

Study on the Mobile Air Conditioning Sector (MAC) in Albania

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Background

The Mobile Air Conditioning (MAC) sector in Albania plays a growing role in the transport and service economy, providing essential cooling functions for vehicles across the country. Traditionally, the sector has relied heavily on hydrofluorocarbons (HFCs), particularly R-134a, a refrigerant with high global warming potential (GWP). The widespread use and frequent leakage of R-134a contribute significantly to greenhouse gas emissions, undermining national and regional commitments to climate change mitigation.

With the entry into force of the Kigali Amendment to the Montreal Protocol and the European Union's F-gas regulations, Albania faces the dual challenge of ensuring compliance with international obligations while modernizing the MAC sector. A critical part of this transition involves promoting the adoption of alternative low-GWP refrigerants, as well as strengthening systems for proper recovery, recycling, and reclamation of R-134a.

Currently, the capacity for systematic refrigerant recovery and reclamation in Albania remains limited, and awareness among technicians and operators about best practices is uneven. Without targeted interventions, significant volumes of R-134a risk being vented or improperly managed, causing environmental harm and economic inefficiency.

This study provides a structured analysis of the MAC sector in Albania, identifies key gaps, and proposes strategies for transition. By promoting sustainable alternatives, strengthening technician training, and developing infrastructure for refrigerant recovery and recycling, Albania can reduce emissions, align with international climate goals, and ensure a resilient MAC sector.

Executive Summary

Between 2019 and 2025, Albania's vehicle fleet has grown steadily across all categories, with passenger cars and small vans forming the largest share. Analysis of the refrigerants used in Mobile Air Conditioning (MAC) systems shows that R134a remains the dominant refrigerant, particularly in older vehicles, while R1234yf is rapidly gaining ground in new vehicles across all subsectors. Adoption of R744 (CO₂) remains negligible.

The fleet exhibits a dual structure, comprising a large stock of older vehicles that rely on high-GWP R134a, alongside a growing proportion of newer vehicles equipped with climate-friendly R1234yf. Buses, tractors, and agricultural machinery show the highest proportional growth of low-GWP refrigerants, reflecting modernization in both public and agricultural transport. These trends indicate that Albania is progressively aligning with international climate obligations. However, further measures—such as accelerated fleet renewal and incentives for low-GWP technologies will be necessary to fully phase down R134a.

Problem Statement

Despite the increasing importance of the MAC sector in Albania, several critical challenges hinder its sustainable development and alignment with international climate commitments. The sector continues to rely predominantly on R-134a, a refrigerant with a high global warming potential. A particularly pressing issue is that many technicians continue to recharge new systems designed for low-GWP refrigerants, such as R1234yf, with R-134a due to its significantly lower price and wider availability on the local market. This practice not only undermines the proper functioning of modern vehicle air-conditioning systems but also contributes to increased greenhouse gas emissions and environmental harm. While alternative low-GWP refrigerants are available, their adoption in Albania remains limited due to technical, regulatory, and financial barriers.

Furthermore, the systems for recovery, recycling, and reclamation of R-134a are underdeveloped. Licensed operators and technicians have limited access to the necessary infrastructure and specialized equipment for handling refrigerants safely and efficiently. This situation leads to high rates of refrigerant leakage and venting, resulting in unnecessary environmental damage and the loss of a valuable resource that could otherwise be recovered and reused.

There is also a lack of consistent training and certification programs for technicians working in the MAC sector, which contributes to uneven application of best practices and non-compliance with international standards. Without targeted measures, Albania risks falling behind in meeting the phasedown requirements for HFCs under the Kigali Amendment and the EU F-gas Regulation, while simultaneously increasing the environmental footprint of its vehicle fleet.

Addressing these issues requires a comprehensive strategy that promotes the transition to alternative refrigerants, strengthens national capacity for R-134a recovery, recycling, and reclamation, and enforces proper refrigerant handling practices in accordance with international standards.

1. Inventory of Vehicles in Albania (2019–2025)

Understanding the structure and evolution of Albania's vehicle fleet is essential for assessing the development and environmental implications of the *Mobile Air Conditioning (MAC) sector*. The number and types of vehicles in circulation directly influence the demand for refrigerants, their servicing patterns, and ultimately the country's total greenhouse gas emissions from mobile sources. To ensure consistency and clarity in interpreting the data, the following *definitions* are applied when classifying vehicles:

Definitions

- *Vehicles for Mixed Transport*: Vehicles with a total weight when fully loaded not exceeding 3.5 tons, or 4.5 tons for vehicles with electric traction powered by batteries. These vehicles are intended for the transport of both people and goods, with a maximum of nine seats, including the driver's seat.
- *Special Transport Vehicles*: Vehicles designed for the transport of specific goods or people under special conditions. They are equipped with specialized mechanisms or adaptations that allow them to fulfill these unique operational requirements.
- *Truck*: A vehicle intended exclusively for the transport of goods, typically over medium to long distances.
- *Semi-Truck*: A motor vehicle intended solely for towing trailers or semi-trailers, without a built-in cargo-carrying platform.
- *Vehicles for Special Use*: Vehicles permanently equipped with special mechanisms or installations that determine their main function. These vehicles may transport personnel, materials, or equipment necessary for the operation of these mechanisms, as well as goods or people directly related to their specialized purpose.
- *Bus*: A motor vehicle designed for the transport of passengers, having a seating capacity of more than nine seats, including the driver's seat.
- *Tractors and Agricultural Vehicles*: Wheeled or tracked motor vehicles designed primarily for agricultural and forestry operations, including the transport of agricultural goods or machinery.
- *Technological Machines*: Vehicles equipped with specialized technological mechanisms for performing industrial or construction-related tasks, such as cranes, concrete mixers, or similar mobile equipment.
- *INSTAT (Institute of Statistics)*: The national statistical authority of Albania, responsible for the collection, analysis, and publication of official statistical data, including vehicle registration and sectoral transport statistics.

By applying these definitions, the analysis ensures uniformity in categorizing vehicles and comparability of data across different years. The detailed inventory for 2019–2025, presented in Table 1, serves as a key input for estimating refrigerant usage, emissions, and recovery potential within Albania’s MAC sector. This classification also provides a foundation for evaluating future trends, such as the adoption of electric vehicles and the transition to low-GWP refrigerants.

Between 2019 and 2025, Albania has experienced a steady increase in the total number of registered vehicles, driven by economic growth, rising imports of used cars, and the gradual introduction of newer, more efficient models. Table 1 below provides an overview of the vehicle inventory by major sub-sectors, illustrating both the overall expansion of the fleet and the relative distribution among different categories such as passenger cars, transport vehicles, buses, and agricultural machinery.

Table 1. Inventory of vehicles by years 2019–2025

| <i>Grouping by Sub-sector</i> | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025* |
|--|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| Total Cars & small vans | 496,816 | 539,497 | 593,280 | 639,379 | 699,337 | 775,217 | 806,080 |
| Total vehicles for mixed transport | 44,096 | 46,884 | 49,596 | 51,674 | 53,915 | 57,544 | 59,089 |
| Total vehicles for special transport | 6,297 | 6,860 | 7,411 | 7,926 | 8,441 | 9,160 | 9,488 |
| Total larger vehicles | 17,703 | 18,582 | 19,542 | 20,487 | 21,520 | 22,924 | 23,574 |
| Total vehicles for special use | 3,486 | 3,755 | 3,977 | 4,291 | 4,540 | 4,871 | 5,010 |
| Total buses | 7,214 | 7,627 | 7,867 | 8,211 | 8,562 | 8,886 | 9,064 |
| Total tractors and agricultural machines | 1,538 | 1,673 | 2,016 | 2,891 | 3,107 | 3,692 | 4,167 |
| Total technological machines | 746 | 819 | 825 | 846 | 874 | 898 | 787 |
| Total | 577,896 | 625,697 | 684,514 | 735,705 | 800,296 | 883,192 | 917,259 |

**Data for 2025 refers to 30 June 2025*

The expansion of Albania’s vehicle fleet between 2019 and mid-2025 has direct implications for the Mobile Air Conditioning (MAC) sector. Cars and small vans represent by far the largest share of the national fleet, increasing from about 497,000 units in 2019 to over 806,000 in 2025—a growth of more than 60 percent in just six years. This category alone drives the bulk of MAC demand and, consequently, refrigerant consumption, primarily of R-134a.

Other categories such as mixed transport vehicles, heavy trucks, buses, and vehicles for special transport have also grown steadily, while tractors and agricultural machinery have more than doubled, reflecting modernization in rural sectors. However, public transport (buses) has expanded at a slower pace compared to private cars, which indicates rising reliance on individual mobility. This trend suggests higher refrigerant demand and potential emissions from an increasingly large MAC fleet, particularly if recovery and recycling measures remain weak.

From a policy perspective, the rapid increase in the vehicle stock underscores the urgency of developing a coherent national strategy for refrigerant management. Without effective systems for recovery, recycling, and reclamation, Albania risks higher levels of R-134a leakage, increased greenhouse gas emissions, and misalignment with the Kigali Amendment and EU F-gas Regulation. Strengthening technician training, investing in recovery infrastructure, and incentivizing the uptake of low-GWP alternatives are therefore critical measures to ensure that fleet growth does not undermine climate commitments.

Vehicle Inventory by Year of Production (as of 2019)

To complement the fleet growth analysis (Table 1), it is also important to assess the age structure of vehicles in Albania, since the year of production strongly influences refrigerant type, efficiency, and leakage rates. Table 2 presents the distribution of the national fleet by subsector and year of production, up to 31 December 2019.

Table 2. Inventory of vehicles until 31.12.2019 by year of production

| Description of Sub-sector | Year of production | | | | Total |
|--|--------------------|----------------|---------------|--------------|----------------|
| | Before 2005 | 2005–2009 | 2010–2014 | After 2015 | |
| Cars & small vans | 260,766 | 168,181 | 63,248 | 4,621 | 496,816 |
| Vehicles for mixed transport | 11,865 | 12,956 | 16,524 | 2,751 | 44,096 |
| Vehicles for special transport | 1,628 | 3,257 | 936 | 476 | 6,297 |
| Trucks & semi-trucks (larger vehicles) | 5,434 | 9,250 | 2,134 | 885 | 17,703 |
| Vehicles for special use | 945 | 1,538 | 759 | 244 | 3,486 |
| Buses | 1,843 | 3,952 | 912 | 507 | 7,214 |
| Tractors & agricultural machines | 476 | 651 | 317 | 94 | 1,538 |
| Technological machines | 142 | 398 | 154 | 52 | 746 |
| Total | 283,099 | 200,183 | 84,984 | 9,630 | 577,896 |

An analysis of this table highlights several key trends in the age profile of Albania’s vehicle fleet, each with important implications for the MAC sector.

- *Dominance of older vehicles:*
 - Nearly 53% of cars and small vans were produced before 2005 (around 261,000 units).
 - Similar trends are evident across other subsectors, with large shares of trucks, buses, and mixed transport vehicles also dating from pre-2005.
 - These vehicles are typically less energy efficient, prone to higher leakage rates, and almost exclusively equipped with R-134a or even older refrigerants in some cases.

- *Limited penetration of new vehicles:*
 - Vehicles produced after 2015 represent only a small fraction of the fleet—for example, less than 1% of cars and small vans.
 - This indicates that Albania’s MAC sector continues to rely heavily on older, high-GWP refrigerants, with limited introduction of newer models designed for alternative refrigerants such as HFO-1234yf.

- *High refrigerant leakage potential:*
 - Older vehicles not only consume more refrigerant due to larger system charges but also have higher risks of leakage, compounding emissions.
 - The dominance of pre-2010 vehicles suggests that R-134a demand for servicing and refilling will remain high in the coming years, unless measures are taken to accelerate fleet renewal and enforce recovery practices.

- *Sector-specific observations:*
 - Buses and trucks, many of which are pre-2010, account for a significant portion of refrigerant demand due to larger system capacities compared to private cars.
 - Agricultural and technological machinery are relatively small in number but still rely on older MAC systems, often with little oversight or regulation.

The age distribution of Albania's fleet highlights the structural challenge of transitioning to low-GWP refrigerants. Even with fleet growth (Table 1), the persistence of older vehicles ensures that R-134a will remain the dominant refrigerant in the near to medium term.

Vehicle Inventory by Year of Production (as of 2020)

To track changes in the age structure of Albania's vehicle fleet, Table 3 presents the distribution of vehicles by subsector and year of production as of 31 December 2020.

Table 3. Inventory of vehicles until 31.12.2020 by year of production

| Description of Sub-sector | Year of production | | | | Total |
|--|--------------------|----------------|---------------|---------------|----------------|
| | Before 2005 | 2005–2009 | 2010–2014 | After 2015 | |
| Cars & small vans | 339,896 | 140,963 | 38,339 | 20,299 | 539,497 |
| Vehicles for mixed transport | 11,877 | 12,984 | 15,579 | 3,656 | 44,096 |
| Vehicles for special transport | 1,619 | 3,247 | 1,416 | 578 | 6,860 |
| Trucks & semi-trucks (larger vehicles) | 5,190 | 9,659 | 2,811 | 922 | 18,582 |
| Vehicles for special use | 938 | 1,529 | 995 | 293 | 3,755 |
| Buses | 1,827 | 3,948 | 1,258 | 594 | 7,627 |
| Tractors & agricultural machines | 474 | 706 | 427 | 136 | 1,743 |
| Technological machines | 148 | 405 | 204 | 62 | 819 |
| Total | 361,969 | 173,441 | 61,029 | 26,540 | 622,979 |

A comparison of the 2019 and 2020 data reveals several important developments in the vehicle age structure, with direct implications for refrigerant demand in the MAC sector:

- *Gradual renewal of the fleet*
 - The share of vehicles produced after 2015 increased, particularly for cars and small vans (from just 4,621 units in 2019 to 20,299 in 2020).
 - While still a minority, this indicates an ongoing renewal of the fleet with newer vehicles that may increasingly use low-GWP alternatives such as HFO-1234yf.
- *Persistence of older vehicles*
 - Despite this progress, the majority of vehicles remain older than 2005.
 - For example, in 2020 more than 339,000 cars and small vans (63% of the total fleet) were over 15 years old.
 - These older vehicles continue to rely on R-134a and represent a significant source of leakage and service demand.
- *Sector-specific developments*
 - Mixed transport vehicles remained stable in number, but with a slightly higher share of post-2015 models.
 - Buses and trucks show a similar pattern, with a modest increase in newer units but still dominated by pre-2010 stock.
 - Agricultural and technological machinery remain almost entirely old, reflecting slow modernization in these sectors.

➤ *Implications for refrigerant demand*

- The MAC servicing market in 2020 was still dominated by R-134a consumption due to the large stock of older vehicles.
- However, the gradual increase in newer vehicles suggests that parallel demand for alternative refrigerants (e.g., HFO-1234yf) may begin to emerge, although on a very small scale.

The 2020 data shows a slow but notable shift toward newer vehicles in Albania’s fleet.

Vehicle Inventory by Year of Production (as of 2021)

To further illustrate the evolution of Albania’s vehicle fleet, Table 4 presents the distribution of vehicles by subsector and year of production as of 31 December 2021.

Table 4. Inventory of vehicles until 31.12.2021 by year of production

| Description of Sub-sector | Year of production | | | | Total |
|--|--------------------|----------------|---------------|---------------|----------------|
| | Before 2005 | 2005–2009 | 2010–2014 | After 2015 | |
| Cars & small vans | 340,349 | 174,389 | 51,597 | 26,945 | 593,280 |
| Vehicles for mixed transport | 11,898 | 13,285 | 19,989 | 4,424 | 49,596 |
| Vehicles for special transport | 1,609 | 3,248 | 1,889 | 665 | 7,411 |
| Trucks & semi-trucks (larger vehicles) | 5,132 | 9,716 | 3,474 | 1,220 | 19,542 |
| Vehicles for special use | 937 | 1,552 | 1,178 | 310 | 3,977 |
| Buses | 1,773 | 3,928 | 1,552 | 614 | 7,867 |
| Tractors & agricultural machines | 468 | 712 | 598 | 238 | 2,016 |
| Technological machines | 135 | 398 | 224 | 68 | 825 |
| Total | 362,301 | 207,228 | 80,501 | 34,484 | 684,514 |

An analysis of this table highlights the following:

- *Fleet growth continues* - The total number of cars and small vans increased to 593,280 units in 2021, confirming this category’s dominance in the national fleet and its central role in driving refrigerant demand.
- *Gradual modernization*
 - Vehicles produced after 2015 show further growth compared to 2020. For instance, cars and small vans in this category increased from 20,299 units (2020) to 26,945 units (2021).
 - Mixed transport vehicles and trucks also registered higher shares of post-2015 models, signaling ongoing—but still slower.
- *Persistence of an aging fleet*
 - Despite signs of renewal, most of the fleet remains pre-2009. For cars and small vans, nearly 87% are older than in 2009.
 - These older vehicles are fully dependent on R-134a, highlighting continued reliance on high-GWP refrigerants.
- *Sector-specific observations*
 - Mixed transport vehicles saw a notable increase in post-2010 models, suggesting modernization of the logistics sector.
 - Buses and special-use vehicles remain largely old, with only small numbers of newer units added.

- Tractors and agricultural machinery increased slightly, but most units are still outdated, meaning inefficient MAC systems remain prevalent in rural areas.
- *Refrigerant implications*
 - The large proportion of vehicles older than 2010 confirms that R-134a will continue to dominate refrigerant demand in Albania for the foreseeable future.
 - The modest but visible increase in post-2015 vehicles indicates that future demand for HFO-1234yf and other low-GWP alternatives may begin to rise gradually.

The 2021 fleet profile demonstrates that Albania is entering a transition phase:

- The short-term priority remains the management of R-134a, through recovery, recycling, and reclamation, since the majority of vehicles still depend on this refrigerant.
- At the same time, the emergence of newer vehicles highlights the need for Albania to prepare its servicing sector for dual refrigerant use (R-134a and alternatives such as HFO-1234yf).
- Stronger import policies to restrict very old vehicles, combined with targeted incentives for fleet modernization, could accelerate the shift toward low-GWP refrigerants.

Vehicle Inventory by Year of Production (as of 2022)

To further illustrate the evolution of Albania’s vehicle fleet, Table 5 presents the distribution of vehicles by subsector and year of production as of 31 December 2022.

Table 5. Inventory of vehicles until 31.12.2022 by year of production

| Description of Sub-sector | Year of production | | | | Total |
|--------------------------------------|--------------------|----------------|----------------|---------------|----------------|
| | Before 2005 | 2005–2009 | 2010–2014 | After 2015 | |
| Cars & small vans | 385,943 | 141,944 | 79,696 | 31,796 | 639,379 |
| Vehicles for mixed transport | 11,311 | 13,113 | 20,314 | 6,936 | 51,674 |
| Vehicles for special transport | 1,552 | 3,187 | 1,959 | 1,228 | 7,926 |
| Truck & semi-truck (Larger vehicles) | 4,754 | 8,922 | 3,895 | 2,916 | 20,487 |
| Vehicles for special use | 881 | 1,511 | 1,211 | 688 | 4,291 |
| Buses | 1,641 | 3,886 | 1,661 | 1,023 | 8,211 |
| Tractors and agricultural machines | 465 | 718 | 1,326 | 382 | 2,891 |
| Technological machine | 129 | 385 | 246 | 86 | 846 |
| Total | 406,676 | 173,666 | 110,308 | 45,055 | 735,705 |

The data from Table 5 provides a comprehensive overview of the structure of the Albanian vehicle fleet by year of production as of December 31, 2022, which is crucial for assessing the MAC sector and its environmental implications.

- *Dominance of old vehicles (<2005 production)*
 - The largest share of the fleet (406,676 vehicles, or 55% of the total) consists of vehicles manufactured before 2005.
 - This indicates an aging vehicle stock, with significant implications for higher fuel consumption, outdated air conditioning systems, and continued use of refrigerants with high global warming potential (GWPs).

- *Cars and small vans are the largest category*
 - With 639,379 units, cars and small vans represent 87% of the total fleet.
 - Within this group, more than 60% were produced before 2009, showing limited renewal of private vehicles despite growing mobility needs.
- *Mixed transport and larger vehicles*
 - Vehicles for mixed transport (51,674 units) and trucks/semi-trucks (20,487 units) also show a significant presence of older models, with around 70% of these vehicles produced before 2010.
 - These categories are essential for freight and logistics, and their outdated air conditioning systems contribute disproportionately to refrigerant leakages.
- *Public transport vehicles (buses)*
 - The fleet includes 8,211 buses, where over 65% were produced before 2010.
 - This is particularly relevant for the MAC sector, since buses rely heavily on air conditioning to provide passenger comfort, leading to higher refrigerant demand and emissions.
- *Special-use vehicles, tractors, and machines*
 - While numerically smaller, categories such as agricultural machinery (2,891 units), technological machines (846 units), and special-use vehicles (4,291 units) also show a predominance of older stock.
 - Although their contribution to refrigerant consumption is less than passenger vehicles, their outdated equipment further highlights the persistence of obsolete technology.
- *Fleet renewal and environmental impact*
 - Vehicles produced after 2015 account for only 6% of the total stock (45,055 units).
 - This limited penetration of new, more energy-efficient vehicles indicates that Albania faces challenges in renewing its vehicle fleet. As a result, the MAC sector will continue to rely heavily on older systems using HFC refrigerants with high GWP, unless accelerated policies are implemented.

Vehicle Inventory by Year of Production (2023)

The information in Table 6 provides an overview of Albania's vehicle fleet as of December 31, 2023, broken down by subsector and year of production, highlighting the structure and age profile of the stock.

Table 6. Inventory of vehicles until 31.12.2023 by year of production

| Description of Sub-sector | Year of production | | | | Total |
|--------------------------------------|--------------------|----------------|----------------|---------------|----------------|
| | Before 2005 | 2005–2009 | 2010–2014 | After 2015 | |
| Cars & small vans | 404,067 | 151,326 | 98,160 | 45,784 | 699,337 |
| Vehicles for mixed transport | 10,675 | 12,842 | 21,111 | 9,287 | 53,915 |
| Vehicles for special transport | 1,472 | 3,171 | 2,188 | 1,610 | 8,441 |
| Truck & semi-truck (Larger vehicles) | 4,579 | 8,723 | 4,112 | 4,106 | 21,520 |
| Vehicles for special use | 821 | 1,468 | 1,289 | 962 | 4,540 |
| Buses | 1,512 | 3,665 | 1,932 | 1,453 | 8,562 |
| Tractors and agricultural machines | 453 | 724 | 1,404 | 526 | 3,107 |
| Technological machine | 122 | 381 | 256 | 115 | 874 |
| Total | 423,701 | 182,300 | 130,452 | 63,843 | 800,296 |

Compared with the 2022 inventory (Table 5), some notable developments have direct implications for the MAC sector:

- *Growth of the total fleet*
 - The vehicle stock increased from 735,705 in 2022 to 800,296 in 2023 (an addition of about 64,600 vehicles, or 8.8% growth).
 - This expansion reflects a continuing upward trend in motorization in Albania, mainly driven by imports of used vehicles.
- *Cars and small vans remain dominant*
 - With 699,337 units, cars and small vans account for 87% of the total fleet, nearly identical to 2022.
 - The most significant increase occurred in the post-2010 categories, especially 2010–2014 and >2015, which together added more than 32,000 vehicles compared to 2022.
- *Fleet aging, but with signs of renewal*
 - Vehicles produced before 2005 still represent over 52% of the total fleet (423,701 units), down slightly from 55% in 2022.
 - Meanwhile, the share of vehicles produced after 2015 rose to 8%, compared to 6% in 2022.
 - This indicates a slow but positive trend in fleet renewal, with more modern vehicles entering the market, though the fleet remains dominated by older, less efficient models.
- *Mixed transport and freight vehicles*
 - Vehicles for mixed transport increased modestly to 53,915 units, with a gradual shift toward newer models (>2010).
 - Trucks and semi-trucks grew to 21,520 units, with a significant increase in vehicles produced after 2015 (from 2,916 in 2022 to 4,106 in 2023).
 - This suggests a gradual modernization of freight transport, which is essential for reducing refrigerant leakage and improving energy efficiency.
- *Public transport (buses)*
 - The bus fleet grew slightly to 8,562 units.
 - Importantly, there is a visible rise in newer buses (>2015 models), which increased from 1,023 in 2022 to 1,453 in 2023.
 - This is a positive signal for passenger comfort and MAC efficiency, as newer buses typically rely on improved air conditioning systems with lower leakage rates.
- *Special-use, agricultural, and technological vehicles*
 - These categories (about 8,500 units combined) remain relatively stable in size but show gradual increases in the newer production years.
 - While their overall contribution to refrigerant demand is small, fleet renewal in these categories also helps reduce high-GWP refrigerant use.
- *Environmental implications*
 - Despite moderate progress, the fleet remains heavily skewed toward vehicles older than 15 years, which means higher fuel consumption and reliance on outdated MAC systems.
 - However, the trend between 2022 and 2023 shows that newer vehicles are entering the market at a faster rate, providing opportunities for the transition to low-GWP refrigerants and improved maintenance practices.

The 2023 data confirm that Albania's vehicle fleet is still dominated by old vehicles, but the share of newer models is increasing. Cars and small vans continue to shape the MAC sector, while freight and public transport vehicles show early signs of renewal.

Vehicle Inventory by Year of Production (2024)

The information in Table 7 outlines the distribution of vehicles across subsectors and production years as of December 31, 2024.

Table 7. Inventory of vehicles until 31.12.2024 by year of production

| Description of Sub-sector | Year of production | | | | Total |
|--------------------------------------|--------------------|----------------|----------------|----------------|----------------|
| | Before 2005 | 2005–2009 | 2010–2014 | After 2015 | |
| Cars & small vans | 425,755 | 143,981 | 102,622 | 102,859 | 775,217 |
| Vehicles for mixed transport | 10,665 | 12,846 | 22,294 | 11,739 | 57,544 |
| Vehicles for special transport | 1,461 | 3,174 | 2,657 | 1,868 | 9,160 |
| Truck & semi-truck (Larger vehicles) | 4,484 | 8,468 | 5,296 | 4,676 | 22,924 |
| Vehicles for special use | 810 | 1,463 | 1,604 | 994 | 4,871 |
| Buses | 1,440 | 3,619 | 2,096 | 1,731 | 8,886 |
| Tractors and agricultural machines | 448 | 726 | 1,840 | 678 | 3,692 |
| Technological machine | 118 | 373 | 265 | 129 | 885 |
| Total | 445,181 | 174,150 | 138,674 | 124,674 | 882,679 |

The data in Table 7 present the vehicle inventory in Albania as of 31 December 2024 (reported as of June 2025). Compared to previous years (2022 and 2023), the numbers indicate significant changes in both the size and age distribution of the fleet, with direct relevance for the MAC sector.

- *Substantial increase in the total fleet*
 - The total number of vehicles reached 882,679 in 2024, up from 800,296 in 2023 and 735,705 in 2022.
 - This represents a 20% growth in just two years, showing the rapid expansion of motorization in Albania, primarily driven by imported used vehicles.
- *Cars and small vans dominate even more*
 - With 775,217 units, cars and small vans continue to represent 88% of the fleet, an even higher share than in 2022 and 2023.
 - Importantly, there is a sharp growth of vehicles produced after 2015, which more than doubled from 45,784 in 2023 to 102,859 in 2024.
 - This signals a significant renewal trend in private passenger vehicles, directly impacting MAC systems through increased use of more efficient and lower-GWP refrigerants.
- *Mixed transport and freight vehicles*
 - Vehicles for mixed transport reached 57,544 units, with the majority still in the 2010–2014 group.
 - Larger vehicles (trucks and semi-trucks) grew steadily to 22,924 units, with the share of post-2015 models increasing to over 20%, suggesting gradual modernization in freight transport.
- *Public transport (buses)*
 - The bus fleet reached 8,886 units, showing a modest but steady growth.
 - The share of newer buses (>2015) increased again, from 1,453 in 2023 to 1,731 in 2024.
 - This is important for the MAC sector since buses require intensive use of air conditioning, and fleet renewal reduces leakage rates and GWP impacts.
- *Special-use, agricultural, and technological vehicles*

- These categories remain relatively small (together around 9,400 units), but also show incremental renewal with a rising share of post-2010 models.
- While their contribution to refrigerant demand is minor compared to passenger cars and buses, the presence of newer models supports overall sector modernization.
- *Shift in the age distribution of the fleet*
 - Vehicles produced before 2005 still account for 50% of the fleet (445,181 units), but this is a steady decline from 55% in 2022 and 52% in 2023.
 - Meanwhile, vehicles produced after 2015 jumped to 14% of the fleet in 2024, compared to just 6% in 2022 and 8% in 2023.
 - This is the most significant change, pointing to a visible acceleration in the renewal process.
- *Environmental and MAC implications*
 - The rapid entry of newer vehicles into the fleet means a greater share of vehicles with modern MAC systems, likely using lower-GWP refrigerants such as HFO-1234yf.
 - However, the large stock of pre-2005 vehicles remain a challenge, as they continue to rely on outdated MAC systems prone to higher leakage of high-GWP refrigerants.
 - Policies promoting fleet modernization, low-GWP refrigerant servicing, and stricter controls on imports of very old vehicles will be crucial for achieving environmental targets.

As a conclusion: by 2024, Albania’s vehicle fleet shows both continuity and change: while the stock of old vehicles remains very large, the number of newer vehicles—especially post-2015 passenger cars—has grown rapidly. This shift marks the beginning of a structural transformation in the MAC sector, with increasing opportunities to phase down high-GWP refrigerants and improve energy efficiency. The trend between 2022 and 2024 demonstrates that although Albania still faces significant challenges from its aging fleet, fleet renewal is accelerating, and this can be strategically leveraged through supportive policies.

Vehicle Inventory of vehicles until 30.06.2025 by year of production

The information in Table 8 outlines the distribution of vehicles across subsectors and production years as of June 30, 2025.

Table 8. Inventory of vehicles until 30.06.2025 by year of production

| DESCRIPTION OF SUB-SECTOR | Year of production | | | | Total |
|--------------------------------------|--------------------|----------------|----------------|----------------|----------------|
| | Before 2005 | 2005–2009 | 2010–2014 | After 2015 | |
| Cars & small vans | 425,755 | 143,981 | 102,622 | 102,859 | 775,217 |
| Vehicles for mixed transport | 10,665 | 12,846 | 22,294 | 11,739 | 57,544 |
| Vehicles for special transport | 1,461 | 3,174 | 2,657 | 1,868 | 9,160 |
| Truck & semi-truck (Larger vehicles) | 4,484 | 8,468 | 5,296 | 4,676 | 22,924 |
| Vehicles for special use | 810 | 1,463 | 1,604 | 994 | 4,871 |
| Buses | 1,440 | 3,619 | 2,096 | 1,731 | 8,886 |
| Tractors and agricultural machines | 448 | 726 | 1,840 | 678 | 3,692 |
| Technological machine | 118 | 373 | 265 | 129 | 885 |
| Total | 445,181 | 174,150 | 138,674 | 124,674 | 882,679 |

Table 8 provides the latest available vehicle inventory in Albania (as of 30 June 2025). This data builds on the earlier tables (2022, 2023, and 2024) and shows both stability and gradual transformation in the vehicle structure.

- *Fleet stabilization after strong growth*
 - The total fleet remains at 882,679 vehicles, essentially unchanged from the end of 2024 inventory (Table 7).
 - This suggests that after rapid growth between 2022 and 2024, fleet expansion may have temporarily stabilized, possibly due to import regulations, market saturation, or economic conditions.
- *Cars and small vans continue to dominate*
 - With 775,217 units, cars and small vans still make up 88% of the total fleet, mirroring 2024.
 - Importantly, vehicles produced after 2015 remain at over 100,000 units (13% of the category), reflecting the gradual penetration of newer passenger cars with modern MAC systems.
- *Mixed transport and freight vehicles*
 - Vehicles for mixed transport (57,544) and larger trucks/semi-trucks (22,924) show little change from 2024.
 - However, in both groups, the share of 2010 and newer models (over 50%) remains significant, pointing to a more modern freight fleet compared to passenger cars.
- *Public transport (buses)*
 - The bus fleet (8,886 units) remains stable.
 - Over 37% are produced after 2010, an encouraging sign for public transport modernization, since buses consume large amounts of refrigerants for air conditioning systems.
- *Special-use, agricultural, and technological vehicles*
 - These categories show only marginal changes compared to 2024, with a combined total of around 9,400 units.
 - Their contribution to refrigerant demand remains small but reflects the same aging-to-renewal dynamic seen across the fleet.
- *Fleet age profile*
 - Pre-2005 vehicles still represent 50% of the total stock (445,181 units), showing no decline since 2024.
 - Meanwhile, vehicles produced after 2015 remain at 14% of the fleet, the same level reached in 2024.
 - This indicates that while a structural renewal has begun, the process may be slowing, and the fleet is still dominated by older, less efficient vehicles.
- *Implications for the MAC sector*
 - The persistence of old vehicles suggests continued high leakage rates from outdated MAC systems using HFC refrigerants.
 - At the same time, the entry of newer post-2015 vehicles provides opportunities for introducing low-GWP refrigerants and better servicing practices.
 - Without stronger policies, however, the balance between old and new vehicles may not shift quickly enough to meet climate and environmental goals.

By mid-2025, Albania's vehicle fleet has reached a point of stabilization, with no significant increase from 2024. While the share of post-2015 vehicles remains at 14%, the dominance of pre-2005 vehicles (50%) continues to pose challenges for the MAC sector. The data underline the urgency of accelerating fleet renewal, introducing import restrictions on very old vehicles, and supporting the adoption of low-GWP refrigerants in newer MAC systems.

The following conclusions summarize the insights derived from Tables 1–8

- *Fleet growth is rapid but uneven*
 - The total fleet expanded from ~736,000 vehicles (2022) to nearly 883,000 (2024–2025).
 - Growth is driven mainly by private cars and small vans, which now represent 88% of the fleet.
- *Old vehicles dominate the market*
 - Pre-2005 vehicles account for ~50% of the stock in 2024–2025, down only slightly from 55% in 2022.
 - These vehicles use outdated MAC systems, rely almost exclusively on R-134a, and have high leakage potential.
- *Signs of renewal are emerging*
 - Post-2015 vehicles grew from 6% in 2022 to 14% in 2024–2025.
 - This shift marks the beginning of structural fleet modernization, with newer MAC systems that are more efficient and may use low-GWP refrigerants (e.g., HFO-1234yf).
- *Sector-specific trends:*
 - Cars & vans: Core driver of MAC demand and refrigerant use.
 - Freight transport: Gradually modernizing; >20% of trucks are now post-2015.
 - Buses: Still largely old, but newer units are entering into service, reducing leakage intensity.
 - Agricultural/technological machinery: Small in number but largely outdated, with poor refrigerant management.
- *Environmental and policy implications:*
 - R-134a will remain dominant in the short to medium term due to the prevalence of older vehicles.
 - Leakage from pre-2005 vehicles represent the largest source of refrigerant emissions.
 - Without stronger controls on imports of old vehicles, Albania risks being locked into continued dependence on high-GWP refrigerants.

Based on the analysis presented, the recommendations outlined below are suggested:

- *Short-term (0–5 years):*
 - Strengthen recovery, recycling, and reclamation systems for R-134a.
 - Expand technician training and certification programs to enforce good practices.
 - Introduce incentives for servicing reclaimed refrigerants.
- *Medium-term (5–10 years):*
 - Accelerate renewal of the fleet by tightening import rules for old vehicles.
 - Support the transition to low-GWP refrigerants in post-2015 vehicles.
 - Establish collection and destruction systems for end-of-life refrigerants.
- *Long-term (>10 years):*
 - Achieve a complete transition toward low-GWP refrigerants across the MAC sector.
 - Integrate MAC management into Albania’s broader climate and transport strategies.

In summary, Albania’s MAC sector is at a turning point. The dominance of old vehicles ensures continued demand for R-134a in the short term, but the visible entry of newer vehicles opens opportunities for transition. With targeted policies, Albania can transition from a high-leakage, high-GWP system to a more modern, climate-friendly MAC sector that aligns with international commitments.

2. Inventory of Vehicles by refrigerant in Albania (2019–2025)

Understanding the composition of Albania’s vehicle fleet by refrigerant type is essential for assessing the environmental impact of mobile air conditioning systems and planning for sustainable refrigerant management. This chapter presents a detailed inventory of vehicles operating in Albania between 2019 and 2025, categorized according to the type of refrigerants used in their air conditioning systems. Table 9, titled “*Inventory of Vehicles Divided by*

Refrigerants for the Years 2009–2025”, below, provides a comprehensive overview of the fleet composition over this period, highlighting trends in refrigerant use, the adoption of low-global warming potential (GWP) alternatives, and the continued presence of older refrigerants. These insights form the basis for evaluating recovery, recycling, and emissions reduction strategies in the country.

Table 9. Inventory of vehicles divided by the refrigerants for the years 2009 - 2025

| DESCRIPTION OF SECTOR | Type of refrigerants | 2019 No. of units | 2020 No. of units | 2021 No. of units | 2022 No. of units | 2023 No. of units | 2024 No. of units | 2025 No. of units (31.06.2025) |
|---|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|--------------------------------------|
| Cars & small vans | R134a | 492,195 | 519,198 | 566,335 | 607,432 | 653,550 | 672,358 | 692,683 |
| | R1234yf | 4,612 | 20,275 | 26,897 | 31,889 | 45,718 | 102,777 | 113,313 |
| | R744 | 9 | 24 | 48 | 56 | 69 | 82 | 84 |
| Total Cars & small vans | | 496,816 | 539,497 | 593,280 | 639,377 | 699,337 | 775,217 | 806,080 |
| Vehicles for mixed transport | R134a | 41,345 | 43,594 | 45,727 | 42,566 | 43,628 | 45,805 | 45,959 |
| | R1234yf | 2,751 | 3,656 | 4,424 | 6,936 | 9,287 | 11,739 | 13,130 |
| Total vehicles for mixed transport | | 44,096 | 46,884 | 49,596 | 51,764 | 53,915 | 57,544 | 59,089 |
| Vehicles for special transport | R134a | 5,821 | 6,282 | 6,746 | 6,516 | 6,831 | 7,242 | 7,325 |
| | R1234yf | 476 | 578 | 665 | 1,228 | 1,610 | 1,868 | 2,163 |
| Total vehicles for special transport | | 6,297 | 6,860 | 7,411 | 7,926 | 8,441 | 9,110 | 9,488 |
| Truck & semi-truck (Larger vehicles) | R134a | 16,818 | 17,660 | 18,322 | 17,571 | 17,414 | 18,248 | 18,313 |
| | R1234yf | 885 | 922 | 1,220 | 2,916 | 4,106 | 4,676 | 5,461 |
| Total truck & semi-truck (Larger vehicles) | | 17,703 | 18,582 | 19,542 | 20,487 | 21,520 | 22,924 | 23,574 |
| Vehicles for special use | R134a | 3,242 | 3,462 | 3,667 | 3,413 | 3,578 | 3,877 | 3,888 |
| | R1234yf | 244 | 293 | 310 | 688 | 962 | 994 | 1,122 |
| Total Vehicles for special use | | 3,486 | 3,755 | 3,977 | 4,101 | 4,540 | 4,871 | 5,010 |
| Buses | R134a | 6,707 | 7,033 | 7,253 | 7,188 | 7,109 | 7,155 | 7,196 |
| | R1234yf | 507 | 594 | 614 | 1,023 | 1,453 | 1,731 | 1,868 |
| Total buses | | 7,214 | 7,627 | 7,867 | 8,211 | 8,562 | 8,886 | 9,064 |
| Tractors and agricultural machines | R134a | 1,444 | 1,607 | 1,778 | 2,509 | 2,528 | 3,014 | 3,686 |
| | R1234yf | 94 | 136 | 238 | 382 | 526 | 678 | 931 |
| Total tractors and agricultural machines | | 1,538 | 1,743 | 2,016 | 2,891 | 3,107 | 3,692 | 4,617 |
| Technological machine | R134a | 694 | 757 | 757 | 760 | 759 | 756 | 754 |
| | R1234yf | 52 | 62 | 68 | 86 | 115 | 129 | 144 |
| Total technological machine | | 746 | 819 | 825 | 846 | 874 | 885 | 898 |

The inventory of vehicles in Albania, classified by the type of refrigerants used, demonstrates a progressive transformation of the fleet between 2019 and 2025. The data highlights a gradual decline in the dominance of R134a,

the traditional refrigerant in the MAC (Mobile Air Conditioning) sector, and the increasing adoption of more environmentally friendly alternatives such as R1234yf and, to a much smaller extent, R744 (CO₂).

- *Cars and Small Vans* - Cars and small vans form the largest share of the vehicle fleet and therefore set the primary trend. In 2019, more than 492,000 units used R134a, with the number steadily rising to almost 693,000 units by mid-2025. However, during the same period, vehicles with R1234yf grew at a much faster pace—from only 4,600 units in 2019 to over 113,000 units in 2025. This illustrates the intense penetration of R1234yf, aligning with global regulatory shifts. The adoption of R744, although symbolic, remains minimal, with only 84 units expected in 2025.
- *Vehicles for Mixed Transport* - This subsector shows slower growth compared to passenger vehicles. R134a remains dominant with around 46,000 units in 2025, showing relative stability over the years. However, R1234yf expands significantly from 2,751 units in 2019 to over 13,000 in 2025, reflecting the gradual replacement or purchase of newer models compliant with low-GWP refrigerants.
- *Vehicles for Special Transport* - For special transport vehicles, R134a is expected to continue dominating, reaching approximately 7,300 units by 2025. Nonetheless, the share of R1234yf more than quadruples between 2019 and 2025, growing from 476 to over 2,160 units. This suggests an accelerated, yet still partial, transition in this category.
- *Trucks and Semi-trucks (Larger Vehicles)* - This subsector remains relatively stable in size, with R134a-based systems fluctuating around 17,000–18,000 units. However, the transition to R1234yf is notable, increasing from 885 units in 2019 to 5,461 units in 2025. This suggests a gradual modernization of the larger vehicle fleet, where new purchases are increasingly relying on climate-friendly refrigerants.
- *Vehicles for Special Use* - The fleet of vehicles for special use shows modest growth. Units with R134a are expected to remain at about 3,900 by 2025, while R1234yf vehicles are projected to expand steadily, nearly fivefold, from 244 units in 2019 to over 1,120 units in 2025. The share of R1234yf is gradually becoming more visible in this segment.
- *Buses* - represent another key category. R134a remains stable at just over 7,000 units, with little fluctuation. In contrast, R1234yf usage grows consistently, rising from 507 units in 2019 to nearly 1,870 units in 2025. This demonstrates that new bus fleets entering the Albanian market are increasingly compliant with refrigerant transition requirements.
- *Tractors and Agricultural Machinery* - This sector shows one of the highest proportional growth rates. R134a units more than double from 1,444 in 2019 to 3,686 in 2025, while R1234yf usage grows almost tenfold, from 94 to 931 units over the same period. The adoption of low-GWP refrigerants in agricultural machinery highlights modernization trends in rural transport and equipment.
- *Technological Machinery* - This is the smallest sector in absolute numbers, remaining almost static in terms of R134a use (around 750 units across the years). Yet, R1234yf use increases nearly threefold, from 52 in 2019 to 144 units in 2025. Although small in scale, this category reflects the same replacement trend seen in larger sectors.

Key trends and their implications are summarized below:

- R134a remains dominant across all vehicle categories in 2025, but its share is steadily declining relative to total fleet growth.
- R1234yf shows rapid and consistent growth in all subsectors, becoming the key alternative refrigerant. This reflects compliance with EU and international climate policies targeting HFC phase-down.
- R744 (CO₂) adoption is negligible, limited to a handful of passenger vehicles, indicating that Albania's market follows the global trend of preferring R1234yf over R744 due to cost and technological factors.

- The largest absolute transition occurs in cars and small vans, while the highest proportional growth is seen in tractors, agricultural machinery, and buses, which are progressively adopting low-GWP technologies.
- By mid-2025, Albania's vehicle fleet shows a clear dual structure: the bulk still operates on R134a, but a significant and growing portion relies on R1234yf, signaling a medium- to long-term phase-out of high-GWP refrigerants.

The analysis of Albania's MAC sector inventories from 2019 to 2025 reveals a transition pathway towards lower-GWP refrigerants, though the pace differs across vehicle categories.

- R134a continues to dominate the fleet in absolute numbers, especially in cars and small vans, mixed transport vehicles, and larger trucks. Its widespread presence shows the inertia of the existing fleet and the slow turnover rate of vehicles.
- R1234yf has emerged as the main alternative refrigerant, registering substantial growth across all sectors. From only a marginal presence in 2019, it expands rapidly by 2025, particularly in passenger cars, buses, and agricultural machinery. This reflects the growing presence of new, regulation-compliant vehicles in the Albanian market.
- R744 (CO₂) plays a minimal role, with uptake limited to a very small number of passenger vehicles, suggesting that technological and cost barriers prevent its broader adoption.
- Growth in tractors, agricultural machinery, and buses highlights modernization in subsectors beyond passenger cars, where new purchases are increasingly linked to climate-friendly technologies.

Overall, the Albanian MAC sector is undergoing a dual dynamic: the existing stock remains largely dependent on high-GWP R134a, while new additions rely on R1234yf, in line with global environmental policies. This indicates that, while Albania is on the right track towards compliance with the HFC phase-down under the Kigali Amendment, further measures will be necessary to accelerate fleet renewal and promote alternative refrigerants.

The assessment of Albania's vehicle inventory between 2019 and 2025 provides a comprehensive picture of the growth, composition, and technological transition of the Mobile Air Conditioning (MAC) sector. The combined analysis of the tables highlights several key findings:

- *Steady Growth of the Vehicle Fleet* - Across all categories, Albania's vehicle fleet has shown consistent expansion. Passenger cars and small vans remain the dominant segment, but increases are also evident in mixed transport vehicles, trucks, buses, tractors, and agricultural machinery. This growth reflects both economic development and rising mobility needs.
- *Age Structure and Modernization* - The distribution of vehicles by year of production shows a gradual shift towards newer models. However, a significant share of the fleet is still composed of older vehicles. This age structure delays the full penetration of advanced MAC technologies and keeps high-GWP refrigerants in circulation.
- *Dominance of R134a with Emerging Alternatives* - R134a continues to be the predominant refrigerant across all vehicle categories in 2025, underscoring the inertia of existing stocks. However, the analysis reveals a strong and accelerating uptake of R1234yf, particularly in passenger cars, buses, and agricultural machinery. This suggests that newly purchased vehicles are increasingly meeting international climate policies and EU market trends.
 - R1234yf growth: From marginal levels in 2019, its use expands across all subsectors, reaching significant shares by 2025.
 - R744 (CO₂): Adoption remains minimal, limited to a handful of passenger vehicles, suggesting technological and economic barriers to its broader application in Albania.
- *Sectoral Dynamics*

- Passenger cars and small vans lead the transition, showing the largest absolute increase in R1234yf units.
- Buses and tractors/agricultural machinery demonstrate the highest proportional growth, reflecting modernization and gradual compliance with low-GWP requirements in these sectors.
- Special vehicles and trucks show slower but steady adoption of alternatives, indicating longer replacement cycles in heavy-duty segments.
- *Dual Structure of the Fleet* - By mid-2025, the Albanian MAC sector is characterized by a dual structure:
 - A large stock of older vehicles is still reliant on R134a.
 - A growing share of newer vehicles using R1234yf, driving the transition towards sustainable refrigerants.
- *Policy and Compliance Implications* - Albania is clearly moving in line with the objectives of the Kigali Amendment to the Montreal Protocol, with evidence of increasing reliance on low-GWP refrigerants. However, the persistence of R134a in the majority of the fleet highlights the need for:
 - Accelerated fleet renewal programs.
 - Incentives for low-GWP refrigerants and technologies.
 - Capacity building for servicing and recovery to manage the high volumes of R134a still in circulation.

The period 2019–2025 shows that Albania’s MAC sector is expanding and gradually modernizing, with clear signs of transition towards climate-friendly refrigerants. While R134a will continue to dominate in the short term due to the age of the fleet, the growing penetration of R1234yf provides a strong foundation for achieving compliance with international obligations and for reducing the sector’s climate impact in the medium to long term.

3. Transition of Refrigerants in Albania’s MAC Sector (2019–2025)

Understanding the distribution of total refrigerant use across different subsectors is crucial for evaluating national consumption patterns and identifying priority areas for transition to low-GWP alternatives. This chapter provides an overview of refrigerant use in Albania from 2019 to 2025, disaggregated by subsector and refrigerant type. Table 10, titled “Total Refrigerant Use (HFCs and HFOs) by Subsector, 2019–2025 (kg),” presents detailed data on consumption trends within key sectors such as refrigeration, air conditioning, and mobile cooling applications. The analysis highlights the evolution of refrigerant demand, the gradual adoption of lower-impact substitutes, and the sectors where legacy refrigerants continue to be used. These findings support informed policy and planning for sustainable refrigerant management and emission reduction.

Analysis of refrigerant consumption in Albania’s Mobile Air Conditioning (MAC) sector from 2019 to 2025 reveals a gradual yet consistent shift from high-GWP HFC-R134a to low-GWP HFO-R1234yf. Total refrigerant use in the sector increased from about 578 tonnes in 2019 to nearly 898 tonnes in 2025, reflecting growth in the number of vehicles equipped with air conditioning systems. HFC-R134a remains dominant, accounting for around 85% of total use in 2025, while HFO-R1234yf has expanded its market share from less than 2% in 2019 to over 15% in 2025. The change is most evident in passenger cars and small vans, driven by the import of newer vehicles that comply with the EU MAC Directive prohibiting high-GWP refrigerants in new models. The adoption of CO₂ (R744) systems remains negligible. Overall, the trend indicates an ongoing technological shift toward low-GWP refrigerants, although the high share of older vehicles still using R134a slows the transition. Strengthening vehicle import controls, technician training, and awareness measures could further accelerate the adoption of environmentally friendly refrigerants in Albania’s MAC sector.

Table 10. Total Refrigerant Use (HFCs and HFOs) by Subsector, 2019–2025 (kg)

| Type of refrigerants | Year 2019 | | | Year 2020 | | | Year 2021 | | | YEAR 2022 | | | YEAR 2023 | | | YEAR 2024 | | | YEAR 2025 | | |
|---|-----------|-------------|----------|-----------|-------------|----------|-----------|-------------|----------|-----------|-------------|----------|-----------|-------------|----------|-----------|-------------|----------|-----------|-------------|----------|
| | HFC-R134a | HFO-R1234yf | CO2-R744 | HFC-R134a | HFO-R1234yf | CO2-R744 | HFC-R134a | HFO-R1234yf | CO2-R744 | HFC-R134a | HFO-R1234yf | CO2-R744 | HFC-R134a | HFO-R1234yf | CO2-R744 | HFC-R134a | HFO-R1234yf | CO2-R744 | HFC-R134a | HFO-R1234yf | CO2-R744 |
| Cars & small vans | 492,195 | 4,612 | 9 | 519,198 | 20,275 | 24 | 566,335 | 26,897 | 48 | 607,432 | 31,889 | 56 | 653,550 | 45,718 | 69 | 672,358 | 102,777 | 82 | 672,358 | 113,313 | - |
| Vehicles for mixed transport | 41,345 | 2,751 | - | 43,594 | 3,656 | - | 45,727 | 4,424 | - | 42,566 | 6,936 | - | 43,628 | 9,287 | - | 45,805 | 11,739 | - | 45,959 | 13,130 | - |
| Vehicles for special transport | 5,821 | 476 | - | 6,282 | 578 | - | 6,746 | 665 | - | 6,516 | 1,228 | - | 6,831 | 1,610 | - | 7,242 | 1,868 | - | 7,325 | 2,163 | - |
| Truck & semi-truck (Larger vehicles) | 16,818 | 885 | - | 17,660 | 922 | - | 18,322 | 1,220 | - | 17,571 | 2,916 | - | 17,414 | 4,106 | - | 18,248 | 4,676 | - | 18,313 | 5,461 | - |
| Vehicles for special use | 3,242 | 244 | - | 3,462 | 293 | - | 3,667 | 310 | - | 3,413 | 688 | - | 3,578 | 962 | - | 3,877 | 994 | - | 3,888 | 1,122 | - |
| Buses | 6,707 | 507 | - | 7,033 | 594 | - | 7,253 | 614 | - | 7,188 | 1,023 | - | 7,109 | 1,453 | - | 7,155 | 1,731 | - | 7,196 | 1,868 | - |

Based on the data presented in Table 11, several notable trends can be identified:

- The total refrigerant use in the MAC sector shows a steady increase from approximately 578 tonnes in 2019 to about 898 tonnes in 2025, considering the combined quantities of HFCs, HFOs, and CO₂.
- There is a clear transition from HFC-134a, a high-GWP refrigerant, toward HFO-1234yf, a low-GWP alternative that is increasingly adopted in newer vehicle models.
- CO₂ (R744) remains marginally used, accounting for less than 0.01% of total refrigerant consumption, indicating a very limited penetration of CO₂-based MAC systems in Albania.

Tracking the shift in main refrigerants over time provides valuable insight into Albania’s progress toward adopting climate-friendly cooling technologies. Table 11, titled “Shift in Main Refrigerants,” summarizes the transition from high-global warming potential (GWP) substances, such as HFCs, toward low-GWP and natural alternatives. The data illustrate how market preferences, regulatory measures, and technology availability have influenced refrigerant selection across sectors. This analysis helps assess the pace of change, identify remaining dependencies on high-GWP refrigerants, and guide future actions to accelerate the adoption of sustainable alternatives in line with national and global climate objectives.

Table 11. Shift in Main Refrigerants

| Year | HFC-R134a (kg) | HFO-R1234yf (kg) | CO ₂ -R744 (kg) | Key Observation |
|------|----------------|------------------|----------------------------|---|
| 2019 | 568,266 | 9,621 | 9 | HFC-R134a dominant (>98% of market) |
| 2020 | 599,593 | 26,516 | 24 | Slight HFO growth |
| 2021 | 650,534 | 34,436 | 48 | HFOs still <5% of market |
| 2022 | 687,955 | 45,148 | 56 | Gradual increase in HFOs |
| 2023 | 735,397 | 63,777 | 69 | HFO share reaches ~8% |
| 2024 | 758,455 | 124,592 | 82 | Significant rise in HFO adoption (+95%) |
| 2025 | 759,479 | 138,132 | - | HFO share ~15%; HFCs still dominant |

Despite the increasing use of low-GWP HFOs, HFC-R134a remains the predominant refrigerant in Albania’s MAC sector in 2025, still accounting for around 84% of the total refrigerant use. The transition is gradual and delayed, consistent with the country’s slower fleet turnover and limited availability of new-generation vehicles.

Subsector Analysis - The analysis below outlines key findings on refrigerant use by subsector over the 2019–2025 period:

a) Cars & Small Vans

- Largest subsector (~85–88% of total refrigerant use).
- HFC-R134a remains the primary refrigerant until 2023.
- Sharp growth in HFO use after 2023: from 45,718 kg (2023) to 113,313 kg (2025).
- Indicates increasing import of newer vehicles using R1234yf after 2023.
- No CO₂ adoption (unlike some EU countries where CO₂ is used in premium vehicles).

b) Vehicles for Mixed & Special Transport

- Show a similar but slower shift pattern to HFOs.
- From 2,751 kg (2019) → 13,130 kg (2025) for mixed transport.
- Limited technological renewal in these fleets, meaning older vehicles remain in use longer.

c) Trucks, Buses, and Special Use Vehicles

- HFO uptake remains minor, with most still using R134a in 2025.
- These segments are typically slower to transition due to higher retrofit costs and a lack of manufacturer changes.

d) Tractors & Agricultural Machines

- Show a noticeable increase in both R134a and HFO quantities by 2025.
- Reflects growth in agricultural mechanization and imports of newer models with alternative refrigerants.

Rate of Transition - The data below illustrate the pace and direction of Albania's refrigerant transition between 2019 and 2025, highlighting the rapid growth in HFO consumption compared to the slower increase in HFC use—an indication of the early but accelerating shift toward low-GWP technologies mainly driven by the import of newer vehicles following the EU MAC Directive, as follows:

- From 2019 to 2025, HFO consumption increased by over 14× (from 9.6 tonnes to 138 tonnes).
- **The annual growth rate of HFOs ≈ is 48% per year, while the HFC–R134a growth rate is only ~5%.**
- Indicates early phase of technological transition, mainly driven by import of new vehicles post-2020 following EU MAC Directive (Regulation (EU) No 517/2014).

Environmental Implications - The gradual replacement of high-GWP refrigerants, such as R134a, with low-GWP alternatives like R1234yf is expected to reduce CO₂-equivalent emissions from the mobile air conditioning sector substantially. However, the continued predominance of HFC-R134a indicates that the full decarbonization potential has yet to be achieved as follows:

- Since R134a has a GWP of 1,430 and R1234yf has a GWP <1, the gradual substitution will lead to a significant decrease in total CO₂-equivalent emissions from the MAC sector over time.
- However, due to the high remaining share of HFC-R134a, the decarbonization potential is not yet fully realized.

Key Insights - The key insights summarized below outline the main trends, challenges, and opportunities observed in Albania's refrigerant transition and consumption patterns:

1. A gradual but consistent shift toward low-GWP refrigerants such as R1234yf is underway.
2. HFC-R134a continues to dominate the market, mainly due to the significant number of older vehicles still in operation.
3. CO₂ (R744) technology has not yet been introduced in Albania's mobile air conditioning (MAC) sector, indicating room for future technological advancement.

4. Acceleration after 2023 is likely reflected in the increased import of newer EU vehicles compliant with the MAC Directive.
5. Policy implication: Strengthening import controls, incentives for new vehicles, and awareness programs for servicing technicians can support faster adoption of low-GWP refrigerants.

The table below illustrates the evolution of refrigerant market shares in Albania’s mobile air conditioning (MAC) sector from 2019 to 2025. The data reveal a gradual decline in the dominance of HFC-R134a, whose share decreased from 98.3% in 2019 to 84.6% in 2025, reflecting the ongoing introduction of lower-GWP alternatives. In parallel, the market share of HFO-R1234yf has steadily increased from 1.7% to 15.4% over the same period, signaling the early phase of transition toward more sustainable refrigerants. CO₂ (R744) technology remains absent from the market throughout this timeframe, indicating that its adoption has yet to begin in Albania’s MAC sector.

Table 12: Summary - Market Share Evolution

| Year | R134a – Market Share | R1234yf – Market Share | CO ₂ - Market Share |
|------|----------------------|------------------------|--------------------------------|
| 2019 | 98.3% | 1.7% | ~0% |
| 2020 | 95.7% | 4.2% | ~0% |
| 2021 | 94.9% | 5.0% | ~0% |
| 2022 | 93.8% | 6.2% | ~0% |
| 2023 | 92.0% | 8.0% | ~0% |
| 2024 | 85.9% | 14.1% | ~0% |
| 2025 | 84.6% | 15.4% | 0% |

Refrigerant Charge and Emission Overview for the Period 2019–2021

The data presented in Table 13 provide an overview of the estimated refrigerant charge quantities and associated emission rates in Albania’s mobile air conditioning (MAC) sector for the period 2019–2021. This analysis serves to quantify the total amount of refrigerant contained within the vehicle fleet and the corresponding emissions released into the atmosphere during operation, servicing, and end-of-life stages. Understanding these parameters is crucial for assessing the sector’s environmental impact and identifying opportunities for enhanced refrigerant recovery and emission reduction measures.

Table 13. Overview of Refrigerant Charge Quantities and Emission Rates for the Years 2019–2021

| Description of sector | Type of refrigerants | P | G | Refrigerant charge in | Service leak rate in % (verlv) * | 2019 | | | | 2020 | | | | 2021 | | | |
|-----------------------|----------------------|---|---|-----------------------|-------------------------------------|-----------------|--------------|-----------------------|----------------------|-----------------|-----------|--------------------|----------------------|-----------------|-----------|--------------------|----------------------|
| | | | | | | No. of vehicles | Bank (in Kg) | Service needs (in Kg) | Service needs CO2-eq | No. of vehicles | Bank (Kg) | Service needs (Kg) | Service needs CO2-eq | No. of vehicles | Bank (Kg) | Service needs (Kg) | Service needs CO2 eq |

| Buses | Vehicles for special | | Truck & semi-truck | | Vehicles for | | Vehicles for | | Cars & small vans | | |
|--------|----------------------|-------|--------------------|--------|--------------|-------|--------------|--------|-------------------|---------|---------|
| | R1234yf | R134a | R1234yf | R134a | R1234yf | R134a | R1234yf | R134a | R744 | R1234yf | R134a |
| 1430 | 4 | 1430 | 4 | 1430 | 4 | 1430 | 4 | 1430 | 1 | 4 | 1430 |
| 9 | 1.6 | 1.6 | 1.6 | 1.6 | 0.8 | 0.8 | 0.8 | 0.8 | 0.6 | 0.6 | 0.6 |
| 20% | 10% | 20% | 10% | 20% | 10% | 20% | 10% | 20% | 20% | 10% | 20% |
| 6,707 | 244 | 3,242 | 885 | 16,818 | 476 | 5,821 | 2,751 | 41,345 | 9 | 4,612 | 492,195 |
| 60,363 | 390 | 5,187 | 1,416 | 26,909 | 381 | 4,657 | 2,201 | 33,076 | 5 | 2,767 | 295,317 |
| 12,073 | 39 | 1,037 | 142 | 5,382 | 38 | 931 | 220 | 6,615 | 1 | 277 | 1,063 |
| 17,264 | | 1,483 | | 7,696 | | 1,331 | | 9,459 | | | 84,460 |
| 7033 | 293 | 3462 | 922 | 17660 | 578 | 6282 | 3656 | 43594 | 24 | 20,275 | 519,198 |
| 63,297 | 469 | 5,747 | 1,531 | 28,256 | 462 | 5,026 | 2,925 | 34,875 | 14 | 12,165 | 311,519 |
| 12,659 | 47 | 1,149 | 153 | 5,651 | 46 | 1,005 | 292 | 6,975 | 3 | 1,217 | 62,304 |
| 18,102 | | 1,643 | | 8,081 | | 1,437 | | 9,974 | | | 89,095 |
| 7253 | 310 | 3667 | 1220 | 18322 | 665 | 6746 | 4424 | 45727 | 48 | 26,897 | 566,335 |
| 65,277 | 496 | 5,867 | 1,952 | 29,315 | 532 | 5,397 | 3,539 | 36,582 | 29 | 16,138 | 339,801 |
| 13,055 | 50 | 1,173 | 390 | 5,863 | 53 | 1,079 | 354 | 7,316 | 6 | 1,614 | 67,960 |
| 18,669 | | 1,677 | | 8,384 | | 1,543 | | 10,462 | | | 97,183 |

Table 14: Sectoral Contributions (based on CO₂-eq, 2021)

| Subsector | CO ₂ -eq Year 2021 | Share of Total HFC-134a Emissions |
|----------------------------------|----------------------------------|--------------------------------------|
| Cars & small vans | 97,183 t | ≈70% |
| Buses | 18,669 t | ≈13% |
| Trucks & semi-trucks | 8,384 t | ≈6% |
| Mixed transport vehicles | 10,462 t | ≈8% |
| Special transport vehicles | 1,543 t | 1% |
| Special use vehicles | 1,677 t | 1% |
| Tractors & agricultural machines | 611 t | <1% |
| Technological machines | 260 t | <1% |

Interpretation - The passenger car and small van segment is by far the most significant contributor, accounting for about two-thirds of total emissions, followed by buses and mixed-transport vehicles. These three groups together represent nearly 90% of all HFC-134a-related CO₂-eq emissions in the MAC sector.

Table 15: Year-to-Year Evolution by Major Subsector

| Subsector | CO ₂ -eq Year 2019 | CO ₂ -eq Year 2020 | CO ₂ -eq Year 2021 | Change 2019–2021 |
|----------------------|----------------------------------|----------------------------------|----------------------------------|------------------|
| Cars & small vans | 84,460 | 89,095 | 97,183 | +15% |
| Mixed transport | 9,459 | 9,974 | 10,462 | +11% |
| Buses | 17,264 | 18,102 | 18,669 | +8% |
| Trucks & semi-trucks | 7,696 | 8,081 | 8,384 | +9% |

Observation - Emissions growth is consistent across all major subsectors, correlating with a steady increase in the vehicle fleet size and ongoing use of HFC-134a in servicing older vehicles.

Main drivers of CO₂-eq increase are as follows:

- *Fleet expansion*: The Number of air-conditioned vehicles increased each year.
- *Slow turnover to low-GWP technologies*: Older vehicles using R-134a continue to dominate servicing needs.
- *Servicing emissions*: With an assumed 20% annual leak rate for R-134a, servicing remains the largest contributor to emissions.
- *Delayed adoption of R-1234yf*: Only newer vehicles (post-2018–2019 imports) use it; overall penetration still below 10% by 2021.

Environmental Implications – Although some progress has been made in reducing refrigerant consumption, the overall greenhouse gas impact of the MAC sector continues to generate notable environmental consequences.

- Despite modest improvements, total greenhouse gas impact (in CO₂-eq) continues to grow annually due to the high GWP of R-134a (1,430).
- The transition to R-1234yf and other low-GWP refrigerants offers large mitigation potential — replacing 1 kg of R-134a avoids ~1.4 tonnes of CO₂-eq emissions.

- Without targeted measures, such as stricter import controls, recovery/recycling schemes, and technician training, emissions from the MAC sector will continue to rise.

As a conclusion - Between 2019 and 2021, the MAC sector's CO₂-eq emissions increased from 122,000 to nearly 139,000 tonnes, reflecting growth in vehicle air-conditioning systems and ongoing reliance on high-GWP refrigerants. Cars and vans remain the primary source, accounting for around 70% of emissions. Although low-GWP refrigerants (R-1234yf) are gradually entering the market, their climate benefit is not yet reflected in national totals due to their limited uptake in the existing fleet.

Refrigerant Charge and Emission Overview for the Period 2022 – 2024

The data presented in Table 16 below, provide an overview of the estimated refrigerant charge quantities and associated emission rates in Albania's mobile air conditioning (MAC) sector for the period 2022–2024. This analysis serves to quantify the total amount of refrigerant contained within the vehicle fleet and the corresponding emissions released into the atmosphere during operation, servicing, and end-of-life stages.

Table 16: Overview of refrigerant charge amounts & emission rates, for the years 2022 - 2024

| Vehicles for mixed | Cars & small vans | | | | 2022 | | | | 2023 | | | | 2024 | | | | |
|--------------------|-----------------------|----------------------|------|-----------------------|-----------------------------------|---|-----------|---------------------|------------------|---|-----------|---------------------|------------------|---|-----------|---------------------|------------------|
| | Description of sector | Type of refrigerants | GWP | Refrigerant charge in | Service leak rate in % (verly) ** | No. of vehicles by refrigerant they use | Bank (Kg) | Sevicing needs (Kg) | CO2 eq. in mTons | No. of vehicles by refrigerant they use | Bank (Kg) | Sevicing needs (Kg) | CO2 eq. in mTons | No. of vehicles by refrigerant they use | Bank (Kg) | Sevicing needs (Kg) | CO2 eq. in mTons |
| R1234y | R134a | R134a | 1430 | 0.8 | 20% | 6936 | 42566 | 6,811 | 9,740 | 9287 | 43628 | 6,980 | 9,981 | 11738 | 45805 | 7,329 | 10,480 |
| 4 | R744 | R1234yf | 4 | 0.6 | 10% | 555 | 31,889 | 1,913 | 4,740 | 7,430 | 27,431 | 2,743 | 9,981 | 9,390 | 36,644 | 7,329 | 10,480 |
| 0.8 | 1 | 4 | 1430 | 0.6 | 20% | 555 | 0.6 | 0.6 | 0.8 | 9287 | 43628 | 6,980 | 9,981 | 11738 | 45805 | 7,329 | 10,480 |
| 10% | 20% | 10% | 20% | 20% | 607,432 | 364,459 | 72,892 | 104,236 | 653,550 | 392,130 | 78,426 | 112,149 | 672,358 | 403,415 | 80,683 | 115,377 | |
| 6936 | 56 | 31,889 | 56 | 34 | 19,133 | 19,133 | 1,913 | 45,718 | 45,718 | 27,431 | 2,743 | 102,777 | 102,777 | 61,666 | 61,666 | 6,167 | 6,167 |
| 5,549 | 34 | 19,133 | 34 | 34 | 364,459 | 364,459 | 72,892 | 104,236 | 653,550 | 392,130 | 78,426 | 112,149 | 672,358 | 403,415 | 80,683 | 115,377 | |
| 555 | 7 | 1,913 | 7 | 7 | 72,892 | 72,892 | 72,892 | 104,236 | 653,550 | 392,130 | 78,426 | 112,149 | 672,358 | 403,415 | 80,683 | 115,377 | |
| 9287 | 9 | 45,718 | 9 | 41 | 45,718 | 45,718 | 1,913 | 45,718 | 45,718 | 27,431 | 2,743 | 102,777 | 102,777 | 61,666 | 61,666 | 6,167 | 6,167 |
| 7,430 | 41 | 27,431 | 41 | 8 | 27,431 | 27,431 | 1,913 | 45,718 | 45,718 | 27,431 | 2,743 | 102,777 | 102,777 | 61,666 | 61,666 | 6,167 | 6,167 |
| 743 | 8 | 2,743 | 8 | 8 | 78,426 | 78,426 | 78,426 | 112,149 | 112,149 | 78,426 | 78,426 | 78,426 | 112,149 | 112,149 | 78,426 | 78,426 | 112,149 |
| 11738 | 82 | 102,777 | 82 | 49 | 102,777 | 102,777 | 6,167 | 61,666 | 61,666 | 61,666 | 6,167 | 61,666 | 61,666 | 61,666 | 6,167 | 61,666 | 6,167 |
| 9,390 | 49 | 61,666 | 49 | 10 | 61,666 | 61,666 | 6,167 | 61,666 | 61,666 | 61,666 | 6,167 | 61,666 | 61,666 | 61,666 | 6,167 | 61,666 | 6,167 |
| 939 | 10 | 6,167 | 10 | 10 | 80,683 | 80,683 | 80,683 | 115,377 | 115,377 | 80,683 | 80,683 | 80,683 | 115,377 | 115,377 | 80,683 | 115,377 | 115,377 |

| Buses | | Vehicles for special | | Truck & semi-truck | | Vehicles for special | |
|---------|--------|----------------------|-------|--------------------|--------|----------------------|-------|
| R1234yf | R134a | R1234yf | R134a | R1234yf | R134a | R1234yf | R134a |
| 4 | 1430 | 4 | 1430 | 4 | 1430 | 4 | 1430 |
| 9 | 9 | 1.6 | 1.6 | 1.6 | 1.6 | 0.8 | 0.8 |
| 10% | 20% | 10% | 20% | 10% | 20% | 10% | 20% |
| 1023 | 7188 | 688 | 3413 | 2916 | 17571 | 1228 | 6516 |
| 9,207 | 64,692 | 1,101 | 5,461 | 4,666 | 28,114 | 982 | 5,213 |
| 921 | 12,938 | 110 | 1,092 | 467 | 5,623 | 98 | 1,043 |
| | 18,501 | | 1,562 | | 8,041 | | 1,492 |
| 1453 | 7109 | 962 | 3578 | 4106 | 17414 | 1610 | 6831 |
| 13,077 | 63,981 | 1,539 | 5,725 | 6,570 | 27,862 | 1,288 | 5,465 |
| 1,308 | 12,796 | 154 | 1,145 | 657 | 5,572 | 129 | 1,093 |
| | 18,298 | | 1,637 | | 7,968 | | 1,563 |
| 1731 | 5155 | 994 | 3877 | 4676 | 18248 | 1868 | 7242 |
| 15,579 | 46,395 | 1,590 | 6,203 | 7,482 | 29,197 | 1,494 | 5,794 |
| 1,558 | 9,279 | 159 | 620 | 748 | 5,839 | 149 | 1,159 |
| | 13,269 | | 887 | | 8,350 | | 1,657 |

| Technological | | Tractors and | |
|----------------------|-------|----------------|----------------------|
| R1234yf | R134a | R1234yf | R134a |
| 4 | 1430 | 4 | 1430 |
| 1.2 | 1.2 | 1.2 | 1.2 |
| 10% | 20% | 10% | 20% |
| 86 | 760 | 382 | 2509 |
| 103 | 912 | 458 | 3,011 |
| 10 | 182 | 46 | 602 |
| | 260 | | 861 |
| 115 | 759 | 526 | 2528 |
| 138 | 911 | 316 | 3,034 |
| 14 | 182 | 32 | 607 |
| | 260 | | 868 |
| 129 | 756 | 678 | 3014 |
| 155 | 907 | 814 | 3,617 |
| 15 | 181 | 81 | 723 |
| | 259 | | 1,034 |
| TOTAL (CO2eq) | | 144,693 | TOTAL (CO2eq) |
| | | | 152,724 |
| TOTAL (CO2eq) | | 151,313 | |

* Refrigerant charge: FACT SHEET 12 "Mobile air conditioning" UNEP Ozone Secretariat

**Service leak rate in % (yerly): FACT SHEET 12 "Mobile air conditioning" UNEP Ozone Secretariat + consultation with technicians

The refrigerant R1234yf is used in cars of recent years, for this reason the servicing needs are taken to be 10%, from 20% in the case of R134a.

Analysis: CO₂-Equivalent Emissions in Albania’s MAC Sector (2022–2024) - The analysis of CO₂-equivalent emissions from Albania’s mobile air conditioning (MAC) sector for the period 2022–2024 provides valuable insight into the sector’s climate impact.

General Trend

- The total CO₂-eq emissions from HFC-134a continue to increase, although the growth rate starts to stabilize:
 - 2022: 144,693 tonnes CO₂-eq
 - 2023: 152,724 tonnes CO₂-eq
 - 2024: 151,313 tonnes CO₂-eq

So, +5.5% rise from 2022 to 2023, followed by a slight decline (-0.9%) in 2024. This slight drop likely reflects the increased penetration of low-GWP HFO-1234yf, especially in passenger vehicles, and the gradual phaseout of older R-134a-charged systems.

Table 17 below provides data on the sectoral distribution of CO₂-eq emissions, and it is evident that the passenger cars and small vans category dominates, contributing over three-quarters of total CO₂-eq emissions, driven by their very large fleet and high usage rate. Buses and mixed-transport vehicles are the next most significant contributors, together representing nearly 15% of the total.

Table 17: Sectoral Contributions (based on CO₂-eq, 2024)

| Subsector | CO ₂ -eq Year 2024 | Share of Total HFC-134a Emissions |
|--------------------------|-------------------------------|-----------------------------------|
| Cars & small vans | 115,377 | ≈76% |
| Mixed transport vehicles | 10,480 | ≈7% |
| Trucks & semi-trucks | 8,350 | ≈6% |
| Buses | 13,269 | ≈9% |
| Special transport | 1,657 | 1% |
| Special use vehicles | 887 | <1% |
| Agricultural machinery | 1,034 | <1% |
| Technological machinery | 259 | <1% |

Table 18: Year-to-Year Evolution of Key Sectors

| Subsector (HFC-134a) | CO ₂ -eq Year 2022 | 2023 CO ₂ -eq Year 2023 | CO ₂ -eq Year 2024 | Trend (2022–2024) |
|----------------------|-------------------------------|------------------------------------|-------------------------------|-------------------|
| Cars & small vans | 104,236 | 112,149 | 115,377 | ↑ +11% |
| Mixed transport | 9,740 | 9,981 | 10,480 | ↑ +8% |
| Buses | 18,501 | 18,298 | 13,269 | ↓ -28% |
| Trucks & semi-trucks | 8,041 | 7,968 | 8,350 | Stable |

| | | | | |
|------------------------|-------|-------|-------|--------|
| Special transport | 1,492 | 1,563 | 1,657 | ↑ |
| Agricultural machinery | 861 | 868 | 1,034 | ↑ +20% |

The following summarizes the main findings derived from the table analysis:

- *Passenger cars* continue to be the primary driver of emissions growth due to the expansion of the fleet, still relying heavily on R-134a.
- *Buses* show a significant decline in CO₂-eq by 2024, likely due to the retirement of older units or the adoption of newer buses using HFO-1234yf or other low-GWP refrigerants.
- *Other subsectors* remain stable or increase slightly, consistent with fleet modernization and continued use of R-134a systems in heavy vehicles.

Emerging Role of Low-GWP HFO-1234yf has been identified as follows:

- The use of R-1234yf increased sharply in all light vehicle categories:
 - In cars & small vans, the number of vehicles using HFO rose from 31,889 (2022) to 102,777 (2024).
 - **However, due to its very low GWP (≈4), its CO₂ -eq impact remains insignificant, below 1% of total sector emissions.**
- This shift signals a positive long-term decarbonization trend, although its effect on overall CO₂-eq totals is still minor up to 2024.

Environmental Implications - The analysis of emission trends from the MAC sector reveals both progress and ongoing challenges in reducing climate impact. While the gradual shift toward lower-GWP refrigerants is beginning to curb emission growth, HFC-134a continues to dominate, highlighting the critical need for stronger mitigation measures and improved refrigerant management practices.

- The total CO₂-eq emissions from the MAC sector rose by ~5% annually on average between 2019 and 2023, reaching a plateau in 2024.
- The turning point around 2023–2024 suggests that fleet renewal and introduction of HFO-1234yf are beginning to offset emissions growth.
- Despite this, HFC-134a remains the dominant refrigerant, representing over 98% of the CO₂-eq load in 2024.
- Each kilogram of R-134a released equals about 1.4 tonnes of CO₂, underscoring the importance of leak prevention, recovery, and proper servicing.

As a conclusion, between 2022 and 2024, Albania’s MAC sector generated an average of 150,000 tonnes CO₂-eq per year from R-134a refrigerant emissions. While total emissions remain high, the growing share of vehicles using low-GWP HFO-1234yf marks a positive transition. The data indicate the early stages of stabilization in greenhouse gas impact, which could evolve into a steady decline if the adoption of low-GWP refrigerants continues alongside stronger servicing practices and improved recovery systems

4. Challenges of Low-GWP Refrigerant Adoption: R134a Use in New Cars

The transition to low-GWP refrigerants is a cornerstone of Albania's strategy to reduce emissions from the Mobile Air Conditioning (MAC) sector in alignment with the Kigali Amendment to the Montreal Protocol and the EU F-Gas Regulation. However, a significant obstacle has emerged in recent years: the continued use of R134a in newly imported vehicles that are originally designed to operate with the next-generation refrigerant HFO-1234yf.

This challenge is driven primarily by economic and market factors, but it also reflects regulatory gaps, limited awareness, and insufficient technical capacity within the servicing sector. If left unaddressed, this issue risks undermining the environmental progress made so far and delaying Albania's compliance with international obligations on fluorinated gases.

Current Situation

Most newly imported passenger cars, particularly those manufactured after 2017, are designed to use R1234yf, a refrigerant with an ultra-low Global Warming Potential (GWP \approx 4). In contrast, R134a, the refrigerant used in older vehicles, has a GWP of approximately 1,430, making it more than 300 times more harmful to the climate.

Despite this, many Albanian workshops continue to recharge R1234yf systems with R134a, primarily because:

- R134a is cheaper and widely available through existing supply chains;
- R1234yf remains expensive and less accessible;
- There is a lack of enforcement of refrigerant-use regulations; and
- Some technicians and vehicle owners are unaware of the technical and environmental consequences of using the wrong refrigerant.

Key Challenges are as follows:

a) *Technical Risks* - Using R134a in systems designed for R1234yf poses serious compatibility and safety risks. The two refrigerants operate under different pressure and chemical conditions, and R134a can cause:

- Compressor malfunction and reduced system efficiency;
- Seal deterioration and refrigerant leakage;
- Overheating or component damage; and
- Potential safety hazards due to improper system performance. These problems not only shorten the lifespan of the vehicle's air conditioning system but also increase maintenance costs and risk to end users.

b) *Environmental Impact* - From an environmental standpoint, this practice greatly increases CO₂-equivalent emissions from the MAC sector. Every kilogram of R134a released has the same warming effect as about 1.4 tonnes of CO₂, while R1234yf's impact is almost negligible. Continued reliance on R134a therefore undermines Albania's emission reduction targets, contradicts the Kigali Amendment phase-down schedule, and weakens alignment with EU F-Gas policies that are expected to apply in the future.

c) *Market Distortion* - The persistent price difference between R134a and R1234yf has led to unfair competition in the servicing market. Workshops that follow proper practices and invest in specialized R1234yf equipment and recovery tools face economic disadvantages compared to those using cheaper but non-compliant alternatives. This creates a disincentive for professional workshops to adopt low-GWP refrigerant technologies, thereby slowing the overall market transformation.

d) *Regulatory and Institutional Gaps* - Existing national regulations do not yet provide clear enforcement mechanisms to prevent the misuse of refrigerants. Customs controls focus primarily on imports rather than the end use of refrigerants in workshops. Moreover, limited inspection capacity and a lack of certification systems for MAC technicians allow these practices to persist with minimal accountability.

e) *Awareness and Training Deficiencies* - Many technicians and vehicle owners remain unaware of the importance of using the correct refrigerant. Workshops often lack technical knowledge about the differences in lubricant type, operating pressure, and safety requirements between R1234yf and R134a. Awareness campaigns and structured training have been limited so far, particularly outside major urban areas.

Measures to Prevent Improper Use of R134a - To address this issue effectively, a comprehensive national strategy should be implemented that combines policy action, training, market regulation, and awareness initiatives. The following measures are recommended:

Strengthen Regulatory Framework and Enforcement

- Introduce specific legal provisions prohibiting the use of R134a in systems designed for R1234yf.
- Establish a certification system for MAC servicing workshops and technicians, making it illegal to operate without proper authorization.
- Enforce traceability requirements for refrigerant imports and sales, ensuring that only licensed users can purchase and handle R1234yf.
- Conduct regular inspections of workshops and apply penalties for non-compliance.

Improve Market Conditions for Low-GWP Refrigerants

- Facilitate the import and distribution of R1234yf to improve availability and reduce price disparities.
- Consider tax or customs incentives for low-GWP refrigerants and associated equipment to make them more competitive.
- Encourage partnerships between the private sector and training institutions to expand the supply of compliant products and services.

Build Technical Capacity

- Develop and implement training programs for MAC technicians on proper handling, charging, and recovery of R1234yf.
- Support vocational schools and technical centers to integrate low-GWP refrigerant management into their curricula.
- Promote the use of refrigerant identifiers and other diagnostic tools to prevent incorrect charging.

Raise Awareness Among Stakeholders

- Conduct public information campaigns highlighting the environmental and safety implications of using the wrong refrigerant.
- Distribute guidelines and manuals for workshops, importers, and vehicle owners on the correct servicing procedures.
- Collaborate with automobile associations and importers to promote best practices and compliance with EU standards.

Enhance Monitoring and Data Collection

- Establish a national registry for refrigerant use in the MAC sector, including data on imports, servicing, and recovery.
- Require annual reporting from certified workshops on refrigerant consumption and recovery rates.
- Integrate these data into Albania's national greenhouse gas inventory to better quantify the MAC sector's contribution to total emissions.

Outlook - The proper adoption of low-GWP refrigerants such as R1234yf is essential for achieving Albania's climate and environmental goals. Addressing the misuse of R134a in new vehicles is not only an environmental necessity but also an economic and regulatory opportunity to modernize the servicing sector. Through stronger policies, targeted enforcement, and increased technical capacity, Albania can ensure a smooth and sustainable transition to climate-friendly refrigerant technologies, reinforcing its commitment to the Montreal Protocol and the European Green Deal objectives.

ANEXX – List of Car Dealers and Vehicle Services

Major car dealers in Albania - All car dealers offer services for vehicle air conditioning systems

- **BMW Albania (H.L Group):** official BMW representative, on the Tirana-Durres Highway, Km 2;
- **Auto Star Albania sh.a.:** Official and exclusive Mercedes-Benz dealer in Albania. Tirana Durres Highway, Km7, Kashar, Tirana;
- **Porsche Albania:** official Porsche showroom at km7 of the Tirana–Durres Highway;
- **Volkswagen Albania:** near City Park, on the Tirana–Durres Highway (km7);
- **Kia Motors – Artinel 95 sh.p.k:** official Kia representative in the Vore area, Tirana;
- **Toyota (Auto Union 4×4):** official Toyota and Dacia representative near Bogdan Street in Tirana;
- **Nissan Albania (Tendence 3A sh.a.):** official representative for Renault, Nissan and Dacia, in the center of Tirana;
- **AVEL Sh.p.k., the official and exclusive dealer of the Peugeot brand:** Tirana Durres Highway, Km5, Monun Street No. 58, Kashar Village, 1051 Tirana, Albania;
- **Auto France AL: the official and exclusive dealer for the Citroën brand** Tirana–Durres Highway, Km5, Secondary Road (Kashar), Tirana;
- **Automaster: official dealer and exclusive distributor for the Fiat brand** (including Fiat Auto, Fiat

Professional and Jeep) Tirana–Durres Highway, KM4, Building No. 115, Mëzez, Tirana;

- **Albanian Motor Company HYUNDAI, is the official and exclusive distributor of the Hyundai brand, Tirana–Durres Highway, Km 2 (Mëzez), Tirana;**
- **Albanian Motor Company – FORD. The official dealer and exclusive distributor for the Ford brand is Albanian Motor Company (AMC). Tirana–Durres Highway Km10, (Kashar) Tirana;**
- **Autovision sh.a.: official dealer and exclusive distributor for the IVECO brand — for commercial vehicles, trucks and vans** Tirana–Durres Highway, km. 9 or km. 22, Vlashaj area (near Bolv Oil Station), Maminas, Durres;
- **Mektrin Motors:** Official dealer and exclusive distributor for **Land Rover in Albania** Tirana–Durres Highway, Km 6 (Xhafzotaj), Durres, Albania;
- **Auto Master S.A. – Mazda Albania** official dealer and exclusive distributor for the Mazda brand Secondary Industrial Road Vora–Tirana, Vora, Albania.

The primary services that specialize in and provide services for vehicle air conditioning systems

- **Auto Klima Gerti (Tirana)**, “Sadik Petrela” Street, Tirana: Specialized service for the repair and maintenance of car air conditioners — includes gas filling, compressor, and radiator repair. Usable for old and new models with a work guarantee and several years of experience.
- **Auto Klima Albania, (Vora -Tirana):** Offers installation and repair of air conditioning systems for cars, commercial vehicles and minibuses. Includes pressure control, gas quantity verification, compressors, cabin filters, condensers and quality spare parts;
- **Elektro Auto Genti**, “Teodor Keko” Street, Tirana: They offer air conditioner gas filling, computer diagnostics and repairs. It is ideal if you are looking for a service that combines the climate with the vehicle's electronic system;
- **Auto Klima Flori**, “4 Rrugët” Street, Shijaku- Durres: Offers, gas filling, leak elimination with test bench, compressor repair, aluminum welding, line cleaning, line assembly for fields without a system;
- **Auto Klima Doni**, Gërdec Vora Street, Tirana: Repair, filling, assembly and spare parts for air conditioning systems, Compressor control, pressure, cabin filters with quality and precision;
- **“Servis Turi” (Vlora)** “Pelivan Leskaj” Street, Vlora Center VLORA: offers refrigeration and air conditioning system reconstruction, spare parts and electronic diagnostics;
- **Autoservis Edi Lika:** Old Tirana–Durres Road, Peza Helmes, Tirana, near Offers repair of air conditioning systems for any type of car, AC gas filling, condenser repairs, Overhaul and supply of compressors – new or used;
- **Rreshka Clima Service** – “Fadil Bodinaku” Street, Selita, Tirana: Specialization in the repair of radiators for vehicle air conditioners, gas filling (R134a);
- **Autoservis ELS-Astiri, Unaza e Re, Tirana: Offers electro-auto computer diagnostics and air conditioning system repair services;**
- **Auto Servis Vaska/Entoni & Adi**, “Gjergj Kastrioti” Street, near the “Çole” bridge, Vlora Center VLORE: Offers technical diagnostics for vehicles, including air conditioning systems;
- **Auto-servis Turi**, Address SH61, Tirana: Air conditioning services and refills for vehicles;
- **Edi fresku – Reddit**, Treasury Street Tirana: AC and electro-auto services.



Auto-service Edi LIKA, Old Street, Tirana – Durres, Peza Helmes Tirana



Auto Klima Albania, Vora -Tirana



Auto-service Nardi

Auto-service Nardi, Alidemi Street, Tirana: Offers services such as air conditioner diagnostics and service, gas filling, condenser repair, filter and compressor replacement;

Auto-service Alstezo, Tirana–Durrës Highway, km8, Kashar, Tirana: Offers air conditioning system repairs – including gas filling, leak checks, compressor repairs, condensate, etc.;

Fati Auto-service, “Llazi Miho Street 1000 - Tirana: Offers air conditioner gas filling, condensation repairs, welding, etc.;

Auto Servis Plus, with service in Bllok, Artificial Lake and Dinamo Stadium, Tirana: In addition to other services,

they also offer service and gas filling for vehicle air conditioners, etc.

Air Conditioning Gas Filling + Car Service, Isuf Elezi Street, Tirana: Dedicated service for air conditioning services and gas filling;

AutoKlima- Lezha, Lezha–Tirana Highway, km7 Lezha: Specialized in air conditioning system services.

Several car service centers in Tirana and the central districts, which, in addition to other services, also offer services for vehicle air conditioning systems:

Auto-Manoku, Tirana - Kashar Road;

Auto-Tec, “Dritan Hoxha” Street, Lapraka, Tirana;

Garant-Auto, Tirana–Durrës Highway, kilometer 1, Tirana, 1001;

Servis Auto-Kadiu, Tirana–Durrës Highway, km3, Tirana;

Servis Auto-Kadiu, Egnatia Square, Fier;

Top Auto Service, Tirana–Durrës Highway, km2, Tirana 1001;

Auto-service Alstezo, Fier, “Fier Uprising” Neighborhood, “Aulona” Street, Fier;

Bushi Service, “Dritan Hoxha” Street, 118 - 120, Lapraka, Tirana;

Bushi Service, Jail Street, near Krasniqi Autogrill, opposite the “Flatrat e Dijes” school, Fier;

Bushi Service – Lushnja, G. Muca neighborhood, Lushnjë;

Salati Auto Service, “Riza Salati” Street, Vlora;

Auto Service Bledi (2 branches), “Mehmet Cico Petoshati” Street and “Sulejman Delvina” Street;

Auto Service Spiropali, “Nermin Vlora Falaski” Street, “Pavarësia” neighborhood, Vlora;

Autoservisi Leka, “Bardhok Biba” Street, Shkodra;

Auto Servis Daja, Boksi Street, Shkodra;

Auto-service Mati, “Marin Barleti” Street, Shkodra;

Auto-service Plaka, Vllazënia Neighborhood, Shkodra;

Auto-service Elbasan, “Bajram Curri” Street, Elbasan;

Auto Servis Marku, “Seventh of February” neighborhood, Elbasan;

Auto-service Lika, “Ismail Qemali” Street, Elbasan;

Auto-service Albi, “Skanderbeg” Street, Elbasan;

Auto-service Laci, “Myslym Keta” Street, Korçë;

Auto Servis Korçë, “Fan Noli” Street, Korçë;

Auto-service Hasa, “Vodice” neighborhood, Korçë;

Auto-service Zefi, “Loni Papuçiu” Street, Korçë;

Auto Servis Jazhi, Driloni Street, behind Hotel Perles, Pogradec;

Auto Servis Matador, Driloni Street, Pogradec;

Auto Servis Bardhi, “Vllazerimi” Street, Pogradec;

Auto Halili, National Road Pogradec-Korçë, near Kastrati gas station, Pogradec;

Auto Servis Mario Xhelo, “Vllazerimi” Street, Pogradec;

Auto Servis Genci, “Vllazerimi” Street, Pogradec;

Auto Servis LLESHI, “Coku Brothers” Street, Lezha;

Auto Service & Spare Parts Erioni, Lezha (center), Lezha;

Auto Servis- Gjirokastra, Near the national road SH4 in Gjirokastra;

Auto Servis Jani P., 35C5, SH4, Gjirokastra

Auto-service Rabi, National Road Gjirokastër–Kakavijë, 2-storey bus stop, Gjirokastra;

Auto Service Meti, Gjirokastrë–Kakavijë road (near the border with Greece), Gjirokastra;
Electroauto Service Vito, Kakavija, Gjirokastra
Car Service “Lake”, “Idriz Alidhima” Street, Saranda;
Auto Servis Enea Sarande, Qafë Ghashtë (near Pitstop gas station), Saranda;
Auto Servis Joni, Road to the center of Saranda;
GB Servis Auto – Durres, Durres–Tirana Highway, km1, Durrës;
GB Auto-service (“Vala e Detit” Street), (“Vala e Detit” Street, Durrës 2001;
Auto Servis Kullolli, “Vllazerimi” Street, Durrësit center;
Auto-Servis Altini, “Prokop Meksi” Street, Durrës;
Auto Servis & Spare Parts Gysi – Marikaj- Durrës;
Edi Servis, Secondary road Kavaja–Durres, Kavaja;
Auto-Service Bardhi, Kavaja Center, Kavaja;
Servis Cullhaj, Kavaja – Rrogozhina Highway, Kavaja
Auto Servis Rekaj, Fier Vlora Road, KM3 (Kosovica Passage), Fier;
Auto Servis TOLI, Fier Center, Fier;
Auto Servis Kondi, “January 11” neighborhood, behind the Prefecture, Fier;
ALPA SHPK, Laç- Kurbin;
Auto Servis Spaçi, National Road Laç–Milot, Laç-Kurbin;
Auto Servis Elektroauto Marku, Laç- Kurbin;
Servis Tani, Burrel Bridge, Burrel;
SERVIS AUTO, Roeldo, “Formula e Pagëzimit “Street, 8001 Burrel;
Auto Servis Selita, “Qamil Xhika” Street, Burrel;
Auto Servis Gleardo, Zenisht, Burrel, 8001;
Servis Reci, L.Stadium, Peshkopia;
Auto Pjese AGOLLI, “Nazmi Rushiti” Street, Peshkopia;
Akil Dibra Auto Motor & Electric Service, “Fuat Dibra” Street, Peshkopia;
Laci Servis, Lake Street, Bulqiza 8400, Dibër;
Servis Besland, City Neighborhood, Krastë, Bulqiza, “Murat Zhaboli” Street, Building 17, Entr. 1;
Servis KUKESI, Black Drin Bridge, Kukës 8501;
Auto Servis Iseberi, Prizrenit Street, new neighborhood, Kuksi;
Autoservis Flori Kukës, “Mahmut Daci” Street, Kuksi;
Auto Servis Kristi, Otlak village, Berat;
Auto Parts & Service BERAT HOTI, Malishova, Berat;
Servis 7777, Berat;
Auto Servis VISI, near Tomori stadium, Berat;
Auto Servis Buhuri, Ura vajgurore, Berat;
Auto&Moto Servis, PW5Q+MQ3, Berat, 5003, Berat;
Lali’s Auto Servis, in Lushnja city;
Bushi Service Lushnja, G. Muca neighborhood, Lushnja;
Auto Servis Luli, SH72 Street, Lushnja.
Autoservis Geni, area near the Rrogozhina–Lushnjë highway;
Autoservis Emiljani, Vëlmishë, Mallakastra;
Servis Pinderi, National Road Korça–Ersekë, km 4, Korça;
Andrea Servis, Korça–Ersekë road, km.1, Korça;

Auto Servis Genti, Trans-Balkan Road, Vlora;
Auto Servis Bledi, “Mehmet Cico Petoshati” Street/ “Sulejman Delvina” Street, Vlora;
Servis “Nisi”, “Andrea Varfi” Street, near the Old Beach, Vlora;
Auto Servis Ori, Kosovo Street, Vlora;
Car Service Auto Tec Saranda, Saranda–Metoq Road, Metoq (50m from the center);
Autoservice Agimi, V2G5+MCV, Saranda;
ALBES, “Muhamet Gjolllesha” Street, Tirana;
Mechatronic Auto, Dibra Street, Tirana;
E.C.A. (Electric Car Albania), “Ibrahim Rugova” Street, Tirana;
Auto Servis Llaka, Kavaja Street, Tirana;
Tirana Electric Motors, Don Bosko Street, Tirana;
Electric Auto Albania, Barricade Street, Tirana;
Xhihani, Tirana–Durres Highway Km7, Tirana;
Inter Cars Albania, Tirana–Durres Highway, km1, 1001 Tirana;
Truck Albania, “Besim Alla” Street, Tirana;
Segment, Tirana–Durres Highway Km7, Tirana;
Servis 2000, Former Textile Factory Kombinat, Tirana;
Autoservis Arbri, “Siri Kodra” Street, Tirana;
Classic, Tirana–Durrës Highway, km1;
Autoservis Bogova, “Sefer Kondi” Street, Selite, Tirana;
Auto Balla, Rreth Village, Shijak;
Auto Servis Gjoka, Durres–Shijak national road, Rrashbull, Durres;
Servis Varaku, 8GVX+W79, Shijak, Durres;
GMA Auto, Koxhas village, Shijak, Durres;
Auto-Servis Loni, Shijak, Durres;
Auto Keçi, Shijak- Durres;
Auto gesti, Shijak, Durres;
Auto Servis Andi, Krujë;
Auto Servis Gysi, Fushë-Kruja;
Auto Servis Luli, Fushë-Kruja;
Auto Servis Altini, “Prokop Meksi” Street, Kruja;
Auto Mera, Highway Fushë-Kruja – Milot, Kruja;
Auto Servis Eri, Arrameras 1, Kruja.