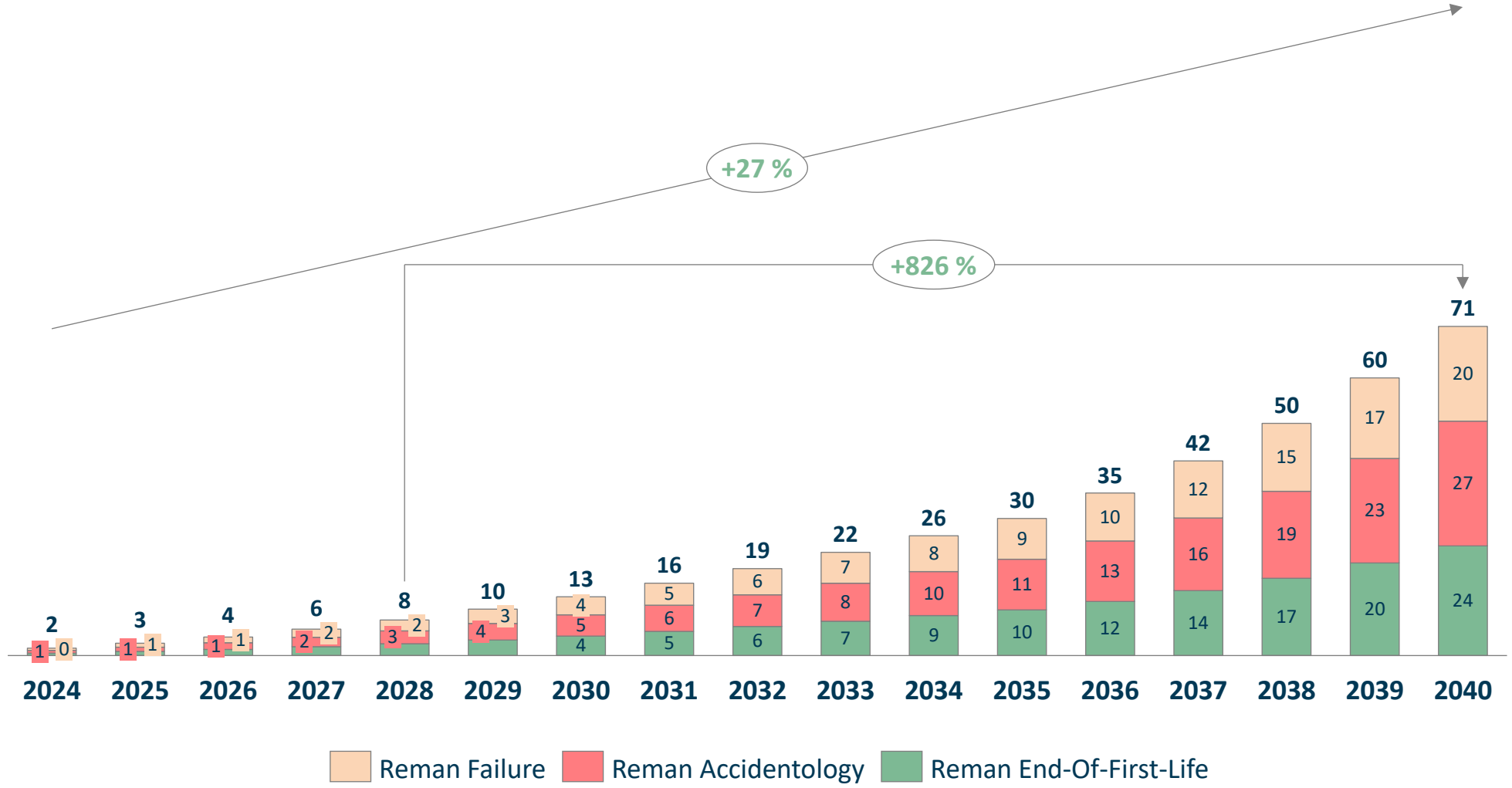


Source : EMISIA, Strat Anticipation Model

At the global level, the market for the sale of remanufactured Power Electronics Modules is estimated at 30 M€ by 2035 & 71 M€ by 2040

Power Electronics for HDVs - Volume to be remanufactured in value

TOTAL VALUE IN POWER ELECTRONICS TO BE REMANUFACTURED PER SOURCE IN EUROPE | In M €, 2024-2040, 8 Countries selected in scope



Note : Remanufactured modules are sold at 60% of new price here
Source : EMISIA, Strat Anticipation Model

CONTENTS

The HDV industry uses various battery packs configurations. Almost always with modular packs, whose can be frame-mounted, or under the Cab/roof/ or at the rear

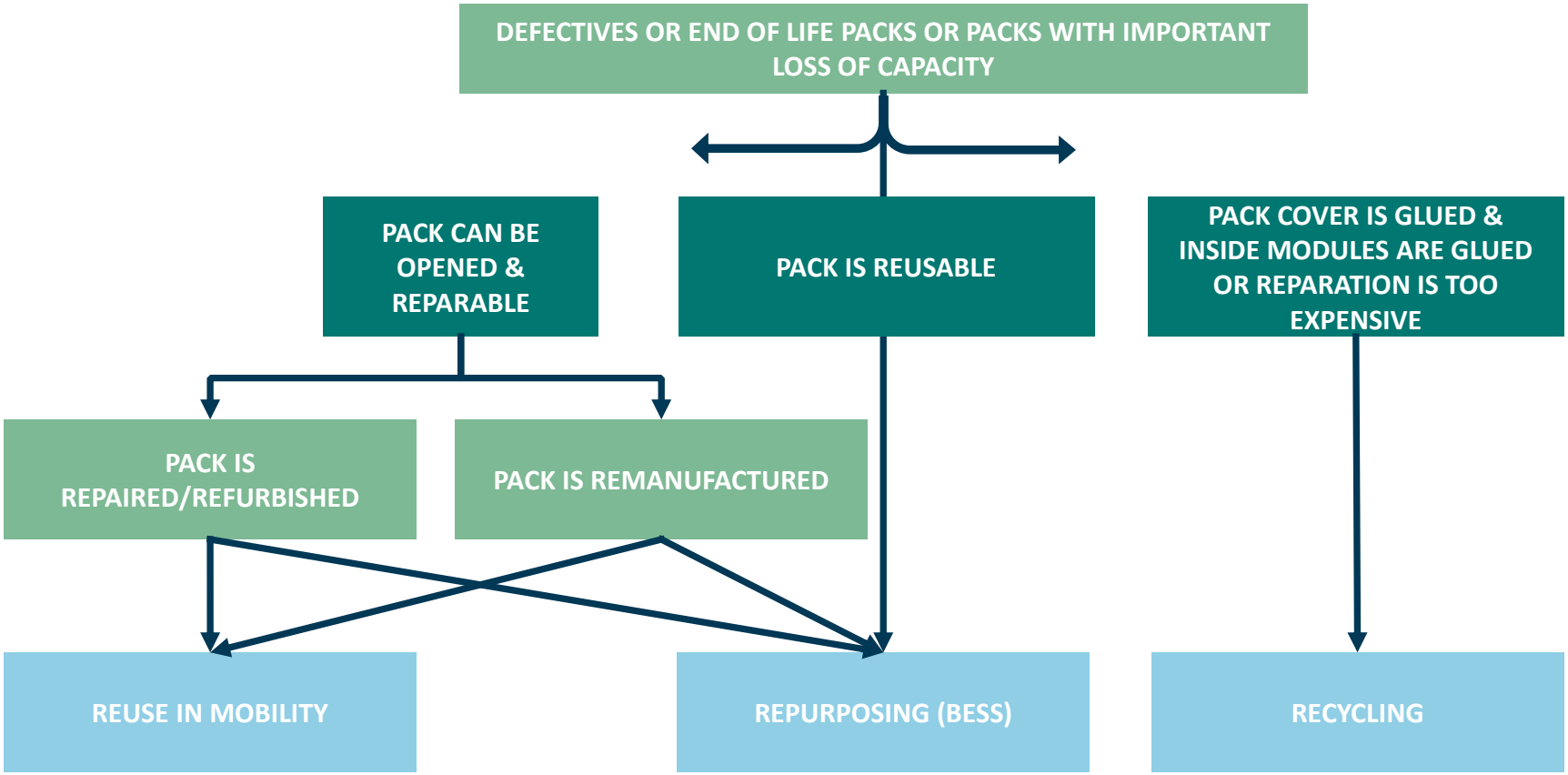
Battery Packs for HDVs - Used technologies

POSSIBLE CONFIGURATIONS FOR HDVs BATTERY PACKS		
ASPECT		**DESCRIPTION**
PACK DESIGN TYPE	Modular Packs	Multiple packs (2-6) connected in series/parallel, each containing 90-104 kWh, for flexibility and scalability.
	Monolithic Packs	Single large pack (500-700 kWh) for simplicity, less common due to payload trade-offs.
SERIES/PARALLEL CONFIG	Series/Parallel Arrangements	Combines series and parallel connections (e.g., 2P4S or 6S6P) to increase both voltage and capacity. Packs are grouped in series for voltage, or in parallel for capacity.
	Either all Packs in Series or in Parallel	Connects all packs uniformly
PACK PLACEMENT	Frame-Mounted	Between chassis rails, optimizes payload but limits space.
	Under-Cab/Roof/Rear	Under-cab, roof, or rear for weight distribution across the vehicle.
	Cell-to-Chassis (CTC)/Cell-to-Body (CTB)	Cells integrated into frame, saves 10-15% weight, rare due to safety concerns.

HDV : Heavy-Duty Vehicle
Source : Strat Anticipation research & analysis

Packs can be repaired/remanufactured, sent to repurposing or recycled. OEMs are on Repair/Reman/Repurpose, while Recyclers work directly with Gigafactories

Pack Reparability Decision Tree



AN END-OF-LIFE OR DEFECTIVE BATTERY PACK WILL BE EVALUATED FOR BOTH RECYCLING, REMANUFACTURING & REPURPOSING. IF REMANUFACTURED, IT WILL COMPETE WITH NEXT-GENERATION BATTERIES.

Source : Strat Anticipation research & analysis

A Battery can be reused, repaired/refurbished or remanufactured. If these processes are not economically viable the battery will be recycled

Battery for HDVs - End-of-life option descriptions

END-OF-LIFE OPTION DESCRIPTIONS			
REMANUFACTURING	**REPAIR/REFURBISH**	**REPURPOSE**	**RECYCLING**
▪ **SOH Range**: 70-90%. ▪ **Process**: Rebuild through an industrial process at the factory level to try and approach a new condition replacing most degraded components. Disassemble the battery pack, addressing the Electromechanical Defect of a Battery Cell/Module by installing new cells/modules, upgrading BMS to resolve Software defect, fixing the Mechanical Defect of the Cooling System with new components, and replacing cables with Bad Soldering/Corrosion. The battery SOH will not be 100% again.	▪ **SOH Range:** 50–95%. ▪ **Process**: Addresses specific faults to restore functionality for original or secondary use. Test for electromechanical Defect of a Battery Cell/Module, Mechanical Defect of the Cooling System (e.g., repair leaks or blockages), and Cables: Bad Soldering/Corrosion (resolder joints or replace corroded cables). Replace or repair affected components, and test for safety and performance. Focuses on localized fixes rather than a full overhaul.	▪ **SOH Range**: ≥80%. ▪ **Process and Key Details**: Deploy battery in secondary applications or in other mobility applications with minimal changes. Test SOH, ensure safety (no leaks, stable voltage), and verify performance for low-demand uses. It might be needed to recalibrate BMS.	▪ **SOH Range:** <60% or non-economically viable for other processes. ▪ **Process**: Dismantle to recover materials (copper, plastics …). Separate cells and components, use pyrometallurgy or hydrometallurgy to extract and purify materials (cobalt, lithium).

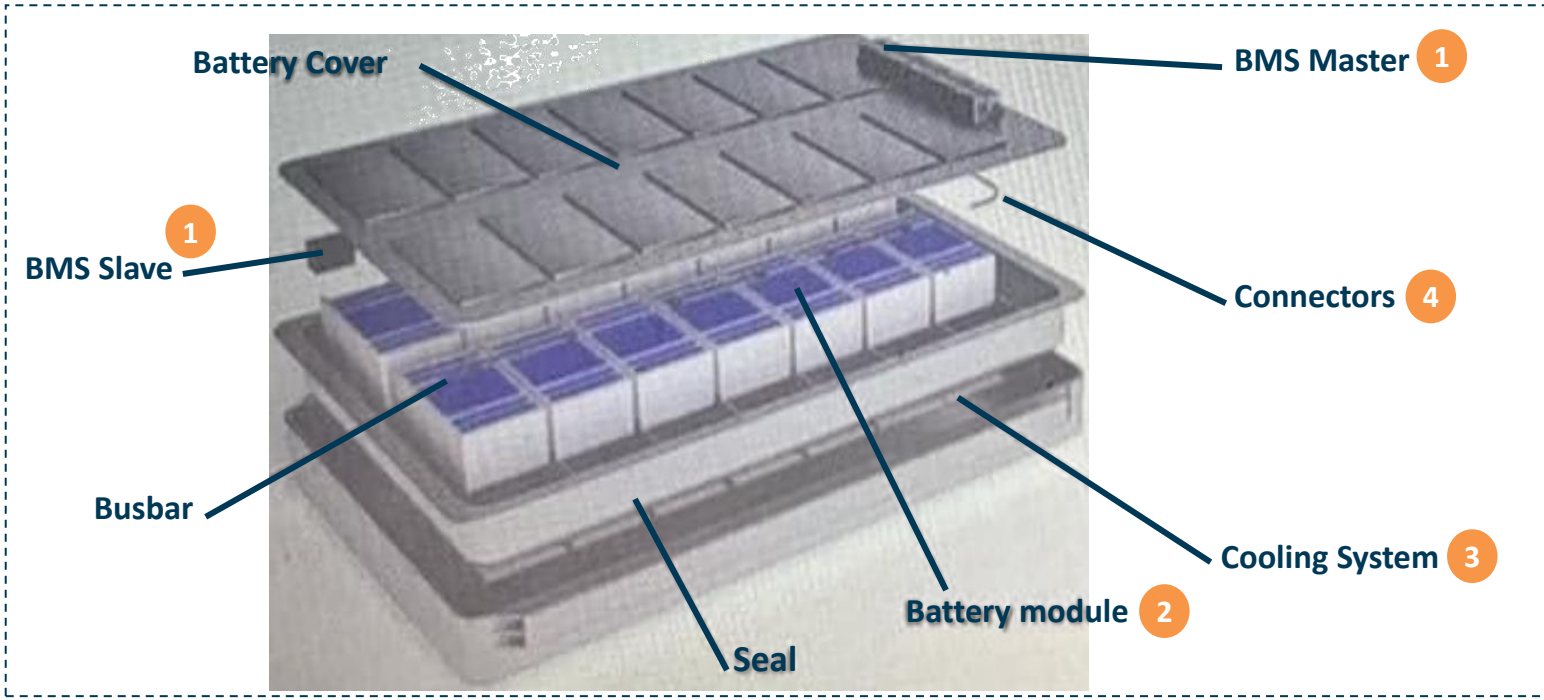
Source : Transport & Environment, Ufine *Battery Reconditioning Explained: A Comprehensive Guide*, Strat Anticipation analysis

We have identified 4 failure types of a Battery Pack : BMS Defect, Software issue, faulty module, cooling system defect & connection problems

Battery for HDVs - Possible Causes of Failures

	1	2	3	4
DEFECT	ELECTRICAL DEFECT OF BMS OR SOFTWARE	ELECTROMECHANICAL DEFECT OF A BATTERY CELL/MODULE	MECHANICAL DEFECT OF THE COOLING SYSTEM	CABLE : BAD SOLDERING/ CORROSION
REPAIR	REPLACEMENT OF FAULTY BMS & SW UPDATE	EXCHANGE OR REPAIR OF MODULE	REPAIR OF COOLING SYSTEM	CONNECTOR CHANGE OR NEW WELDING

BEV BATTERY PACK DECOMPOSITION



NEED FOR REPAIR

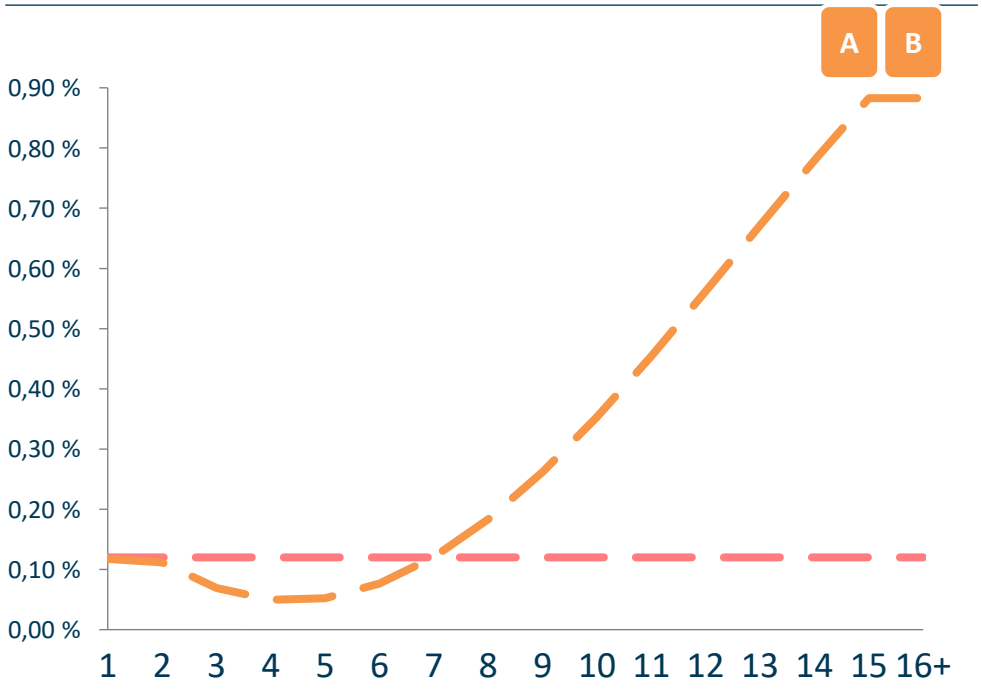
- Procedure for High Voltage safe disassembly & re-assembly
- Testing and measuring equipment for the existing modules
- Communication with BMS & BMS diagnostic analysis
- Ability to rebalance the pack after the repair

Source : Strat Anticipation analysis

For each of these cases, we provide detailed hypothesis

Battery for HDVs - Replacement from accidentology, failure & for second life

BATTERY TO REPLACE FROM ACCIDENTOLOGY AND FAILURE PER AGE OF THE VEHICLE | %



C

RETAINED HYPOTHESIS – BATTERY CHANGES AT END OF FIRST LIFE FOR HDVS

Rigid Trucks

At 12 years, the battery pack(s) of a rigid truck has a 35% chance of repair at a workshop (e.g., module replacement or cell balancing) and a 10% chance of full remanufacturing at a battery facility.

Articulated Trucks

At 8 years, the battery pack(s) of an articulated truck has a 35% chance of repair at a workshop (e.g., module repairs or BMS recalibration) and a 20% chance of full remanufacturing at a battery facility.

D

HYPOTHESIS: BATTERY REMANUFACTURING FOR END-OF-LIFE TRUCKS

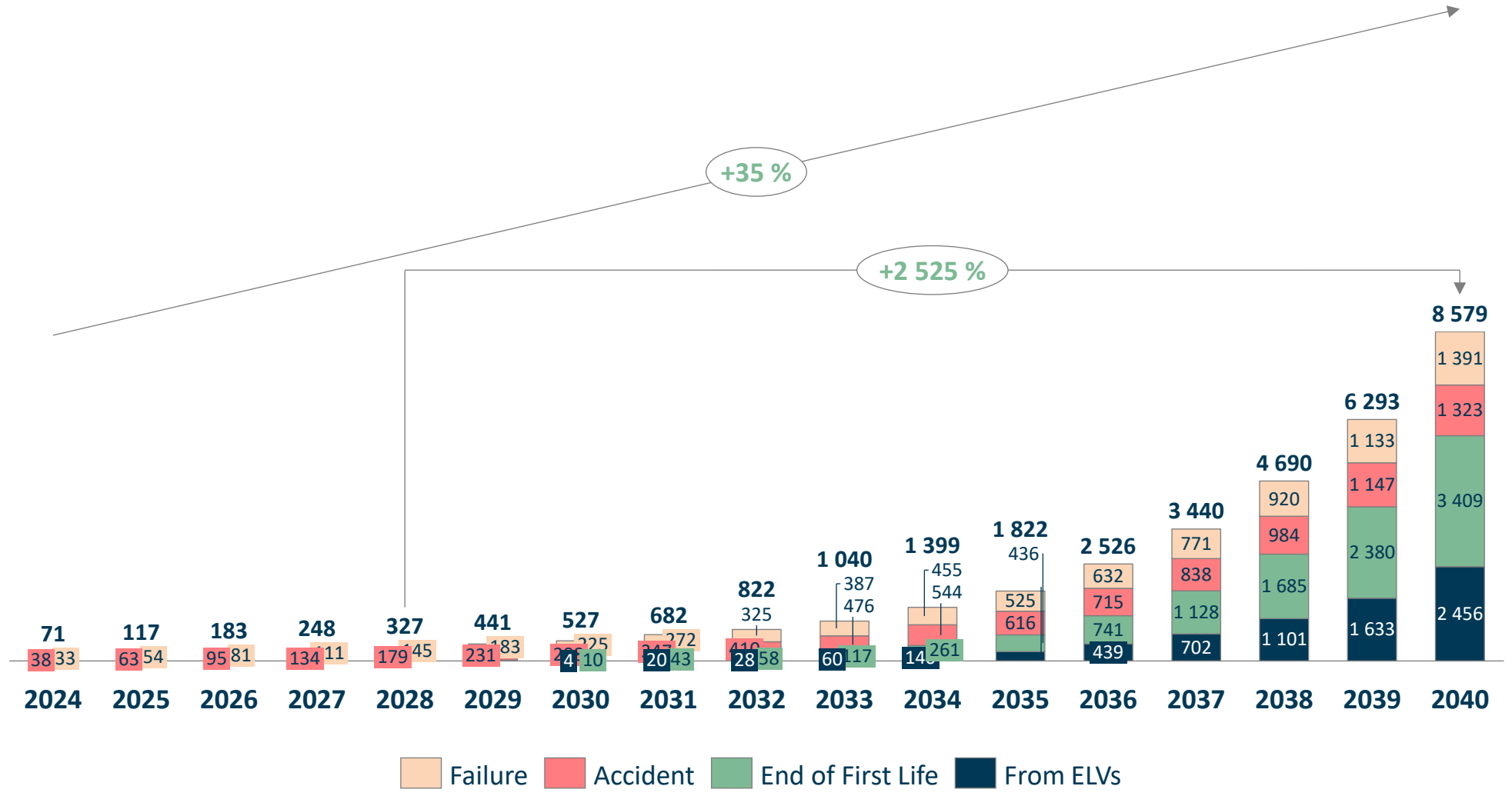
For approximately 30% of scrapped trucks, remanufacturing the battery and using it for mobility or repurposing it is more cost-effective and retains greater value compared to recycling.

Source : Recurrent, Bloomberg NEF, Avicenne, Strat Anticipation research & analysis

With the increasing adoption of electrified HDVs, the baseline scenario projects an annual remanufacturing volume of approximately 1822 battery units by 2035

Battery for HDVs - Volume to be remanufactured in units

TOTAL BATTERY UNITS TO BE REMANUFACTURED PER SOURCE IN EUROPE | In Units, 2024-2040, 8 Countries selected in scope

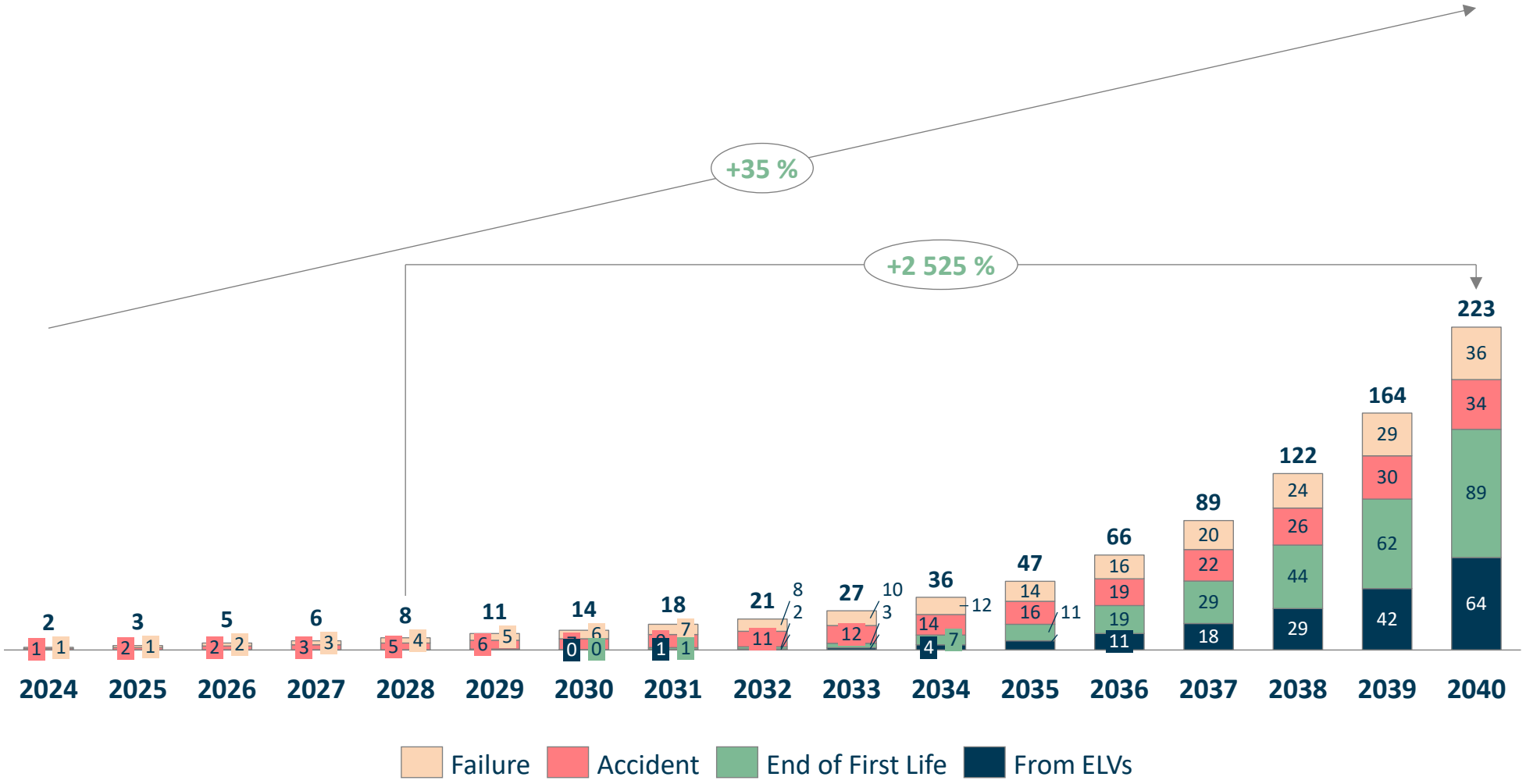


Source : EMISIA, Strat Anticipation Model

At global level, the market for the sale of remanufactured Battery Packs is estimated at 47 M€ by 2035 & 223 M€ by 2040

Battery for HDVs - Volume to be remanufactured in value

TOTAL VALUE IN BATTERY TO BE REMANUFACTURED PER SOURCE IN EUROPE | In M €, 2024-2040, 8 Countries selected in scope



Note : Remanufactured modules are sold at 60% of new price here
Source : EMISIA, Strat Anticipation Model

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ELV centers will have to adapt their treatment chain significantly at several stages : unloading, storage & diagnosis

Recommendations & best practices for the 6 steps of treatment

1 TRANSPORTATION TO ELV CENTER

- **Before the vehicle is loaded**
  - Temperature measurement close to the battery via a laser thermometer
- **Loading and transporting the vehicle**
  - **Disconnect the battery** and insulating tarpaulin if necessary
  - Mandatory equipment: extinguishing means (AVD, etc.), fire tarpaulin

2 UNLOADING THE VEHICLE

- **Features of the BEV/PHEV unloading island**
  - 3 rows of 20m maximum; 6-7 vehicles per row; 1m between each vehicle; fire wall or 6m separation from other installations; 10m from the buildings (ICPE); thermal control of the battery pack to determine if it is at risk

3 STORAGE BEFORE REMOVAL OF THE BATTERY

- **Quarantine area for high-risk vehicles**
  - 7 days of outdoor storage; 60/120 concrete block or 6m apart, 3m high; 20 ELVs max
- **Storage area for non-risk BEVs**
  - 6 months of storage max; island 20x100m max; 10 ELVs per 20m row; no distance between each ELV

4 BATTERY EVALUATION AND CONTROL/REMOVAL

Battery testing of non-at-risk HEVs: lockout, re-tensioning, load and communication testing

- After battery removal, the ELVs are sent back to the treatment part
- The batteries are transported to the storage areas

5 STORAGE OF BATTERIES

- Storage of 'waste' batteries **at risk**
  - Area covered; vermiculite tanks; height of 2m max; Rack storage
- Storage of **batteries (not at risk)**
  - Dry, covered or closed room (10-25°C); 30-50% load; roof to 2712 standards; height of 5m max; Rack storage

6 TRANSPORT OUT OF THE CENTER

Possible opportunities

Reuse : robust outer packaging on pallets; Additional conditions above +333kg
Marking to be used: 

Recycling : Unit packaging of 'sarcophagus' type batteries to prevent any risk
Marking to be used: 

Source : Mobilians & INERIS - Recommandations dédiées au traitement des véhicules électriques et hybride à adopter par les centres de recyclage VHU

Most investments will be made by ELV centers, apart from investments related to safe transport for batteries that leave the center to the collecting points

Player in charge of the action and player in charge of the investment for each treatment step

	PLAYER IN CHARGE OF REALIZING THE STEP	PLAYER IN CHARGE OF THE INVESTMENTS TO BE MADE
1 HDV TRANSPORTATION TO ELV CENTER	Transport service provider, Last owner	ELV centre or external service providers
2 UNLOADING THE HDV VEHICLE	Transport service provider	ELV Center
3 HDV STORAGE BEFORE REMOVAL OF THE BATTERY	ELV Center	ELV Center
4 BATTERY EVALUATION AND CONTROL/REMOVAL	ELV Center	ELV Center
5 STORAGE OF BATTERIES	ELV Center	ELV Center
6 SAFE TRANSPORT OUT OF THE CENTER	Transport service provider	Recyclers, producers or reuse / remanufacturing / repurposing actors for logistics and 'sarcophagus'

HDV : Heavy-Duty Vehicle
Source : Strat Anticipation research & analysis

This adaptation of ELV centers requires many prerequisites in terms of surface area & CAPEX investments, estimated at around €33,000 per center

Estimation of equipment & costs required for each of the 6 treatment steps

PREROGATIVES ELV CENTRE

	EQUIPMENTS (IMMOBILISATION, CAPEX & OPEX)	COSTS
1 TRANSPORTATION TO ELV CENTER	A Laser thermometer; D Lithium or water AVD fire extinguisher; B Insulating Cover; C Power Off Switch; E Anti-fire Cover	(A) 150€, (B) 100€ x 10, (C) 50€, (D) 50€, (E) 1500€/u; **step total = 2000 à 3000€**
2 UNLOADING THE VEHICLE	F Unloading bay; H Battery Pack Thermal Controller; G Firewall wall *(if it is impossible to move the island 6m away from the other installations)*	(F+G) 500m² +1000€, (H) +2000€; **step total = 2000€-3000€ + 1000€**
3 STORAGE BEFORE REMOVAL OF THE BATTERY	I Outdoor quarantine area; K Waterproof water bucket; J Concrete block REI 60 or 120; L Thermal camera and alarm; M Storage area	(I+J) 500m² + 2000€, (M) 1000m² max; (K) 2000€, (L) +5000€, **step total = 7000€ + 2000€**
4 BATTERY EVALUATION AND CONTROL/REMOVAL	N Area covered; O Special battery lift and lift table; P Charging station with temperature control and emergency stop; Q Outdoor Test Area	(N) 150 m² + 10000€, , (Q) 50m² (O) 12000€, (P) 6000€; **step total = 18000€ + 10000€**
5 STORAGE OF BATTERIES	R Covered area "waste", 2m maximum height; S Tubs with vermiculite; T Storage on racks; U Covered/closed "products" area, 5m maximum height; V Keeping the room dry and cool (10-25°C); W Electrical installations for battery charging and maintenance; X Roof in accordance with ruling 2712	(R) 50m² + 5000€, (U+X) 100m² + 15000€, (S) 400€, (T) 600€ (V) + (W) : Installation + elec price **step total = 1000€ + 20000€**
6 TRANSPORT OUT OF THE CENTER	Battery-specific packaging and marking according to the outlet: recycling or reuse, adapted logistics	**Total IMMO : 32 000€ & >700m²** **Total CAPEX : 30500€ to 32000€**

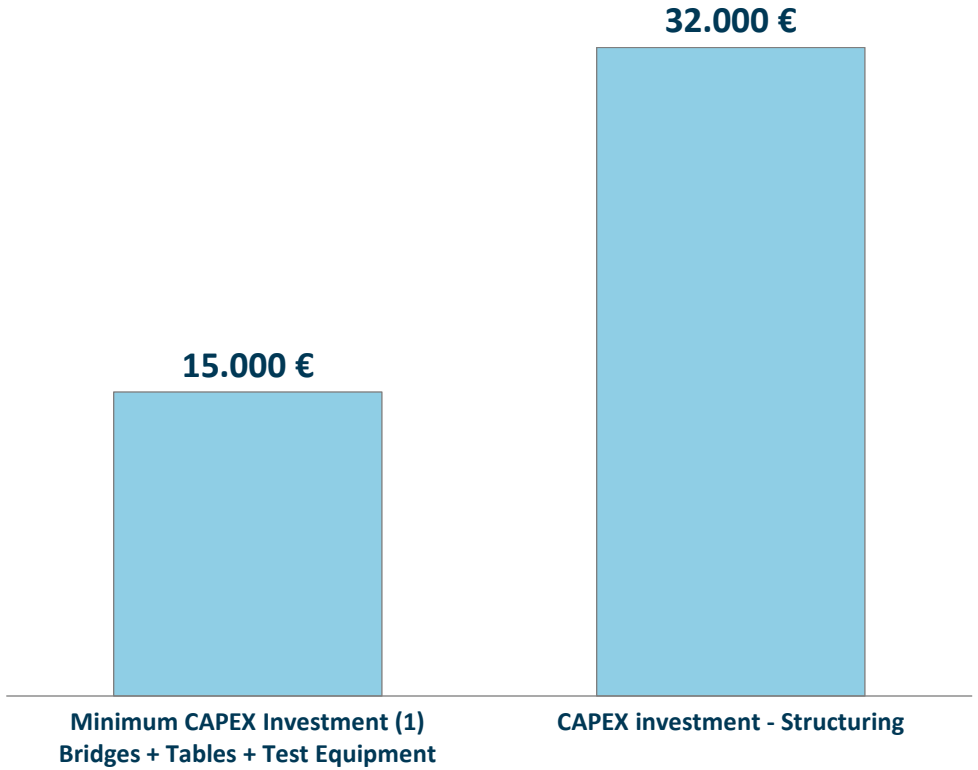
Note : Numbers in terms of CAPEX & IMMO are indicative
Source : Mobilians & INERIS, Strat Anticipation research & analysis

For HDV ELV Centers to position on the first 5 steps, investments will be necessary, among other things, to store batteries as well as to ensure the training of operators.

Total - Training, Immobilization, OPEX & CAPEX

TRAINING	NEED	COST *(1)*	FREQUENCY
People trained by ELV center - basic training	2 people per ELV center	1000 €	1 time / 2 years
ELV Center Trained Individuals - Advanced Training	1 people per centre VHU	1000 €	1 time / 2 years
TOTAL		**2 000€**	**/ 2 years**
Annual price		**1000 €**	**/ year**

OTHER COSTS	DESCRIPTION
IMMOBILIZATION	250 m² covered, +500m² not covered, additional development costs that can be more than €30,000 excluding the purchase of surface area
OPEX	Some dedicated electrical installations, maintenance of temperate premises



ACCORDING TO THE STUDY, THIS INVESTMENT OF 32K REPRESENTS THE MINIMUM NECESSARY TO TREAT AN ELECTRIFIED ELV. FOR AN INPUT VOLUME OF 1 ELECTRIFIED ELV PER DAY, CAPEX WILL BE WELL OVER 150K, WITH ADDITIONAL NON-CAPEX COSTS ALSO HIGHER

HDV : Heavy-Duty Vehicle
Note : Numbers in terms of CAPEX & IMMO are indicative
Source : ADEME - *Impact de l'électrification du parc de voitures sur la filière de traitement des VHUs*, Mobilians & INERIS, Strat Anticipation research & analysis

The 6th step: Transport at the exit of the center, is also expensive because of the need to invest in the boxes to transport the batteries to the recycling plants

Focus on the transport of electric and hybrid vehicle batteries leaving ELV centers

6

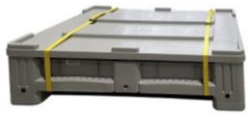
TRANSPORT OUT OF THE CENTER

INVESTMENTS FOR OUT-OF-CENTRE TRANSPORT

Batteries must be transported in specific containers depending on their condition :

- **P901 (Batteries in good condition);** Containers can be made of wood or plastic to ensure waterproofing in the event of an impact
- **P908 (damaged batteries);**
- **P911 (Defective batteries with high risk);** These containers have a fire extinguishing system, with, for example, a degassing valve or carbon dioxide snow valve

P908 Container Cost: 500-3000€



P911 Container Cost: 10k-40k€

ACTORS LIKELY TO BUY THE SPECIFIC CONTAINERS

- Producers (OEMs, in the sense of the ERP) supply P911 boxes
- Recycling and reuse/reman/repurposing actors must **invest in logistics and potentially in specific containers**
- Individual compliance scheme can invest if they want to recover the batteries themselves

A LARGE QUANTITY OF BOXES IS REQUIRED TO ENSURE SMOOTH TRANSPORTATION

Source : Strat Anticipation research & analysis

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The price range is much wider for rigid trucks than for tractors, and the upper end of the range is more stable over time thanks to specific equipment

Residual value of used vehicles, by age ranges

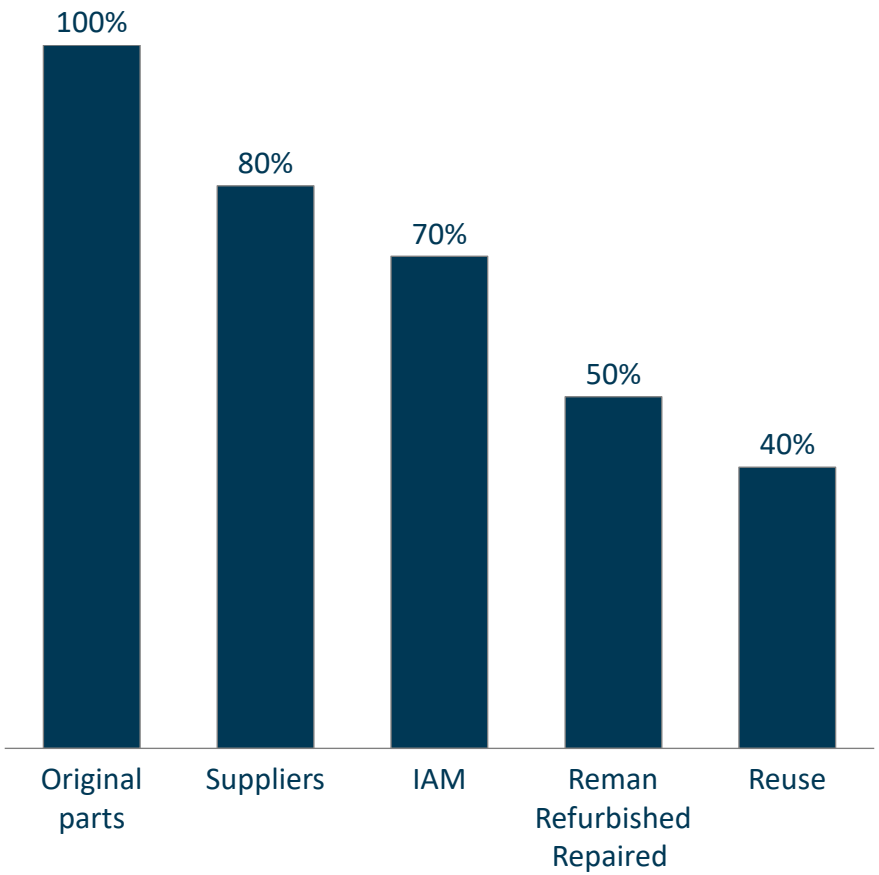
	5 YEARS OR LESS		BETWEEN 6 & 10 YEARS		BETWEEN 11 & 15 YEARS		BETWEEN 16 & 20 YEARS		BETWEEN 21 & 25 YEARS	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
TRACTOR - 4X2	15 000 €	150 000 €	6 000 €	100 000 €	5 000 €	65 000 €	4 000 €	30 000 €	-	-
TRACTOR - 6X2	25 000 €	200 000 €	10 000 €	150 000 €	8 000 €	75 000 €	5 000 €	45 000 €	-	-
RIGID - 4X2	15 000 €	290 000 €	5 000 €	250 000 €	3 500 €	120 000 €	2 500 €	105 000 €	1 800 €	90 000 €
RIGID - 6X2	16 000 €	320 000 €	9 000 €	215 000 €	7 000 €	180 000 €	5 000 €	160 000 €	4 500 €	100 000 €
RIGID - 8X4	45 000 €	600 000 €	25 000 €	370 000 €	17 000 €	250 000 €	15 000 €	215 000 €	12 000 €	150 000 €

Source : Europe-Camions.com, Truck1.eu, Expert interviews, Strat Anticipation research & analysis

Second-hand parts, whether remanufactured/refurbished/repaired or reused, allow for a significant price reduction compared to new original parts for a truck

Business model for an EOL truck - Reuse parts vs. new parts

THEORETICAL PRICE POSITIONING OF THE PARTS OFFER |
Original part price index, 2020



AVERAGE PRICING POSITIONING OF SECOND-HAND PARTS | In %, Renault Trucks, 2020

PARTS OR MODULES	PRICE REFERENCE	% GAP VS PRICE REFERENCE
BODY PARTS	Public price New	35% to 40%
MECHANICAL PARTS	Public price New	35% to 40%
TRIMMED CAB	Public price Replacement	50%
ENGINE	Public price Replacement	20% to 40%
GEARBOX	Public price Replacement	30% to 45%
AXLE HEAD	Public price New	45%
FUEL TANK	Public price New	25%
NAKED MUFFLER	Public price New	45%
FIFTH WEEL	Public price New	15%

Source : Renault Trucks & INDRA & ADEME – Heavy-duty vehicle recycling, Research & analysis Strat Anticipation

We conducted an analysis of key truck part prices based on their age on the main EU resale platforms, enabling us to get a range of total resale potential depending on age

Residual value of used truck main parts, by age ranges

	5 YEARS OR LESS		BETWEEN 6 & 10 YEARS		BETWEEN 11 & 15 YEARS		BETWEEN 16 & 20 YEARS		BETWEEN 21 & 25 YEARS	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
ENGINE UNIT	8 000 €	22 000 €	4 500 €	19 000 €	2 000 €	12 000 €	1 500 €	9 000 €	800 €	5 000 €
GEARBOX	3 500 €	10 000 €	1 500 €	8 000 €	800 €	6 000 €	600 €	5 000 €	400 €	3 500 €
CABIN	3 500 €	18 000 €	2 000 €	12 000 €	1 500 €	9 000 €	1 000 €	6 000 €	750 €	4 000 €
COMPLETE FRONT BUMPER	1 250 €	7 000 €	750 €	4 250 €	500 €	3 000 €	-	-	-	-
SEATS			200 €					3 000 €		
DOOR	1 000 €	2 200 €	250 €	1 500 €	200 €	900 €	150 €	500 €	100 €	500 €
FRONT AXLE	1 250 €	10 000 €	900 €	8 000 €	500 €	6 500 €	400 €	5 000 €	300 €	3 500 €
FUEL TANK	400 €	1 250 €	300 €	1 100 €	250 €	1 000 €	250 €	850 €	100 €	700 €
CATALYTIC CONVERTER	750 €	5 000 €	500 €	3 000 €	300 €	1 500 €	250 €	650 €	-	-
RADIATOR	300 €	1 100 €	250 €	950 €	200 €	850 €	150 €	450 €	100 €	400 €
TOTAL	16 000 €	61 500 €	10 000€	48 000 €	5 000 €	35 000 €	3 750 €	26 000 €	2 350 €	16 700 €

Module Sub-component

Note : These figures do not include remanufactured parts, only used parts that are reused
Source : Europe-Camions.com, Truck1.eu, Expert interviews, Strat Anticipation research & analysis

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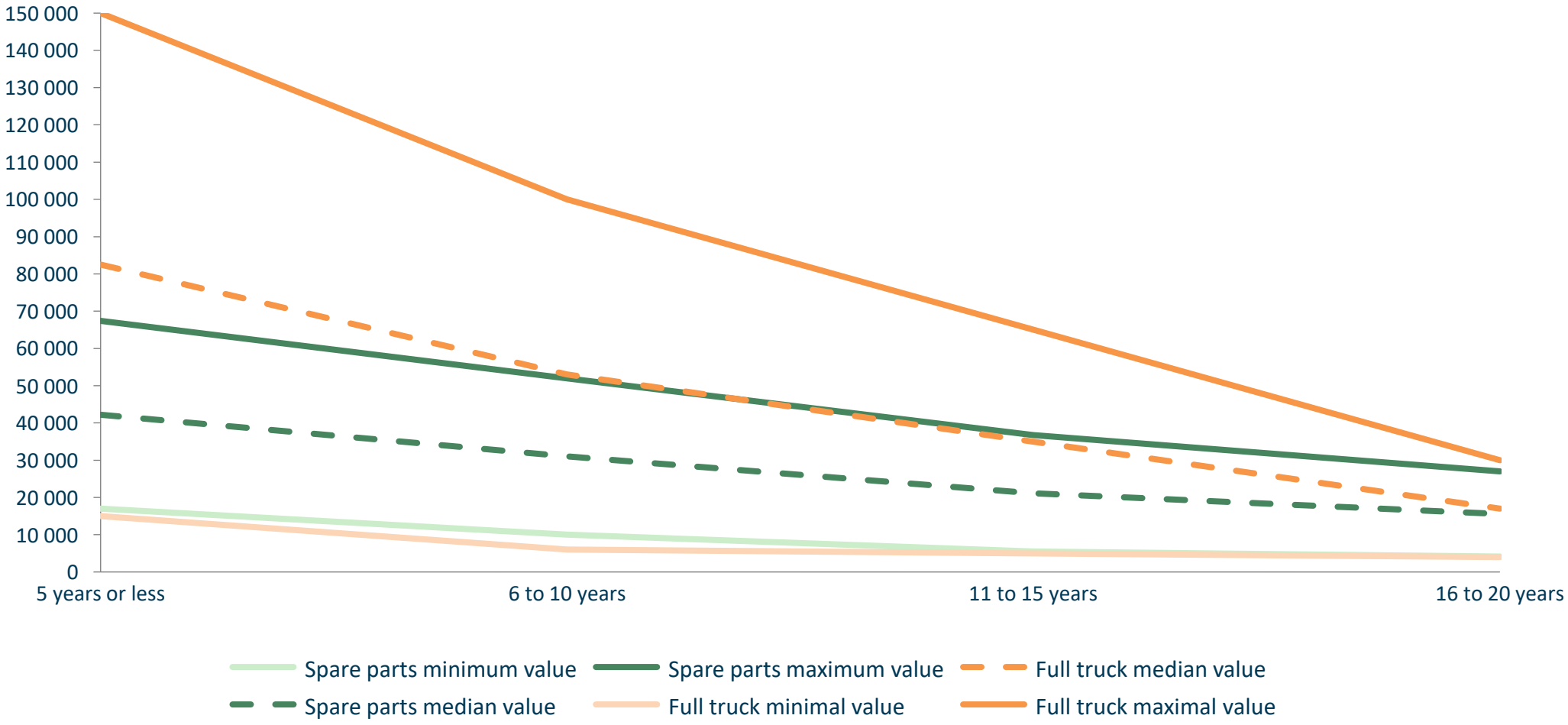
For a 4X2 tractor, there is a crossover in median values over the 15-20-year period, which means that it is more profitable to resell the truck as parts rather than as a whole

Comparative resale value for spare parts & full vehicle (1/5) - 4X2 Tractor

COMPARATIVE RESALE VALUE OF A 4X2 TRACTOR AS SPARE PARTS OR FULL VEHICLE PER AGE RANGE | In € & years, EU, 4X2 Tractor, 2025

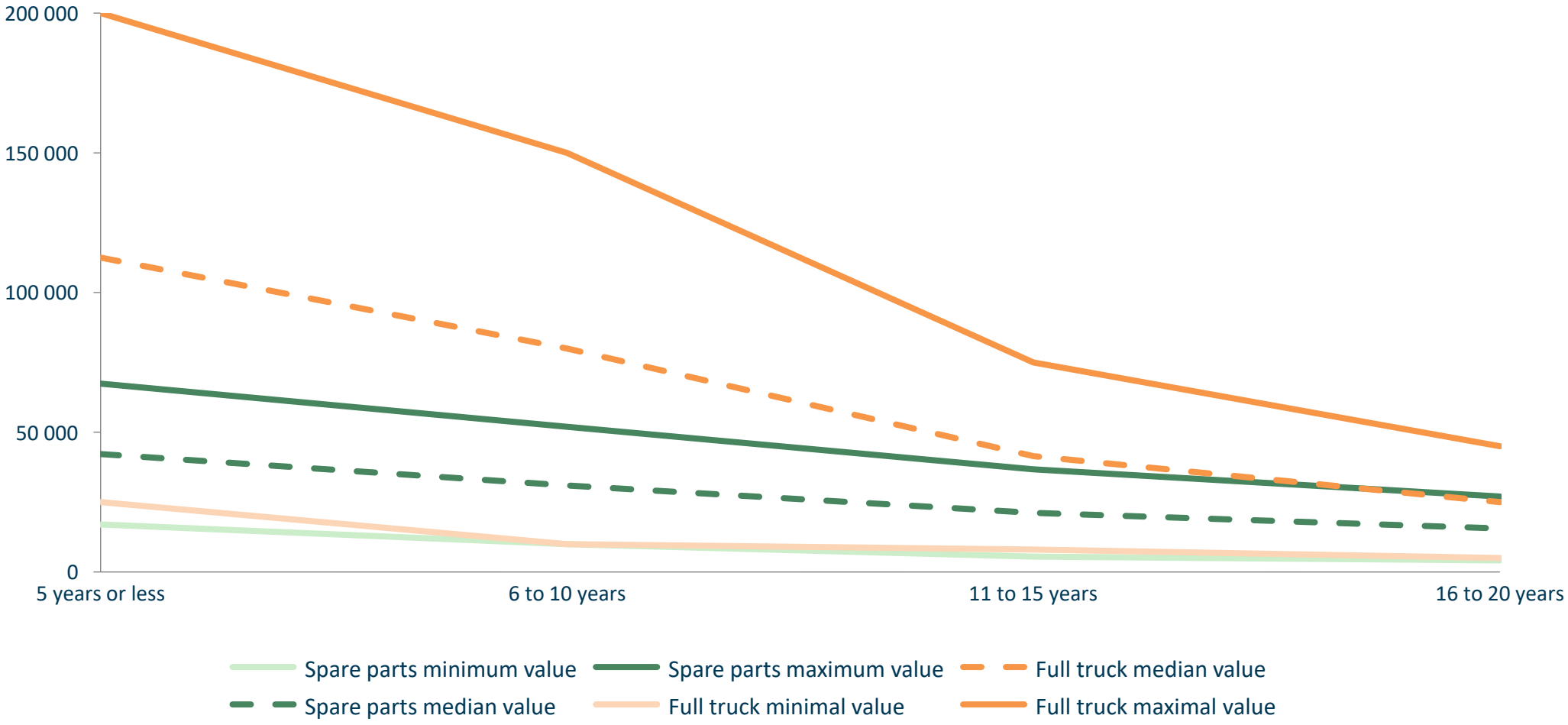


Source : Europe-Camions.com, Truck1.eu, Expert interviews, Strat Anticipation research & analysis

For a 6X2 tractor, the median values are close to crossing over in the 15–20-year period, but this is less clear-cut than for a 4x2

Comparative resale value for spare parts & full vehicle (2/5) - 6X2 Tractor

COMPARATIVE RESALE VALUE OF A 6X2 TRACTOR AS SPARE PARTS OR FULL VEHICLE PER AGE RANGE | In € & years, EU, 6X2 Tractor, 2025

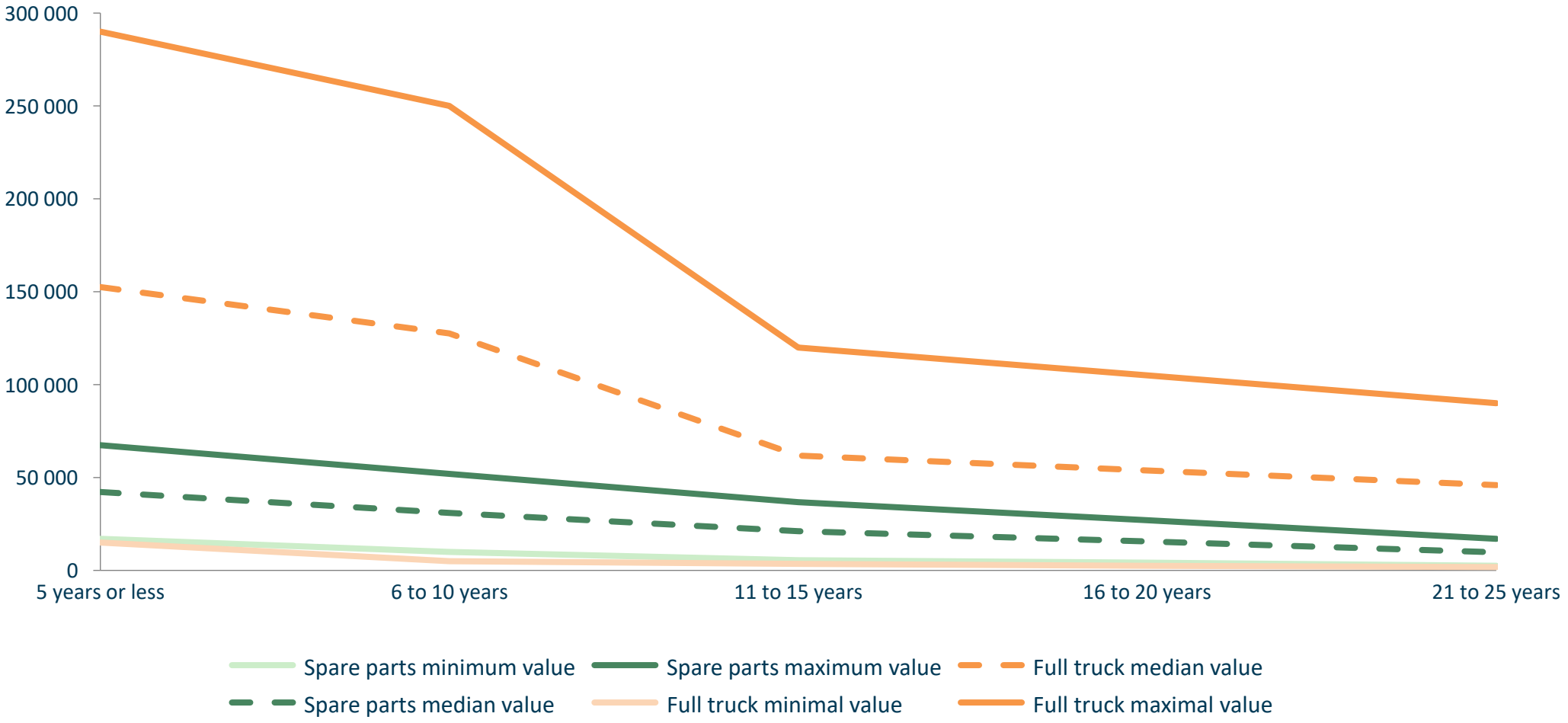


Source : Europe-Camions.com, Truck1.eu, Expert interviews, Strat Anticipation research & analysis

For rigid trucks overall, the median values are far from crossing, as the value of the specific equipment added by a bodybuilder must also be considered

Comparative resale value for spare parts & full vehicle (3/5) - 4X2 Rigid

COMPARATIVE RESALE VALUE OF A 4X2 RIGID AS SPARE PARTS OR FULL VEHICLE PER AGE RANGE | In € & years, EU, 4X2 Rigid, 2025

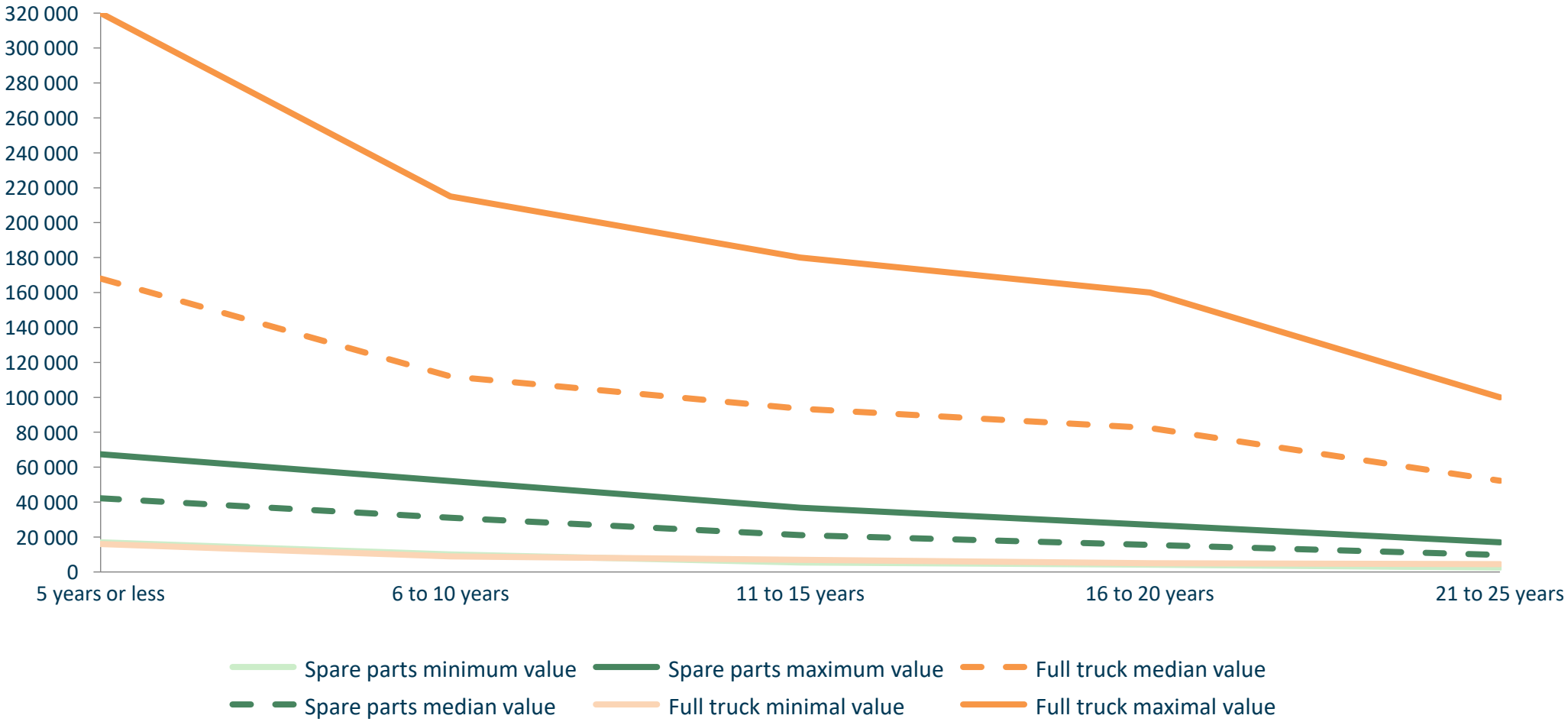


Source : Europe-Camions.com, Truck1.eu, Expert interviews, Strat Anticipation research & analysis

For 6X2 rigids, the median values are far from crossing, but the median & higher values for parts remain above the vehicle price lower value

Comparative resale value for spare parts & full vehicle (4/5) - 6X2 Rigid

COMPARATIVE RESALE VALUE OF A 6X2 RIGID AS SPARE PARTS OR FULL VEHICLE PER AGE RANGE | In € & years, EU, 6X2 Rigid, 2025

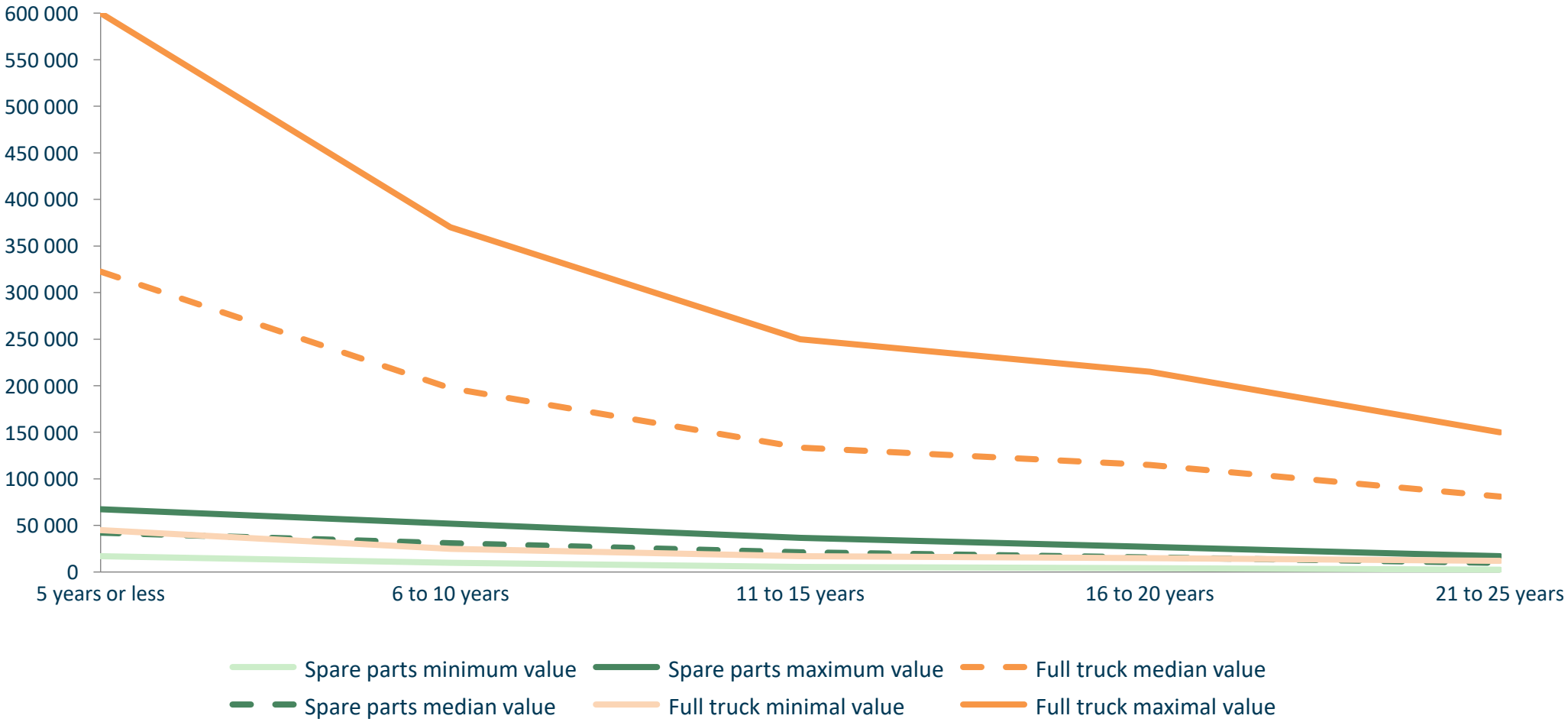


Source : Europe-Camions.com, Truck1.eu, Expert interviews, Strat Anticipation research & analysis

For 8X4 rigids, the absolute difference between the price of parts and the price of vehicles is even greater

Comparative resale value for spare parts & full vehicle (5/5) - 8X4 Rigid

COMPARATIVE RESALE VALUE OF A 8X4 RIGID AS SPARE PARTS OR FULL VEHICLE PER AGE RANGE | In € & years, EU, 8X4 Rigid, 2025



Source : Europe-Camions.com, Truck1.eu, Expert interviews, Strat Anticipation research & analysis

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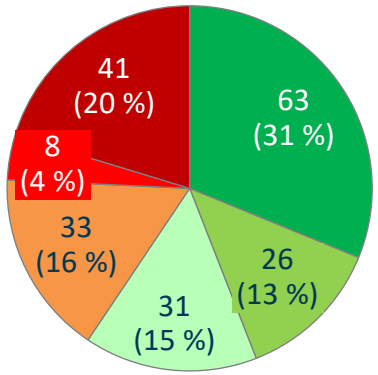
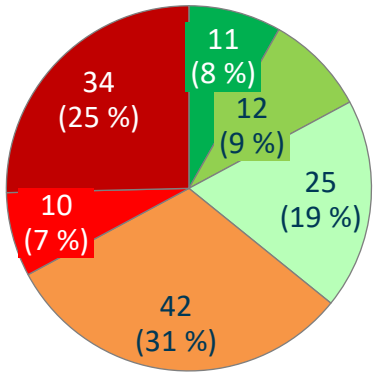
In Western Europe, tippers tend to be resold within the first 10 years, while flatbeds tend to be resold between 11 & 20 years & sliding curtains after 15 years

Age distribution of the 4 main truck body types in ads on 4 key websites - Western Europe

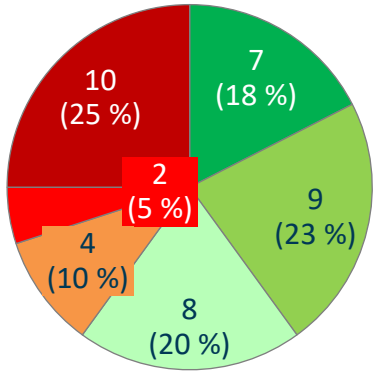
AGE DISTRIBUTION OF TIPPER BODIES IN ADS |
In %, Tippers, Western Europe, 2025



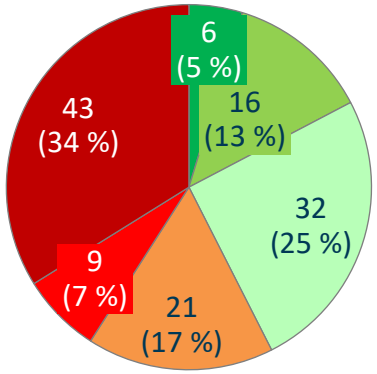
AGE DISTRIBUTION OF FLATBED BODIES IN ADS |
In %, Flatbeds, Western Europe, 2025



AGE DISTRIBUTION OF REFRIGERATED BOXES IN ADS |
In %, Refrigerated, Western Europe, 2025



AGE DISTRIBUTION OF SLIDING CURTAINS BODY IN ADS |
In %, Sliding Curtains, Western Europe, 2025



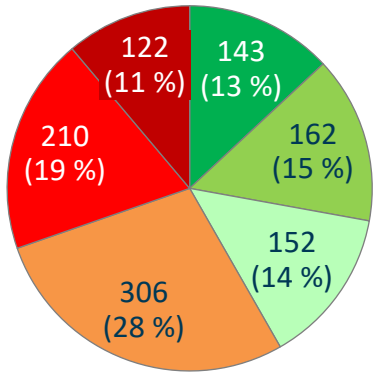
5 years or less
Between 6 and 10 years
Between 11 and 15 years
Between 16 and 20 years
Between 21 and 25 years
More than 25 years

Source : Europe-Camions.com, Truck1.eu, Strat Anticipation research & analysis

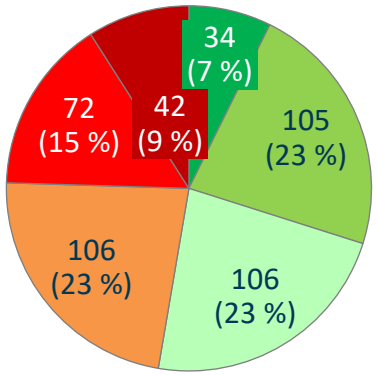
In Eastern Europe, tippers tend to be resold between 16 & 25 years old, while for tanks and refrigerated boxes, sales are mainly between 6 & 15 years old

Age distribution of the 4 main truck body types in ads on 4 key websites - Eastern Europe

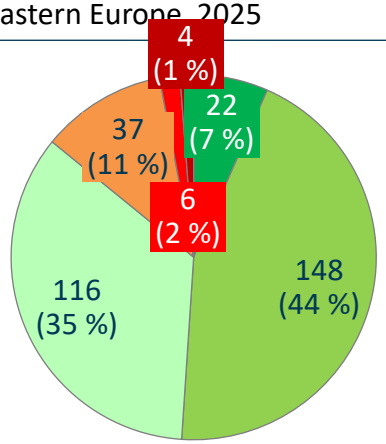
AGE DISTRIBUTION OF TIPPER BODIES IN ADS |
In %, Tippers, Eastern Europe, 2025



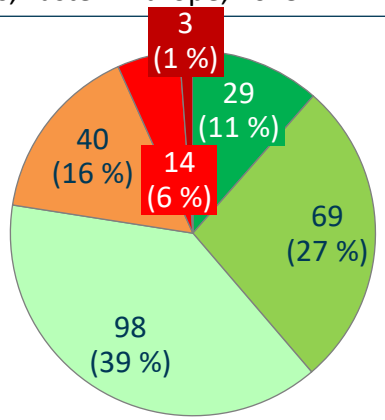
AGE DISTRIBUTION OF FLATBED BODIES IN ADS |
In %, Flatbeds, Eastern Europe, 2025



AGE DISTRIBUTION OF REFRIGERATED BOXES IN ADS |
In %, Refrigerated, Eastern Europe, 2025



AGE DISTRIBUTION OF TANK BODIES IN ADS |
In %, Sliding Curtains, Eastern Europe, 2025



5 years or less
Between 6 and 10 years
Between 11 and 15 years
Between 16 and 20 years
Between 21 and 25 years
More than 25 years

Source : Europe-Camions.com, Truck1.eu, Strat Anticipation research & analysis

All body types considered potentially have value even after 20 years of use, but it does not systematically mean that 100% of those bodies have a resale value

Residual value* of used main body types, by age ranges

	5 YEARS OR LESS		BETWEEN 6 & 10 YEARS		BETWEEN 11 & 15 YEARS		BETWEEN 16 & 20 YEARS		BETWEEN 21 & 25 YEARS	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
TIPPER BODY	9 000 €	35 000 €	8 000 €	26 000 €	4 000 €	24 000 €	3 000 €	14 000 €	1 500 €	8 000 €
FLATBED BODY	-	30 000 €	-	-	-	-	1 000 €	8 000 €	900 €	5 000 €
REFRIGERATED BOX	-	25 000 €	-	15 000 €	2 000 €	9 000 €	1 500 €	6 000 €	1 000 €	5 000 €
SLIDING CURTAIN BODY	18 000 €				850 €					
TANK BODY	30 000 €				1 000 €					

Note : These are price ranges for resold bodies, which are only a fraction of all end-of-life bodies
Source : Europe-Camions.com, Truck1.eu, Expert interviews, Strat Anticipation research & analysis

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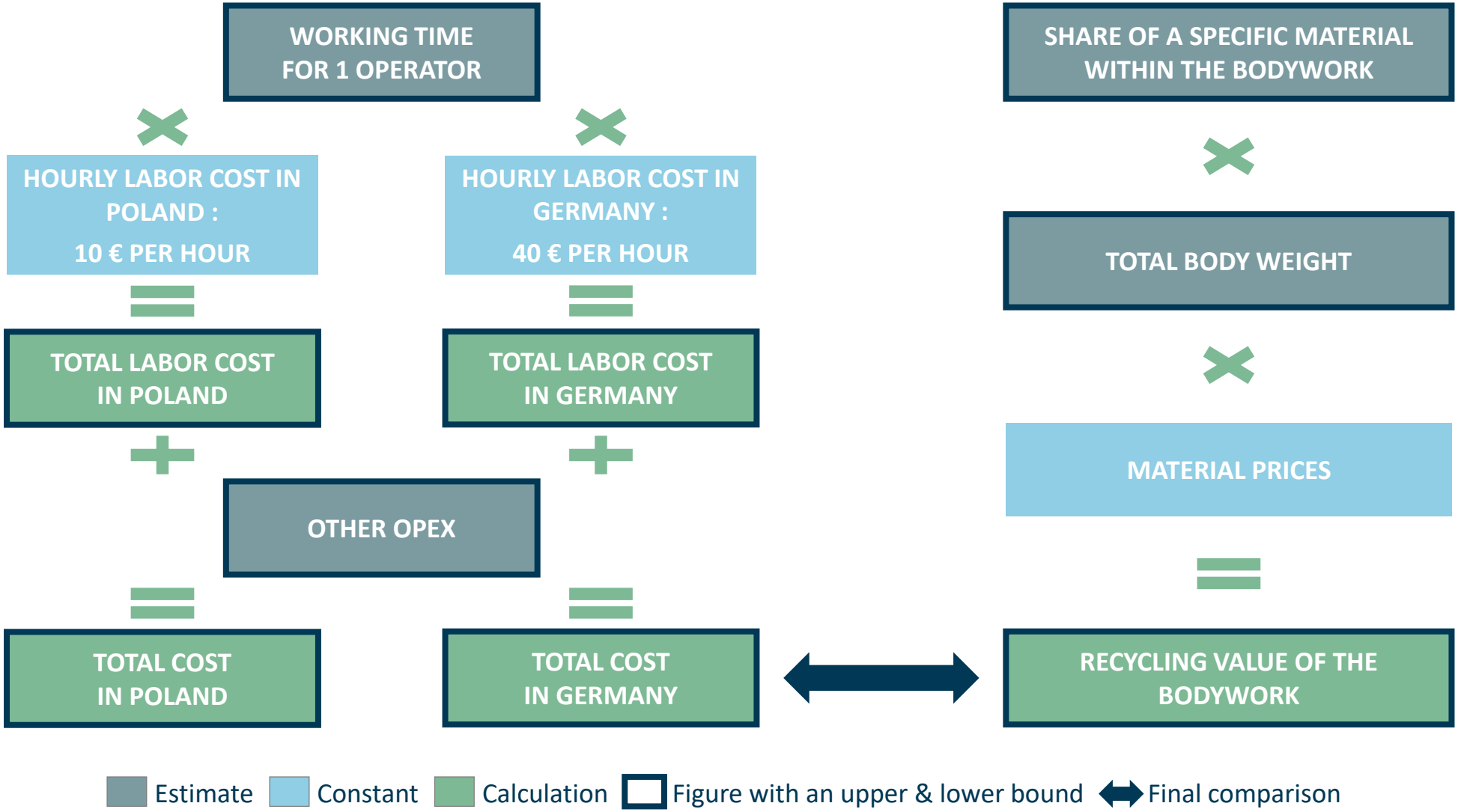
By combining an estimate of work time at each stage & other OPEX, we obtain total costs per body, to be compared with the scrap value generated during the process

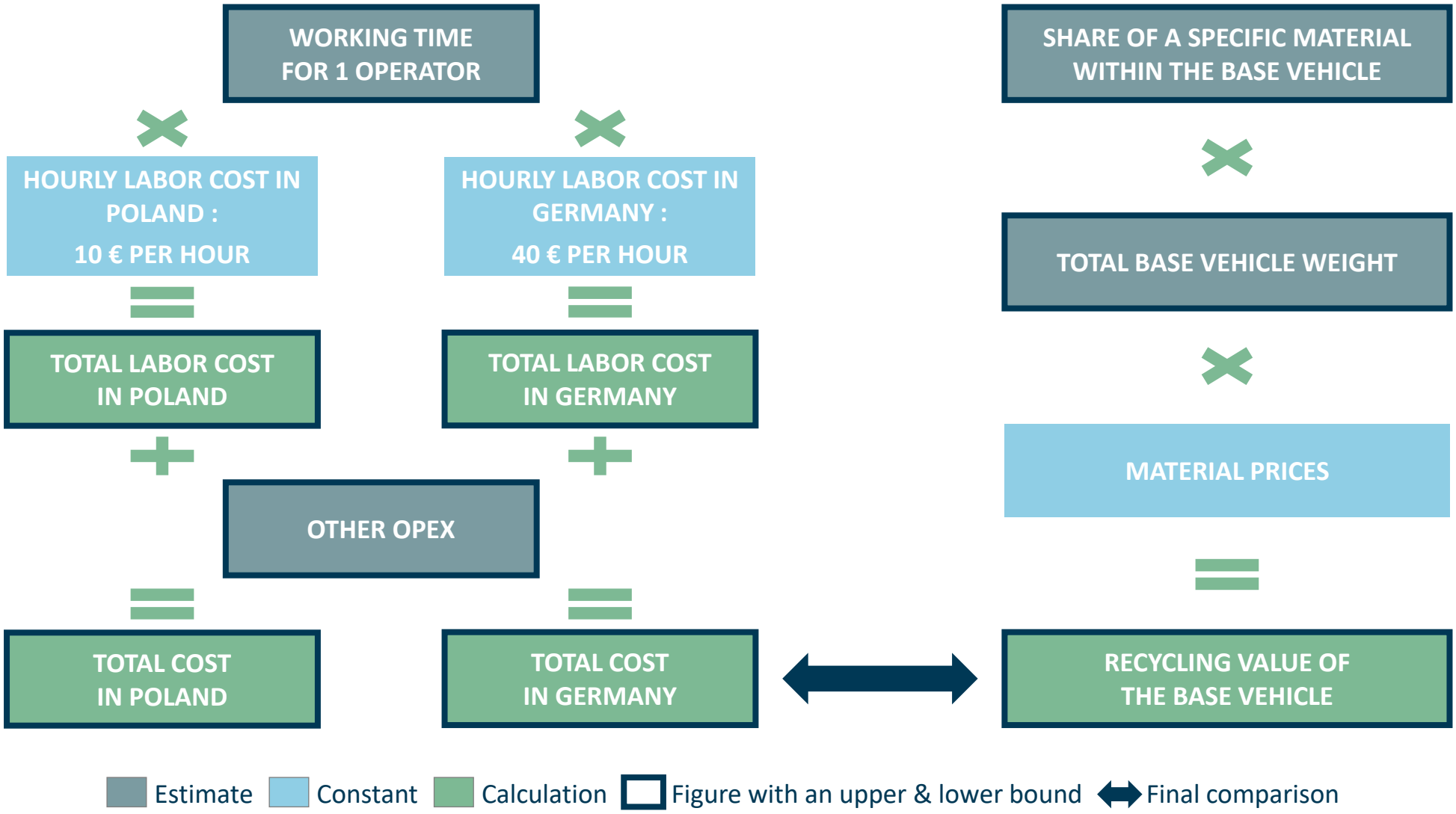
Profitability of recycling the main body types - Assessment methodology



Source : Expert interviews, Strat Anticipation research & analysis

By combining an estimate of work time at each stage & other OPEX, with hourly rates, we obtain total costs per vehicle to be compared with the value generated

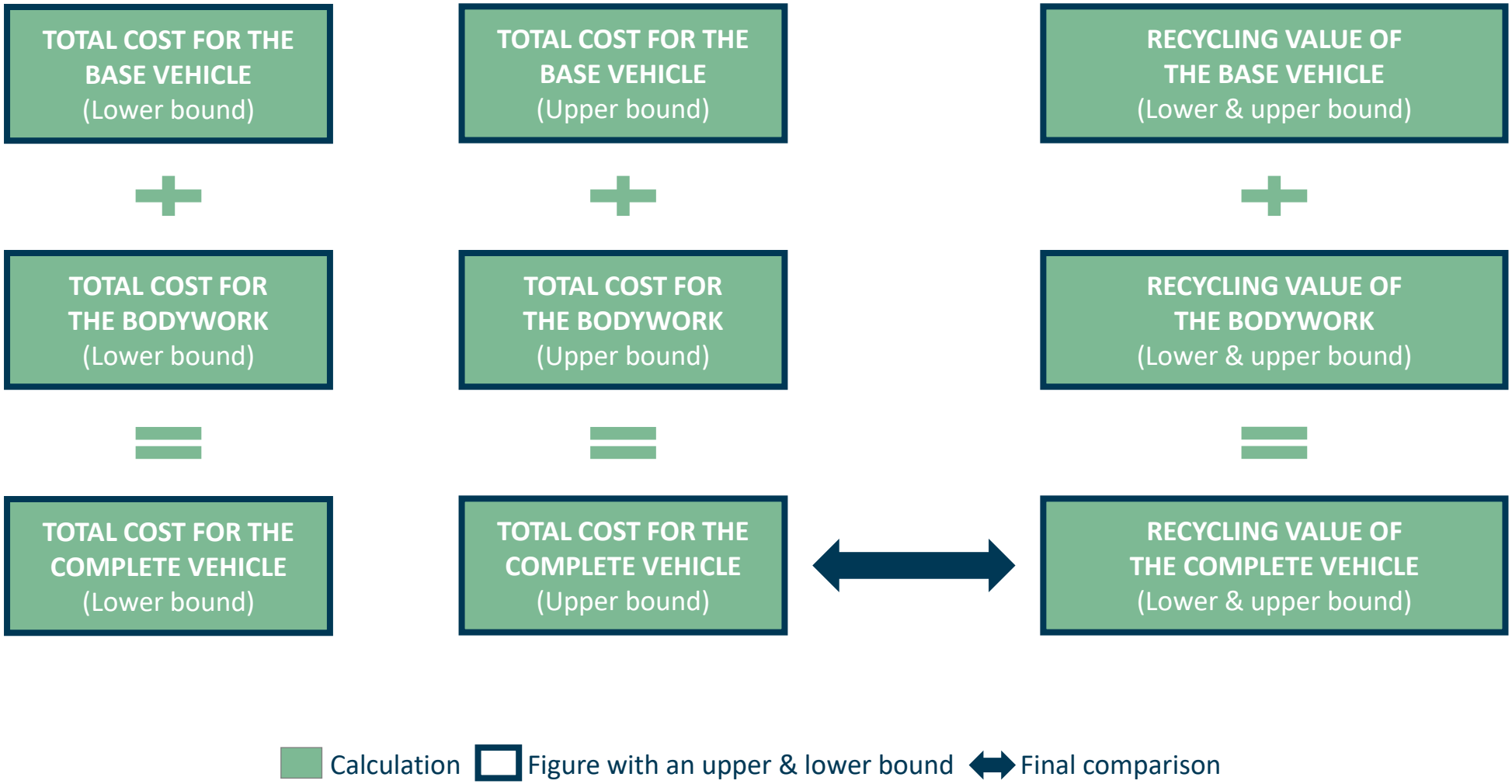
Profitability of recycling the base vehicle (rigids) or tractors - Assessment methodology



Source : Expert interviews, Strat Anticipation research & analysis

By combining the costs for the base vehicle & for the bodywork, we obtain the total costs for the complete vehicle, to be compared with the total scrap value generated

Profitability of recycling the complete vehicle (rigids) - Assessment methodology



Source : Expert interviews, Strat Anticipation research & analysis

Aluminium tippers & food & beverages tanks are the only cases where base vehicle + body is mostly profitable, even though the base vehicle is almost always a net value

Profitability analysis results for recycling a complete rigid truck

	BASE VEHICLE ONLY			BODY ONLY			COMPLETE VEHICLE		
	PROFIT (Lower bound)	PROFIT (Higher bound)	PROFITA-BILITY	PROFIT (Lower bound)	PROFIT (Higher bound)	PROFITA-BILITY	PROFIT (Lower bound)	PROFIT (Higher bound)	PROFITA-BILITY*
RIGID TRUCK - WITHOUT KEY PART RESALE	-599 €	3 025 €							
RIGID TRUCK - WITH KEY PART RESALE	2 100 €	32 414 €							
TRACTOR - WITHOUT KEY PART RESALE	257 €	2 982 €							
TRACTOR - WITH KEY PART RESALE	2 012 €	32 375 €							
TIPPER BODY - STEEL				-334 €	286 €		-933 €	3 311 €	
TIPPER BODY - ALUMINIUM				159 €	1 374 €		-440 €	4 399 €	
FLATBED BODY - STEEL				-373 €	127 €		-972 €	3 152 €	
FLATBED BODY - ALUMINIUM				-193 €	720 €		-792 €	3 745 €	
REFRIGERATED BOX				-1 001 €	704 €		-1 600 €	3 729 €	
SLIDING CURTAINS				-437 €	648 €		-1 036 €	3 673 €	
TANK - FOOD & BEVERAGES				1 192 €	5 616 €		593 €	8 641 €	
TANK - CHEMICALS				-3 348 €	5 006 €		-3 947 €	8 031 €	

Profit in all cases | Profit in most cases | Uncertain profit | Rare profit

Note : We considered only the resale value of materials generated during shredding / recycling processes, without part resale
Source : Expert interviews, Strat Anticipation research & analysis

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Several specificities in the world of heavy-duty vehicles must be considered when implementing EPR, at the risk of creating or imposing unsuitable schemes

Specificities of the HDV sector to be considered when specifying the EPR scheme

HIGHER UNIT VALUE THAN IN AUTOMOTIVE

MORE DEVELOPED REMAN & REVERSE LOGISTICS THAN IN AUTOMOTIVE

EVEN SMALL PLAYERS MANAGE TO GENERATE A PROFIT FROM THE DISMANTLING OF MOST HDVs

COMPLEX MANAGEMENT OF MULTI-STAGE VEHICLES

ORIGINALLY, EPR DESIGNED MORE FOR PRODUCTS THAT ARE A NET LOSS TO RECYCLE

LOWER VOLUMES

HDVs TYPICALLY HAVE SEVERAL LIVES

HIGHER PRODUCT DIVERSITY

NUMEROUS INTRA- & EXTRA-EU EXPORTS, THAT ARE POORLY TRACKED

LARGE NUMBER OF BODY MAKERS

STILL MAINLY A SECONDARY ACTIVITY FOR MOST END-OF-LIFE PLAYERS

Facilitating specificities Complicating specificities

EPR : Extended Producer Responsibility
HDV : Heavy-Duty Vehicle
Source : Expert interviews, Strat Anticipation research & analysis

As it stands, the HDV end-of-life is managed correctly in the EU, and allows several player categories to work around it in a profitable way

HDV end-of-life current situation

VEHICLES DISMANTLED IN THE EU

- **Best case scenario, which ensures full regulatory compliance and preserves local sources of parts & materials**

VEHICLES EXPORTED OUTSIDE THE EU

- **Legal flows that are part of the business model of many fleet owners, who are OEM clients**
- **Issues with critical materials leaving the EU**

VEHICLES DISMANTLED THROUGH UNOFFICIAL CHANNELS

- **Even in this minority configuration, trucks are not abandoned on the side of the road**
- **Nevertheless, there is an issue of traceability & compliance with environmental regulations** (depollution, etc.)
- Difficult to quantify

Key players in the HDV EOL ecosystem, that manage to be profitable in the current situation

FLEET OWNERS	ELV CENTERS	TRADERS
DEALERSHIPS	SHREDDERS	AUCTIONNERS / MARKETPLACES

WHEN IMPLEMENTING THE NEW REGULATION, CARE MUST BE TAKEN NOT TO DISRUPT MECHANISMS THAT ARE ALREADY WORKING WELL

HDV : Heavy-Duty Vehicle
Source : Expert interviews, Strat Anticipation research & analysis

Today, 5 main categories of players are involved in truck dismantling prior to material shredding, with different approaches, but all of them make money with it

Main player categories involved in HDV dismantling as of today

Low volumes → *High volumes*

DEALERSHIP	FLEET OWNER INTEGRATED IN MAINTENANCE	ELV CENTER WITH OCCASIONAL HDV ACTIVITY	ELV CENTER WITH RECURRENT HDV ACTIVITY	SHREDDER INTEGRATED IN ELV CENTERS
Typically, **5-10 HDVs processed per year**	Depends on fleet size	Typically, **20-50 HDVs processed per year**	Typically, **1000+ HDVs processed per year**	Depends on size and number of sites
	Freight transport (truck), Passenger transport (bus & coach)		Most of them are generalist, but some only treat HDVs	
Valuation by resale locally	**Valuation by direct use or open-loop resale**	**Valuation by resale locally**	**Open-loop** resale in general, but **closed-loop** with some **key accounts**	**Valuation by open-loop resale**
To supply clients with used parts **Economic opportunity** **To get reman cores**	**Cannibalization** **Gradual dismantling of part tanks**	**Opportunistic approach** **Dismantling in case of economic opportunity or lack of activity**	**Systematic approach** **Need to amortize facilities**	**Willingness to capture material upstream** **Need to amortize shredding plants**
Dismantling for parts	**Dismantling for parts**			**Dismantling for materials**
Typical depth of dismantling 	Typical depth of dismantling 	Typical depth of dismantling 	Typical depth of dismantling 	Typical depth of dismantling 
CAPEX intensity 	CAPEX intensity 	CAPEX intensity 	CAPEX intensity 	CAPEX intensity 

Source : Site visits, Expert interviews, Strat Anticipation research & analysis

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Some topics related to heavy-duty vehicles were poorly covered by legislation, such as circularity, but legislative projects are underway to address them

Current legislative landscape

Current situation

1. **Directive 2000/53/EC on end-of-life vehicles (ELV Directive)[1]**
   - Regulates the collection and recovery of end-of life vehicles
2. **Directive 2005/64/EC on the type-approval of motor vehicles regarding their reusability, recyclability and recoverability (3R Type-approval Directive)[2]**
   - Regulates the design of new vehicles in relation to their reusability, recyclability & recoverability

Gaps[3]

- Inadequate circularity of vehicles
- "Missing" vehicles: comparing the stock to the input/output reveals a difference of 3-4 million vehicles
- Limited provisions on Extended Producer Responsibility (EPR)
- **Only Light Duty Vehicles are regulated: categories M1 & N1**

Amending Legislation in progress

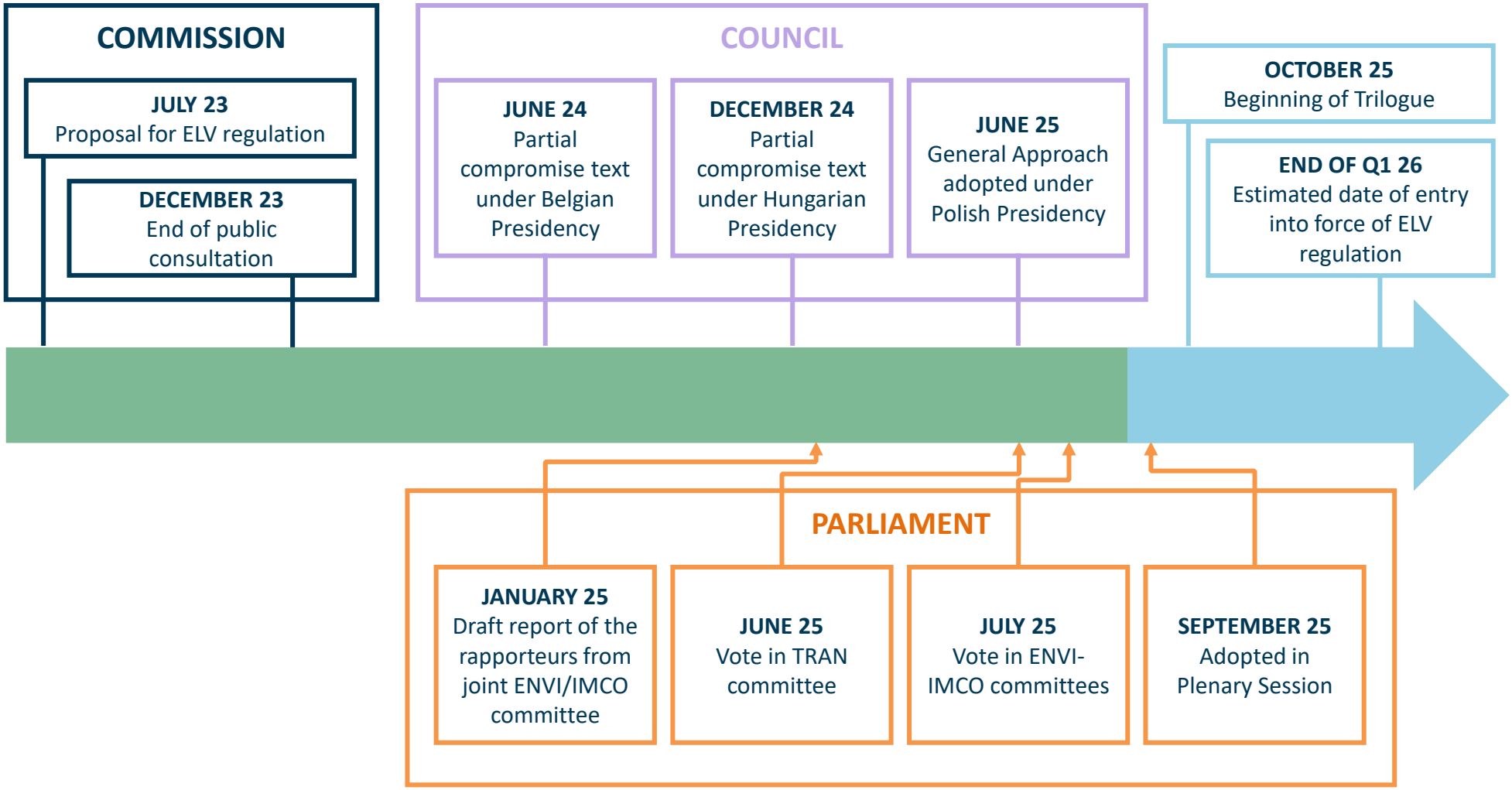
"Circularity requirements for vehicle design & management of end-of-life vehicles"

- Addresses the whole life cycle of vehicles from design to end-of-life
- **Aims to close the gaps identified by the review of the ELV & 3R Type-approval directives**

1 : Directive 2000/53/EC on end-of-life vehicle. EUR-LEX
2 : Directive 2005/64/EC on the type approval of motor vehicles with regard to their reusability, recyclability and recoverability. EUR-Lex
3 : EC, 2023, Study to support the impact assessment for the review of the End-of-Life Vehicles Directive
EPR : Extended Producer Responsibility
Source : E:MISIA

The next step for the ELV regulation is the Trilogue, starting in October, for a potential entry into force by the end of Q1 2026

ELV Regulation timeline



Source : Strat Anticipation research & analysis

The provisions of the text can be classified by theme : design, reporting & financing obligations, as well as export & collection/dismantling/recycling conditions

ELV Regulation articles sorted by topic for OEMs & ATFs

VEHICLE DESIGN	REPORTING, LABELLING & AUTHORISATIONS	FINANCING	COLLECTION, DISMANTLING & RECYCLING PROCESSES	REINCORPORATION OF RECYCLED MATERIALS	EXPORTS
Article 4 Article 5 Article 6 Article 7	Article 4 Article 8 Article 9 Article 10 Article 11 Article 12 Article 13 Article 16 Article 18 Article 19 Article 20 Article 25	Article 16 Article 17 Article 20 Article 21 Article 22	Article 15 Article 16 Article 20 Article 21 Article 20 Article 23 Article 24 Article 27 Article 28 Article 29 Article 30 Article 31 Article 32 Article 34 Article 35 Article 36	Article 4 Article 6	Article 36 Article 37 Article 38 Article 39 Article 40 Article 41 Article 42 Article 43 Article 44 Article 45 Article 46 Article 47

Source : Strat Anticipation research & analysis

Rigid bodies are excluded from the Commission & Parliament versions, whereas the Council includes them, in addition to including heavy-duty special purpose vehicles

ELV Regulation scope

	COMMISSION	COUNCIL	PARLIAMENT
INCLUSION	▸ EIF + 12 months (= 01/01/2027) ▪ M1 & N1 vehicles ▪ M1 & N1 SPV ▸ EIF + 60 months (= 01/01/2031) ▪ M2, M3, N2, N3 & O vehicles* ▪ L3e, L4e, L5e, L6e & L7e vehicles*	▸ EIF + 24 months (= 01/01/2028) ▪ M1 & N1 vehicles ▸ EIF + 36 months (= 01/01/2029) ▪ M1 & N1 SPV ▸ EIF + 60 months (= 01/01/2031) ▪ M2, M3, N2, N3 & O vehicles* ▪ M2, M3, N2 & N3 SPV* ▪ L1e, L2e, L3e, L4e, L5e, L6e & L7e vehicles*	▸ EIF + 12 months (= 01/01/2027) ▪ M1 & N1 vehicles ▪ M1 & N1 SPV ▸ EIF + 60 months (= 01/01/2031) ▪ M2, M3, N2, N3 & O vehicles* ▪ L1e, L2e, L3e, L4e, L5e, L6e & L7e vehicles*
EXCLUSION	▸ Other parts of a vehicle that has been type-approved in **multi-stage type approval** of category N1, N2, N3, M2 or M3 than the base vehicle ▸ Vehicles produced in **small series** ▸ Vehicles of **historical interest**	▸ Parts of vehicles **produced by a small-volume manufacturer** that are type approved in multi-stage ▸ Vehicles produced in **small series** ▸ Vehicles of **historical interest**	▸ Other parts of a vehicle that has been type-approved in **multi-stage type approval** of category N1, N2, N3, M2 or M3 than the base vehicle ▸ Vehicles produced in **small series** ▸ Vehicles of **historical interest**

* Regulation applies but with limited obligations (see art. 2.3, 2.4 & 2.6)
Source : Strat Anticipation research & analysis

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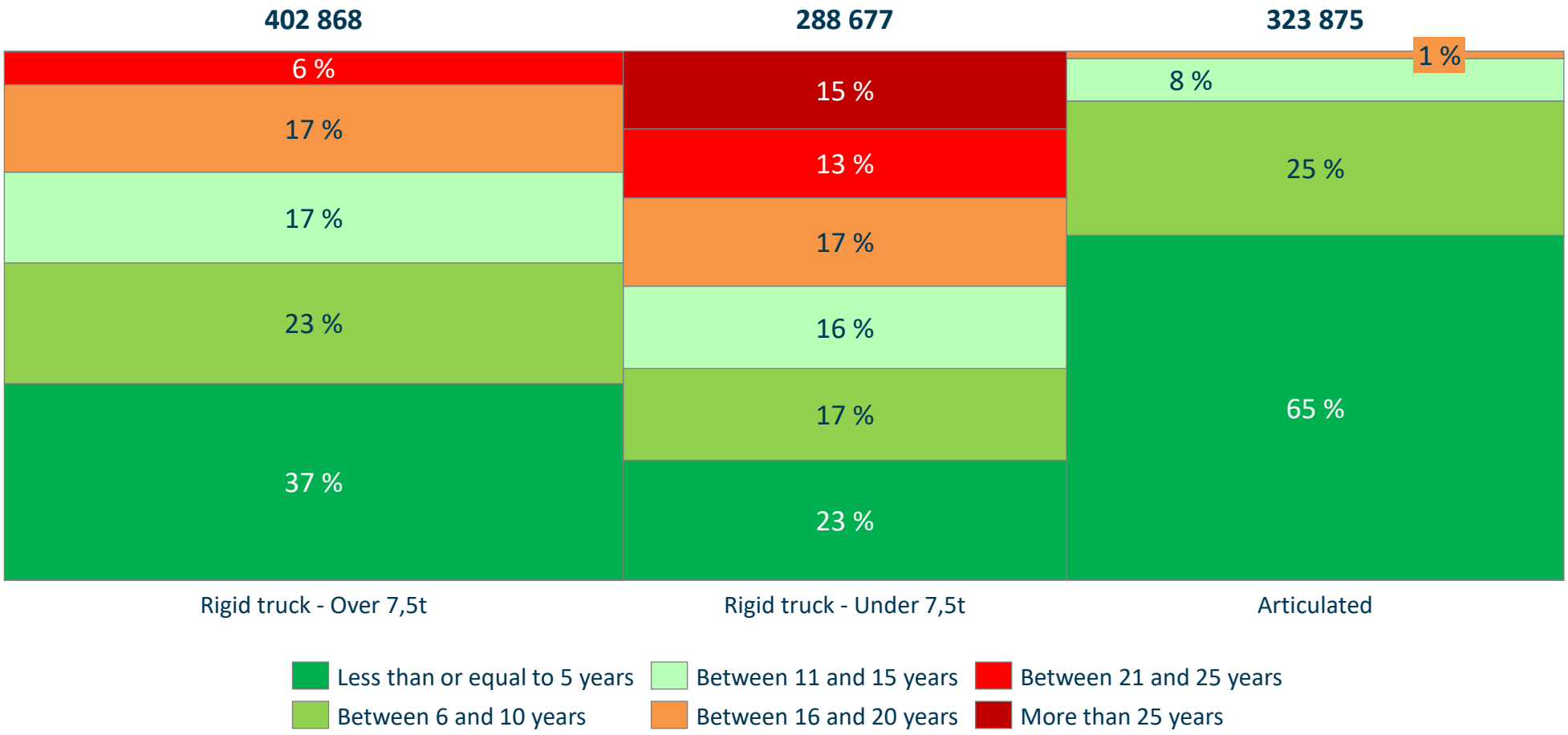
The articulated truck fleet has a bigger proportion (90%) of trucks under 10 years old than the other segments which reach as low as 40% for the rigid trucks under 7,5t

GERMANY - Fleet characteristics

GERMANY TRUCK FLEET BY SUBSEGMENT & AGE CATEGORY | In % and number of vehicles, Germany, 2024

TOTAL : 1 015 420



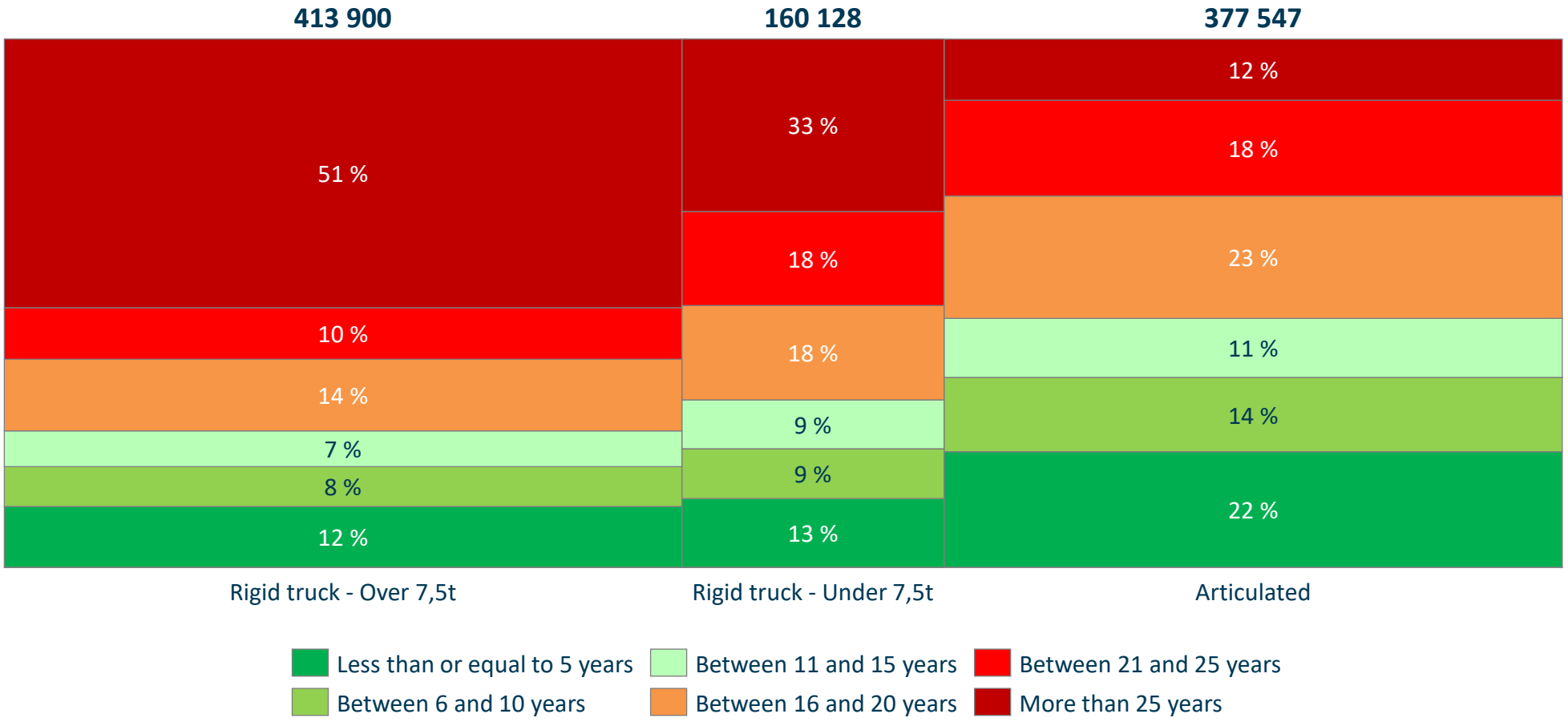
Source : Sybil model - EMISIA, Strat Anticipation research & analysis

The Italian articulated truck fleet age distribution is even across all the age segment while the rigid truck over 7,5t fleet is dominated by more than 25 years trucks

ITALY - Fleet characteristics

ITALY TRUCK FLEET BY SUBSEGMENT & AGE CATEGORY | In % and number of vehicles, Italy, 2024

TOTAL : 951 575



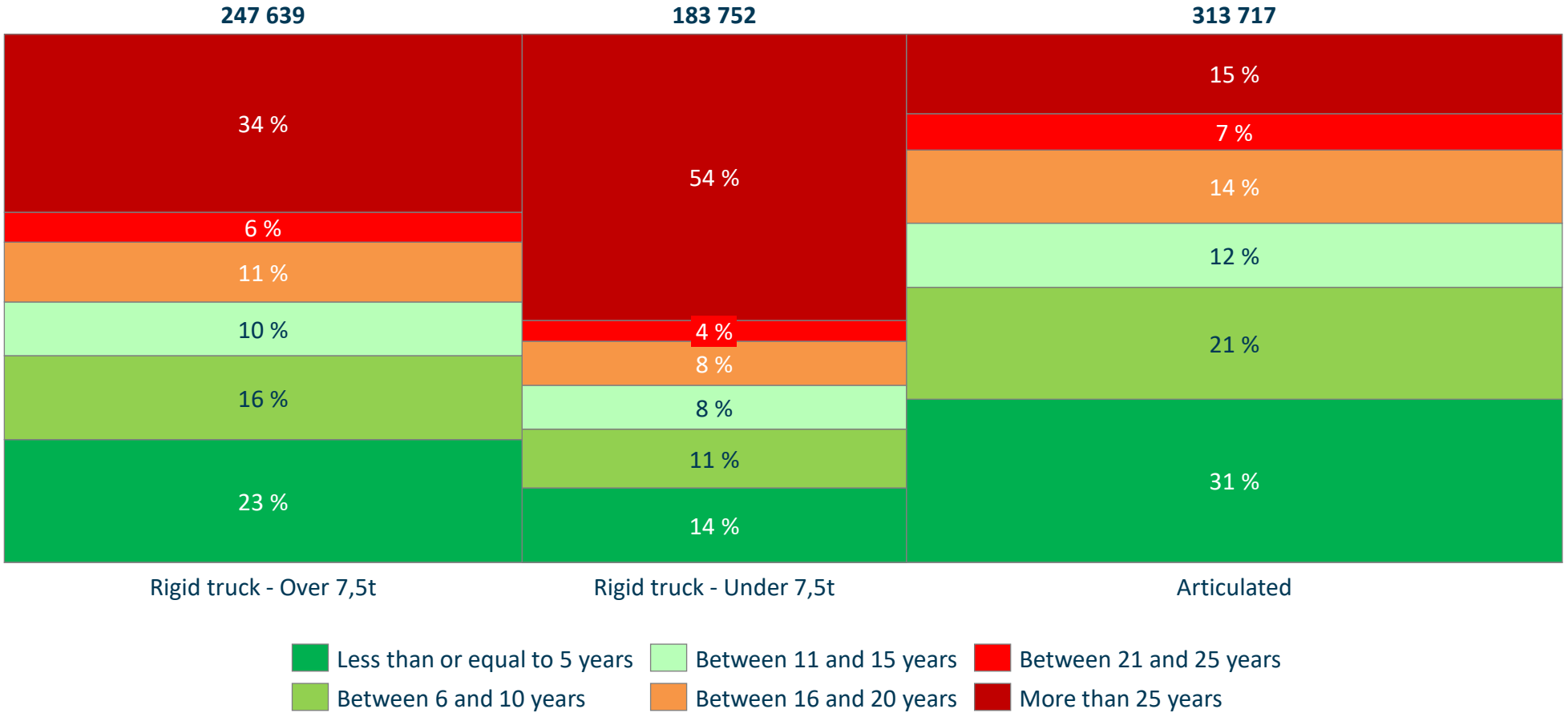
Source : Sybil model - EMISIA, Strat Anticipation research & analysis

Trucks aged over 25 years in Poland represent 54% of the rigids over 7,5t, while they only represent 15% of the articulated truck fleet

POLAND - Fleet characteristics

POLAND TRUCK FLEET BY SUBSEGMENT & AGE CATEGORY | In % and number of vehicles, Poland, 2024

TOTAL : 745 108



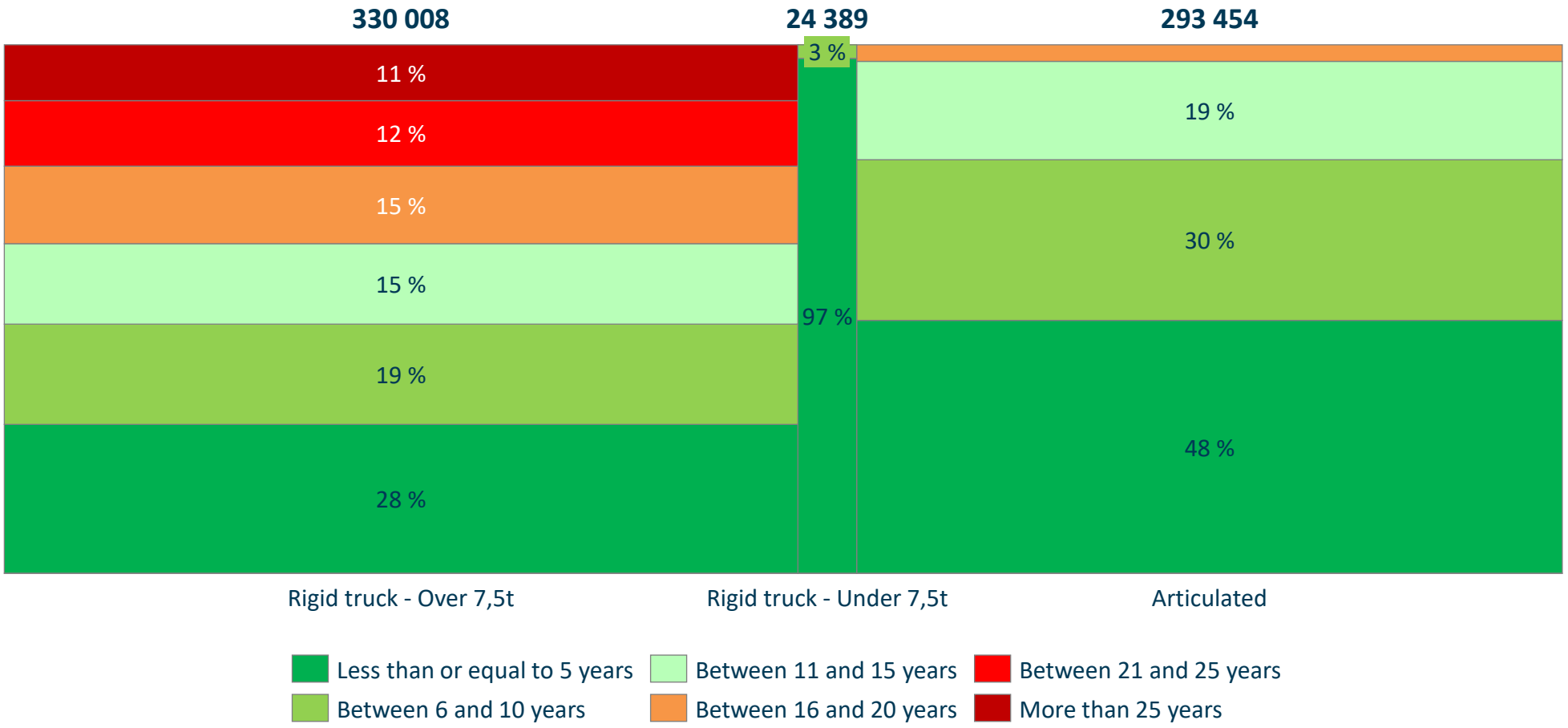
Note : The total fleet number reported by ACEA/Eurostat (> 1,2M) is not respected because not compatible with new registrations data
Source : Sybil model - EMISIA, Strat Anticipation research & analysis

The rigid truck under 7,5t fleet represents less than 4% of the total fleet in France. The articulated truck fleet is younger than the rigid truck over 7,5t fleet

FRANCE - Fleet characteristics

FRANCE TRUCK FLEET BY SUBSEGMENT & AGE CATEGORY | In % and number of vehicles, France, 2024

TOTAL : 647 851



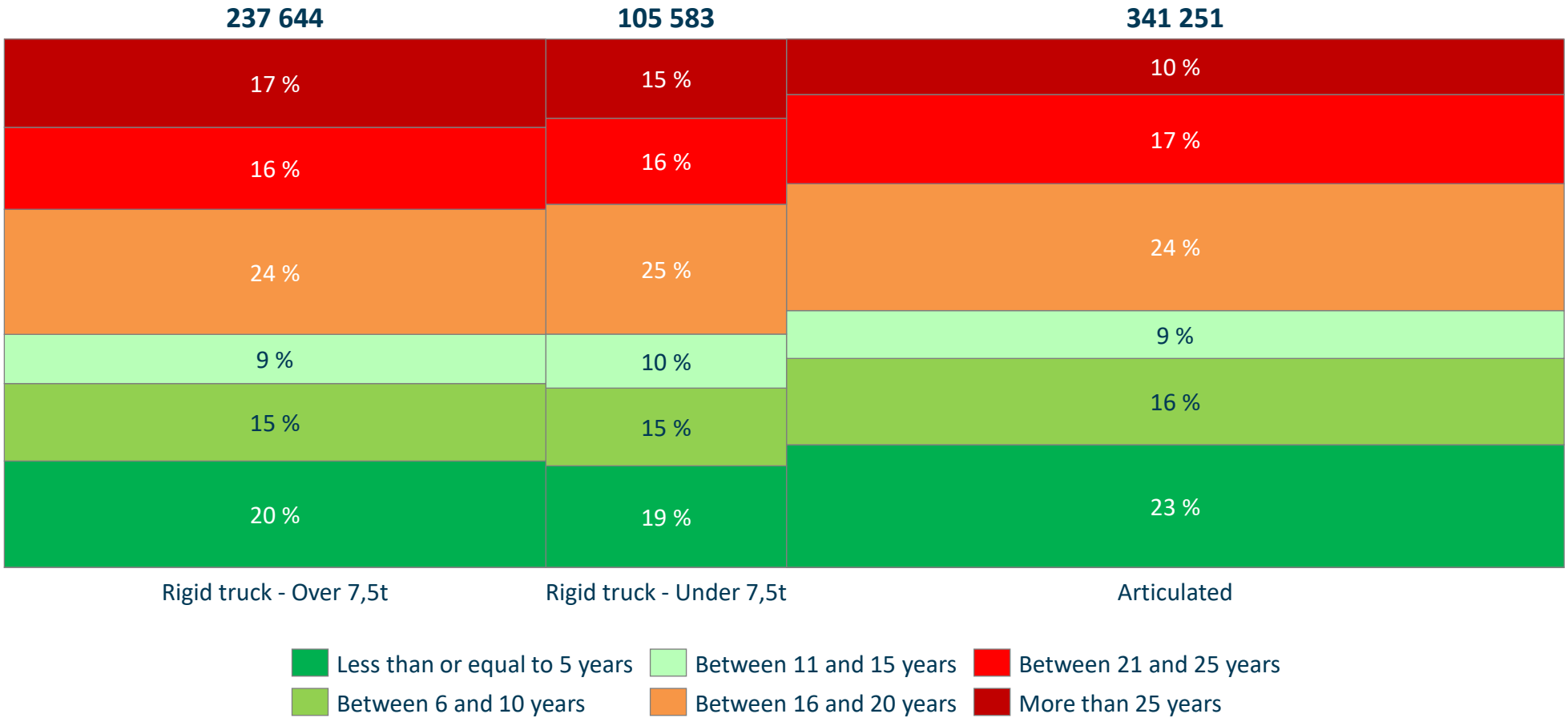
Source : Sybil model - EMISIA, Strat Anticipation research & analysis

In Spain, age distribution is equal across all truck fleet subsegments. It is also equally distributed across all age categories

SPAIN - Fleet characteristics

SPAIN TRUCK FLEET BY SUBSEGMENT & AGE CATEGORY | In % and number of vehicles, Spain, 2024

TOTAL : 684 478



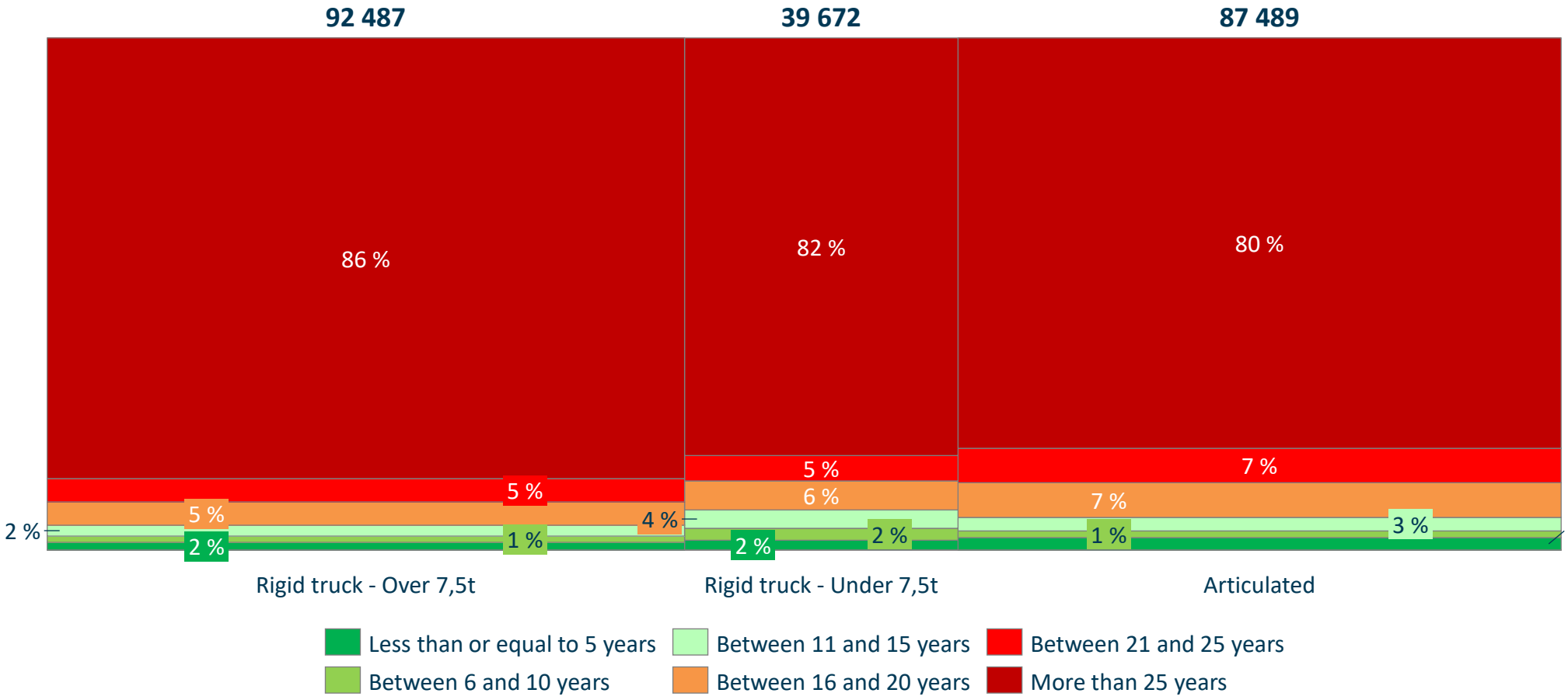
Source : Sybil model - EMISIA, Strat Anticipation research & analysis

In Greece, the truck fleet is old throughout all the subsegments, with at least over 80% of the fleet aged more than 25 years

GREECE - Fleet characteristics

GREECE TRUCK FLEET BY SUBSEGMENT & AGE CATEGORY | In % and number of vehicles, Greece, 2024

TOTAL : 219 648



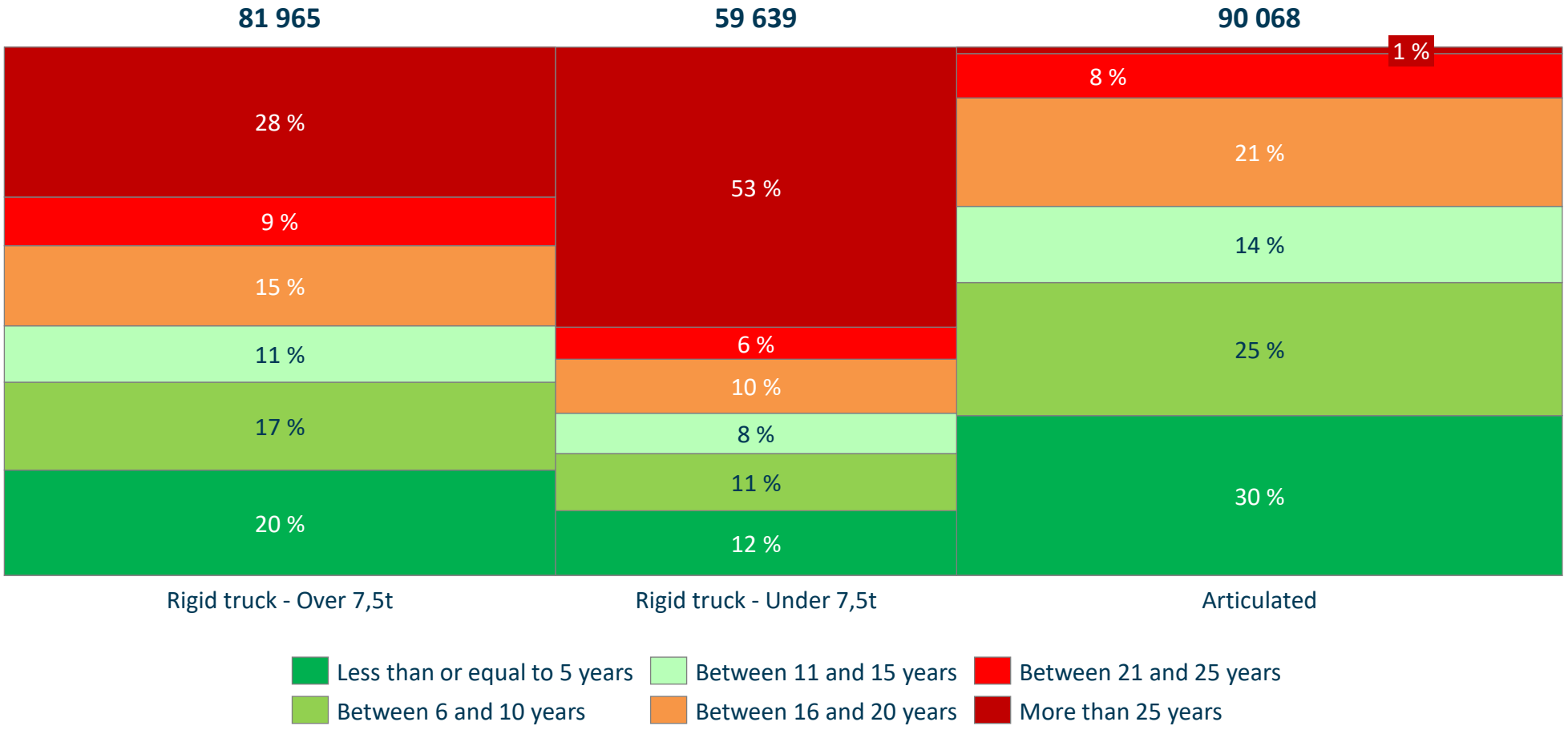
Source : Sybil model - EMISIA, Strat Anticipation research & analysis

In Czech Republic, there is a big age difference between an old rigid truck over 7,5t fleet & a much younger articulated truck fleet

CZECH REPUBLIC - Fleet characteristics

CZECH REPUBLIC TRUCK FLEET BY SUBSEGMENT & AGE CATEGORY | In % and number of vehicles, CZ, 2024

TOTAL : 231 672



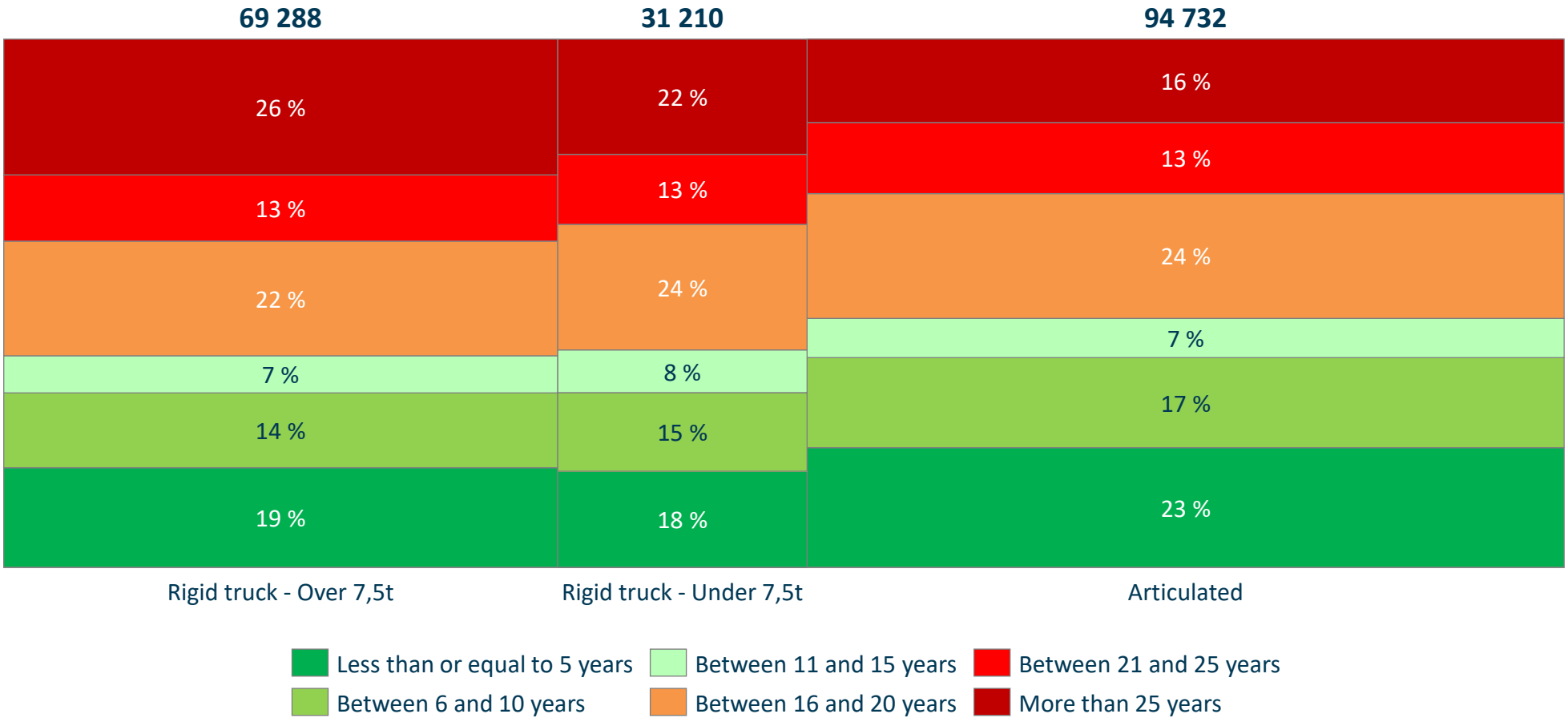
Source : Sybil model - EMISIA, Strat Anticipation research & analysis

In Romania, age distribution is equal across all truck fleet subsegments. It is also equally distributed across all age categories

ROMANIA - Fleet characteristics

ROMANIA TRUCK FLEET BY SUBSEGMENT & AGE CATEGORY | In % and number of vehicles, Romania, 2024

TOTAL : 195 230



Source : Sybil model - EMISIA, Strat Anticipation research & analysis

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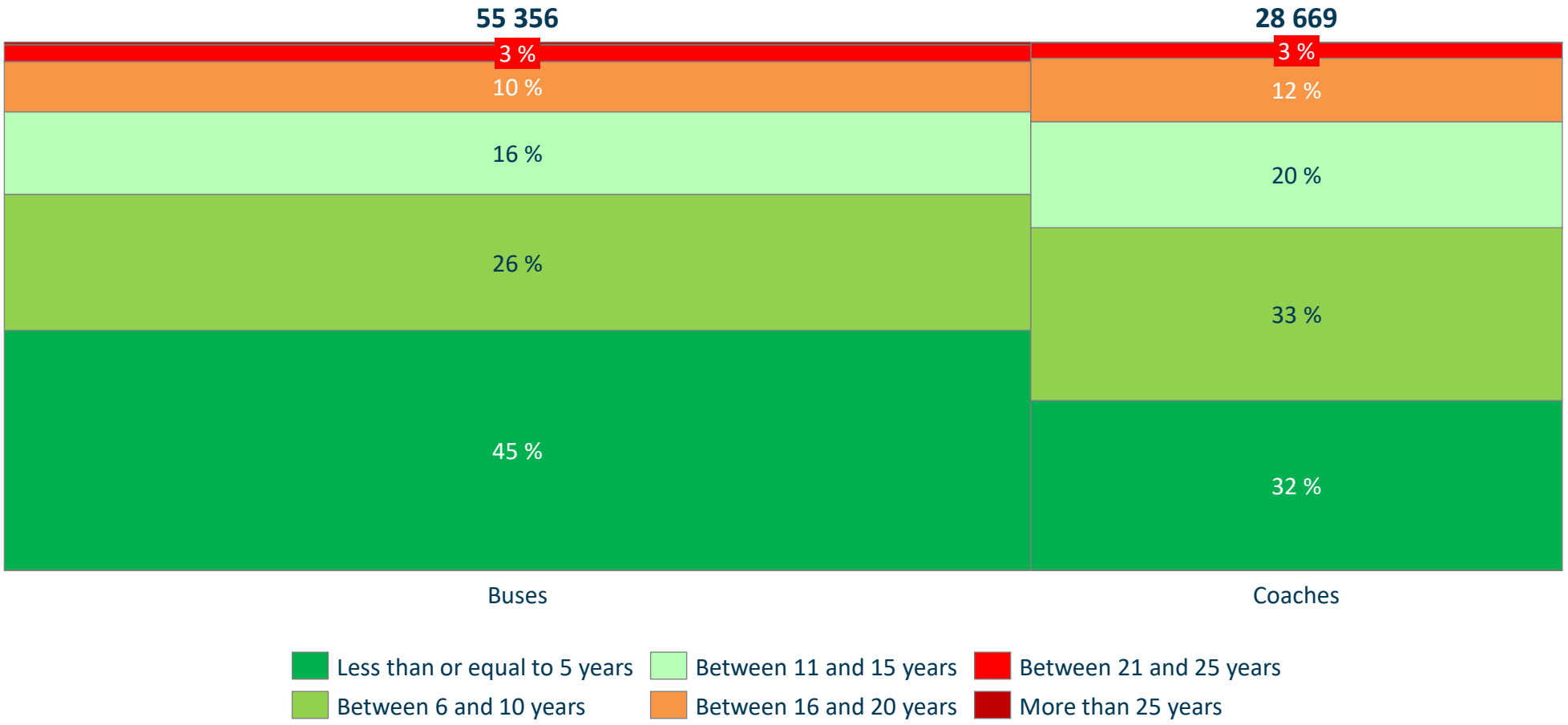
Germany has one of the youngest bus fleets, with 66% aged 10 years old or less. Coaches account for less than a third

GERMANY - Fleet characteristics

GERMANY BUS FLEET BY SUBSEGMENT & AGE CATEGORY | In % and number of vehicles, Germany, 2024

TOTAL : 84 025



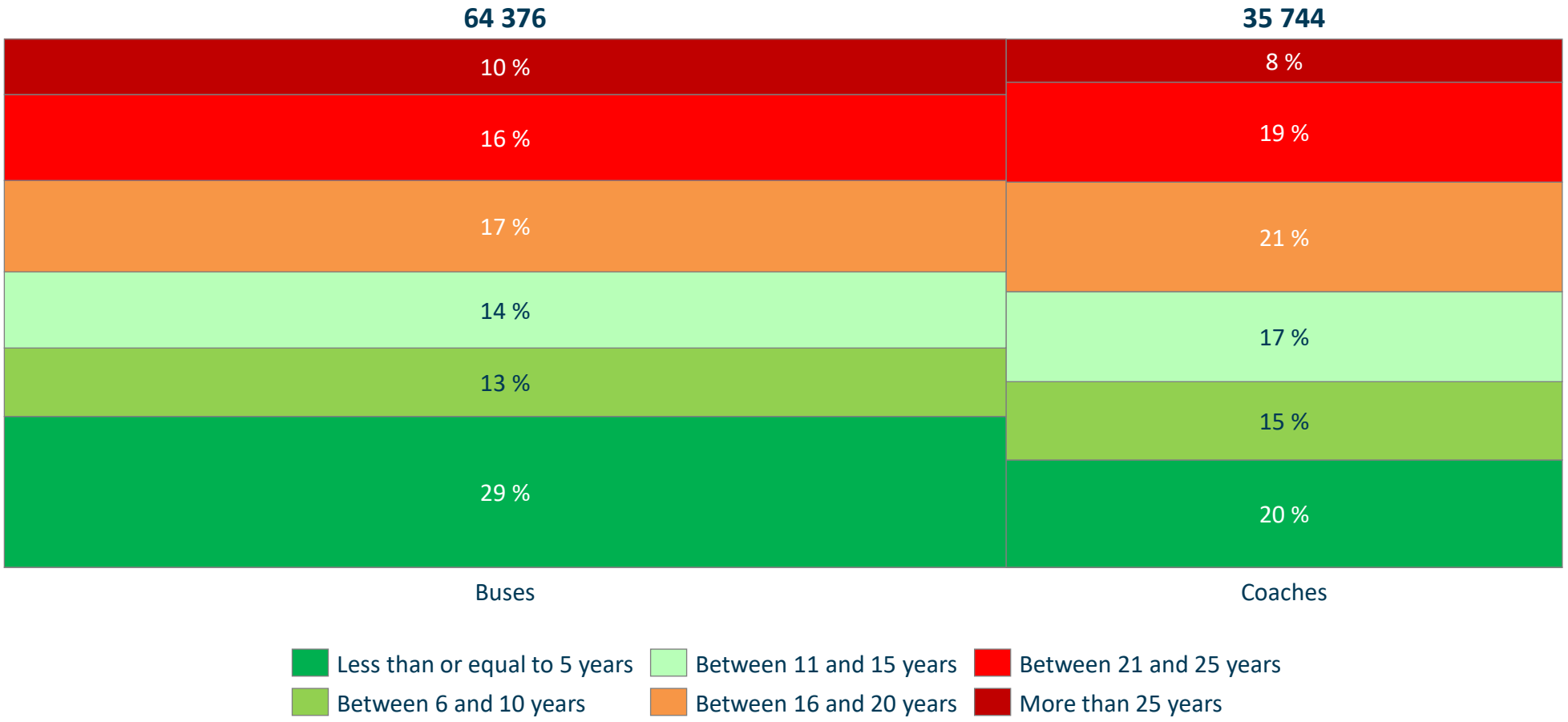
Source : Sybil model - EMISIA, Strat Anticipation research & analysis

Italy's bus fleet is one of the largest in the 8 countries, with over 64k buses & 36k coaches. The age distribution is fairly similar between buses & coaches

ITALY - Fleet characteristics

ITALY BUS FLEET BY SUBSEGMENT & AGE CATEGORY | In % and number of vehicles, Italy, 2024

TOTAL : 100 120



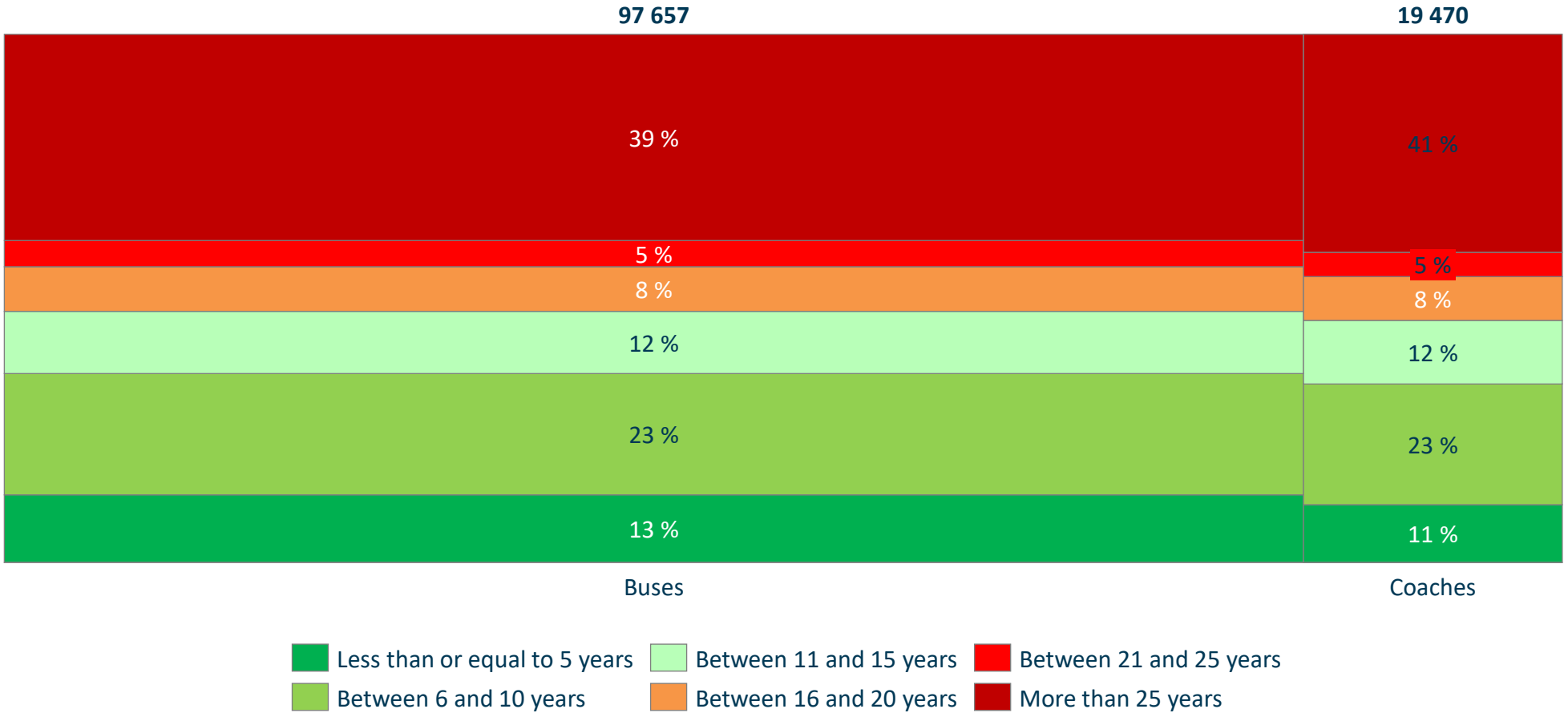
Source : Sybil model - EMISIA, Strat Anticipation research & analysis

Like its truck fleet, the Polish bus fleet is one of the oldest. Moreover, coaches represent less than 20% of the fleet, a much lower share than in other countries

POLAND - Fleet characteristics

POLAND BUS FLEET BY SUBSEGMENT & AGE CATEGORY | In % and number of vehicles, Poland, 2024

TOTAL : 117 127



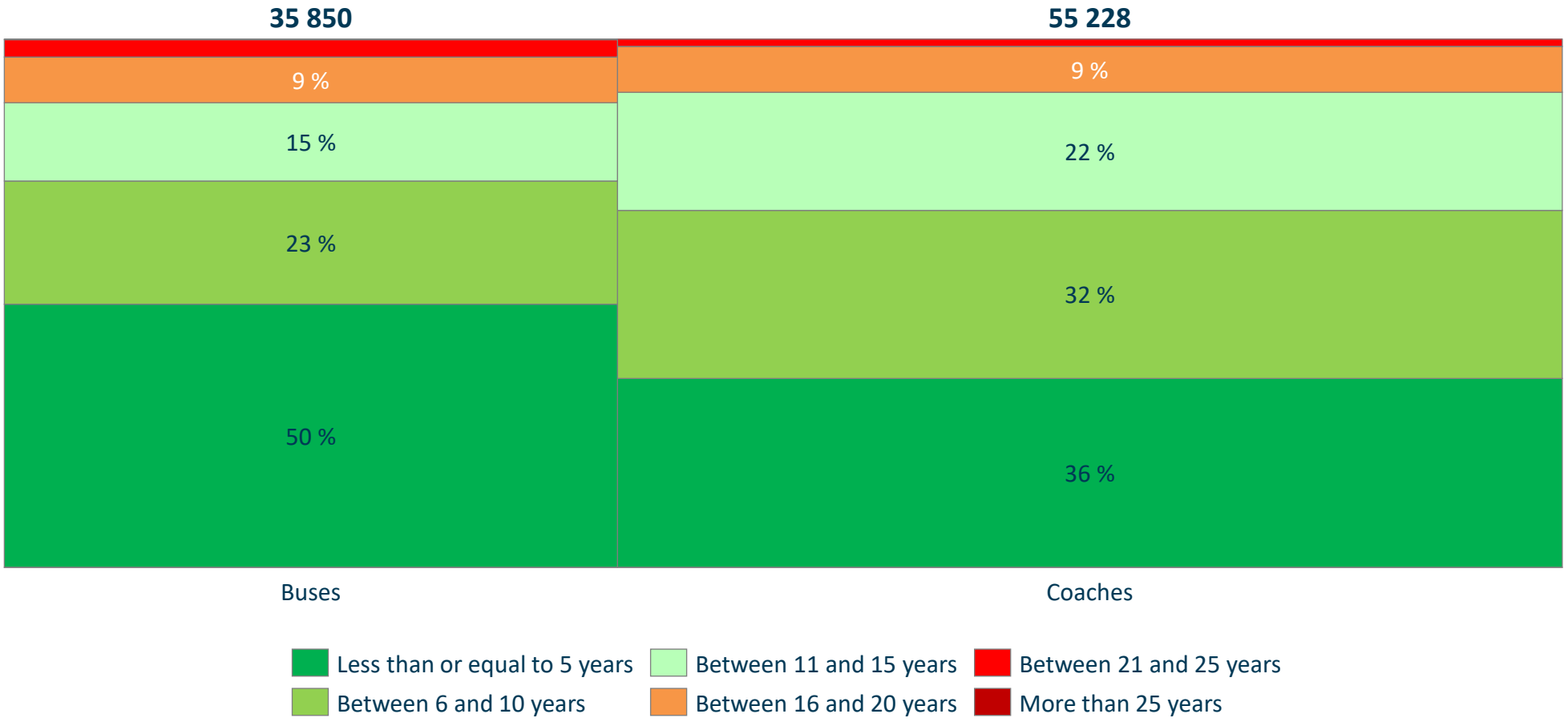
Note : The total fleet number reported by ACEA/Eurostat (> 1,2M) is not respected because not compatible with new registrations data
Source : Sybil model - EMISIA, Strat Anticipation research & analysis

France has one of the highest proportions of coaches, around 61%, and one of the youngest fleets, as only 2% of buses are over 20 years old

FRANCE - Fleet characteristics

FRANCE BUS FLEET BY SUBSEGMENT & AGE CATEGORY | In % and number of vehicles, France, 2024

TOTAL : 91 078



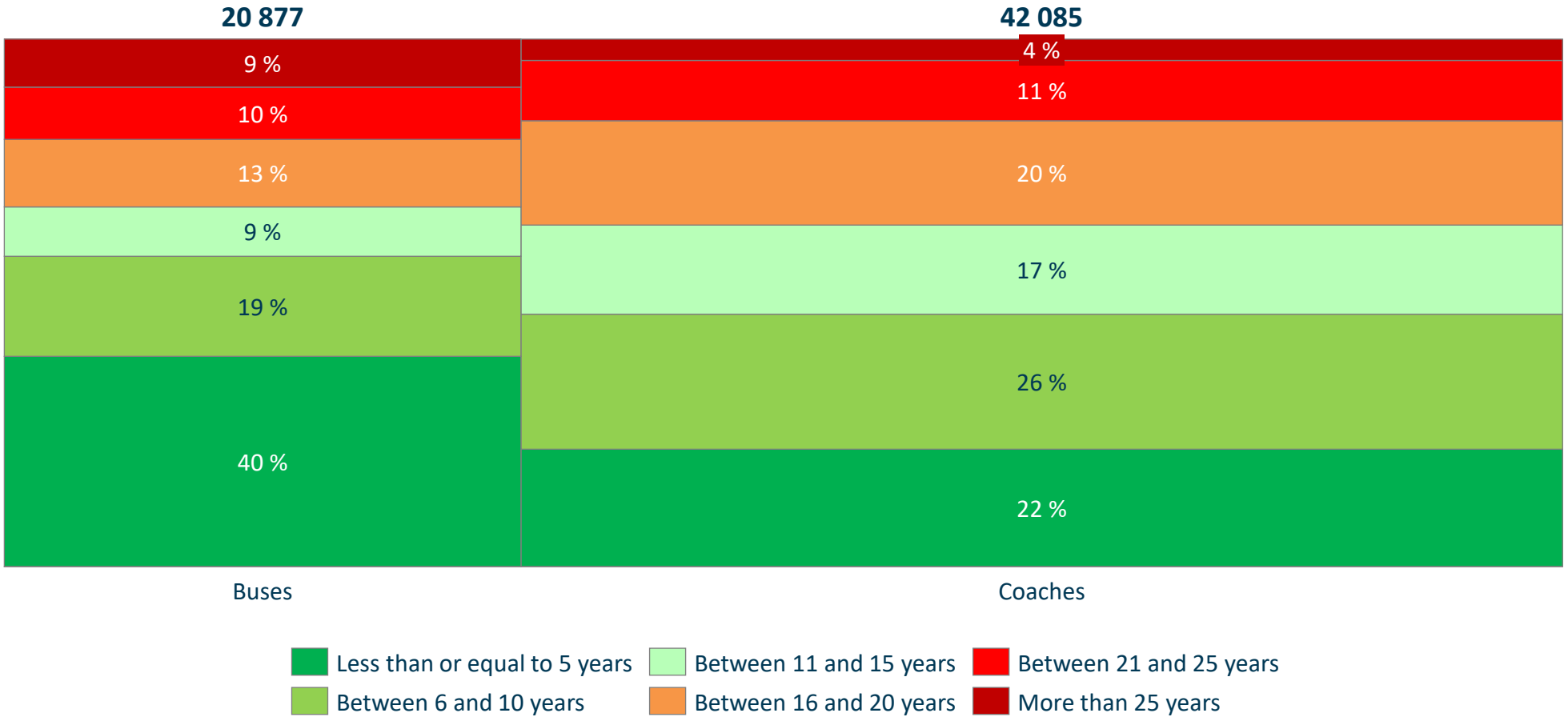
Source : Sybil model - EMISIA, Strat Anticipation research & analysis

Spain has the highest proportion of coaches accounting for 67% of the fleet and the fleet is relatively young, with 66% of buses being 15 years or younger

SPAIN - Fleet characteristics

SPAIN BUS FLEET BY SUBSEGMENT & AGE CATEGORY | In % and number of vehicles, Spain, 2024

TOTAL : 62 962



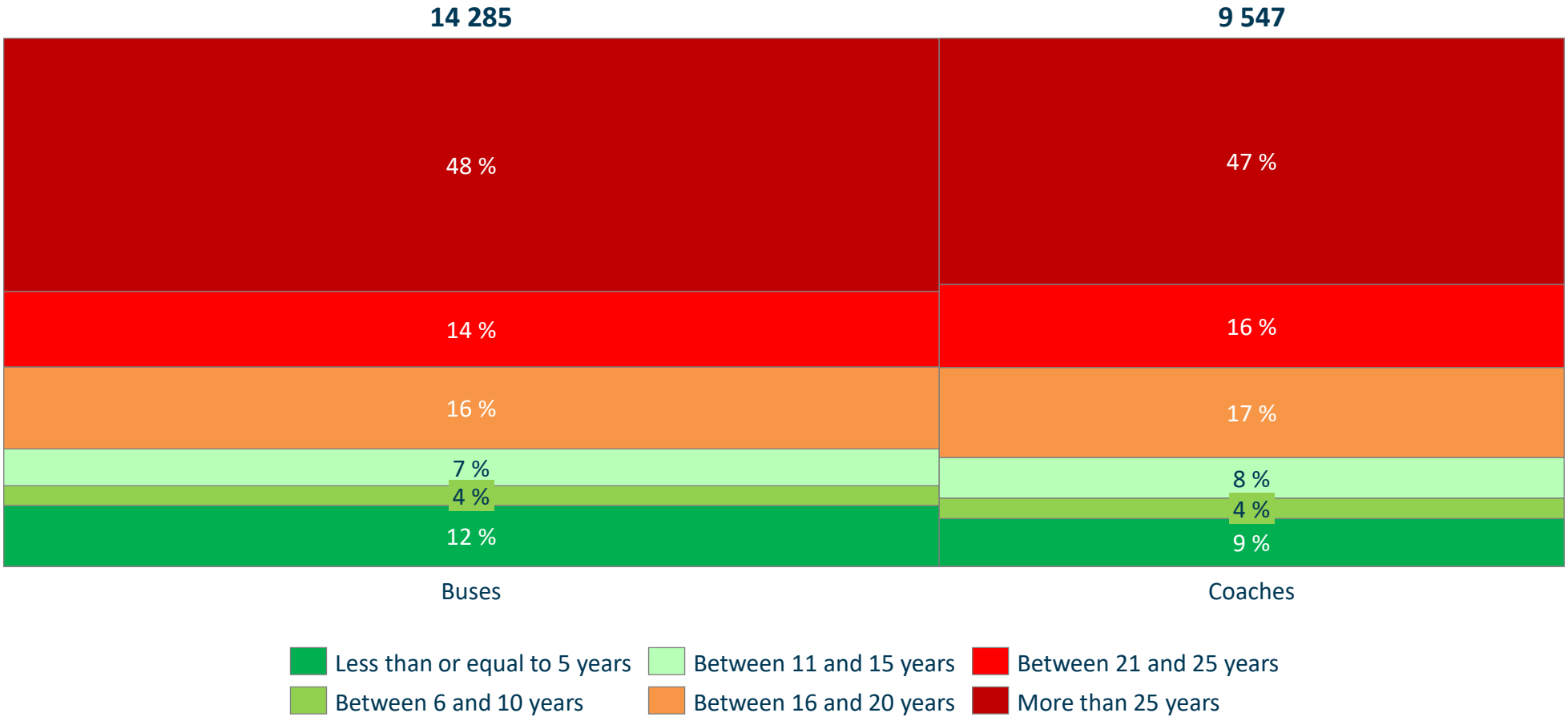
Source : Sybil model - EMISIA, Strat Anticipation research & analysis

Greece has a very old bus & coach fleet compared to other countries, with nearly 79% of buses being 16 years old or older

GREECE - Fleet characteristics

GREECE BUS FLEET BY SUBSEGMENT & AGE CATEGORY | In % and number of vehicles, Greece, 2024

TOTAL : 23 832



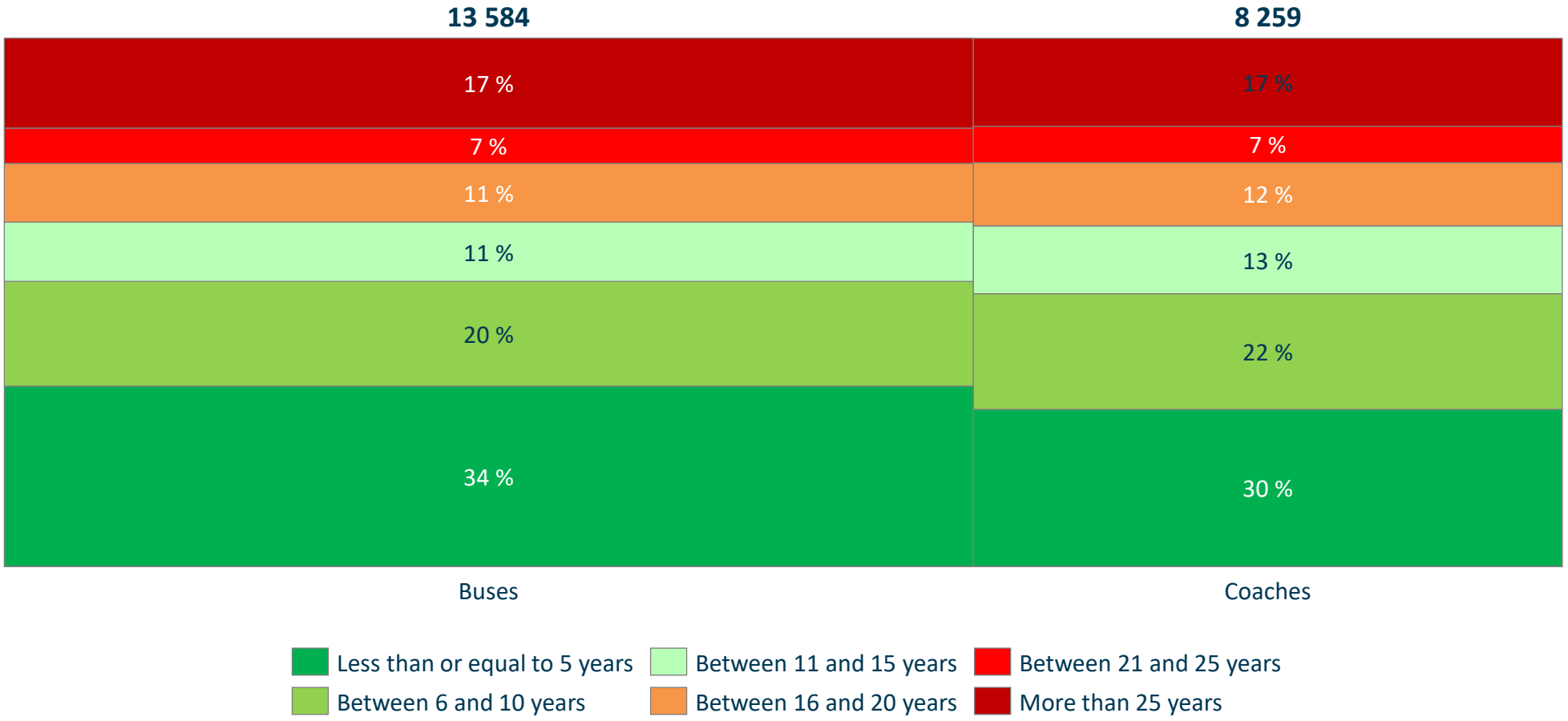
Source : Sybil model - EMISIA, Strat Anticipation research & analysis

Czech Republic has the smallest bus fleet in the 8 countries, with 22k units. The age distribution is fairly even, with a larger share of buses aged 5 years or less

CZECH REPUBLIC fleet characteristics

CZECH REPUBLIC BUS FLEET BY SUBSEGMENT & AGE CATEGORY | In % and number of vehicles, CZ, 2024

TOTAL : 21 843



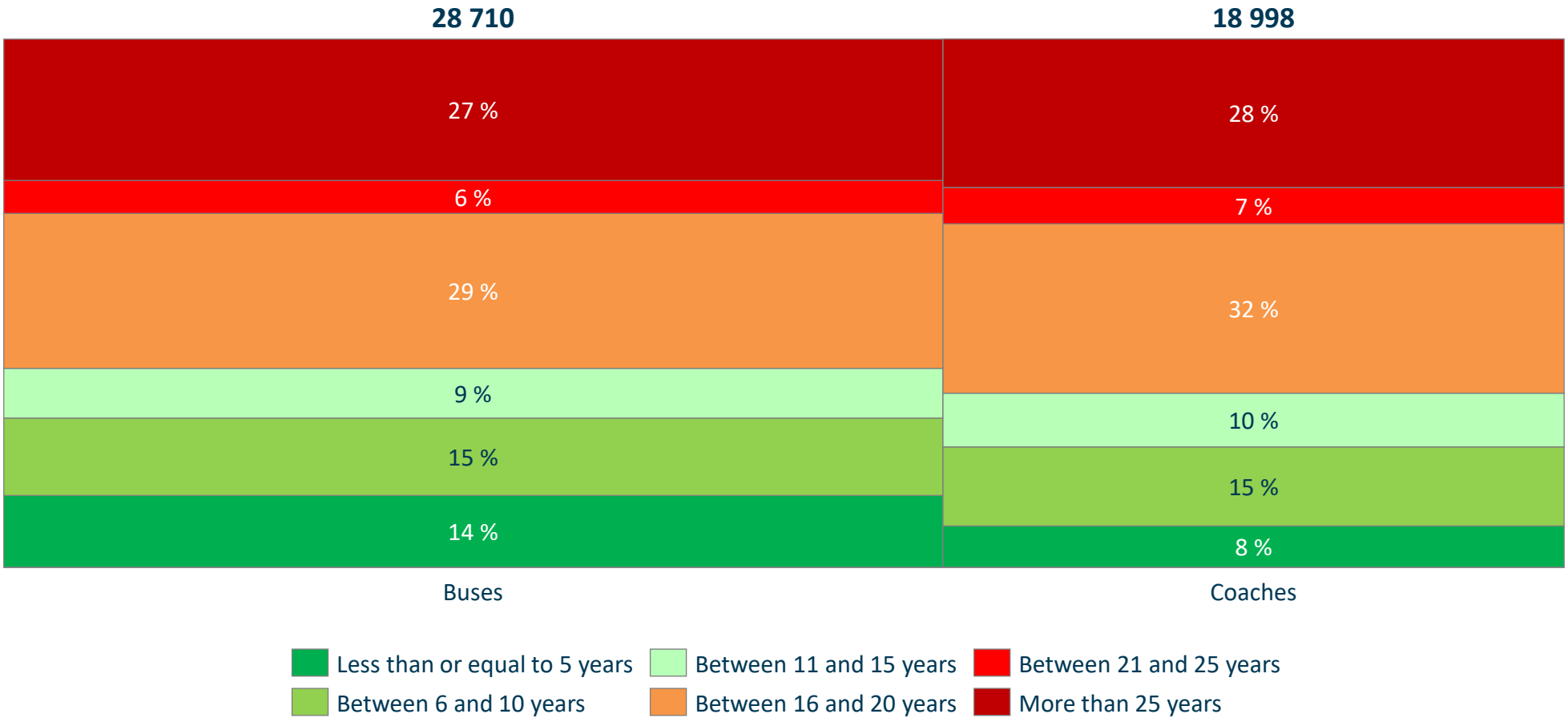
Source : Sybil model - EMISIA, Strat Anticipation research & analysis

Romania has, on one hand, one of the smallest bus fleets with 48k units, and on the other hand, one of the oldest, with 64% of buses aged 16 years or more

ROMANIA fleet characteristics

ROMANIA BUS FLEET BY SUBSEGMENT & AGE CATEGORY | In % and number of vehicles, Romania, 2024

TOTAL : 47 708



Source : Sybil model - EMISIA, Strat Anticipation research & analysis

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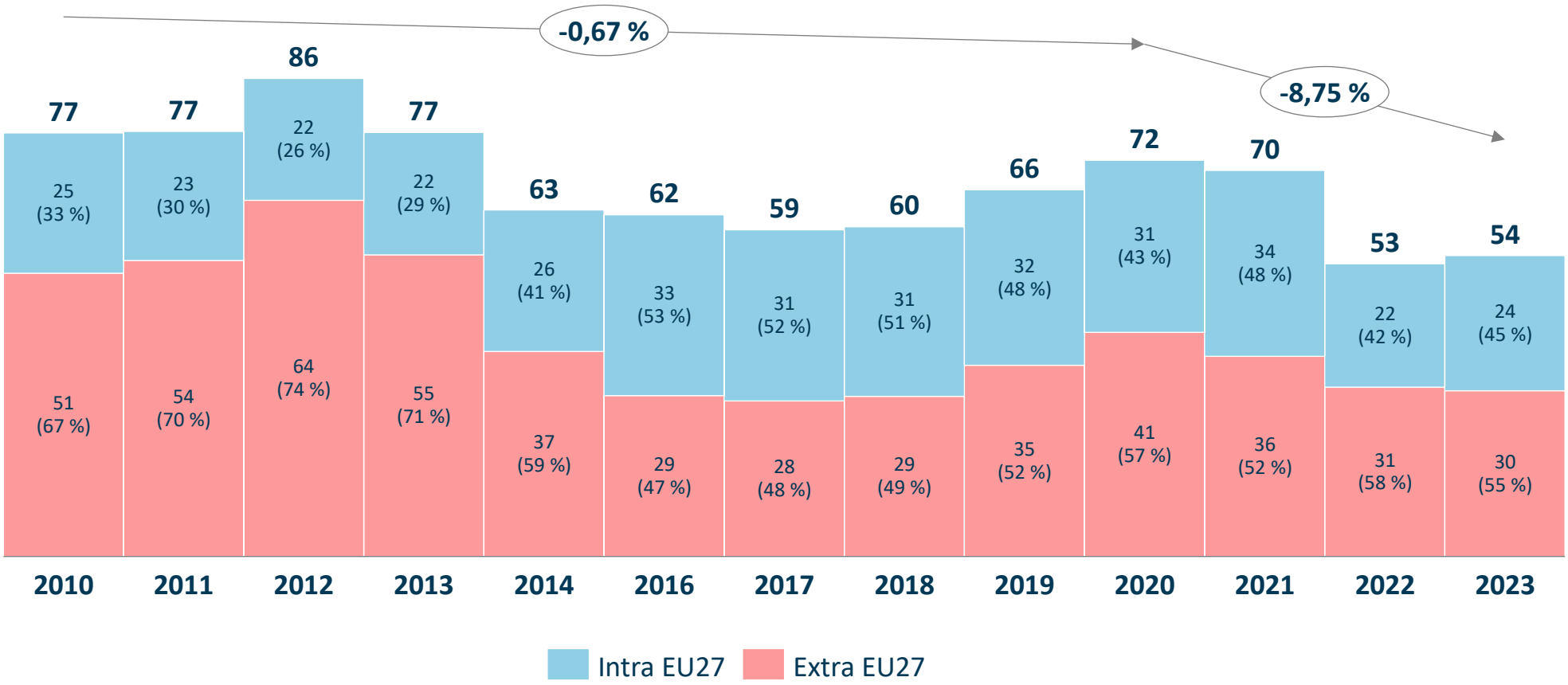
Among these 8 countries, Germany is by far the largest exporter, with most export flows directed outside the EU

Heavy-Duty Vehicle Export Destination - Germany

GERMANY EXPORTED HEAVY DUTY VEHICLES PER DESTINATION | In k units and %, 2010-2023, Germany

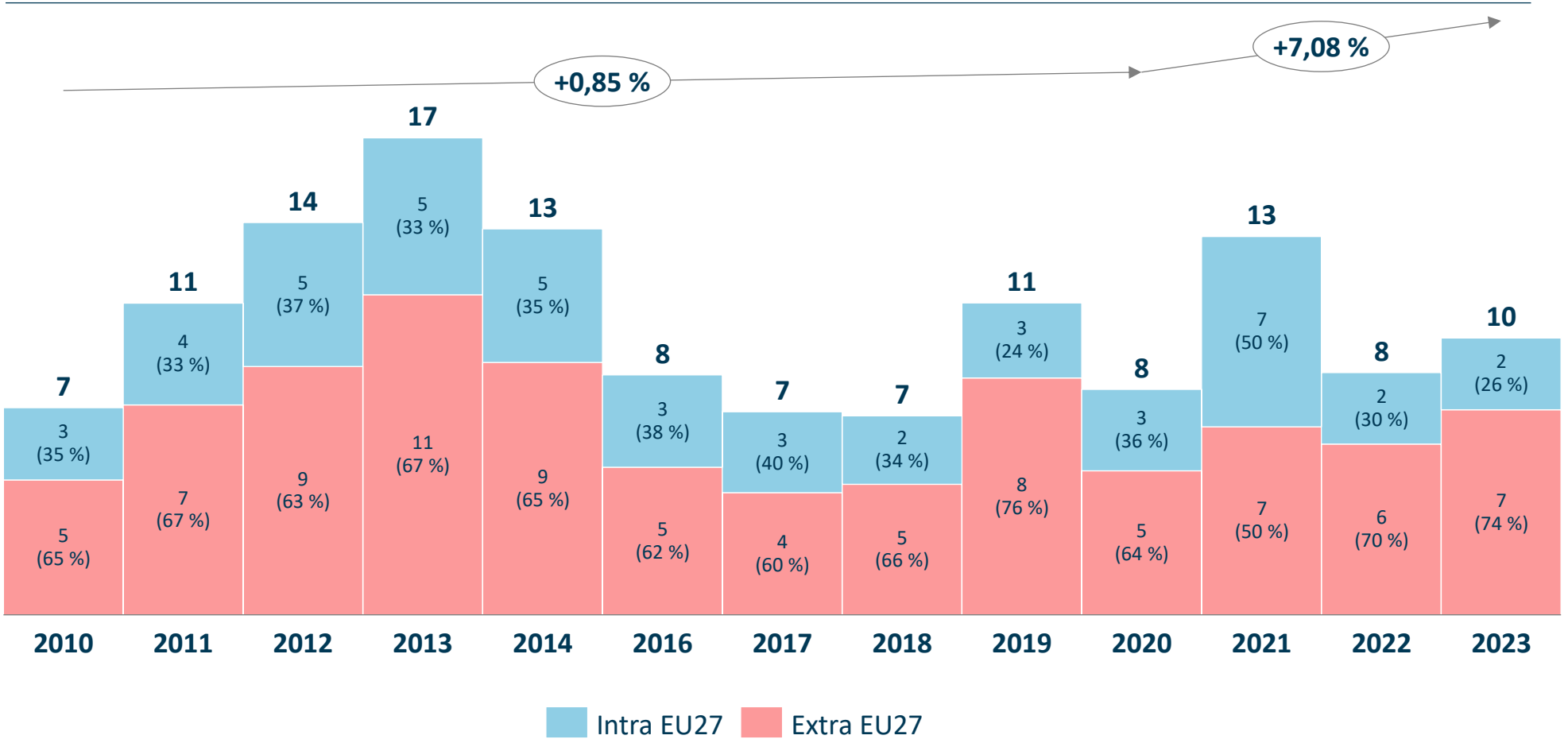


Source : EMISIA, Eurostat, Strat Anticipation analysis

Compared to its fleet, Italy is a small exporter, with 10k units exported in 2023 and limited flows to other EU countries

Heavy-Duty Vehicle Export Destination - Italy

ITALY EXPORTED HEAVY DUTY VEHICLES PER DESTINATION | In k units and %, 2010-2023, Italy

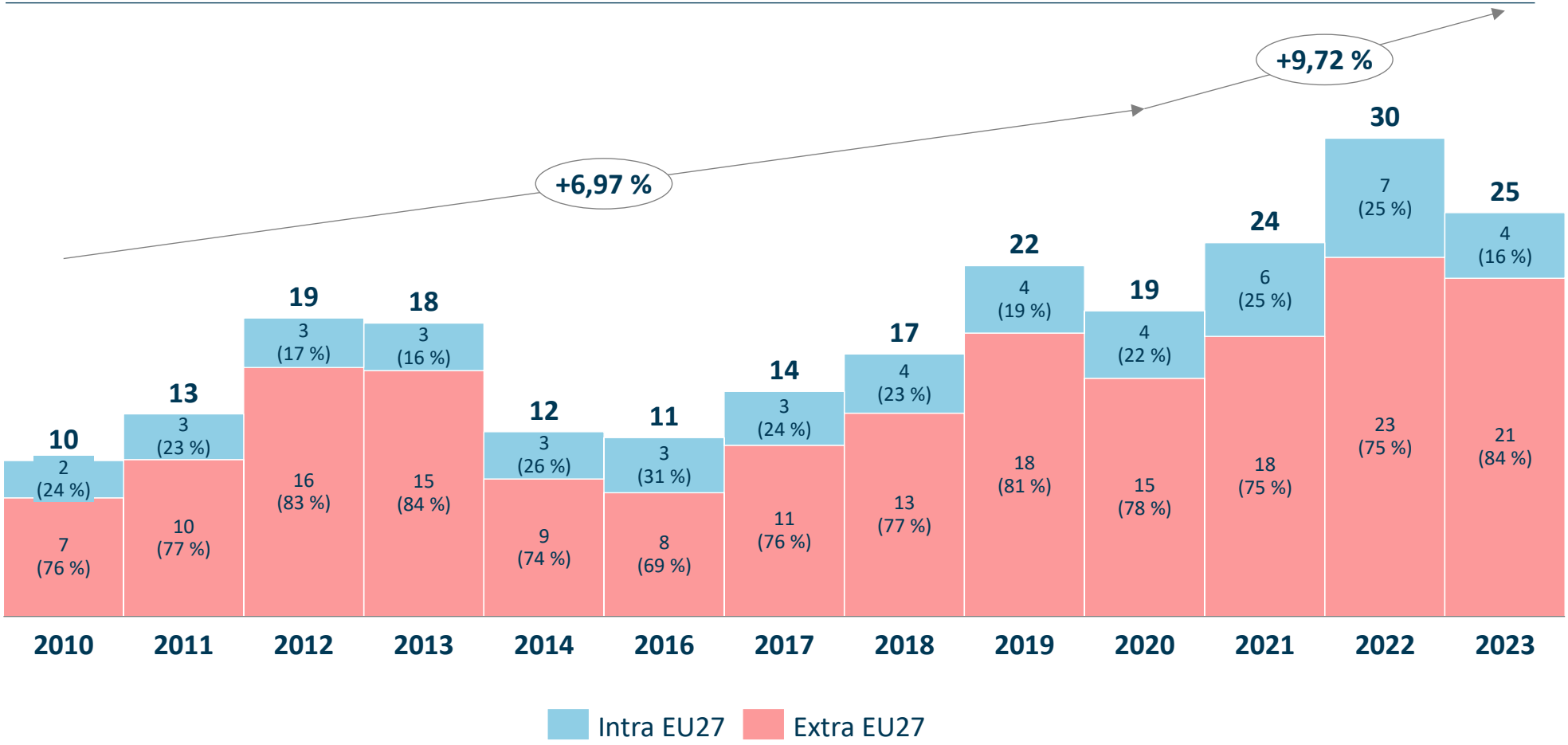


Source : EMISIA, Eurostat, Strat Anticipation analysis

Poland has been expanding its export activity, rising from 10,000 units in 2010 to over 20,000 since 2021, with the vast majority destined for non-EU markets

Heavy-Duty Vehicle Export Destination - Poland

POLAND EXPORTED HEAVY DUTY VEHICLES PER DESTINATION | In k units and %, 2010-2023, Poland

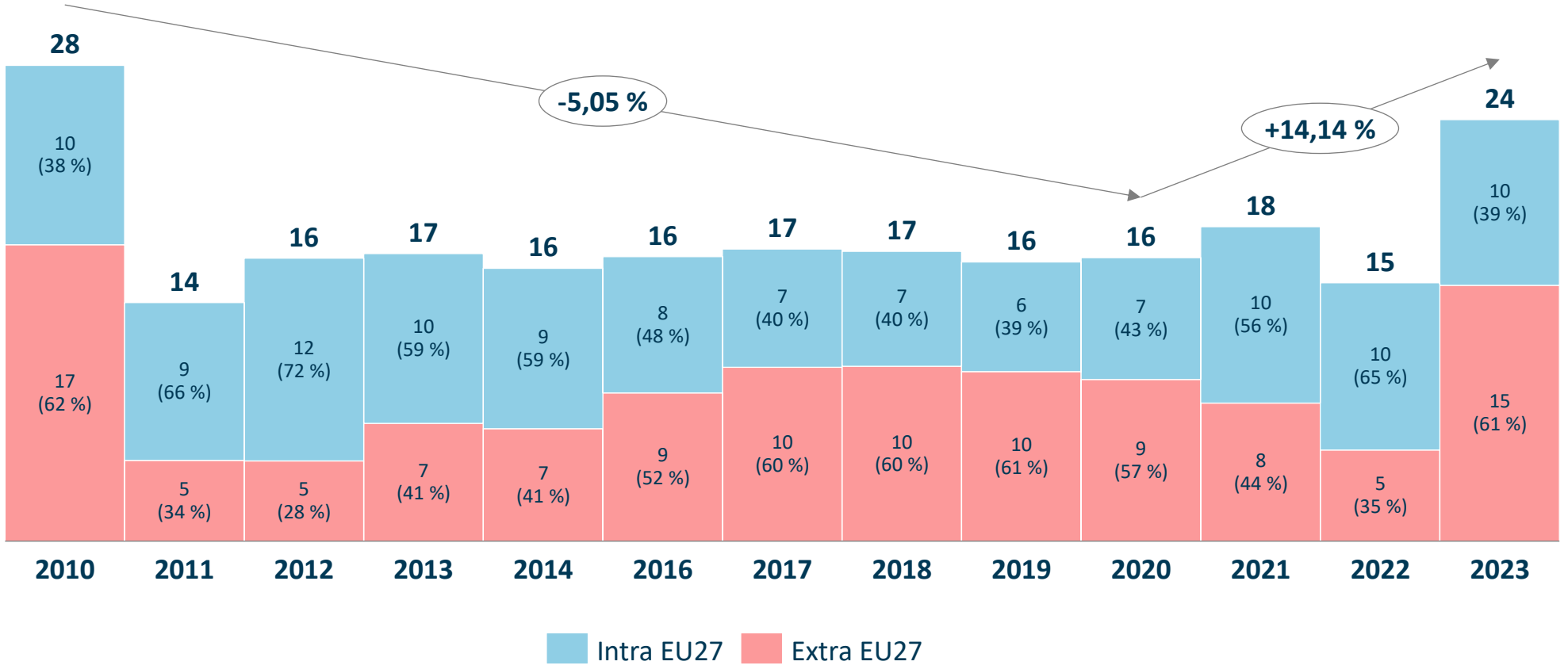


Source : EMISIA, Eurostat, Strat Anticipation analysis

France’s exports stayed around 17,000 units, with a roughly even split between intra- and extra-EU markets

Heavy-Duty Vehicle Export Destination - France

FRANCE EXPORTED HEAVY DUTY VEHICLES PER DESTINATION | In k units and %, 2010-2023, France

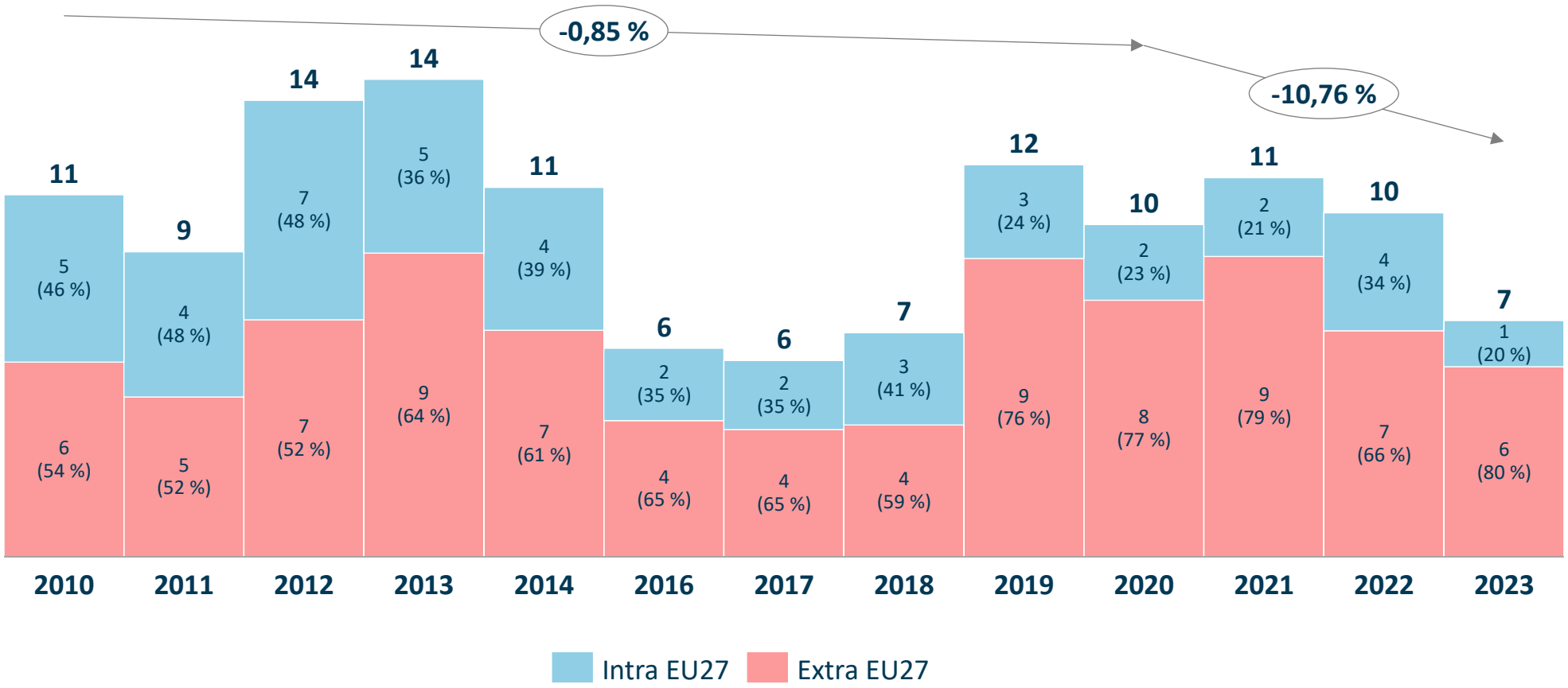


Source : EMISIA, Eurostat, Strat Anticipation analysis

Spain’s exports fell from 12,000 in 2019 to 7,000 in 2023, mostly to non-EU markets

Heavy-Duty Vehicle Export Destination - Spain

SPAIN EXPORTED HEAVY DUTY VEHICLES PER DESTINATION | In k units and %, 2010-2023, Spain

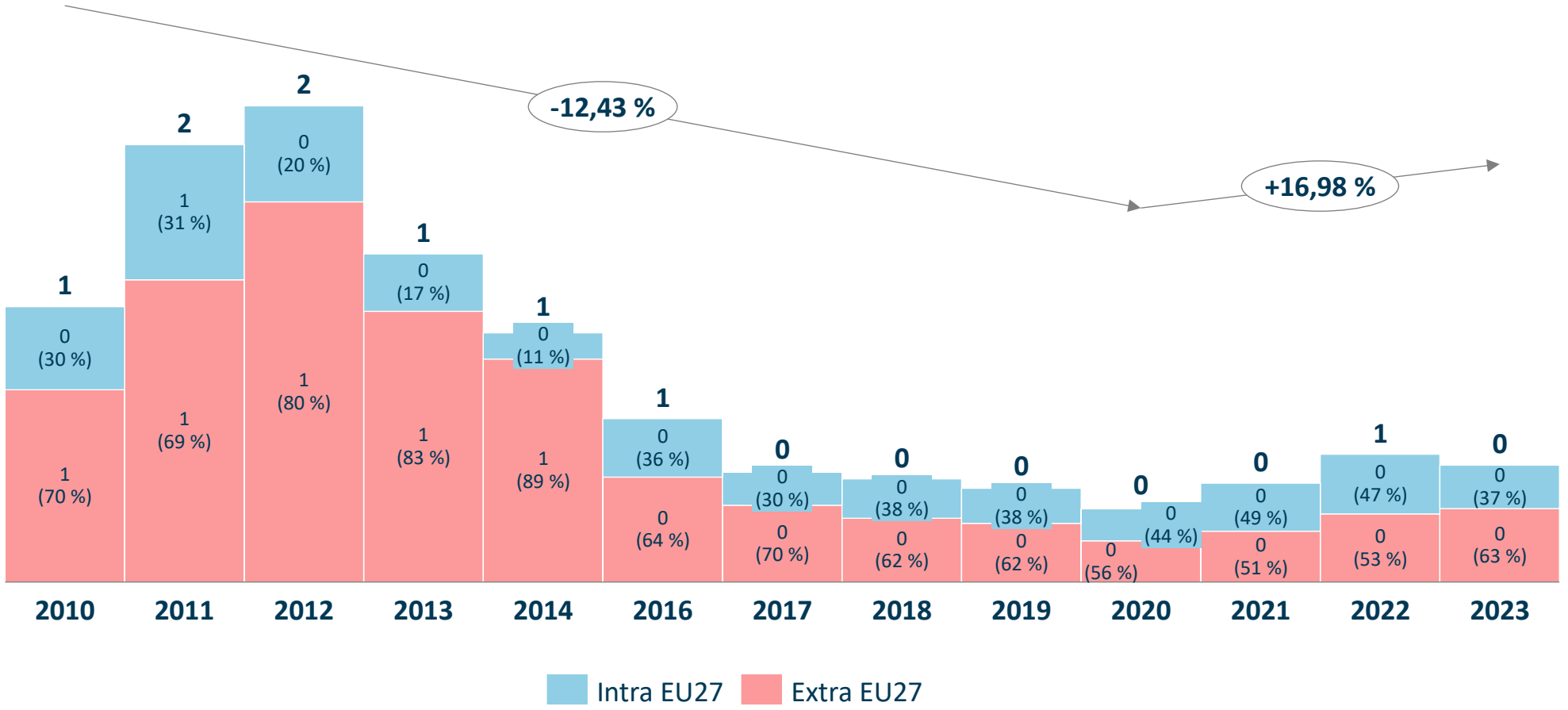


Source : EMISIA, Eurostat, Strat Anticipation analysis

Relative to its fleet size, Greece's exports are minimal, with less than 1,000 vehicles exported between 2017 and 2023

Heavy-Duty Vehicle Export Destination - Greece

GREECE EXPORTED HEAVY DUTY VEHICLES PER DESTINATION | In k units and %, 2010-2023, Greece

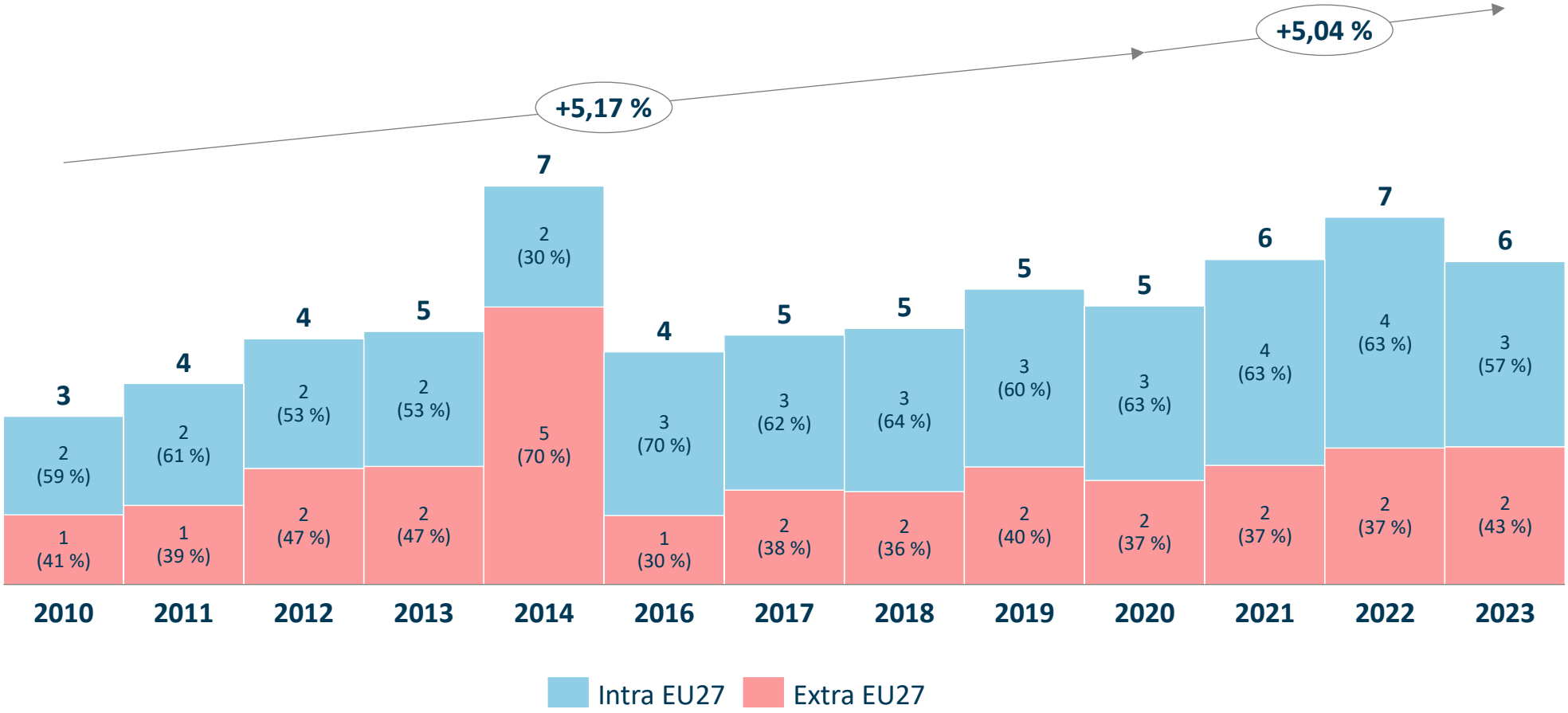


Source : EMISIA, Eurostat, Strat Anticipation analysis

Czechia exports heavily within the EU, with over 60% of shipments intra-EU, and overall exports are trending upward

Heavy-Duty Vehicle Export Destination - Czech Republic

CZECH REPUBLIC EXPORTED HEAVY DUTY VEHICLES PER DESTINATION | In k units and %, 2010-2023, Czech Republic

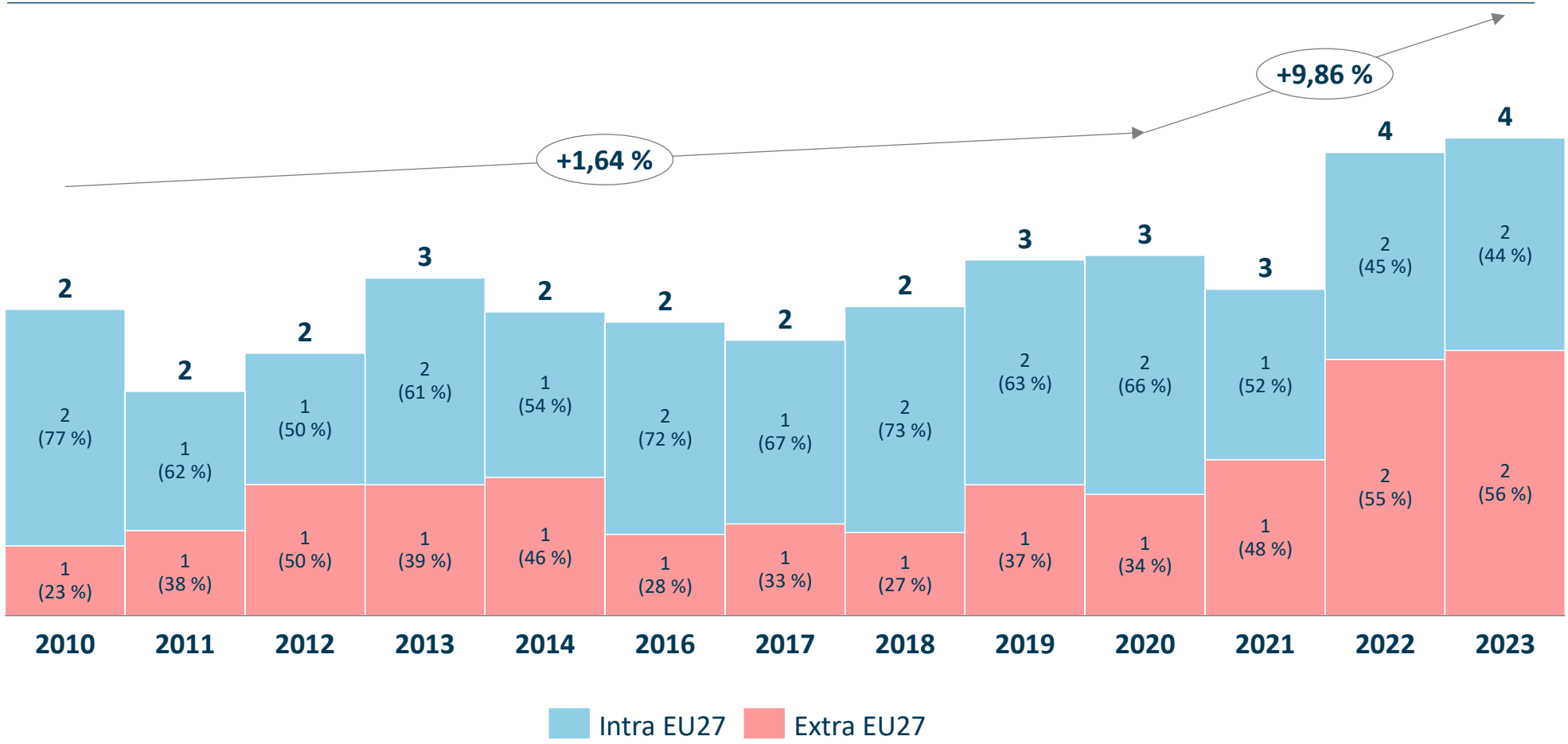


Source : EMISIA, Eurostat, Strat Anticipation analysis

Romania's exports are rising, reaching 4,000 units in 2023, with extra-EU shipments growing faster than intra-EU ones

Heavy-Duty Vehicle Export Destination - Romania

ROMANIA EXPORTED HEAVY DUTY VEHICLES PER DESTINATION | In k units and %, 2010-2023, Romania



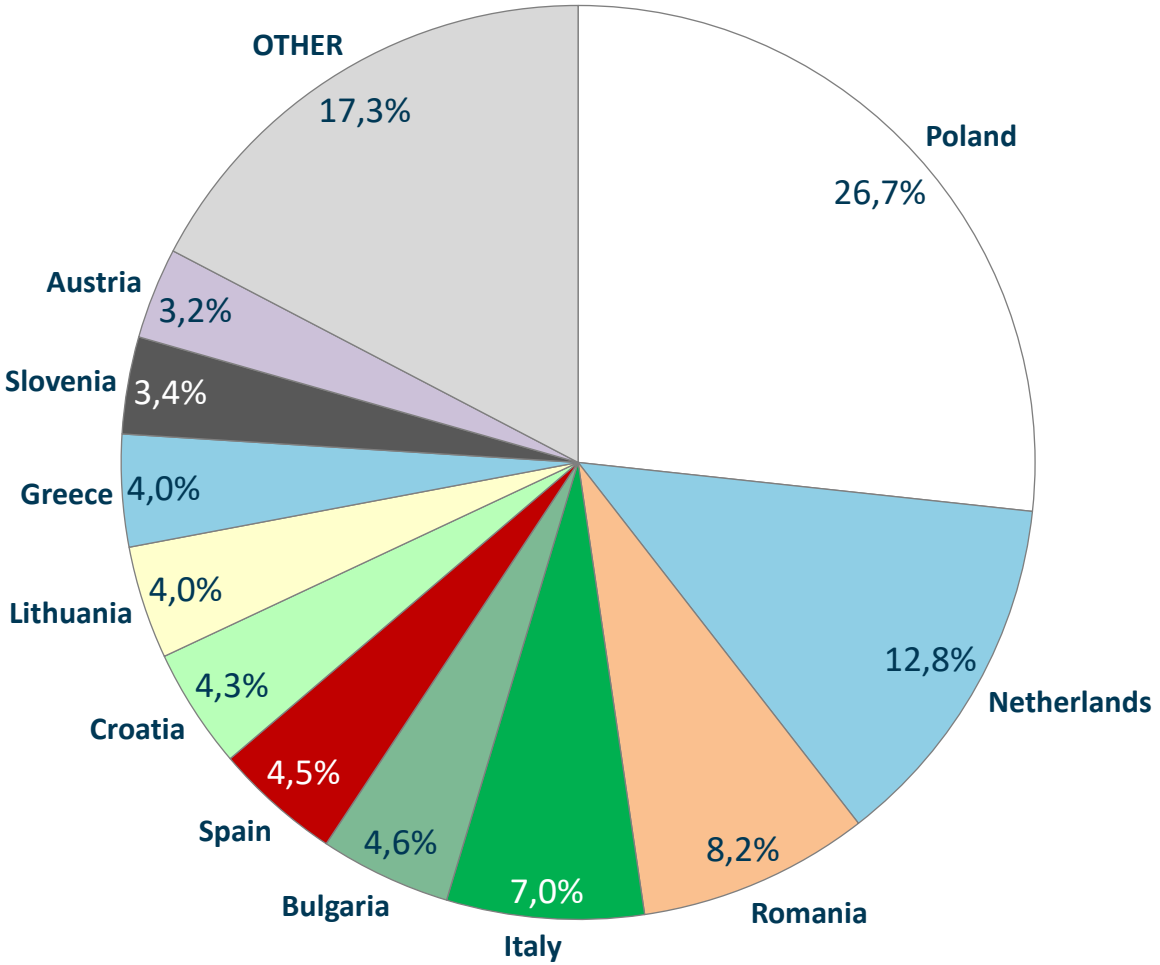
Source : EMISIA, Eurostat, Strat Anticipation analysis

Poland is the largest European importer of German truck exports with over 7k units imported in 2024, 32,3% of the total exports in 2024

GERMANY – Exports Intra EU

GERMANY TRUCK FLEET EXPORTS INTRA EU | In %, Germany, 2024

TOTAL : 26 482



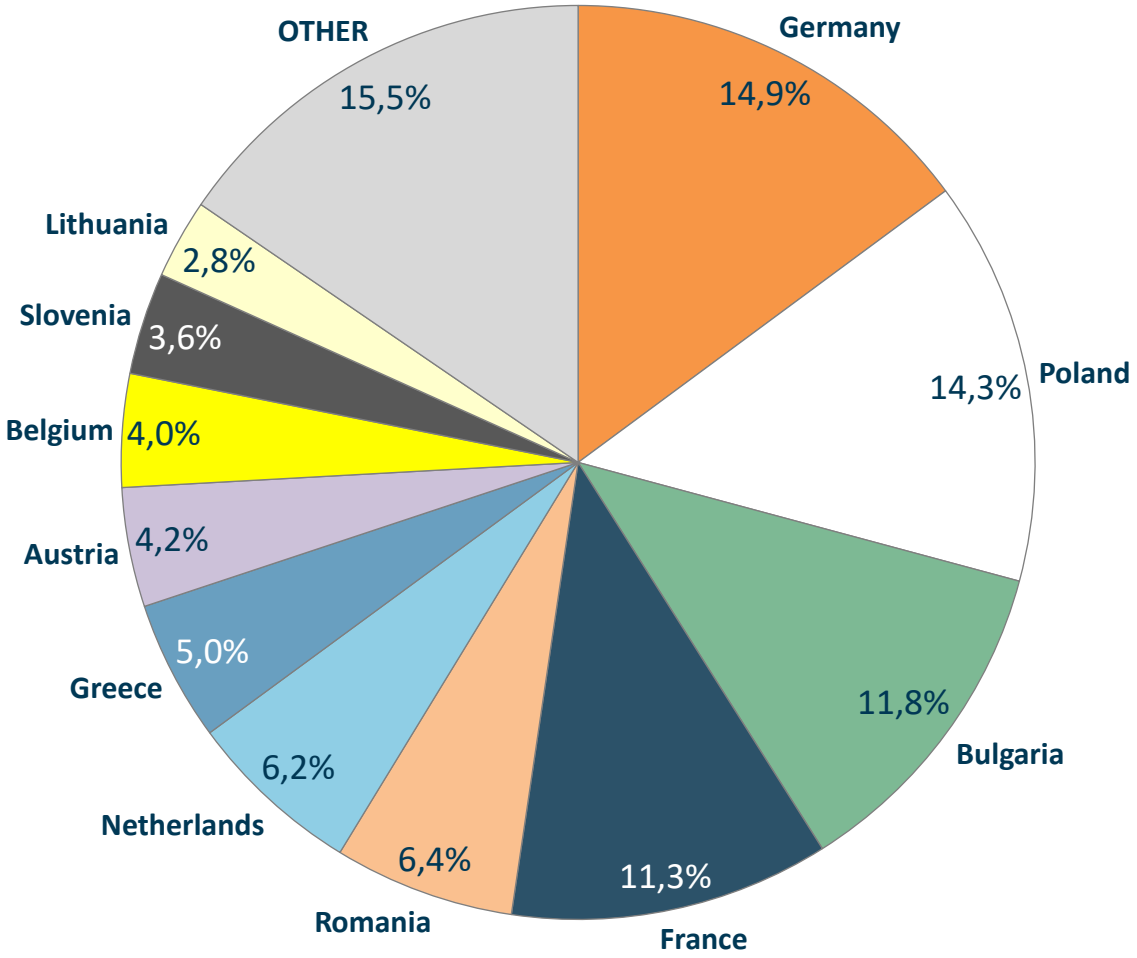
Source : Sybil model - EMISIA, Strat Anticipation research & analysis

Italy's old trucks main exports destinations in Europe are Poland and Germany with around 14% each in 2024

ITALY – Exports Intra EU

ITALY TRUCK FLEET EXPORTS INTRA EU | In %, Italy, 2024

TOTAL : 3 598



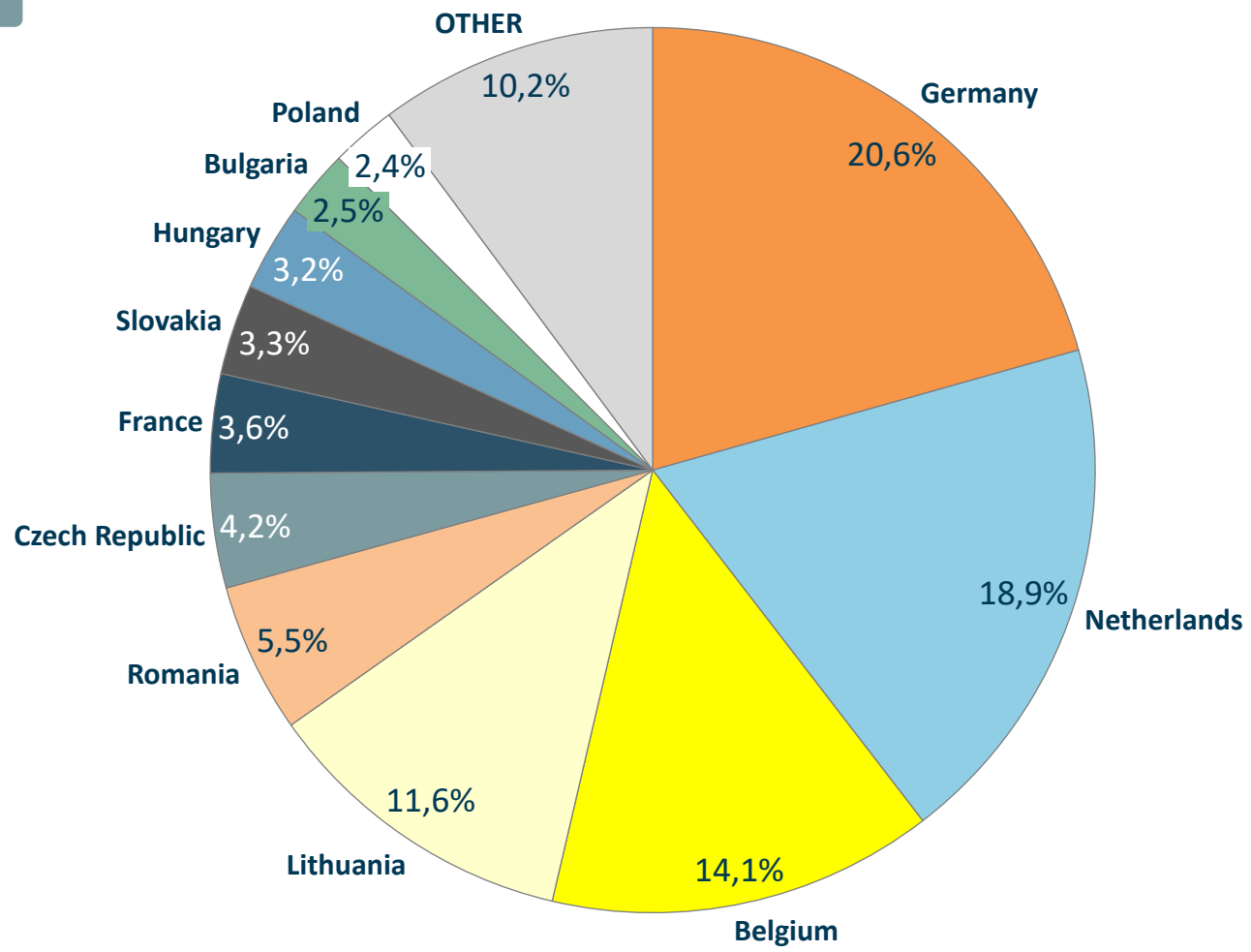
Source : Sybil model - EMISIA, Strat Anticipation research & analysis

Germany and the Netherlands are the largest European importers of Polish intra EU truck exports, importing each around 800 units in 2024

POLAND – Exports Intra EU

POLAND TRUCK FLEET EXPORTS INTRA EU | In %, Poland, 2024

TOTAL : 4 015



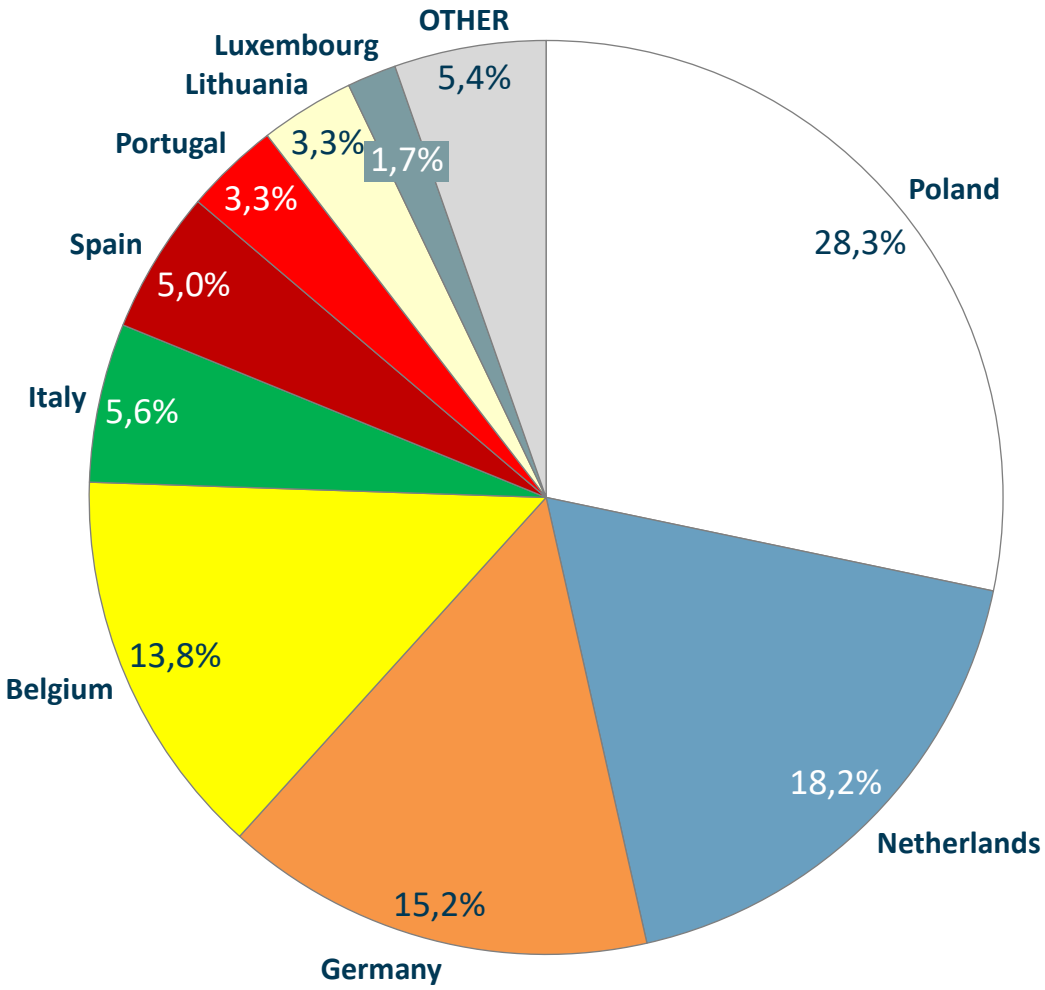
Source : Sybil model - EMISIA, Strat Anticipation research & analysis

Poland is the largest European importer of French's truck exports in Europe with more than 1/4 of them joining the Polish fleet in 2024

FRANCE – Exports Intra EU

FRANCE TRUCK FLEET EXPORTS INTRA EU | In %, France, 2024

TOTAL : 17 198



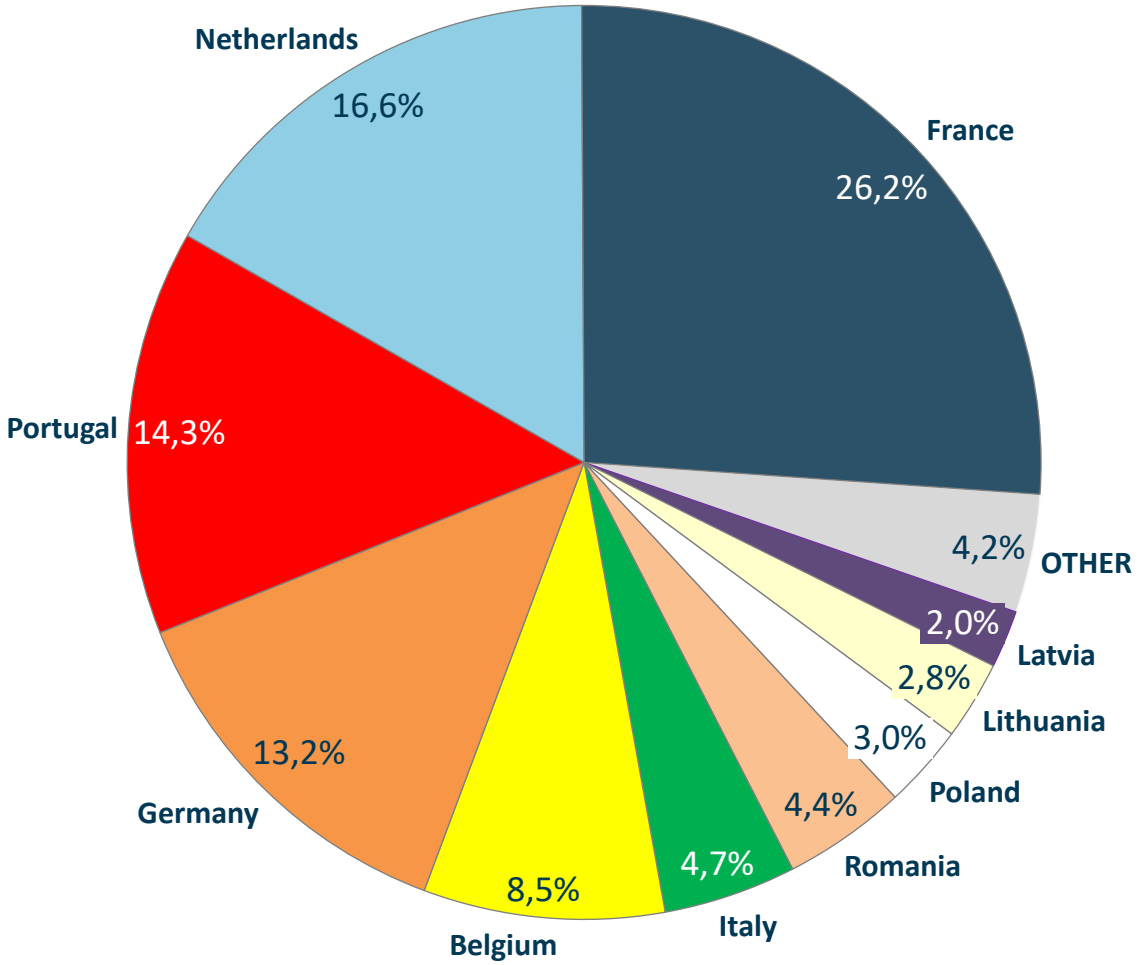
Source : Sybil model - EMISIA, Strat Anticipation research & analysis

More than 1/4 of Spain's European truck exports are intended for the French market

SPAIN – Exports Intra EU

SPAIN TRUCK FLEET EXPORTS INTRA EU | In %, Spain, 2024

TOTAL : 3 340



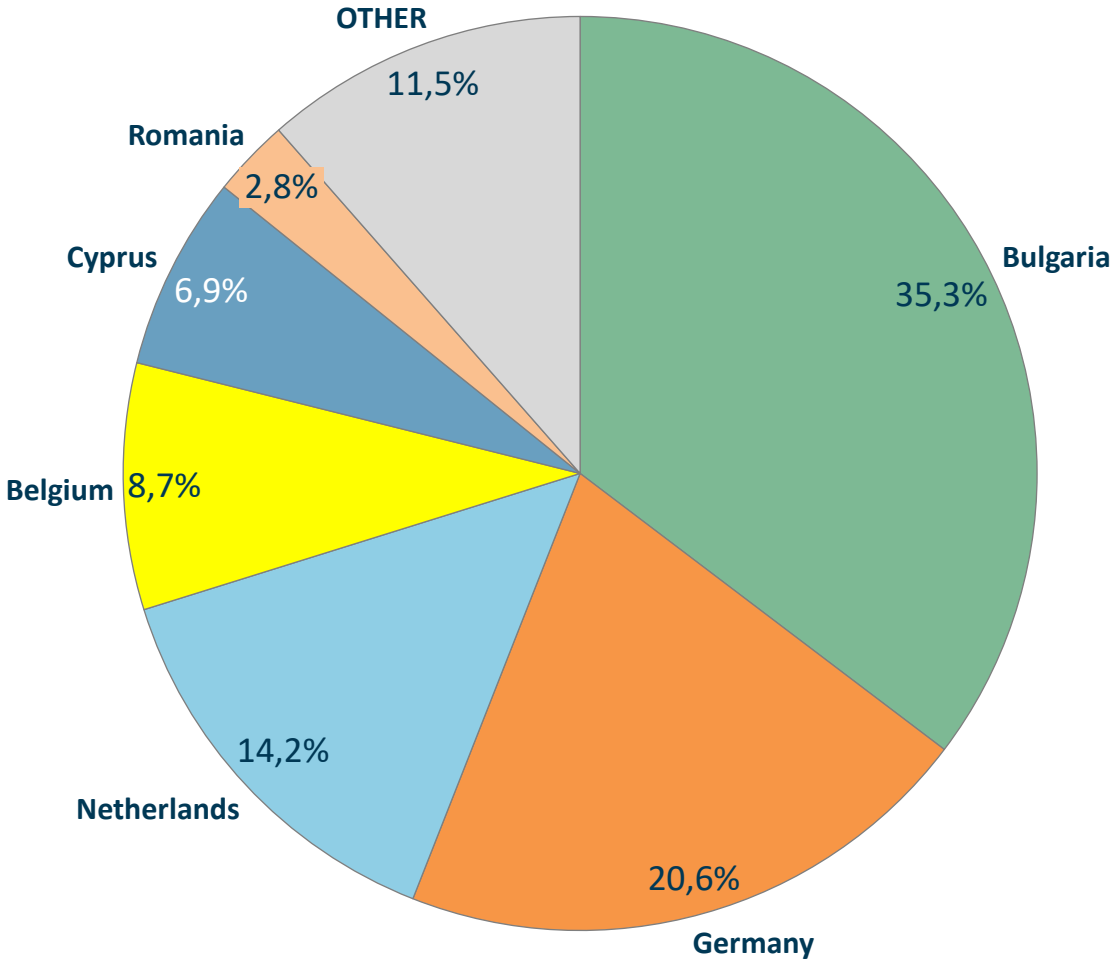
Source : Sybil model - EMISIA, Strat Anticipation research & analysis

With more than 1/3 of the Greek European exports, Bulgaria is the largest importer of Greek trucks in Europe

GREECE – Exports Intra EU

GREECE TRUCK FLEET EXPORTS INTRA EU | In %, Greece, 2024

TOTAL : 217



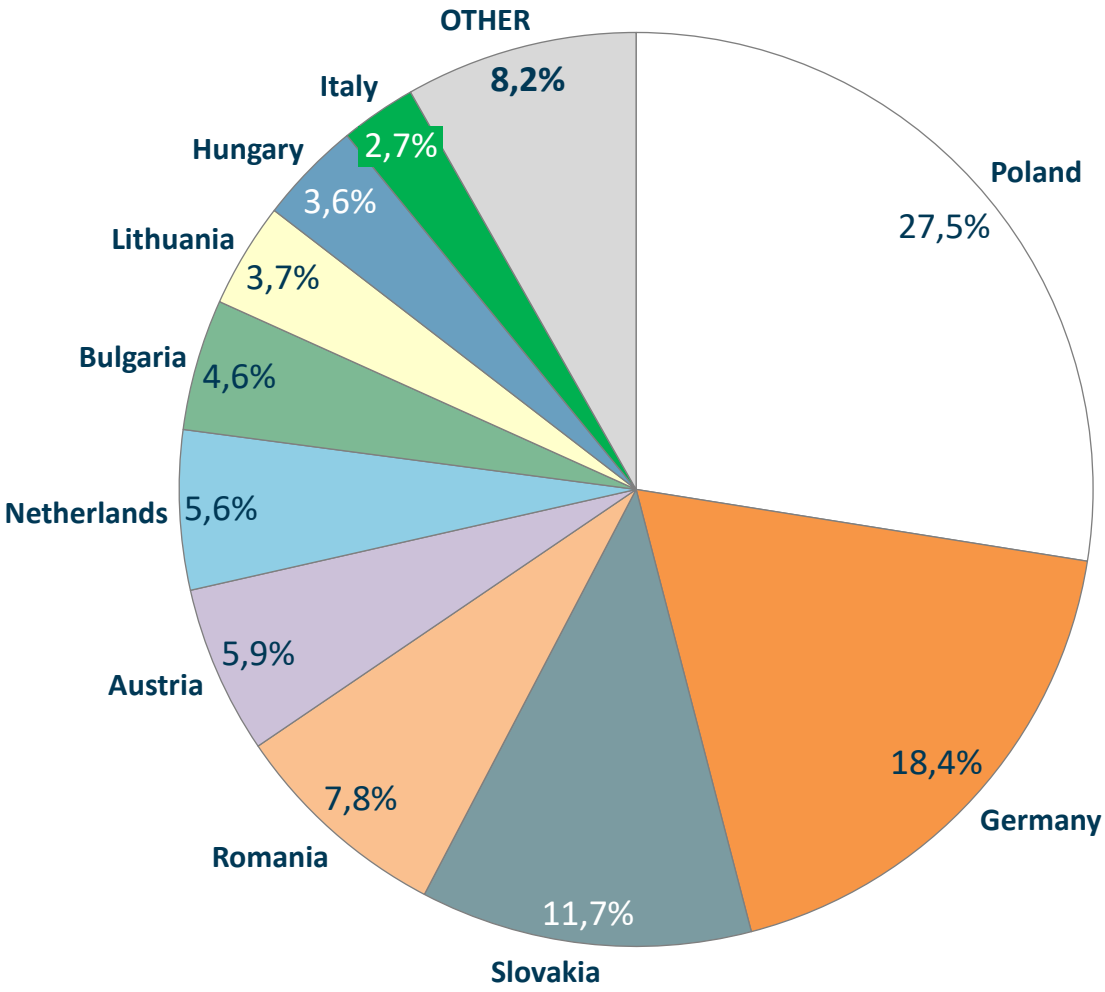
Source : Sybil model - EMISIA, Strat Anticipation research & analysis

With a combined 46%, Germany and Poland are the largest importers of Czech Trucks in Europe

CZECH REPUBLIC – Exports Intra EU

CZECH REPUBLIC TRUCK FLEET EXPORTS INTRA EU | In %, Czech Republic, 2024

TOTAL : 2 908



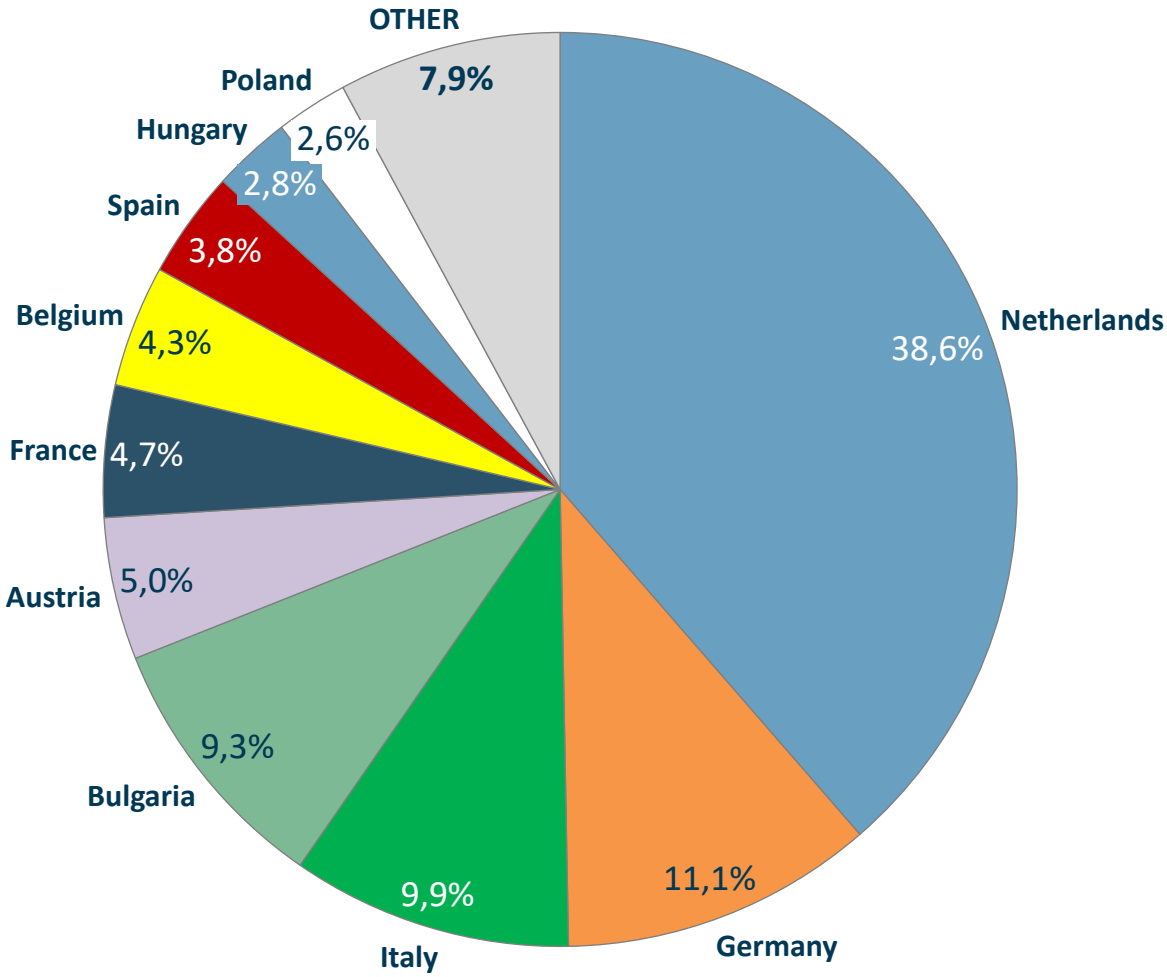
Source : Sybil model - EMISIA, Strat Anticipation research & analysis

The Netherlands is the main European destination for Romanian trucks exports in the EU with 38,6% of European exports in 2024

ROMANIA – Exports Intra EU

ROMANIA TRUCK FLEET EXPORTS INTRA EU | In %, Romania, 2024

TOTAL : 1 370



Source : Sybil model - EMISIA, Strat Anticipation research & analysis

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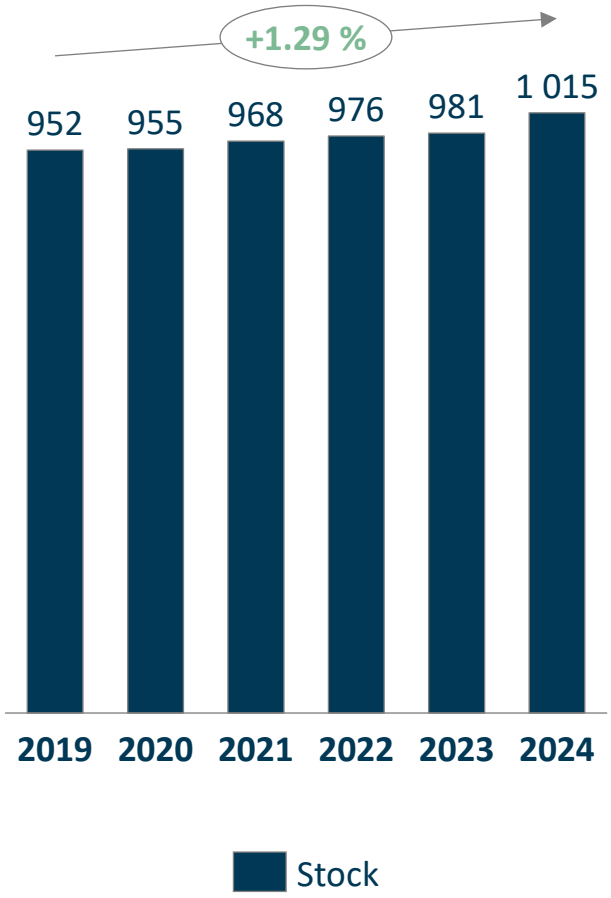
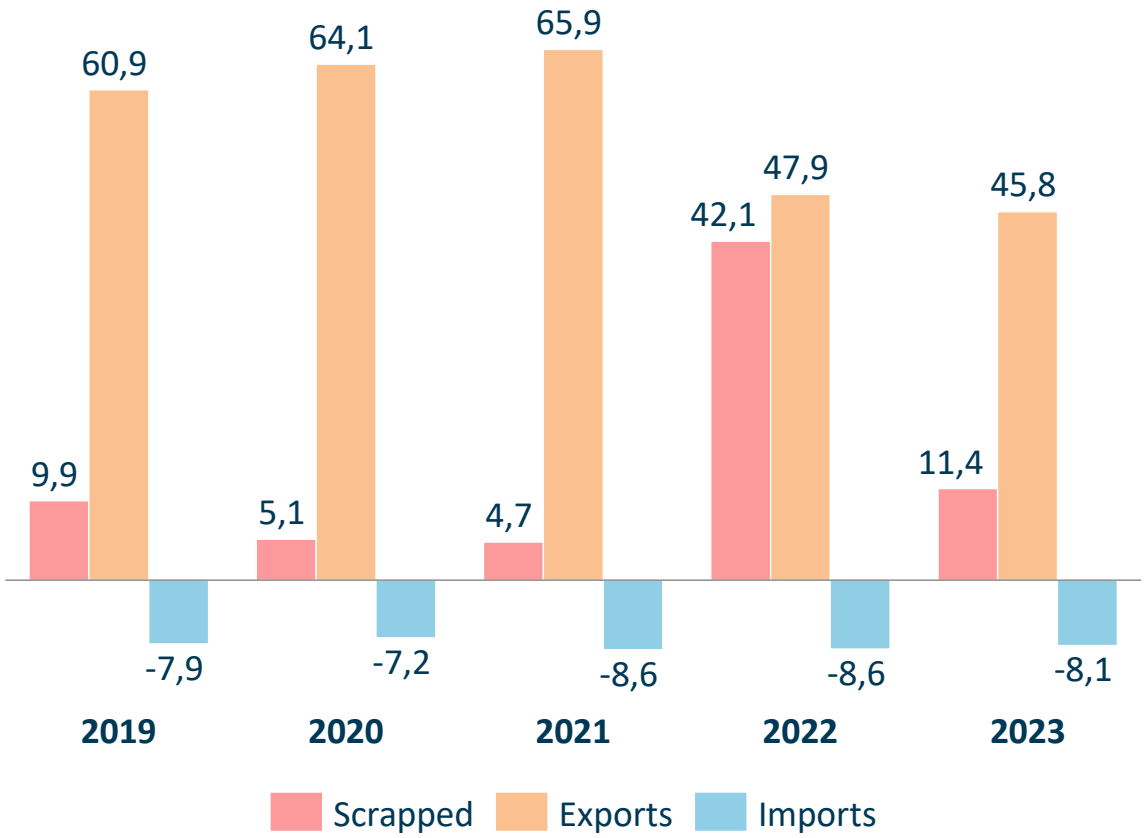
The German truck fleet has grown to 1 015k units in 2024, with annual exports ranging from 46k to 66k trucks and annual scrappage between 4,7k and 42,1k trucks

Truck fleet size & deregistration split in the last few years - Germany

GERMANY TRUCK FLEET |
In k units, 2019-2024, Germany



GERMANY SCRAPPED, EXPORTED AND IMPORTED TRUCKS |
In k units, 2019-2023, Germany



Note: Vehicles that are exported to be scrapped in other country are considered as exports and not scrapped within the country
- Stock, new registrations and average age are from statistics (Source: EMISIA database)
- Imports/Exports are from statistics correcting outliers (Source: Eurostat, national databases)
- Scrappage is calculated from the coupling of the above databases (through EMISIA interviews & experience)

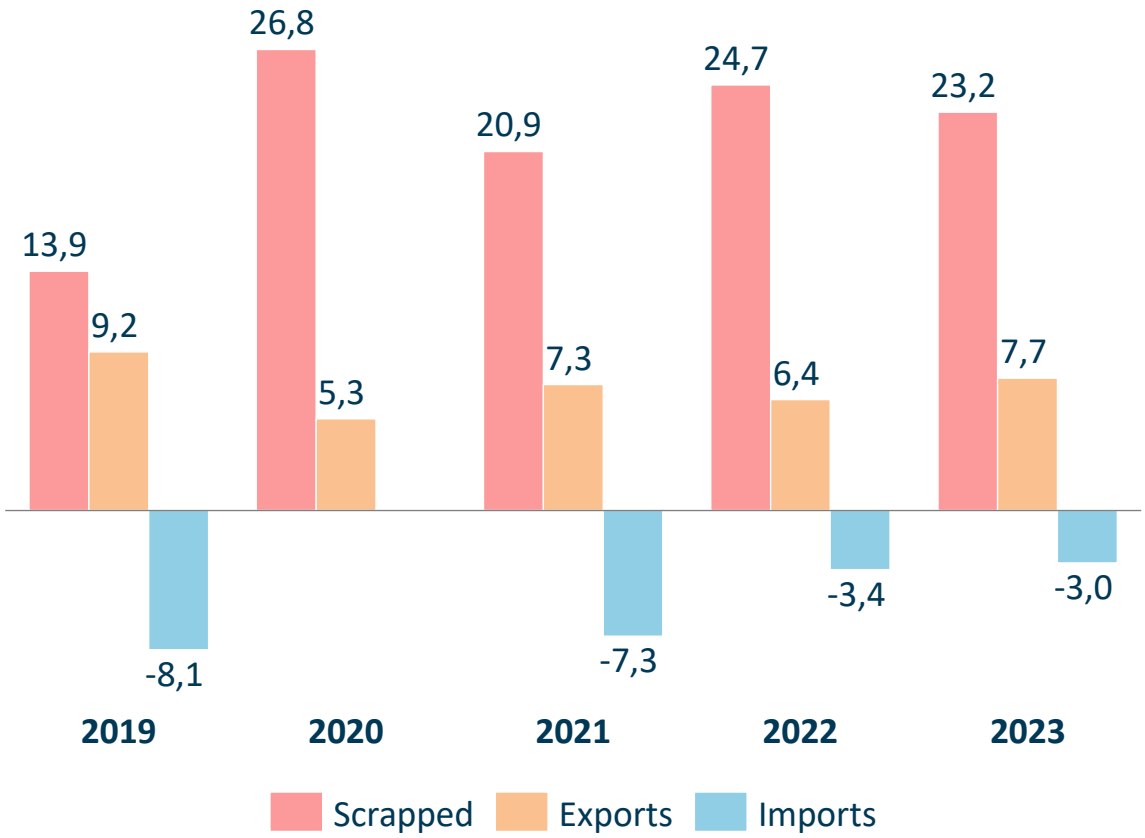
Source : Sybil model - EMISIA, Strat Anticipation research & analysis

The Italian truck fleet is stable around 950k units, with annual exports ranging from 5,3k to 9,2k trucks and annual scrappage between 13,9k and 26,8k trucks

Truck fleet size & deregistration split in the last few years - Italy

ITALY TRUCK FLEET |
In k units, 2019-2024, Italy

ITALY SCRAPPED, EXPORTED AND IMPORTED TRUCKS |
In k units, 2019-2023, Italy

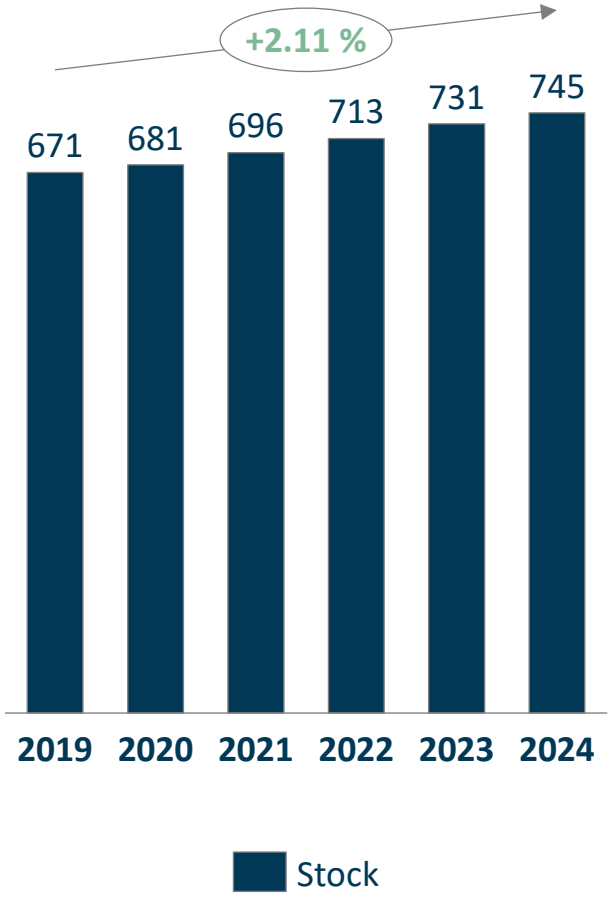


Note: Vehicles that are exported to be scrapped in other country are considered as exports and not scrapped within the country
- Stock, new registrations and average age are from statistics (Source: EMISIA database)
- Imports/Exports are from statistics correcting outliers (Source: Eurostat, national databases)
- Scrappage is calculated from the coupling of the above databases (through EMISIA interviews & experience)
Source : Sybil model - EMISIA, Strat Anticipation research & analysis

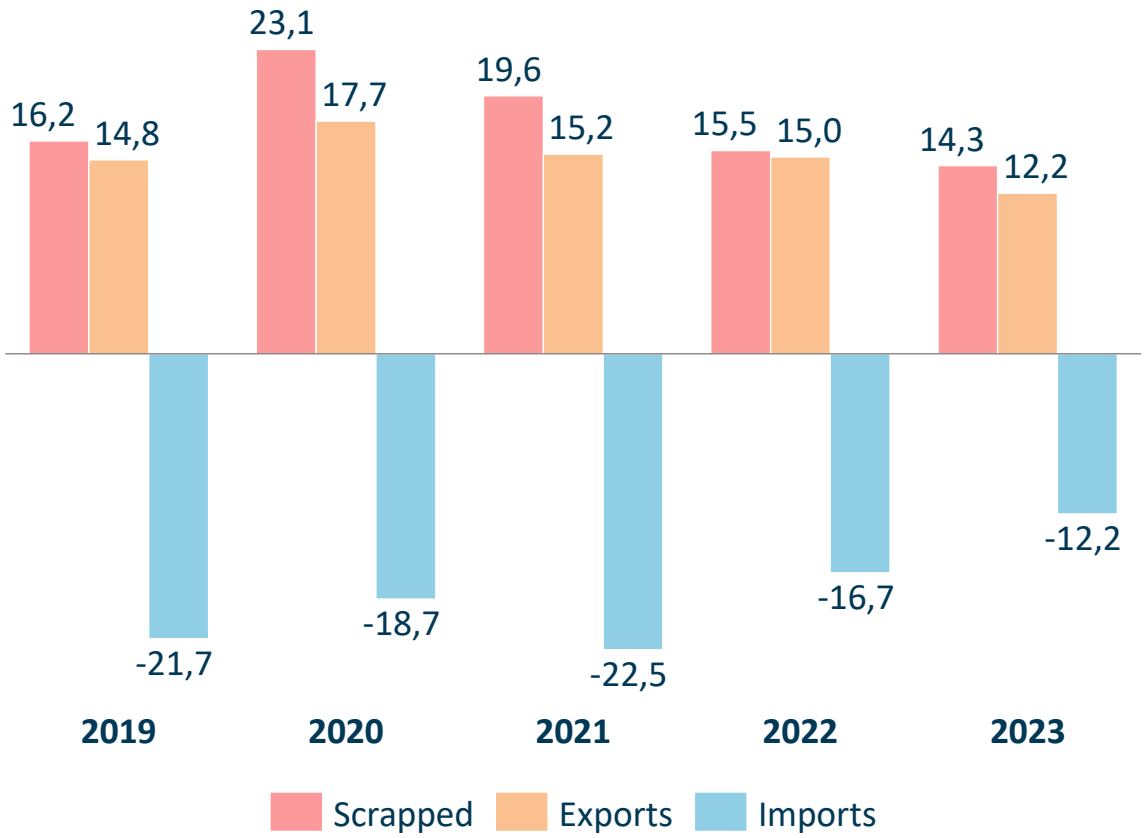
The Polish truck fleet has grown to 745k units in 2024, with annual exports ranging from 12,2k to 17,7k trucks and annual scrappage between 14,3k and 23,1k trucks

Truck fleet size & deregistration split in the last few years - Poland

POLAND TRUCK FLEET |
In k units, 2019-2024, Poland



POLAND SCRAPPED, EXPORTED AND IMPORTED TRUCKS |
In k units, 2019-2023, Poland

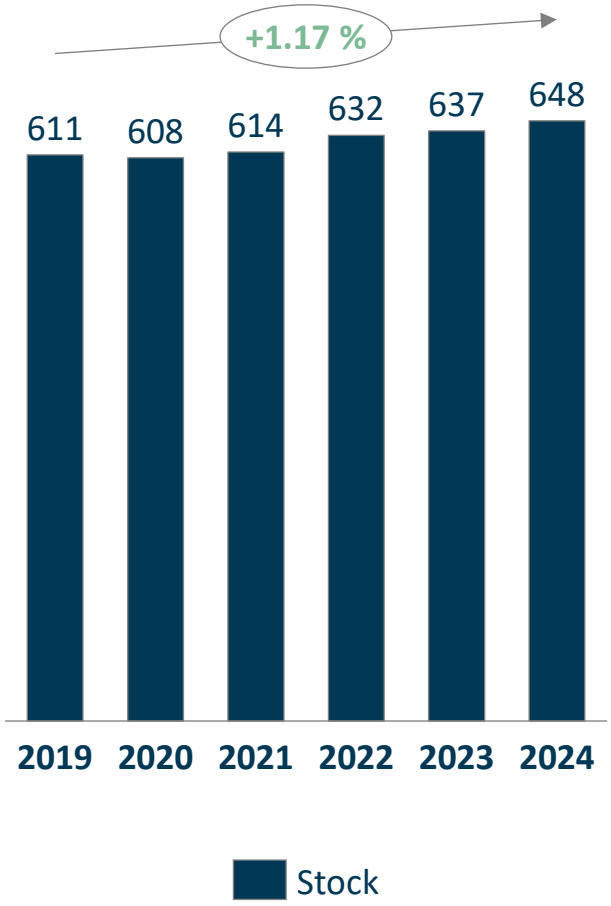


Note: Vehicles that are exported to be scrapped in other country are considered as exports and not scrapped within the country
- Stock, new registrations and average age are from statistics (Source: EMISIA database)
- Imports/Exports are from statistics correcting outliers (Source: Eurostat, national databases)
- Scrappage is calculated from the coupling of the above databases (through EMISIA interviews & experience)
Source : Sybil model - EMISIA, Strat Anticipation research & analysis

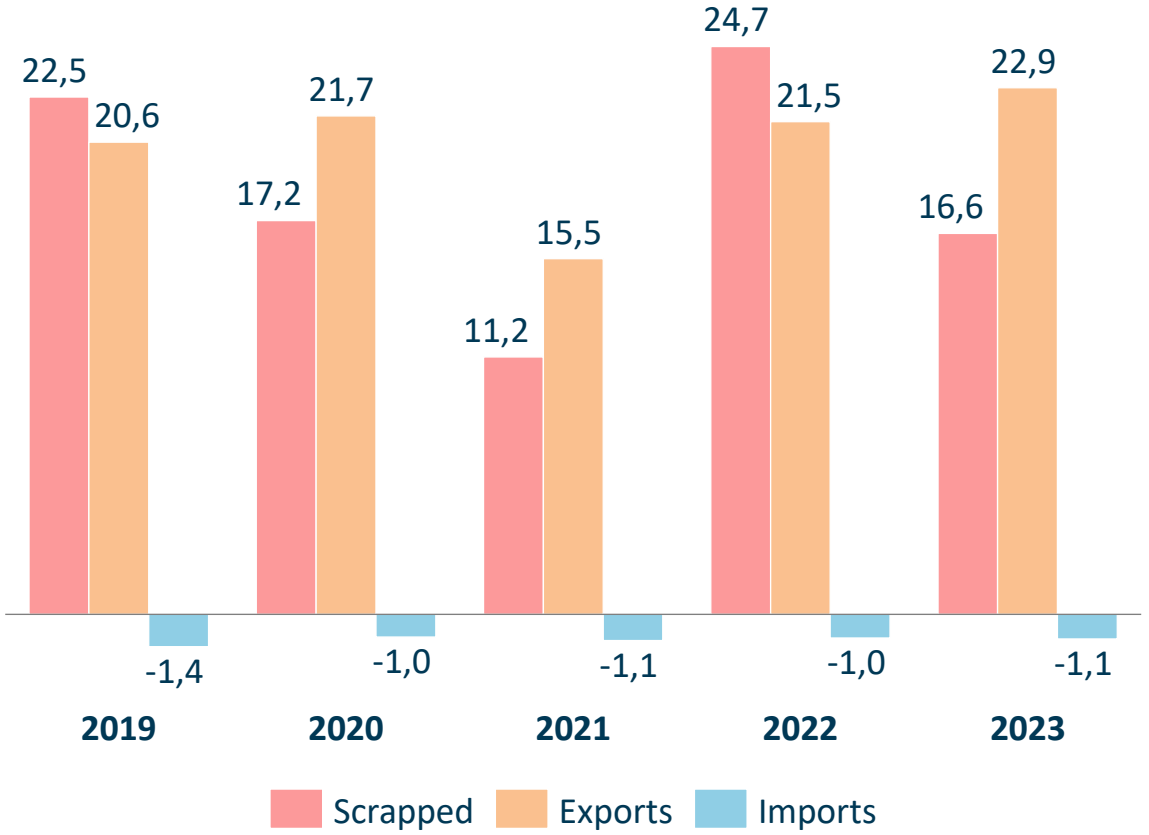
The French truck fleet has grown to 648k units in 2024, with annual exports ranging from 15,5k to 22,9k trucks and annual scrappage between 11,2k and 24,7k trucks

Truck fleet size & deregistration split in the last few years - France

FRANCE TRUCK FLEET |
In k units, 2019-2024, France



FRANCE SCRAPPED, EXPORTED AND IMPORTED TRUCKS |
In k units, 2019-2023, France



Note: Vehicles that are exported to be scrapped in other country are considered as exports and not scrapped within the country
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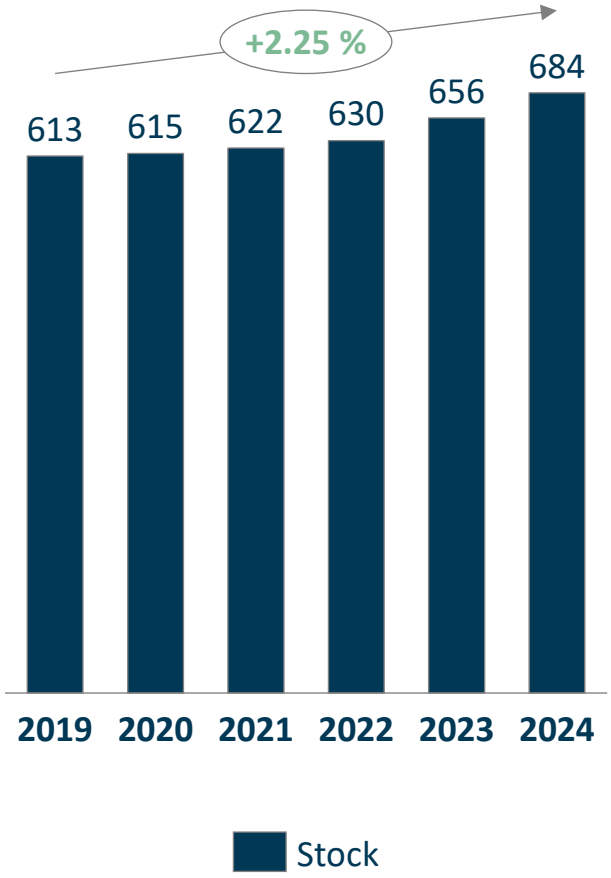
- Scrappage is calculated from the coupling of the above databases (through EMISIA interviews & experience)
Source : Sybil model - EMISIA, Strat Anticipation research & analysis

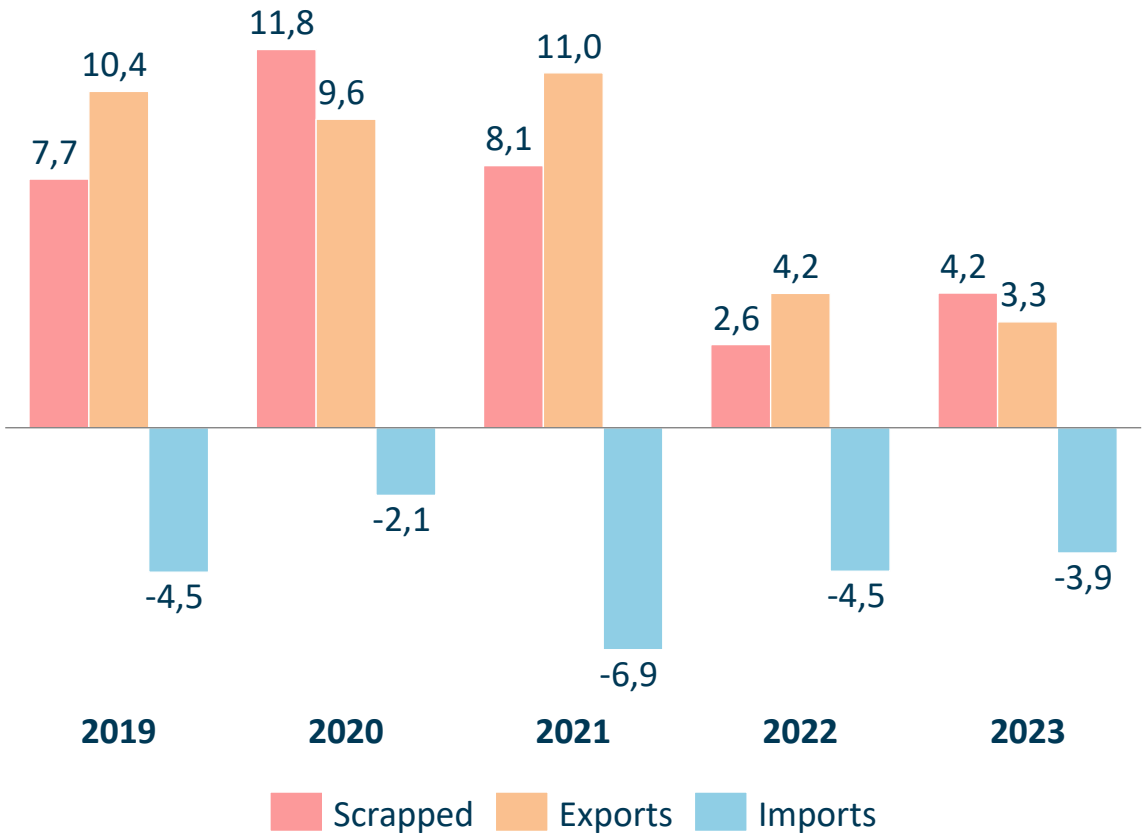
The Spanish truck fleet has grown to 684k units in 2024, with annual exports ranging from 3,3k to 11k trucks and annual scrappage between 2,6k and 11,8k trucks

Truck fleet size & deregistration split in the last few years - Spain

SPAIN TRUCK FLEET |
In k units, 2019-2024, Spain



SPAIN SCRAPPED, EXPORTED AND IMPORTED TRUCKS |
In k units, 2019-2023, Spain



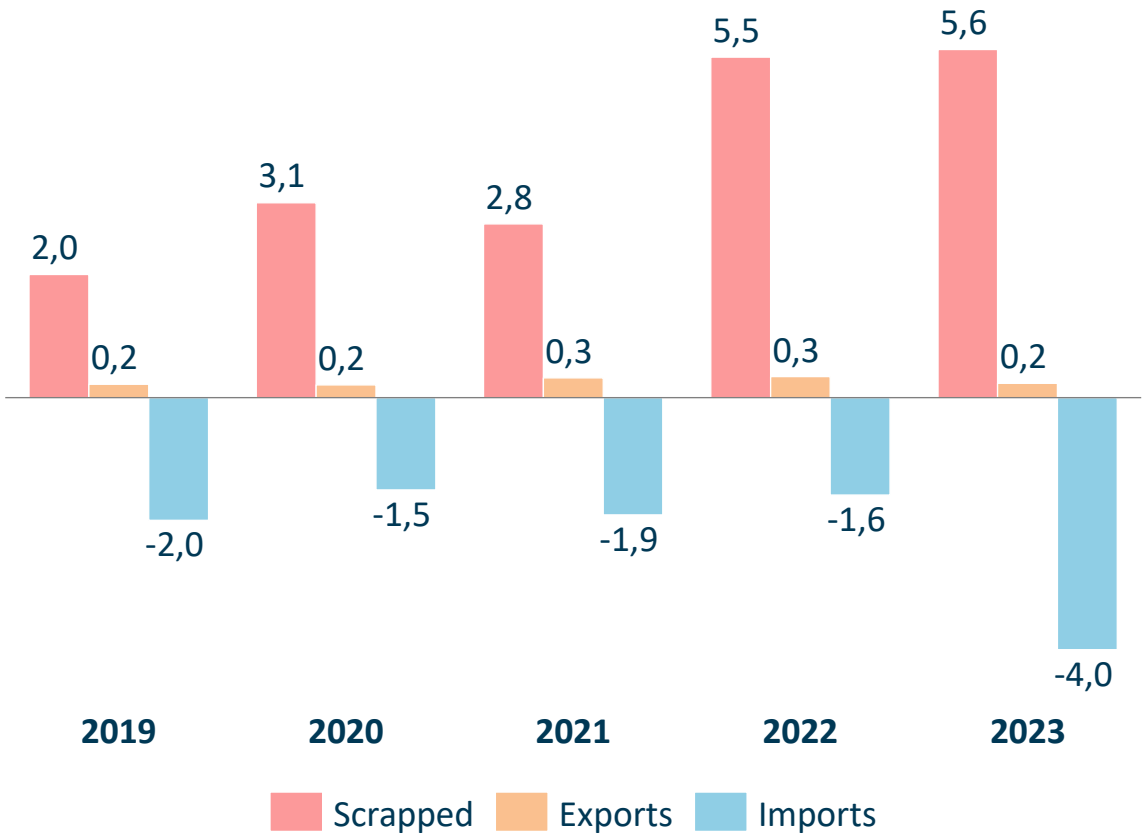
Note: Vehicles that are exported to be scrapped in other country are considered as exports and not scrapped within the country
- Stock, new registrations and average age are from statistics (Source: EMISIA database)
- Imports/Exports are from statistics correcting outliers (Source: Eurostat, national databases)
- Scrappage is calculated from the coupling of the above databases (through EMISIA interviews & experience)
Source : Sybil model - EMISIA, Strat Anticipation research & analysis

The Greek truck fleet is stable at 220k units, with annual exports ranging from 0,2k to 0,3k trucks and annual scrappage between 2,0k and 5,6k trucks

Truck fleet size & deregistration split in the last few years - Greece

GREECE TRUCK FLEET |
In k units, 2019-2024, Greece

GREECE SCRAPPED, EXPORTED & IMPORTED TRUCKS |
In k units, 2019-2023, Greece

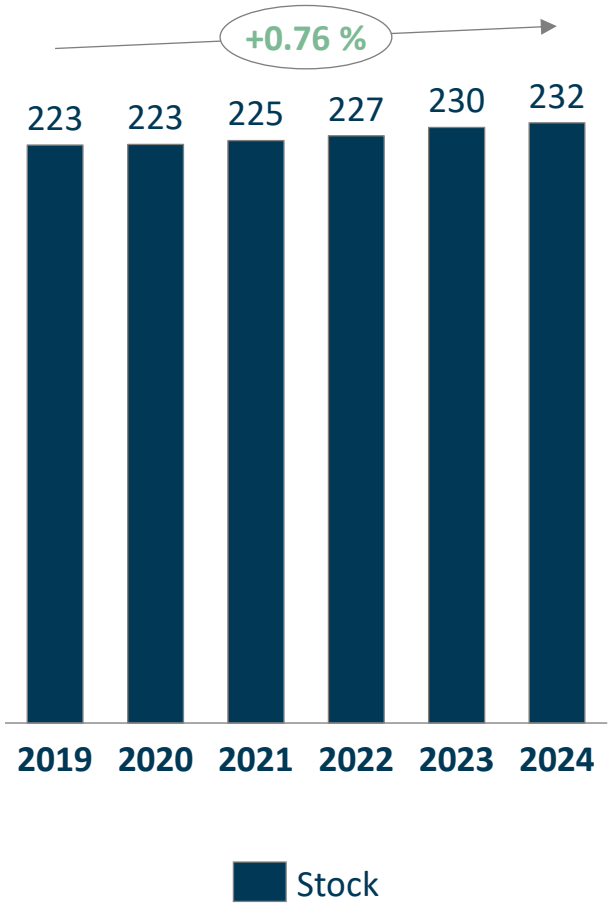


Note: Vehicles that are exported to be scrapped in other country are considered as exports and not scrapped within the country
- Stock, new registrations and average age are from statistics (Source: EMISIA database)
- Imports/Exports are from statistics correcting outliers (Source: Eurostat, national databases)
- Scrappage is calculated from the coupling of the above databases (through EMISIA interviews & experience)
Source : Sybil model - EMISIA, Strat Anticipation research & analysis

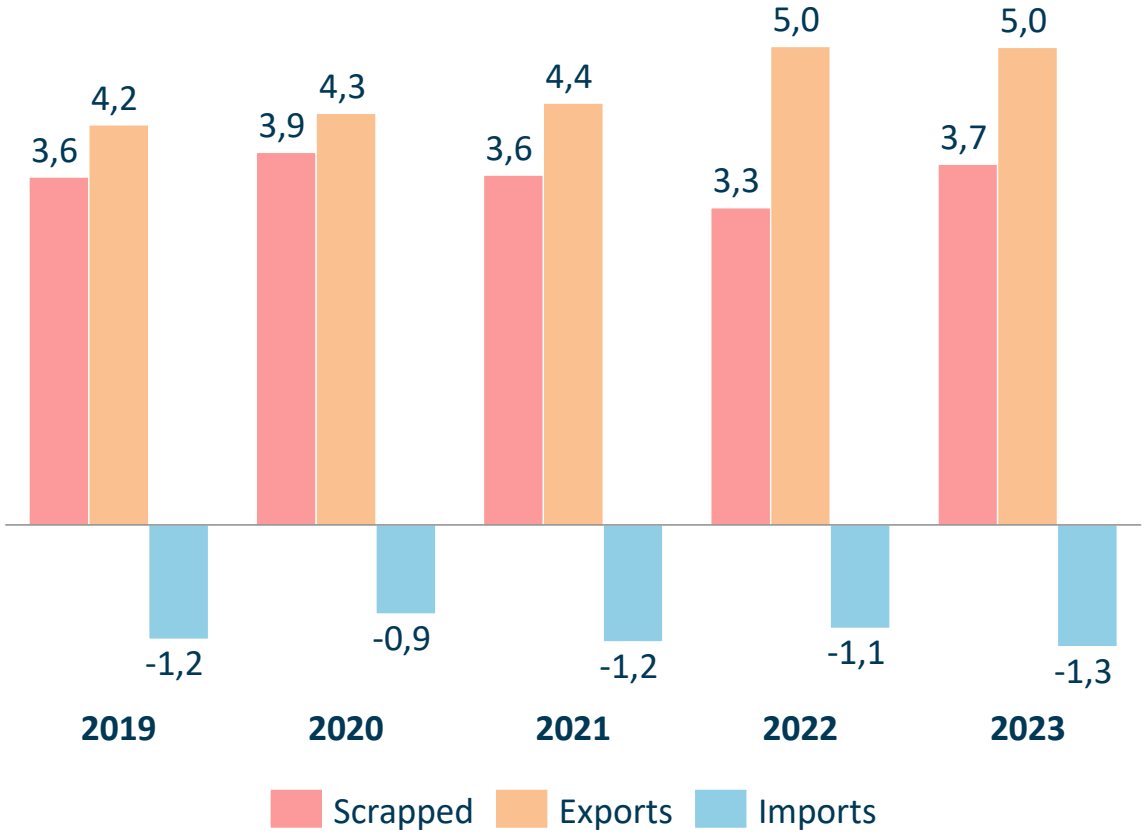
The Czech truck fleet has grown to 232k units in 2024, with annual exports ranging from 4,2k to 5,0k trucks and annual scrappage between 3,3k and 3,9k trucks

Truck fleet size & deregistration split in the last few years - Czech Republic

CZECH REPUBLIC TRUCK FLEET |
In k units, 2019-2024, Czech Republic



CZECH REPUBLIC SCRAPPED, EXPORTED AND IMPORTED TRUCKS |
In k units, 2019-2023, Czech Republic

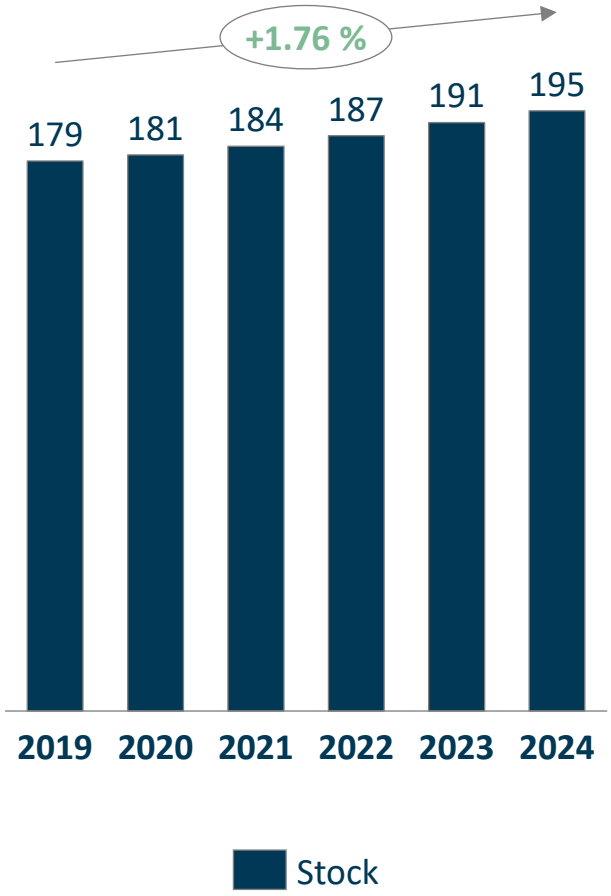


Note: Vehicles that are exported to be scrapped in other country are considered as exports and not scrapped within the country
- Stock, new registrations and average age are from statistics (Source: EMISIA database)
- Imports/Exports are from statistics correcting outliers (Source: Eurostat, national databases)
- Scrappage is calculated from the coupling of the above databases (through EMISIA interviews & experience)
Source : Sybil model - EMISIA, Strat Anticipation research & analysis

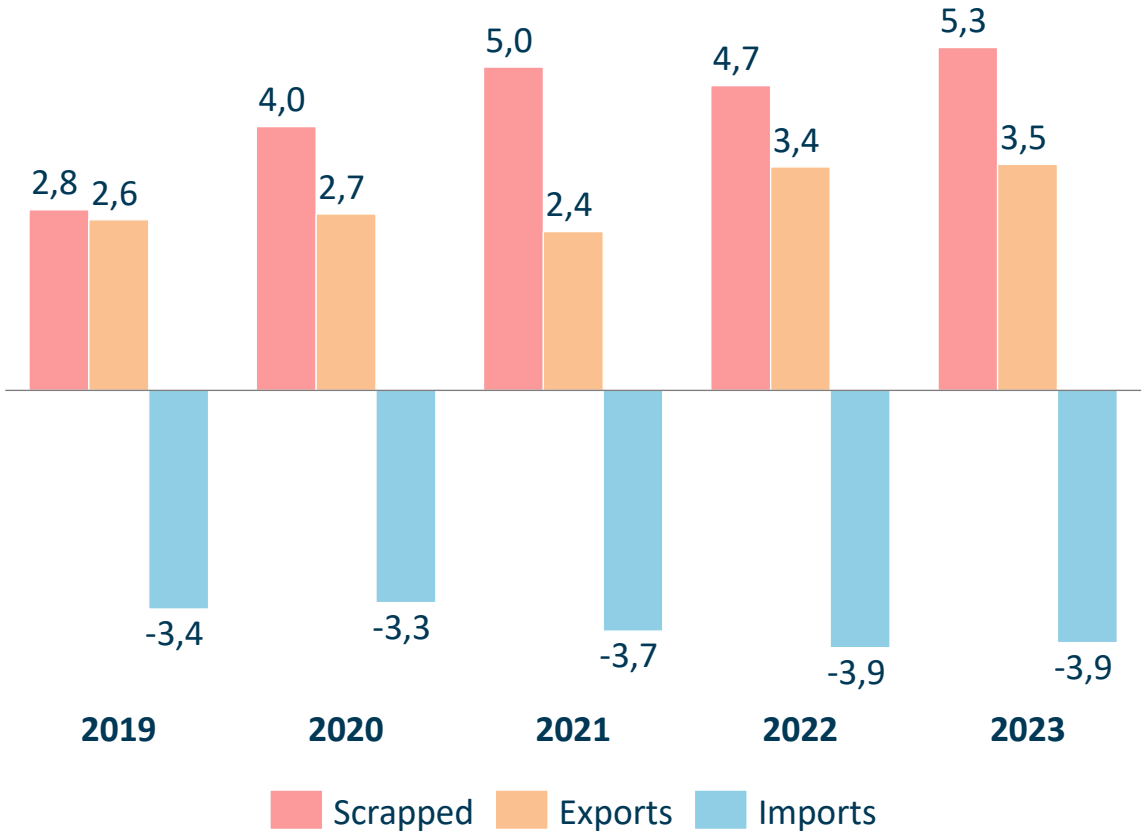
The Romanian truck fleet has grown to 195k units in 2024, with annual exports ranging from 2,4k to 3,5k trucks and annual scrappage between 2,8k and 5,3k trucks

Truck fleet size & deregistration split in the last few years - Romania

ROMANIA TRUCK FLEET |
In k units, 2019-2024, Romania



ROMANIA SCRAPPED, EXPORTED AND IMPORTED TRUCKS |
In k units, 2019-2023, Romania



Note: Vehicles that are exported to be scrapped in other country are considered as exports and not scrapped within the country
- Stock, new registrations and average age are from statistics (Source: EMISIA database)
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- Scrappage is calculated from the coupling of the above databases (through EMISIA interviews & experience)

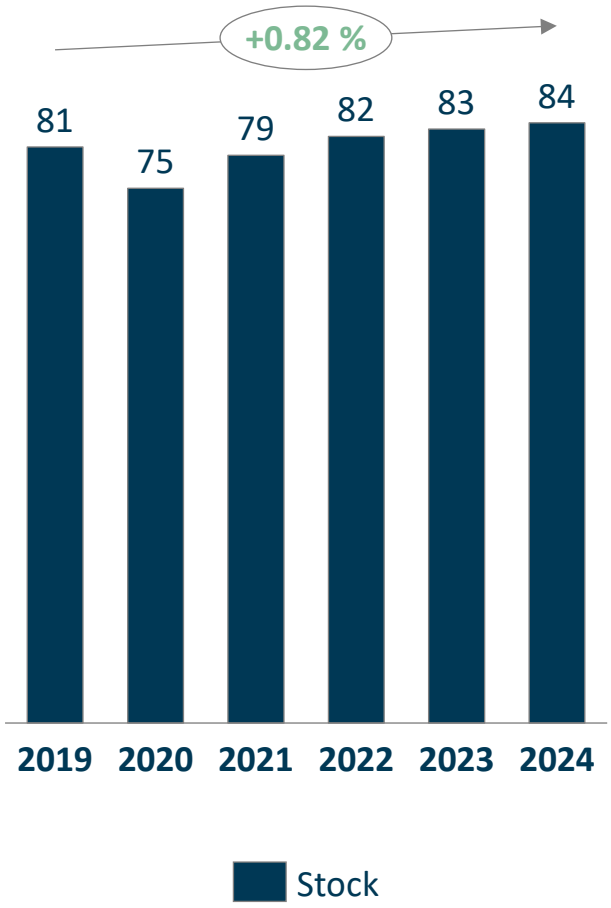
Source : Sybil model - EMISIA, Strat Anticipation research & analysis

CONTENTS

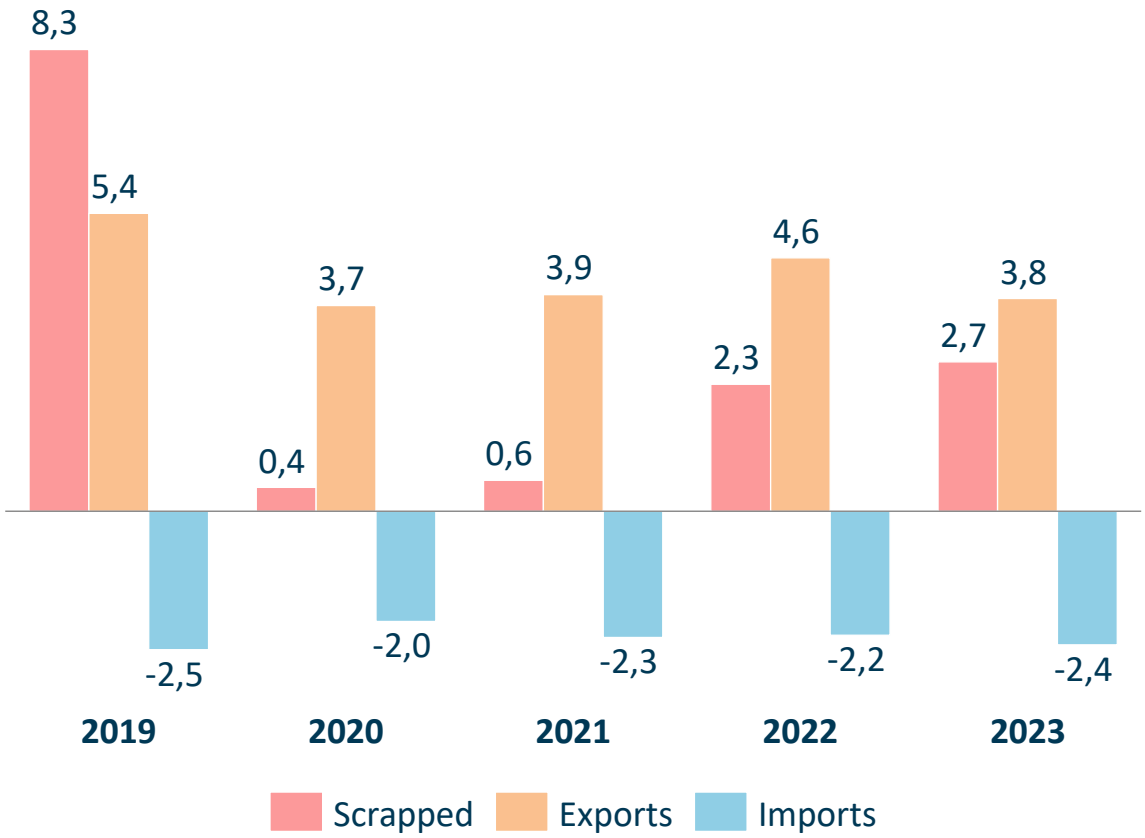
The German bus fleet has grown to 84k units in 2024, with annual exports ranging from 3,7k to 5,4k buses and total scrappage between 0,4k and 8,3k buses per year

Bus fleet size & deregistration split in the last few years - Germany

GERMANY BUS FLEET |
In k units, 2019-2024, Germany



GERMANY SCRAPPED, EXPORTED AND IMPORTED BUSES |
In k units, 2019-2023, Germany



Note: Vehicles that are exported to be scrapped in other country are considered as exports and not scrapped within the country
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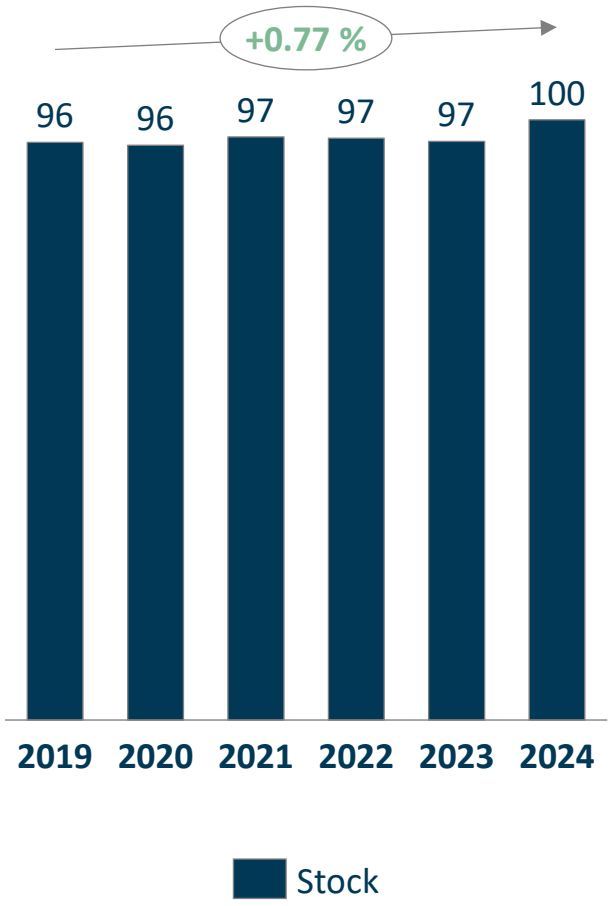
Source : Sybil model - EMISIA, Strat Anticipation research & analysis

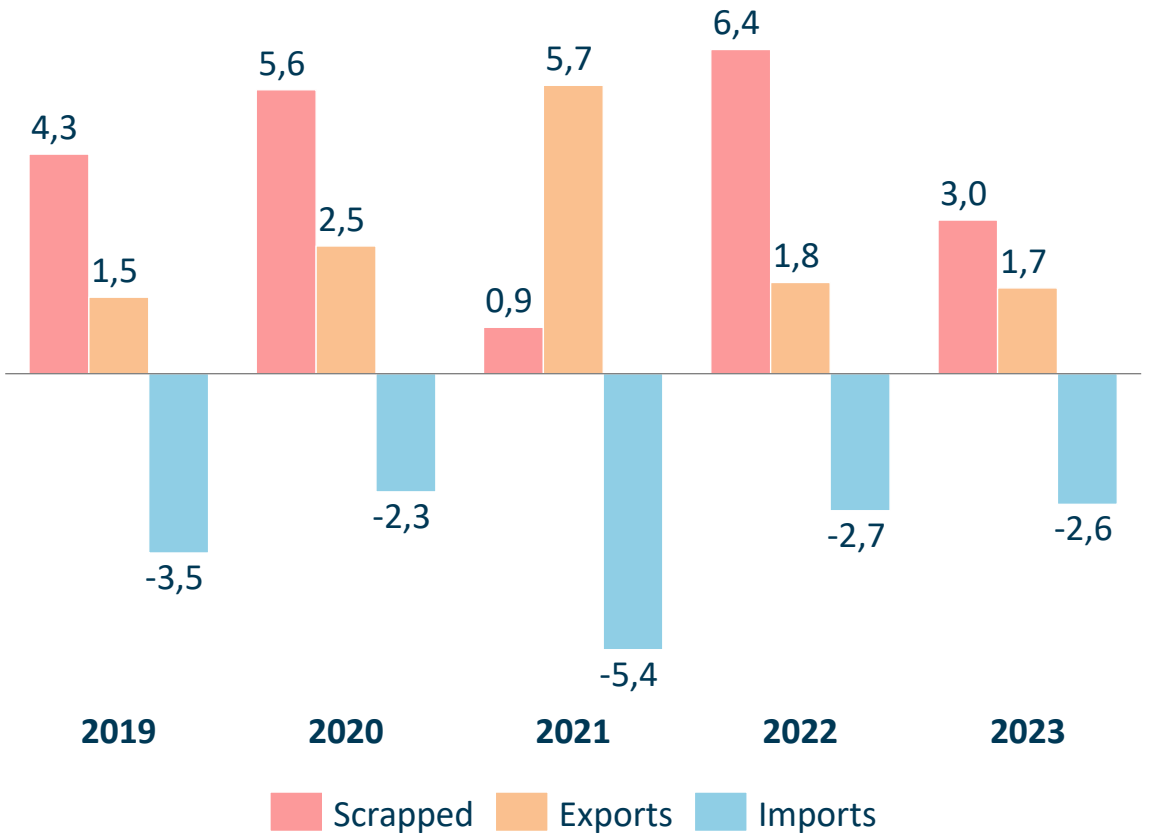
The Italian bus fleet has grown to 100k units in 2024, with annual exports ranging from 1,5k to 5,7k buses and total scrappage between 0,9k and 6,4k buses per year

Bus fleet size & deregistration split in the last few years - Italy

ITALY BUS FLEET |
In k units, 2019-2024, Italy



ITALY SCRAPPED, EXPORTED AND IMPORTED BUSES |
In k units, 2019-2023, Italy



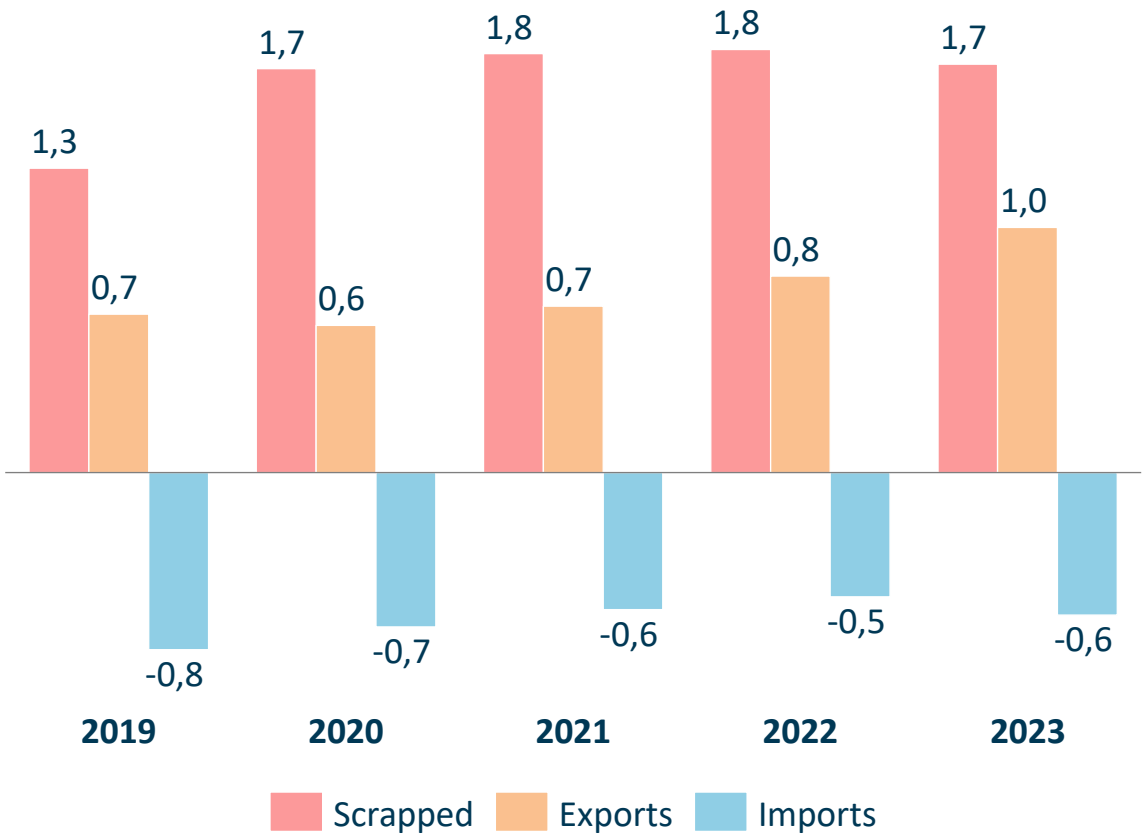
Note: Vehicles that are exported to be scrapped in other country are considered as exports and not scrapped within the country
- Stock, new registrations and average age are from statistics (Source: EMISIA database)
- Imports/Exports are from statistics correcting outliers (Source: Eurostat, national databases)
- Scrappage is calculated from the coupling of the above databases (through EMISIA interviews & experience)
Source : Sybil model - EMISIA, Strat Anticipation research & analysis

The Polish bus fleet is stable around 117k units, with annual exports ranging from 0,6k to 1k buses and total scrappage between 1,3k and 1,8k buses per year

Bus fleet size & deregistration split in the last few years - Poland

POLAND BUS FLEET |
In k units, 2019-2024, Poland

POLAND SCRAPPED, EXPORTED AND IMPORTED BUSES |
In k units, 2019-2023, Poland



Note: Vehicles that are exported to be scrapped in other country are considered as exports and not scrapped within the country
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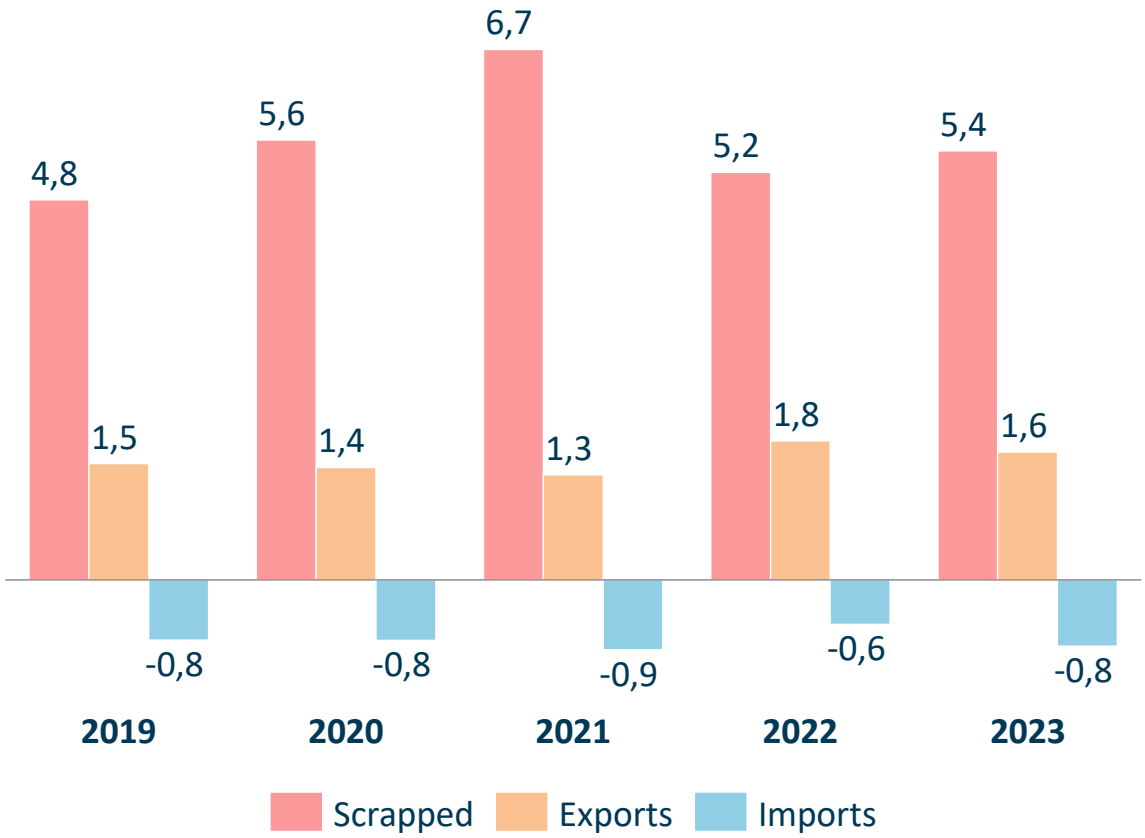
Source : Sybil model - EMISIA, Strat Anticipation research & analysis

The French bus fleet is stable around 91k units, with annual exports ranging from 1,3k to 1,8k buses and total scrappage between 4,8k and 6,7k buses per year

Bus fleet size & deregistration split in the last few years - France

FRANCE BUS FLEET |
In k units, 2019-2024, France

FRANCE SCRAPPED, EXPORTED AND IMPORTED BUSES |
In k units, 2019-2023, France



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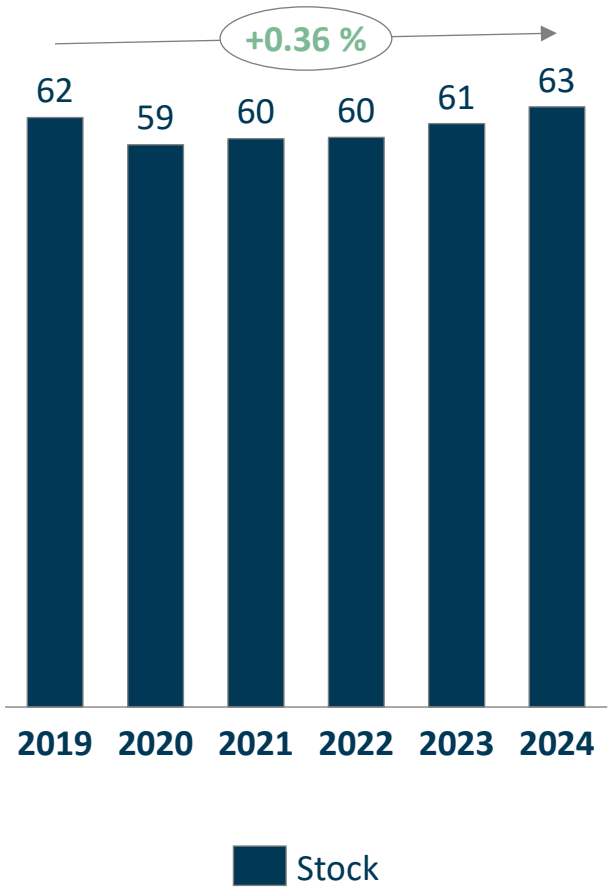
- Scrappage is calculated from the coupling of the above databases (through EMISIA interviews & experience)
Source : Sybil model - EMISIA, Strat Anticipation research & analysis

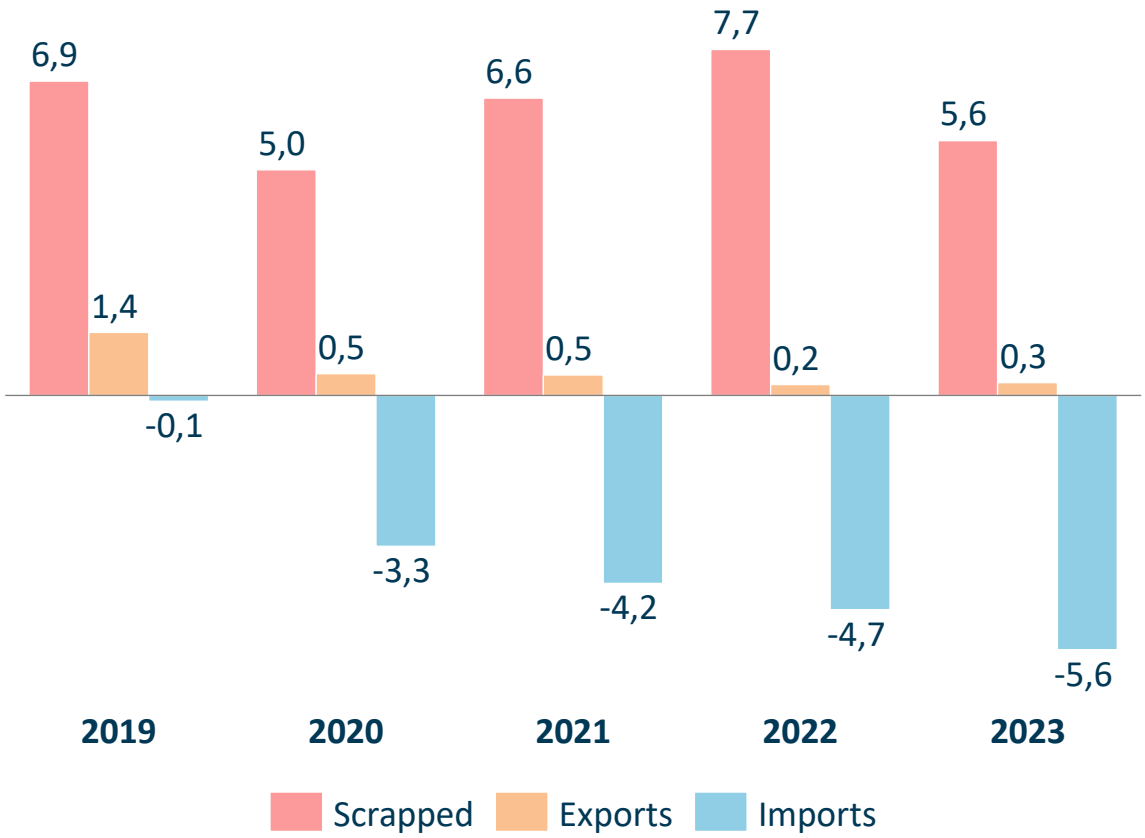
The Spanish bus fleet has grown to 63k units in 2024, with annual exports ranging from 0,2k to 1,4k buses and total scrappage between 5,0k and 7,7k buses per year

Bus fleet size & deregistration split in the last few years - Spain

SPAIN BUS FLEET |
In k units, 2019-2024, Spain



SPAIN SCRAPPED, EXPORTED AND IMPORTED BUSES |
In k units, 2019-2023, Spain



Note: Vehicles that are exported to be scrapped in other country are considered as exports and not scrapped within the country
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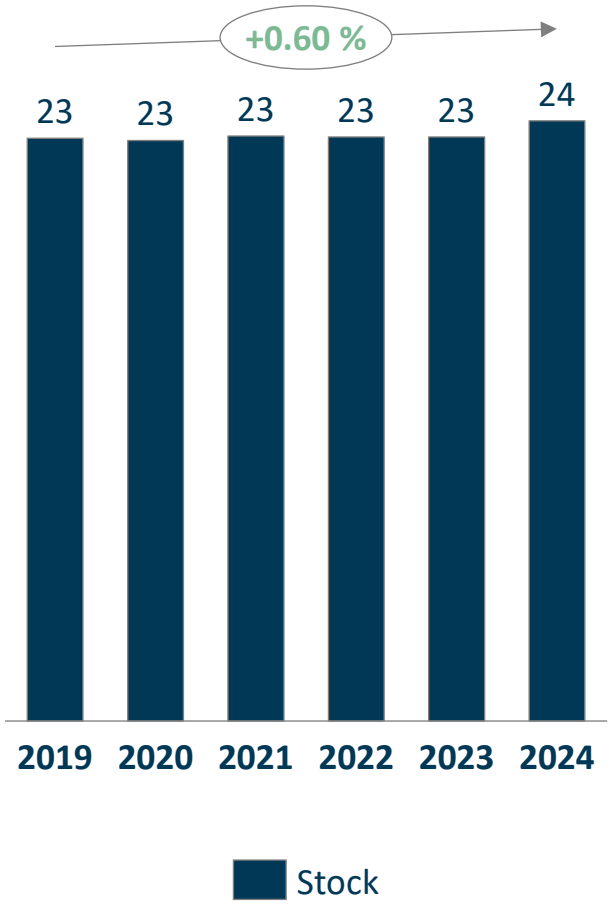
- Scrappage is calculated from the coupling of the above databases (through EMISIA interviews & experience)

Source : Sybil model - EMISIA, Strat Anticipation research & analysis

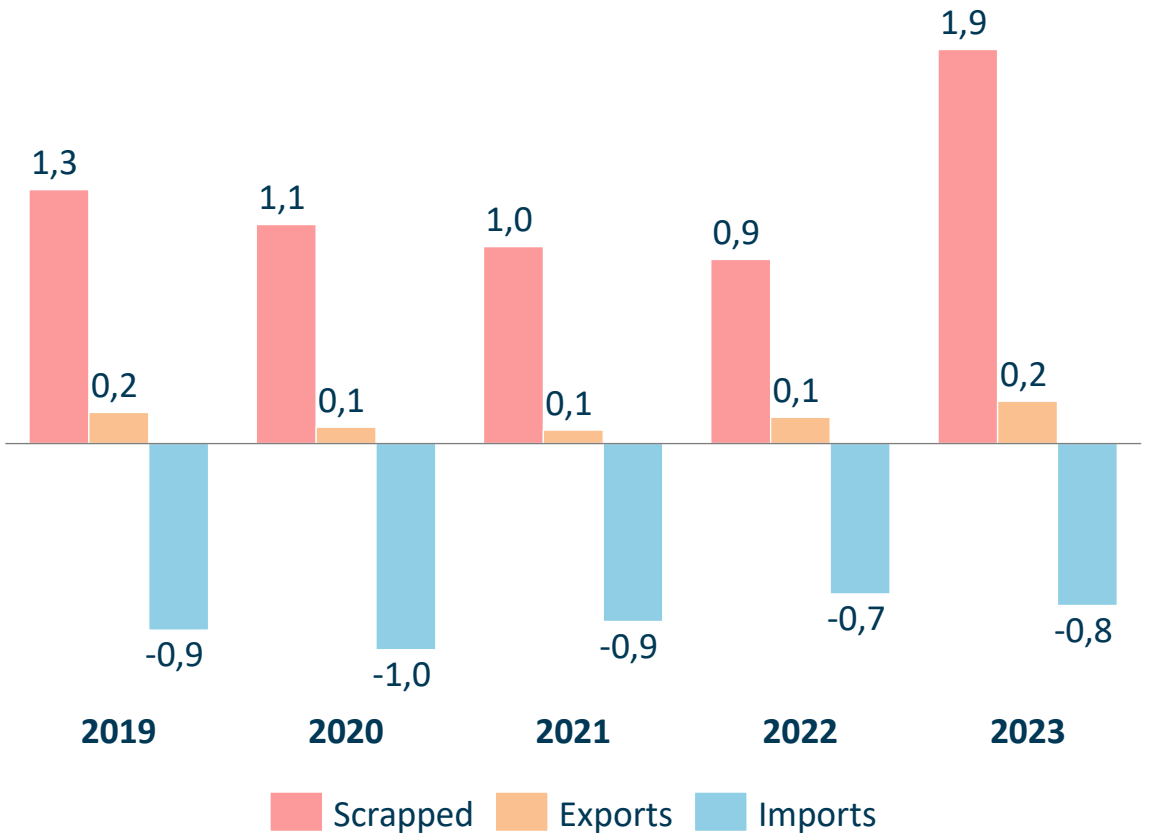
The Greek bus fleet is stable around 23k units, with annual exports ranging from 0,1k to 0,2k buses and total scrappage between 0,9k and 1,9k buses per year

Bus fleet size & deregistration split in the last few years - Greece

GREECE BUS FLEET |
In k units, 2019-2024, Greece



GREECE SCRAPPED, EXPORTED AND IMPORTED BUSES |
In k units, 2019-2023, Greece



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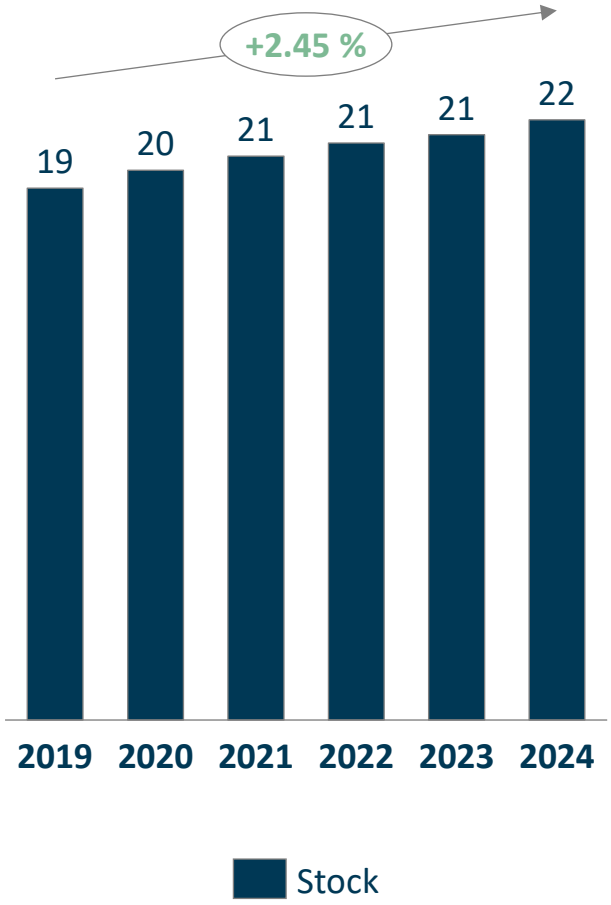
- Scrappage is calculated from the coupling of the above databases (through EMISIA interviews & experience)
Source : Sybil model - EMISIA, Strat Anticipation research & analysis

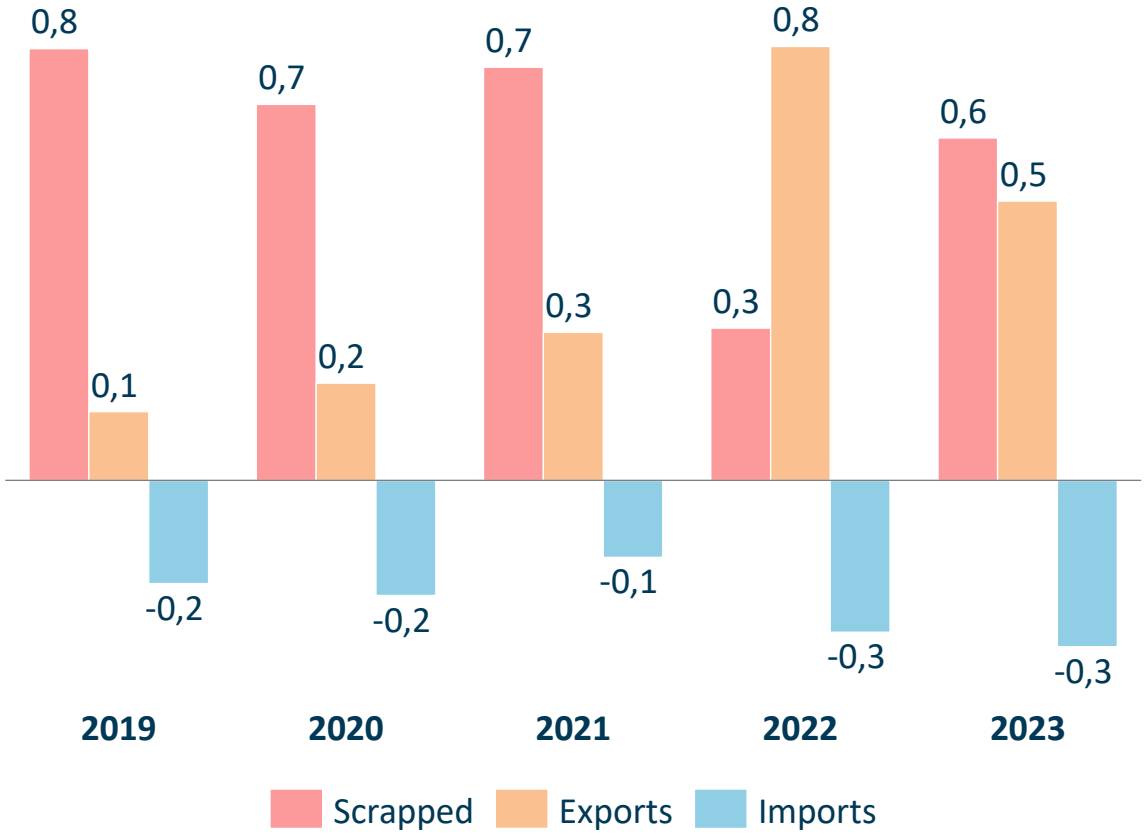
The Czech bus fleet has grown to 22k units in 2024, with annual exports ranging from 0,1k to 0,8k buses and total scrappage between 0,3k and 0,8k buses per year

Bus fleet size & deregistration split in the last few years - Czech Republic

CZECH REPUBLIC BUS FLEET |
In k units, 2019-2024, Czech Republic



CZECH REPUBLIC SCRAPPED, EXPORTED AND IMPORTED BUSES |
In k units, 2019-2023, Czech Republic



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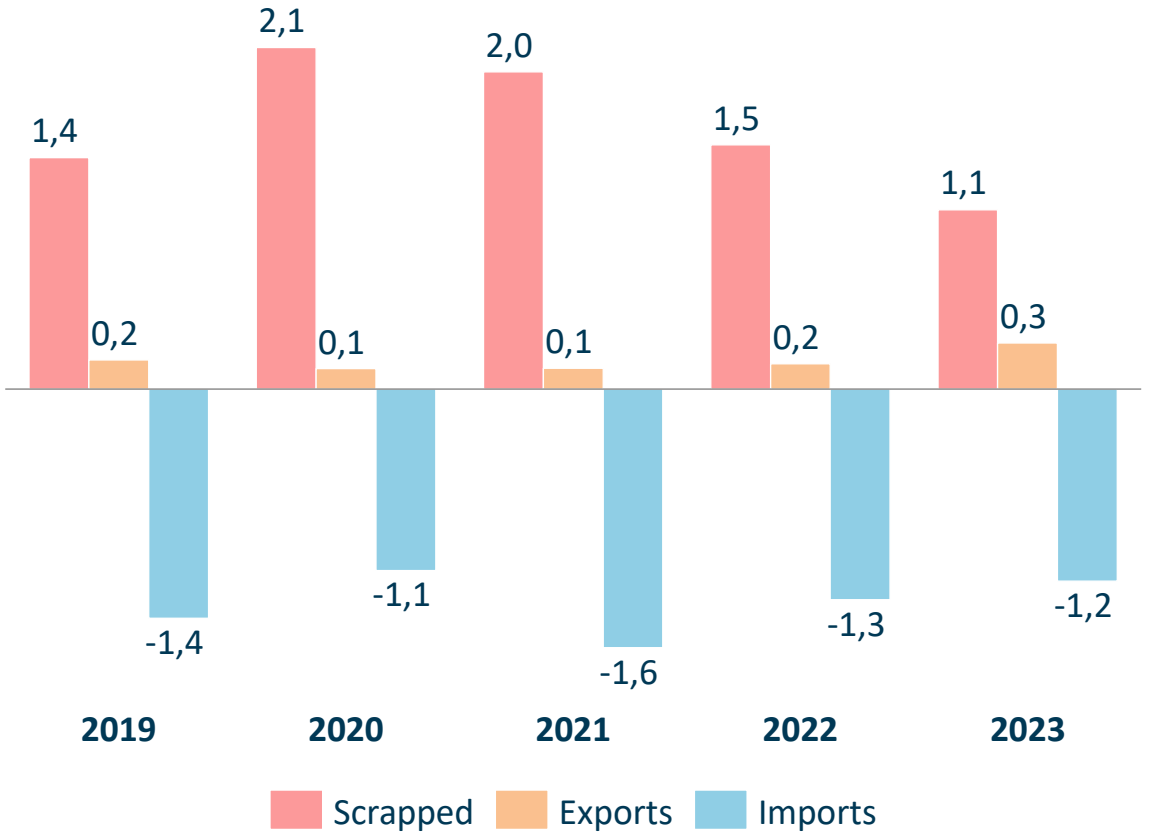
- Scrappage is calculated from the coupling of the above databases (through EMISIA interviews & experience)
Source : Sybil model - EMISIA, Strat Anticipation research & analysis

The Romanian bus fleet is stable around 48k units, with annual exports ranging from 0,1k to 0,3k buses and total scrappage between 1,1k and 2,1k buses per year

Bus fleet size & deregistration split in the last few years - Romania

ROMANIA BUS FLEET |
In k units, 2019-2024, Romania

ROMANIA SCRAPPED, EXPORTED AND IMPORTED BUSES |
In k units, 2019-2023, Romania



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Source : Sybil model - EMISIA, Strat Anticipation research & analysis

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