How Efficient Are Kenya's Cars?

Baseline Assessment of Light-Duty Vehicle Fuel Economy and CO_2 Emissions for newly registered vehicles in Kenya between 2010-2023

Published by

giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

CHANGING TRANSPORT

HARAMBEE

Supported by:

Federal Ministry for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection

based on a decision of the German Bundestag

IKI INTERNATIONAL CLIMATE INITIATIVE

Project Background

The Introducing Measures, Pathways and Roadmaps for Optimizing Vehicle Efficiency and Electrification (IMPROVE) project is implemented by the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH and funded through the International Climate Initiative (IKI) of the German Federal Ministry for Environment, Nature Conservation and Nuclear Safety (BMUV).

IMPROVE supports the development of regulatory instruments that enhance vehicle energy efficiency and promote the electrification of vehicle fleets in its partner countries. It also fosters stakeholder coordination and knowledge exchange on vehicle efficiency, sustainable mobility, and climate change. In Kenya, the project is implemented in collaboration with the State Department for Transport, with a focus on designing regulatory instruments for vehicle efficiency—particularly for newly imported vehicles—while supporting the broader shift toward zero-emission transport solutions.

About Changing Transport

We enable the rapid development of zero emissions transport systems to shape a liveable and just future. GIZ works on changing transport towards a sustainable pathway and facilitating climate actions in mobility. We support decision-makers in emerging and developing countries through training and consulting services, as well as by connecting stakeholders. Our ultimate goal is zero-emission transport. You can learn more about our projects on www.changing-transport.org.

Disclaimer

The content presented in this document has been compiled with the utmost care. Nevertheless, GIZ gives no guarantee that the information provided is current, accurate, complete or error-free. GIZ accepts no liability for damage or loss arising directly or indirectly from the use of this document, provided it has not been caused intentionally or by gross negligence.

GIZ expressly reserves the right to modify or append this document in part or in whole without prior notice, or to halt publication completely or for a limited period. Cartographic presentations in no way constitute recognition under international law of boundaries and territories. The content of GIZ GmbH's documents is protected by copyright. The images used are marked with photo credits where required by law. The use of any images requires the prior consent of GIZ GmbH, if not stated otherwise.

This analysis is based on a vehicle registration dataset shared with University of Nairobi Enterprises and Services (UNES) in Q1 2024. Since then, the National Transport and Safety Authority (NTSA) has continued to implement improvements in its data management systems, alongside ongoing UNES efforts to upgrade and refine the dataset. As a result, subsequent datasets may reflect enhanced accuracy, completeness, or classification updates.

The Kenyan vehicle registration system was updated in 2013-2014, which has led to discrepancies in total registrations between the 2010-2012 period and the 2013-2014 period. Pre-2015 data should be used with caution.

These ongoing improvements could not only affect future registration records but also improve the quality of historical data (for example, for the 2010-2023 period). Future analyses using updated datasets may therefore yield results that differ from those presented in this report. These ongoing improvements should be taken into account when interpreting the findings for specific policy design.

Acknowledgements

We would especially like to express our sincere gratitude to the research team at the University of Nairobi Enterprises & Services Ltd under the lead of Prof. Eng. Ayub Gitau for the comprehensive data analysis and research as well as to Zifei Yang and Alexander Tankou from the International Council of Clean Transportation, who supported the data analysis and reviewed the final report. We are also grateful for the support of the National Transport and Safety Authority (NTSA) for providing the raw data and for their availability in providing additional contextual information, which was essential for the analysis and interpretation of the results.

Content

List of Tables

List of Figures

Exchange rates

Local Currency	EUR	USD	Date
100 KES	0.66 EUR	0.77 USD	28.08.2025

List of Acronyms and Abbreviations

BMUV	German Federal Ministry for Environment, Nature Conservation and Nuclear Safety
CAGR	Compound Annual Growth Rate
CAFÉ	US Corporate Average Fuel Economy
CBA	Cost-Benefit Analysis
CO_2	Carbon Dioxide
CNG	Compressed Natural Gas
EPRA	Energy and Petroleum Regulatory Authority
EV	Electric Vehicle
GFEI	Global Fuel Economy Initiative
GHG	Global Greenhouse Gas
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
IEA	International Energy Agency
ICCT	International Council on Clean Transportation
ICE	Internal Combustion Engine
IMPROVE	Introducing Measures, Pathways, and Roadmaps for Optimizing Vehicle Efficiency and Electrification
IQR	Interquartile Range
JC08	Japanese 08 Test Cycle
KAM	Kenya Association of Manufacturers
KEBS	Kenya Bureau of Standards
km/kWh	Kilometres per Kilowatt-Hour
km/MJ	Kilometres per Megajoule
KRA	Kenya Revenue Authority
LCVs	Light Commercial Vehicles
LDVs	Light-Duty Vehicles
MEPS	Minimum Energy Performance Standards
NEDC	New European Driving Cycle
NEECS	Kenya's National Energy Efficiency and Conservation Strategy
NCCAP	National Climate Change Action Plan
NOx	Nitrogen Oxides
NTSA	National Transport and Safety Authority
PC	Private Car

PM	Particulate Matter
PHEVs	Plug-in Hybrid Electric Vehicles
PSVs	Public Service Vehicles
QISJ	Quality Inspection Services Japan
UNEP	United Nations Environment Programme
UNES	University of Nairobi Enterprises and Services
VAT	Value-Added Tax
WHO	World Health Organization
WLTP	Worldwide Harmonized Light Vehicle Test Procedure
ZEV	Zero Emission Vehicles

Executive Summary

Private cars and vans accounted for over 25% of global oil demand and approximately 10% of energy-related CO_2 emissions in 2022 (International Energy Agency [IEA], 2023a). To remain aligned with the global pathway to net-zero emissions by 2050, and to meet the target of doubling annual energy intensity improvement by 2030, the energy efficiency of light-duty vehicles (LDVs) must improve by at least 5% per year (IEA, 2023a). Achieving this will require Governments to adopt and enforce robust energy efficiency policies within the transport sector.

Energy efficiency, in the transport context, refers to the reduction in energy required to deliver a transport service, typically measured as distance travelled per unit of fuel (e.g., km/litre or MJ/km). Between 2010 and 2021, the energy intensity of global passenger transport improved by an average of 1.6% annually, a trend largely driven by the increasing adoption of electric vehicles in leading markets such as China and the European Union (IEA, 2022a; United Nations, 2022). Improved energy efficiency yields multiple benefits- economic (e.g., reduced fuel costs), environmental (e.g., lower emissions), and social (e.g., enhanced air quality and public health).

In response to these challenges and opportunities, the Government of Kenya, through the State Department for Transport (SDOT) under the Ministry of Roads and Transport, in collaboration with the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), has initiated a comprehensive technical study. This initiative, titled Introducing Measures Pathway and Roadmaps for Optimizing Vehicle Efficiency and Electrification (IMPROVE), seeks to support Kenya's transition to cleaner and more energy-efficient mobility.

The IMPROVE project aims to develop a regulatory and fiscal framework that steers the national vehicle market toward energy efficiency and electrification. The initiative will inform future standards, incentive mechanisms, and data governance structures to help Kenya reduce fossil fuel dependence and achieve its climate commitments.

This report presents a foundational baseline analysis, using NTSA registration records, on the CO_2 emissions and fuel efficiency of Light Duty Vehicles (LDVs) registered in Kenya from 2010 to 2023. It provides key insights into vehicle characteristics, emission profiles, and market trends that will inform evidence-based policy formulation.

Key findings:

- The vehicle registration landscape is marked by a heavy reliance on used vehicle imports, which account for over 90% of annual LDV inflows. The average age for used imported LDVs has remained stable at around 7 years, with 85% to 90% vehicles being between 6 to 8 years old at the time of import into Kenya. Consumers buying new vehicles in Kenya tend to choose more powerful vehicles with higher engine, as the average engine size of new vehicles are much higher than those of used vehicles.
- From 2010 to 2023, the annual registration of LDVs is dominated by passenger cars with sales share between 85% to 96% and petrol vehicles with sales shared between 80% to 90%. The EV adoption remains minimal, with annual

registrations increasing from 8 units in 2018 to 55 units in 2021. However, EVs still account for less than 0.06% of total LDV registrations.

- The overall fleet average engine size decreased from 2010 to 2023 for all sub-types, including petrol Private Car (PC), diesel PC, petrol Light Commercial Vehicle (LCV), and diesel LCV. This shows a trend of increasing preference for smaller engine vehicles.
- While the fleet average CO_2 emission of LCVs remains almost unchanged from 2010 to 2023, the fleet average CO_2 emissions of PCs decreased from 184.3 g/km in 2010 to 154.5 g/km in 2023, equals to a 1.3% annual reduction when considering the 14-year time span.
- Considering the vast majority of vehicles registered are used vehicles and most of those were imported from Japan, the reduction in the fleet average CO_2 emissions is likely due to a combined impact of the decrease in engine size and the spillover effect of the fuel economy standards adopted in Japan, which pushed for technology advancement of the vehicles sold in Japan. Considering the average age of used vehicle at import is 7 years, used vehicle imported from 2010 to 2023 correspond to new vehicles sold in Japan from 2003 to 2016. However, the fleet average CO_2 emissions of PCs sold in Japan have an annual reduction of 3.2% from 2003 to 2016, which is much faster than the average CO_2 decrease of PCs imported to Kenya.
- To accelerate the adoption of advanced technologies and faster decarbonization progress, Kenya needs to introduce regulations and policies that require and/or incentivize import of low-emission and more efficiency vehicles.

Policy considerations:

- Kenya's ambition to decarbonize its road transport sector and improve vehicle efficiency requires a well-integrated policy framework informed by robust data. Based on the international experience, Kenya should consider adoption of supply-side regulations, such as CO_2 emission/fuel economy standards, and zero-emission vehicle (ZEV) mandates and market-based instruments, such as carbon taxes, and feebate systems, to reduce emissions and steer fleets toward cleaner technologies.
- The design and enforcement of any policy instruments need to be supported by a more comprehensive and uniform vehicle data collection system. Kenya should consider:
    - Requiring importers to report information on make/model, fuel economy, CO_2 emission, and other key vehicle specifications during import clearance.
    - Integrating imported vehicle information into NTSA's digital vehicle registration system and formalizing a national vehicle data governance framework across NTSA, KRA, KEBS, EPRA, the Ministry of Energy and Petroleum, and Ministry of Transport
    - Developing a mandatory national vehicle labelling program for all newly imported and locally assembled vehicles.

1 Introduction

1.1 Impact of Transport Emissions

The transport sector is a major contributor to global greenhouse gas (GHG) emissions, with the road transport accounting for approximately 24% of direct CO_2 emissions from fuel combustion (IEA, 2023). As motorization rates increase, particularly in low and middle-income countries, so too does the environmental burden associated with fuel consumption and vehicle inefficiency. In Africa, transport-related GHG emissions are growing at an estimated annual rate of 7%, compared to much slower growth in developed economies like the United States (0.8%) and the United Kingdom (0.12%) (Ayetor et al., 2021). Without effective regulatory and technological interventions, the continent's transport emissions are projected to double by 2030, relative to 2015.

The reliance on fossil fuel-powered vehicles, compounded by the widespread use of low-quality fuels with high sulphur content, exacerbates climate change and local air pollution. Vehicle emissions are a major source of air pollutants such as particulate matter (PM), nitrogen oxides (NOx), and Sulphur oxides (SOx). These pollutants are linked to severe public health outcomes, including respiratory illnesses, cardiovascular disease, and premature death. The World Health Organization (WHO) estimates that air pollution causes over 600,000 premature deaths annually in Africa (Posada et al., 2016).

1.2 Kenya's Transport Sector and Vehicle Efficiency Challenges

Kenya's transport sector is a cornerstone of national development, enabling trade, mobility, and access to essential services. The sector is heavily road-dependent and contributes significantly to Gross Domestic Product (GDP). According to the Kenya National Energy Efficiency and Conservation Strategy (2020), transport is one of the largest energy-consuming sectors in the country.

Kenya's vehicle fleet is dominated by internal combustion engine (ICE) vehicles, most of which are used vehicle imports, accounting for approximately 85%–90% of annual registrations (KAM, 2020; NTSA, 2022). This market dynamic is driven by affordability, but it also introduces vehicles with outdated technologies and poor fuel efficiency into the national fleet. ICE vehicles comprise about 99% of Kenya's vehicle stock, with only a small but growing share of electric vehicles (EVs). The Ministry of Energy has set an aspirational target for EVs to constitute 5% of all new vehicle registrations by 2025.

Between 2011 and 2019, the number of registered vehicles in Kenya grew from 1.6 million to 3.6 million, representing a compound annual growth rate (CAGR) of 9%. According to the Kenya Association of Manufacturers (KAM), motorcycles accounted for 46% of total registrations during this period, followed by private cars at 32%. Popular vehicle types include station wagons (68%), pickups/panel vans (10%), and saloon cars (9%) (KAM, 2020).

Kenya's registration database captures a wide range of vehicle categories:

- Two- and three-wheelers (e.g., motorcycles and tuk-tuks)
- Four-wheelers (private cars, pickups, minibuses)
- Heavy-duty vehicles (trucks and buses)

1.3 Policy and Infrastructure Gaps

Kenya faces significant structural challenges in managing transport emissions, largely due to gaps in policy and infrastructure. One key issue is the absence of comprehensive fuel economy standards, which has led to inefficiency in fuel consumption and increased emissions. Additionally, the country lacks mandatory vehicle emissions testing, making it difficult to regulate and monitor pollution levels effectively.

Another contributing factor is the predominance of second-hand vehicle imports, many of which are equipped with outdated emissions technologies. These older vehicles often produce higher levels of pollutants, exacerbating air quality concerns in urban areas. Moreover, the enforcement of vehicle maintenance regulations remains weak, allowing poorly maintained cars to stay on the roads despite their adverse environmental impact.

Addressing these policy and infrastructure gaps is crucial for improving air quality and reducing the environmental footprint of Kenya's transport sector. Stronger regulations, better enforcement mechanisms, and modernized vehicle standards could significantly curb emissions and promote a more sustainable transport system.

Though, it is crucial to distinguish between two complementary regulatory approaches:

- Air pollutant emission standards, which target pollutants harmful to human health (e.g., PM, NOx)
- Fuel economy and GHG emission standards, which aim to improve vehicle efficiency and reduce CO_2 emissions.

The first targets air pollutants like particulate matter (PM) and nitrogen oxides (NO_x), which harm human health, especially in urban areas. These are addressed through standards such as Euro or Tier norms, which require technologies like catalytic converters or diesel particulate filters. The second focuses on fuel economy and greenhouse gas (GHG) emissions, aiming to reduce fuel consumption and cut CO_2 output. These are regulated using fleet-average efficiency targets or CO_2-based performance standards. While distinct in focus, both pathways offer co-benefits: improving fuel economy reduces GHGs and, indirectly, many air pollutants, especially when vehicles shift to electric powertrains. Together, they form the foundation for cleaner, more efficient transport systems.

Kenya Vision 2030 identifies transport infrastructure modernization as a strategic goal, including road expansion, mass transit systems, and railway development, these efforts, although necessary for reducing congestion, do not automatically translate into fuel economy gains. In fact, road expansion can sometimes induce more driving (a phenomenon known as induced demand) unless accompanied by fuel economy policies, public transport investment, and cleaner vehicle technologies.

Improving Vehicle fuel economy has co-benefits such as lower fuel consumption and energy costs, reduced CO_2 and air pollutant emissions, improved public health outcomes and enhanced economic productivity. To maximize these benefits, Kenya needs an integrated policy approach that includes vehicle efficiency standards, incentives for cleaner technologies, and robust emissions monitoring systems. These reforms should align with Kenya's commitments under the Paris Agreement, the National Climate Change Action Plan (NCCAP 2018–2022), and the National Energy Efficiency and Conservation Strategy (2020).

2 Data Collection and Cleaning

2.1 Data Inventory

Vehicle registration data for this analysis was obtained from the National Transport and Safety Authority (NTSA), the Government agency tasked with managing road transport data in Kenya under the NTSA Act of 2012. The dataset provided was in Excel format and included registration records for 3,779,520 vehicles, including motorcycles, light-duty vehicles (LDVs), buses, lorries, and trailers registered between 2010 and 2023. The selection of the period 2010–2023 was based on two primary considerations:

- **Data availability and completeness:** NTSA's digitized vehicle registration system has been consistently maintained since 2010, providing sufficient reliability for longitudinal analysis.
- **Relevance to current policy planning:** This 14-year window provides a contemporary historical overview to support policy development that aligns with ongoing and future transport and energy initiatives.

As a point of reference, Kenya's registered vehicle fleet currently exceeds 4.5 million as of 2023, with light-duty vehicles and motorcycles constituting the most significant segments (NTSA, 2023). The dataset reviewed for this study represents a substantial share over 80% of the country's total fleet, thus ensuring it is highly representative for technical assessments.

The vehicle registration dataset included various descriptive attributes, enabling detailed disaggregation and profiling. The key variables included:

- Number of vehicles registered
- Condition (new or used)
- Body type (e.g. saloon, station wagon, pick-up)
- Make (e.g. Toyota, Mitsubishi)
- Model (e.g. Nissan X-Trail, Nissan Sunny)
- Year of manufacture
- Date of registration
- Fuel type (e.g. petrol, diesel, hybrid, electric)
- Engine size (in cubic centimetres)
- Vehicle use (e.g. private, commercial, public service)
- Passenger capacity
- Gross Vehicle Weight (GVW)
- Chassis Number
- Vehicle Identification Number (VIN)

This data is the foundation for evaluating trends in fleet composition, vehicle efficiency, emissions, and technology transition over time.

2.2 Data Cleaning

The raw dataset acquired from NTSA required extensive cleaning to ensure the final analysis was based on accurate, consistent, and policy-relevant information. The cleaning process used Microsoft Excel and involved several structured steps to address common data quality issues in large administrative datasets.

2.2.1 Why Data Cleaning Was Necessary

Despite the completeness of NTSA's registration records, the dataset exhibited several challenges that necessitated cleaning:

- **Presence of non-relevant vehicle types:** The dataset included over 3.7 million records of various vehicle categories, including motorcycles, heavy commercial vehicles, buses, and trailers, that are outside the scope of light-duty vehicle (LDV) efficiency analysis.
- **Inconsistent classifications:** Some entries had unclear or misclassified vehicle types, necessitating standardization of body type categories (e.g., inconsistencies between "Station Wagon" and "SW", or "Saloon" vs. "Sedan").
- **Data entry errors:** Several records contained outliers or anomalies, such as impossible values for engine size (e.g., zero (0) cc or substantially large engine sizes), missing or future-dated years of manufacture, and mismatches between fuel type and engine configuration.
- **Duplicate records:** Some vehicles seemed to have been registered more than once due to data entry duplication or inconsistencies in VIN and chassis numbers.
- **Incomplete entries:** A portion of the dataset was missing critical fields such as fuel type, year of manufacture, or engine size variables that are essential for emissions and fuel economy analysis.

Table 1 Missing Vehicle Attributes

Data Attributes	Blank Rows
Condition Description (e.g. used / new)	4861
Body Type Description (e.g., station wagon / saloon / pick up / van etc.)	1191
Vehicle Make Description (e.g. Toyota, Mitsubishi, BMW)	109
Model (e.g. Corolla, Hiace, Passo, Probox, Fielder, Alphard, Wingroad, X-Trail)	All (Not captured)
Chassis Number	24
Year of Manufacture	24
Year of First Registration	565835
Fuel Type Description (petrol, diesel, electric, hybrid)	1299
Engine Size	29
Vehicle Use Description	3
Number of Passengers	16669
Tare Weight	932
Gross Weight	517788
Load Capacity	422599
Vehicle Type Description	23
Driver Side Description	1925
CO_2 emissions and fuel economy	All (Not captured)

2.2.2 Key Data Cleaning Steps

The following core procedures were implemented during the cleaning process:

Filtering by Vehicle Type

Only light-duty vehicles (LDVs) with a gross vehicle weight below 3,500 kg were retained for analysis. This included passenger cars, station wagons, pick-ups, and small vans. Motorcycles, buses, trucks, and trailers were excluded.

Segregating New and Used Vehicles

Vehicles were categorized as either new or used based on their condition at the time of import or registration. This distinction is important for age profiling and emission modelling, as used vehicles may show different characteristic and performance compared to new vehicles.

Standardizing and Correcting Attribute Values

Fuel types were normalized into common categories (e.g., "Petrol/Electric" reclassified under "Hybrid") to eliminate inconsistencies caused by varied naming conventions in the raw data. This ensured uniform grouping for accurate analysis of fuel economy and emissions across different vehicle types.

Harmonizing Body Type Entries

Body type entries (e.g., "SW", "Station Wagon", "Wagon") were harmonized into standard classifications to support consistent aggregation and comparison. In addition, clearly erroneous values such as negative engine capacities, missing model years, or future-dated manufacture years were flagged and excluded from the dataset to maintain data integrity and analytical validity.

Removing Duplicates and Invalid Records

Records with identical chassis numbers, VINs, and registration dates were evaluated for duplication and removed as appropriate. Entries with incomplete identifiers or implausible combinations of attributes were discarded. After cleaning, the resulting dataset comprised 1,077,341 light-duty vehicle records, which were utilized for the core analysis in this assessment.

Table 2 below summarizes the key data cleaning operations undertaken, ranging from removing non-light-duty vehicles and duplicates to standardizing classification fields and correcting erroneous entries. These steps were essential in refining the dataset to reflect only valid, policy-relevant records supporting meaningful insights into Kenya's vehicle efficiency and emissions trends.

Table 2 Summary of Data Cleaning Operations

Cleaning Operation	Description	Purpose
Vehicle Type Filtering	Excluded motorcycles, trucks, buses, and trailers; retained only light-duty vehicles (LDVs).	Ensure focus on vehicles relevant to fuel economy and emissions analysis.
Condition Segregation	Classified vehicles as new or used based on registration status.	Support analysis on vehicle age, emissions, and import trends.
Attribute Standardization	Harmonized inconsistent labels (e.g., "SW" vs. "Station Wagon", Petrol/Electric" vs. "Hybrid").	Enable consistent categorization and comparison.
Correction of Erroneous Entries	Removed or corrected entries with unrealistic values (e.g., 0cc engine, future manufacture dates).	Improve accuracy and eliminate data distortions.
Handling Missing Data	Identified and flagged records with missing key variables (e.g., fuel type, year of manufacture).	Prepare for imputation or exclusion in analytical models.
Duplicate Record Removal	Removed entries with repeated VINs, chassis numbers, or matching registration metadata.	Prevent inflation of fleet size and analytical bias.
Fuel Type Consolidation	Grouped variants of similar fuel types under standardized labels.	Ensure clarity in emissions and fuel economy analysis.
Gross Vehicle Weight (GVW) Filtering	Retained only vehicles with GVW <3,500 kg to match LDV classification.	Align with global definitions of light-duty vehicles.

2.3 Data Population

To address the gaps in vehicle specification data particularly missing values for fuel economy, CO_2 emissions, year of first registration, and gross vehicle weight (GVW), a structured process was implemented to enrich the dataset and ensure its suitability for technical assessment. This process leveraged global databases and official inspection sources to improve completeness, accuracy, and consistency.

As earlier shown in Table 1, a significant portion of entries in the raw NTSA dataset lacked GVW values. However, for the purpose of defining and filtering light-duty vehicles (LDVs), we adopted a body-type-based classification approach that aligns with international and local definitions.

Specifically, vehicles with missing GVW values were classified as LDVs if their body types matched common LDV categories, including saloons, station wagons, pick-ups, SUVs, and vans. This classification was informed by both NTSA registration categories and Kenya National Bureau of Statistics (KNBS) reporting in the Economic Survey.

2.3.1 Establishing Vehicle Specifications Using Chassis Numbers

Given that over 90% of used light-duty vehicles (LDVs) imported into Kenya originate from Japan (Global Fuel Economy Initiative [GFEI], 2014), the vehicle identification strategy focused primarily on Japanese pre-export inspection records. Chassis numbers in the NTSA dataset were used to verify key attributes, such as vehicle make, model, engine size, and manufacturing year, through the Quality Inspection Services Japan (QISJ) online portal, a KEBS-appointed inspection agency. The QISJ website (www.qisjp.co.uk) provides verified inspection data for vehicles destined for Kenya, serving as the primary tool for tracing missing values.

2.3.2 Retrieving Fuel Economy and CO_2 Emission Values

Once the vehicle model specifications were confirmed, fuel consumption and CO_2 emission values were obtained from official government databases and national efficiency rating programs. These sources provide laboratory-tested or certified vehicle performance data, matched by model, year, and drivetrain type. The data sources referenced are included in Appendix D- List of International Sources.

These sources provided fuel economy values (L/100km) and CO_2 emissions (g/km), which were then harmonized to the 3-Phase Worldwide Harmonized Light Vehicle Test Procedure (WLTP) standard to ensure comparability across countries and vehicle types.

2.3.3 Determining Vehicle Age Profiles

Kenya's regulatory framework, guided by KS 1515:2019 Road Vehicles-Inspection of road vehicles- Code of practice, and Legal Notice No. 78 of July 2005, requires that all imported used vehicles should not exceed eight years of age from the date of manufacture at the time of importation. These vehicles must undergo a roadworthiness inspection in the country of origin, often conducted by QISJ for Japanese exports.

For many records with missing manufacture years, the QISJ inspection year was used as a proxy since the inspection typically occurs just before registration in Kenya. This provided a reliable basis for estimating vehicle age, which is a crucial input for emissions and depreciation modelling.

2.4 Data Quality Challenges

Several data quality challenges were encountered during the enrichment and cleaning process that required corrective actions to ensure analytical validity. First, unrealistic or inconsistent values were observed in key fields such as passenger and load capacity. For example, some small passenger cars were recorded with more than 10 passengers, or compact vehicles had payloads exceeding 5,000 kilograms, which are physically implausible. These errors likely resulted from data entry mistakes or misinterpretation of units during the digitization process.

Second, inconsistencies were identified in weight-related fields, such as cases where the gross vehicle weight (GVW) was recorded as less than the tare weight, violating basic physical definitions. In such instances, records were flagged and either corrected using reference values or excluded from analysis.

Third, some emission records were sourced from non-English databases, including Japanese platforms such as:

- 自動車燃費一覧 (Automobile Fuel Economy List)
- JC08 モード走行 (JC08 Mode Driving Cycle)
- 10・15 モード燃費 (10-15 Mode Fuel Economy)

These sources required translation and verification to accurately match vehicle models and convert their results into WLTP-comparable units. Additionally, different testing protocols (e.g., NEDC, JC08, CAFE) required conversion to WLTP using harmonization equations to enable consistent comparison across datasets. Finally, missing values for engine size, fuel type, and the year of registration posed a significant challenge, as these fields are fundamental for calculating emissions. Where records could not be verified or completed using reliable external sources, they were excluded to preserve the integrity of the analysis.

2.5 Fuel Economy and CO_2 Emission Data Harmonization and Conversion

To enable a consistent analysis of energy consumption and CO_2 emissions across Kenya's light-duty vehicle (LDV) fleet, harmonization of fuel economy data was necessary. Vehicles registered in Kenya are primarily imported as used vehicles from Japan, the UK, and other markets, where different test procedures apply, including the Japan JC08, Europe NEDC, and increasingly, the Worldwide Harmonized Light Vehicles Test Procedure (WLTP).

To allow for cross-comparison and aggregation, all type-approval fuel economy or CO_2 emission values were converted to 3-Phase WLTP (3P-WLTP) equivalents using established conversion equations from the International Council on Clean Transportation (ICCT) and related peer-reviewed literature. The 3P-WLTP cycle is the latest test cycle adopted by Japan, the major market that Kenya imports vehicle from. It covers the low, medium, and high-speed phases, which are representative of real-world driving patterns in most urban and peri-urban contexts (ICCT, 2021; Tietge et al., 2019).

The conversion factors are derived from simulations and/or type approval values and enable more accurate comparison of vehicle performance and fuel efficiency under different driving conditions (Zifei & Anup, 2020). For this analysis, CO_2 emission values were converted to the WLTP standard using the following harmonization equations adapted from (Zifei & Anup, 2020):

$$\text{3P-WLTP } CO_2 \text{ (g/km)} = a \times (\text{From Cycle}) + b$$

Table 3 Conversion Factors for Translating Fuel Economy Across Test Cycles

Fuel type	From cycle	To cycle	a	b
Petrol	NEDC	3P-WLTP	1.1194	-1.1618
	JC08		0.9695	24.6742
	10-15		0.9353	39.774
Diesel	NEDC		1.0871	12.73
	JC08		1.0871	12.73
	10-15		0.9353	44.1947

Once harmonized, CO_2 values were converted into petrol equivalent fuel consumption (Lge/100km) using assuming emission factor of petrol of 2.32 kg CO_2/litre.

This standardization step was critical in enabling uniform comparison across all vehicles in the dataset, regardless of country of origin or initial testing protocol.

2.6 Data Structuring and Validation for Analysis

Following data cleaning and enrichment, a final dataset comprising 1,059,079 light-duty vehicle records was assembled. These records span registration years from 2010 to 2023, with corresponding manufacture years ranging from 1997 to 2023. The dataset includes key vehicle attributes such as:

- Vehicle condition (new or used)
- Body type and vehicle use
- Make and model
- Fuel type and engine size
- Emissions and fuel economy indicators
- Weight metrics (tare weight, gross weight, load capacity)

A final round of structuring and validation was undertaken to prepare the cleaned and enriched dataset for statistical modelling and policy analysis. This involved:

Data formatting

Numeric variables (e.g., CO_2 emissions, fuel economy, engine size) were converted to numerical format to support regression and trend analyses. Categorical variables (e.g., fuel type, body type) were standardized to uppercase for consistency.

Outlier detection and treatment

Statistical techniques, including interquartile range (IQR) and z-score analysis, were used to identify and address outliers in areas such as load capacity, tare weight, and gross weight.

Missing value handling

Records lacking values in critical fields such as CO_2 emissions, fuel economy, vehicle age, and estimated value were filtered out to maintain analytical integrity.

Duplication removal

The distinct() function was applied to eliminate duplicate records based on unique identifiers such as chassis number, registration date, and VIN.

Cross-verification

Where applicable, final values were validated against manufacturer specifications, international emissions databases, and pre-export inspection data.

These steps ensured that the dataset was analytically robust, internally consistent, and ready for use in technical assessments of vehicle emissions and fuel economy across Kenya's road transport sector.

2.7 Summary of the Data Pre-processing Steps

Table 4 below summarizes the key steps undertaken during data acquisition, cleaning, enrichment, and structuring, all of which aim to produce a robust and policy-relevant dataset for the technical assessment of Kenya's light-duty vehicle fleet.

Table 4 Summary of Data Processing Steps

Step	Activity	Description	Purpose
1	Data Acquisition	Obtained raw vehicle registration dataset from NTSA (2010–2023).	Establish baseline dataset for analysis.
2	Initial Filtering	Removed non-LDV records (e.g., motorcycles, buses, trailers, HDVs).	Focus dataset on light-duty vehicles only.
3	Attribute Standardization	Harmonized labels for body types, fuel types, and vehicle use.	Ensure consistency across categorical fields.
4	Error Correction	Flagged and corrected unrealistic values (e.g., negative engine size, invalid dates).	Improve accuracy and data integrity.
5	Duplicate Removal	Used distinct() function to eliminate records with identical identifiers.	Prevent overcounting and ensure uniqueness.
6	Missing Data Enrichment	Populated missing fields (e.g., fuel economy, CO_2, manufacture year) using online sources (e.g., QISJ, fueleconomy.gov).	Enhance completeness for technical analysis.
7	Age Profile Estimation	Retrieved year of manufacture using KEBS inspection dates and QISJ database.	Support vehicle aging analysis.
8	Emissions Harmonization	Converted emissions data from JC08, NEDC, and CAFE to WLTP equivalents using standard equations.	Enable cross-country comparability.
9	Fuel Economy Conversion	Converted gCO_2/km to fuel consumption (Lge/100km) using standardized factors.	Translate emissions data into policy-relevant metrics.
10	Outlier Detection & Treatment	Applied IQR and z-scores to identify/remove extreme values in load and weight variables.	Minimize distortion from statistical outliers.
11	Final Validation	Cross-checked against manufacturer and regulatory databases; validated ranges and relationships.	Ensure readiness for modelling and reporting.
12	Dataset Structuring	Reformatted data for trend analysis and econometric modelling.	Prepare dataset for use in reporting and policy development.

This multi-step process involved filtering out irrelevant records, standardizing key variables, enriching missing data using credible external sources, harmonizing emissions data to the WLTP standard, and validating the dataset against established specification.

3 Analysis of LDV Fleet Characteristics and Profiles

The Vehicle Profile Analysis section comprehensively assesses vehicle registration and efficiency trends, focusing on CO_2 emissions, fuel economy, and vehicle use patterns. By examining emissions across different vehicle categories, the analysis identifies high-emission vehicle types and their impact on environmental sustainability.

Additionally, fuel economy trends highlight efficiency variations by fuel type, offering insights for energy policies. Depreciation trends and vehicle value assessments inform taxation and resale value policies. Finally, analysing public and private vehicle usage patterns supports urban planning and emission regulation strategies. These insights contribute to policy development aimed at improving vehicle efficiency in Kenya.

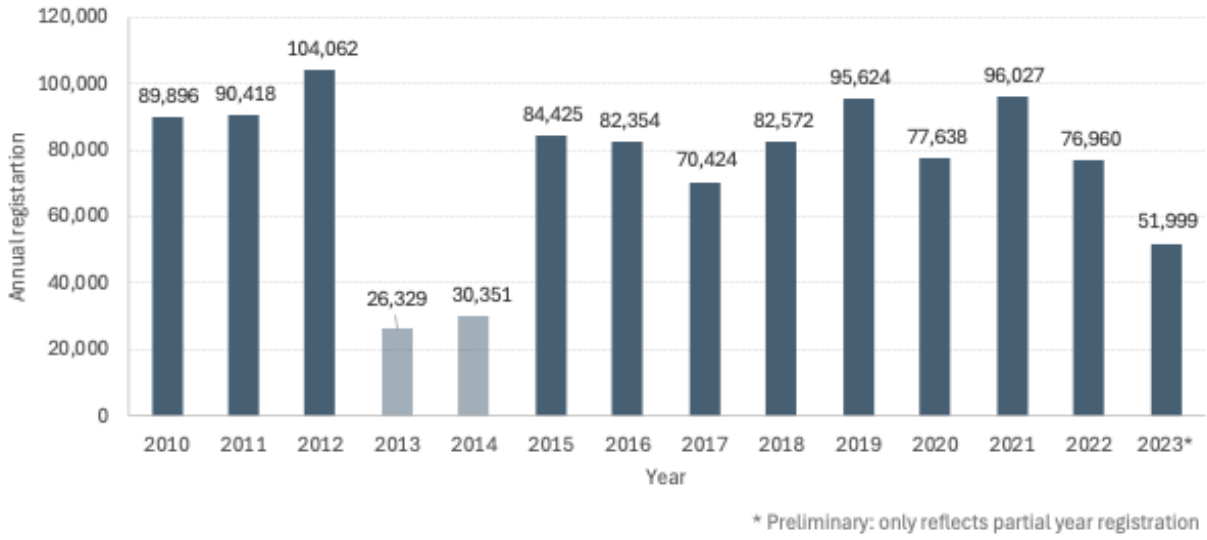
3.1 Vehicle Registration Trend

Figure 1 presents the annual registration volumes of LDVs in Kenya from 2010 to 2023, based on NTSA registration records. While the dataset provides near-complete coverage for most years, it is important to note that data for 2013 and 2014 is incomplete. This gap coincides with the transfer of vehicle registration responsibility from KRA to NTSA, which introduced transitional challenges in data capture and reporting. In addition, the database received for this analysis does not include the full year of 2023 registrations; therefore, the 2023 data only partially reflect the 2023 fleet.

Since it is not clear which portions of the vehicle registration data are missing for 2013 and 2014, fleet characteristics for those two years are not presented, as they may not be representative of the actual fleet. Fleet characteristics for 2023 are, however, presented, as the available data reflect vehicles registered during a partial period of that year.

Note: 2023 data is provisional and may underrepresent actual registrations due to processing delays or incomplete records.

Figure 1 Number of Registered Vehicles (2010 - 2023)



The trend in vehicle registrations in Kenya from 2010 to 2023 reveals a dynamic and volatile automotive market, influenced by economic, policy, and external factors. The period from 2010 to 2012 witnessed a relatively steady increase in vehicle registrations, culminating in a peak of over 104,000 vehicles in 2012.

The registration number in the established database dropped sharply to 26,329 and 30,361 in 2013 and 2014, respectively. The observed drop is primarily attributed to institutional restructuring following the establishment of NTSA. During this transition, key data management systems and vehicle registration functions were transferred from the Kenya Revenue Authority (KRA) to the newly formed NTSA. This shift temporarily disrupted data flows and administrative continuity, affecting the completeness and consistency of vehicle importation and registration records. The period also coincided with adjustments to import procedures and compliance frameworks as NTSA took over as the lead agency.

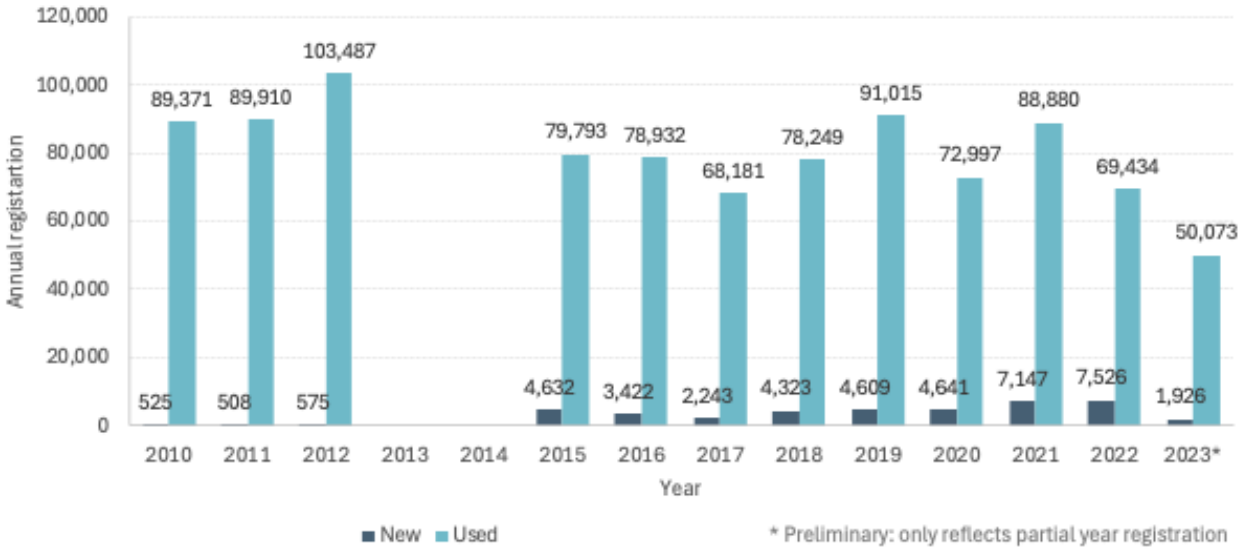
From 2015 onwards, the annual registration fluctuated between 70,000 and 96,000 units, with highest vehicle registrations of 96,026 observed in 2021, possibly reflecting post-COVID trade recovery, easing supply chains, or deferred consumer demand.

The low registration number in 2023 is due to the incompleteness of the data. Although the data does not reflect the full year of registration, the fleet characteristic analysis can be treated as a preliminary reflection of 2023 registration.

3.1.1 Condition of Registered LDVs

The column chart shows, for every calendar year, how many passenger cars and light commercial vehicles entered the Kenyan market as brand-new units versus second-hand imports. From 2010 through 2023, used vehicles have accounted for an average 94 % of annual LDV registrations (Figure 2). New-car volumes, while trending upward from 2017 to 2022, have never exceeded the 10% threshold.

Figure 2 Condition of light-duty vehicles (LDVs) entering Kenya, 2010-2023: "New" vs. "used"



Across all years, used vehicles consistently dominate registrations, far outnumbering new vehicle entries. The clear dominance of used vehicles highlights the importance of second-hand import regulations and the need for fuel economy and emissions labelling at the point of entry.

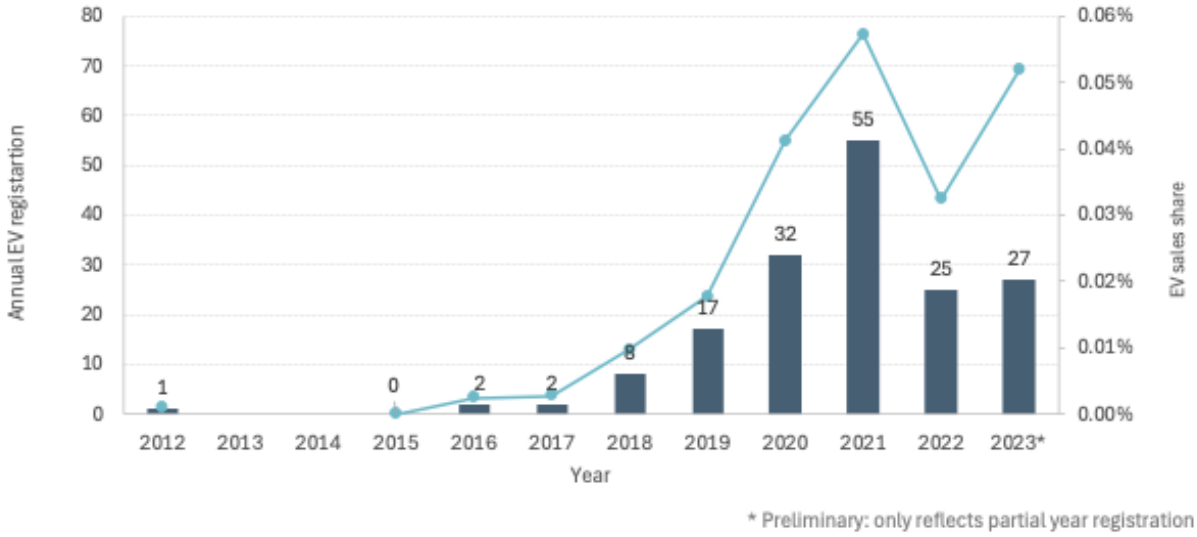
Table 5 Vehicle Registration Condition data analysed

Year	Annual registrations	New vehicle share	Notable inflection points
2010	89,896	0.6%	Resumption of used-car inflows after 2009 recession.
2011	90,418	0.6%	
2012	104,062	0.6%	
2013	/	/	Temporary uptick in new cars driven by corporate fleet renewals and start-up of local assembly lines (Isuzu, Toyota Hino).
2014	/	/	
2015	84,425	5.5%	
2016	82,354	4.2%	Used imports rebound as shilling stabilises; 8-year age-limit still the binding constraint.
2017	70,424	3.2%	
2018	82,572	5.2%	
2019	95,624	4.8%	
2020	77,638	6.0%	COVID-19 logistics bottlenecks suppress overall volumes;
2021	96,027	7.4%	Post-pandemic recovery plus an incentives package for locally assembled units.
2022	76,960	9.8%	Data suggest the highest new-car share in 14 years, but absolute volumes are still modest.
2023 Preliminary	51,999	3.7%	

3.1.2 Registration of electric light-duty vehicles

Based on the cleaned dataset, Figure 3 shows the number of four-wheel EVs (passenger cars + light commercial) that registered between 2012 and 2023.

Figure 3 EV-Uptake of EVs



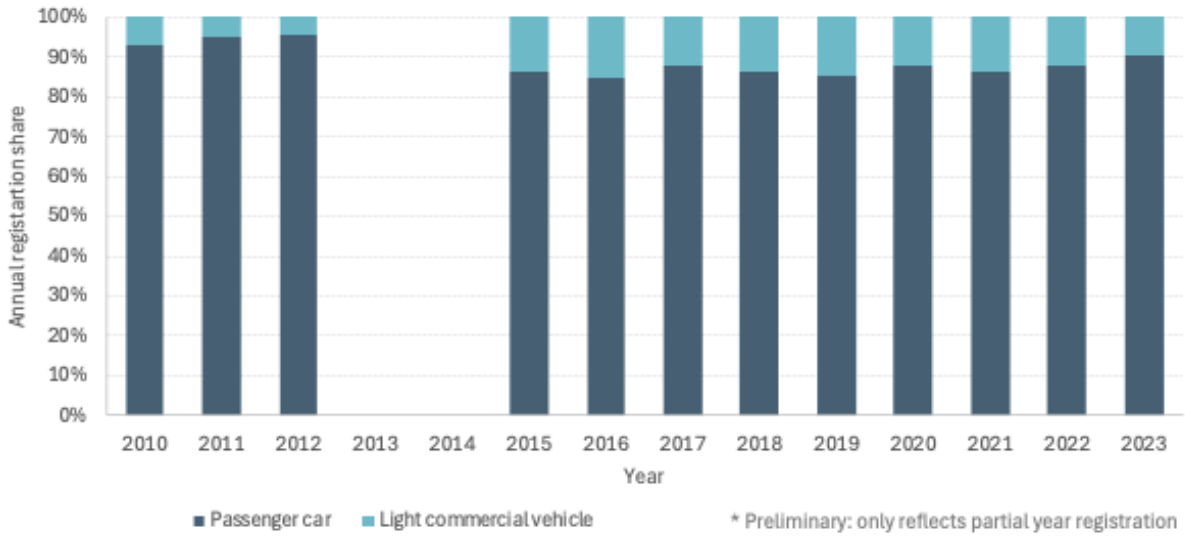
EV registrations increased from 8 units in 2018 to 55 in 2021, reflecting an average annual growth rate of 78%. However, they still account for less than 0.06% of all light-duty vehicle (LDV) imports. Achieving the government's 5% target for new registrations by 2025 would require a significant scale-up. (*See Appendix C.5: Electric Vehicle (EV) Registration Status in Kenya, 2012–2023.*)

3.1.3 LDV Registrations by Vehicle Category

To distinguish trends in vehicle importation and usage, light-duty vehicles (LDVs) in this study were classified into two broad categories based on body type. First, passenger cars (PCs), including saloons, station wagons, hatchbacks, and SUVs, primarily used for personal and family transport. Secondly, the Light Commercial Vehicles (LCVs), such as pickups, vans, and small trucks, which are typically used for commercial, logistical, or dual-use purposes. This classification provides a clearer understanding of market dynamics and the evolving demand between private mobility and commercial transport needs.

Figure 4 shows the annual registration of LDVs by category for the period between 2010 – 2023. Form the chart, it is observed that passenger cars have consistently dominated the registration of vehicles in Kenya. The sales share of PCs ranged from 85% to 90% from 2015 to 2023, dropping from up to 96% in 2012. This trend highlights the importance of PCs in Kenya's LDV market and their role in emission reduction targets and strategy.

Figure 4 Annual registration share of LDVs by category — Passenger Cars vs Light Commercial Vehicles (2010–2023).



Petrol vs Diesel Registrations (2010–2023)

Figure 5 presents the annual registration trends of light-duty vehicles (LDVs) in Kenya by fuel type specifically petrol and diesel from 2010 to 2023. The classification was based on the recorded fuel type field in the vehicle inventory dataset. This chart helps illustrate the fuel preferences among vehicle buyers, which has implications for emissions, fuel demand, and policy development in Kenya's transport sector. It is evident that petrol-powered LDVs consistently dominate the Kenyan market, contributing 80% to 90% of annual registrations throughout the 14-year period.

Figure 5 Annual LDV registration share by fuel type — Petrol vs Diesel (2010–2023).

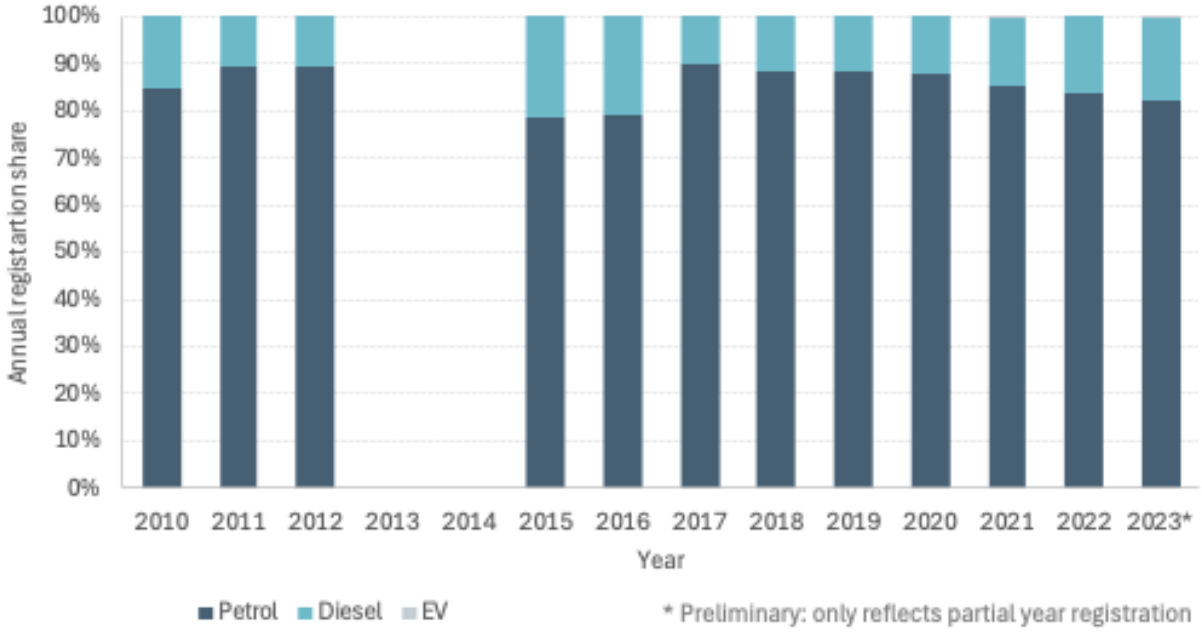
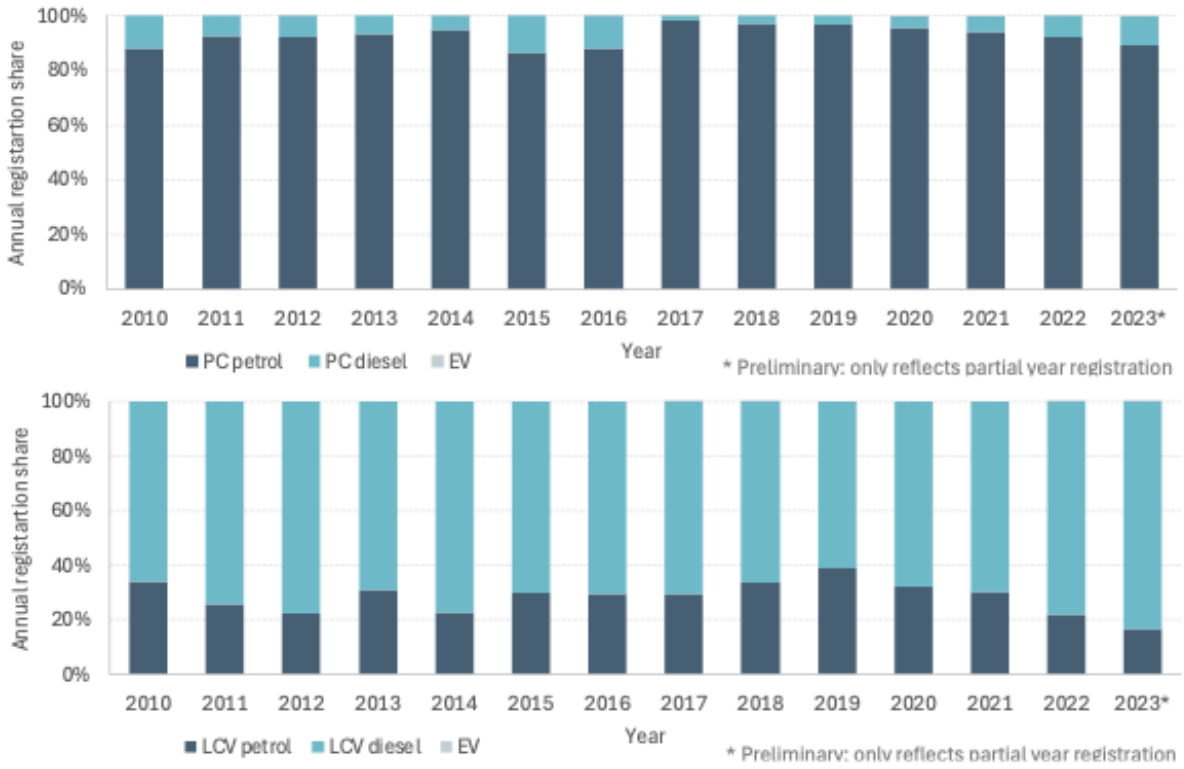


Figure 6 breaks down the fuel market share by PC and LCV. For PCs, petrol vehicles account for around 90% of the annual total registration, with slight decrease of share from 2017 to 2023. For LCVs, the share of diesel vehicles is much higher, accounting for 60% to 80% of the total registration, with an increase trend from 2019 to 2023.

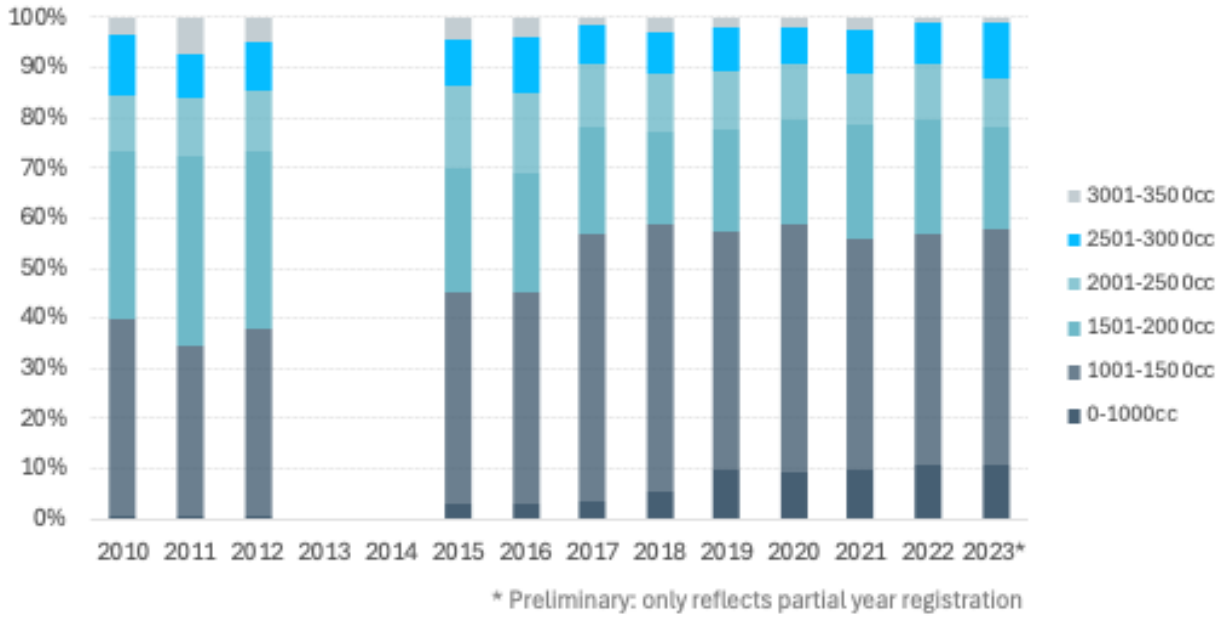
Figure 6 Annual LDV registration share by fuel type and vehicle type — Petrol vs Diesel (2010–2023).



3.1.4 LDV Registrations by Engine Size Category

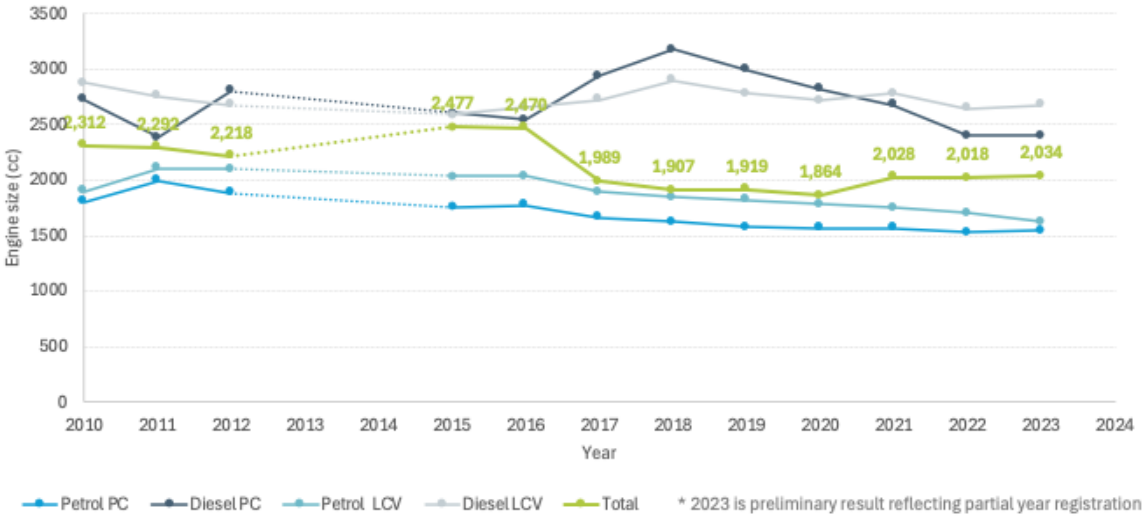
Figure 7 displays the total number of vehicles registered each year, divided by engine size, highlighting the most popular categories. The chart clearly shows that the 1001-1500cc engine size category (shown by the brown bars) has been the leading segment in yearly vehicle registrations from 2010 to 2023. Since 2017, more than half of the registered vehicles have an engine size less than 1500cc. This indicates a strong consumer preference for smaller engines. This dominance is likely driven by factors such as affordability, fuel efficiency, and suitability for urban driving conditions in Kenya.

Figure 7 Vehicle Registration Share by Engine Size (2010 - 2023)



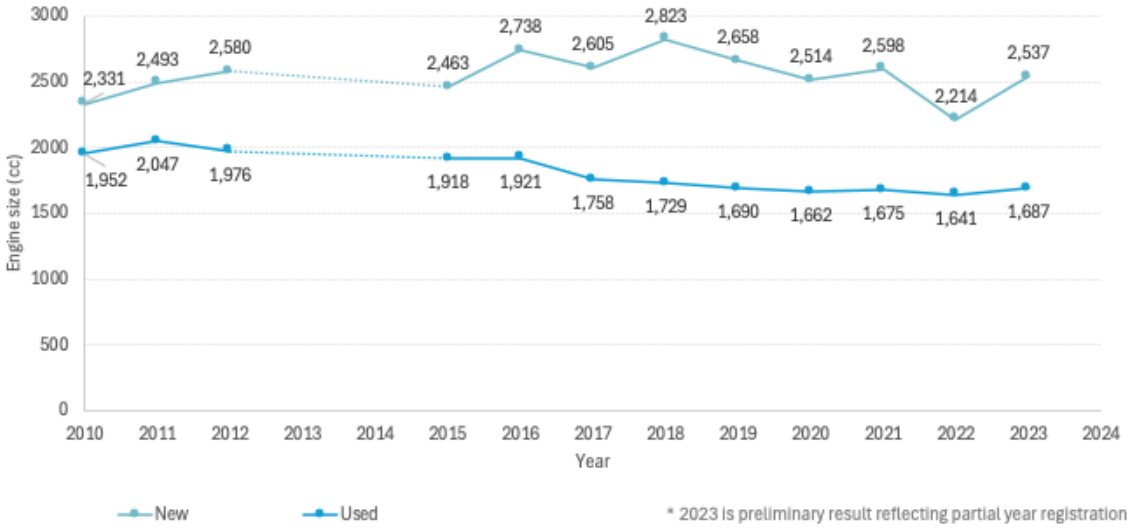
Figures 8 presents a comparative analysis of how the average engine sizes for diesel and petrol vehicles have evolved from 2010 to 2023. In general, the diesel vehicles have much larger engine compared to petrol vehicles for both passenger cars and light-commercial vehicles. The decrease in fleet average engine size from 2015 to 2020 is driven by the decrease of petrol vehicle engine size. Then the increase in fleet average engine size from 2020 and onward is driven by the increase share of diesel vehicles. The overall fleet average engine size was a decrease from 2010 to 2023 for all sub-types, indicating a trend of increasing preference for smaller engine vehicles.

Figure 8 Average Engine Size by Fuel Type (2010 – 2023)



Figures 9 presents a comparative analysis of how the average engine sizes for new and used vehicles have evolved from 2010 to 2023. It is clear that the average engine size of new vehicles are much higher than those of used vehicles, indicating that consumers purchasing new vehicles usually choose more powerful vehicles with bigger engines compare to used vehicle buyers.

Figure 9 Average Engine Size by vehicle condition (2010 – 2023)



3.1.5 Weighted Average Age of LDVs 2010 - 2023

The weighted average age of registered vehicles is a refined metric that offers a more accurate picture of the age profile of a country's vehicle fleet. Unlike a simple arithmetic average, this approach accounts for the number of vehicles registered per type or model, ensuring that frequently registered vehicle groups have a proportionate influence on the final figure.

Each vehicle's age is weighted by its frequency in the dataset, meaning that categories with more units exert a greater effect on the overall average. This method ensures that the computed value more reliably reflects dominant market trends, such as a shift toward newer or older vehicles, than a basic mean.

Figure 10 illustrates the weighted average age of used vehicles registered in Kenya between 2010 and 2023. The weighted average age represents the typical age of registered used vehicles in each year, considering the number of units registered per vehicle age group. The overall trend in the weighted average age is stable, maintaining at slightly below 7 years.

Figure 10 Weighted Average Age for used LDVs (2010 - 2023)

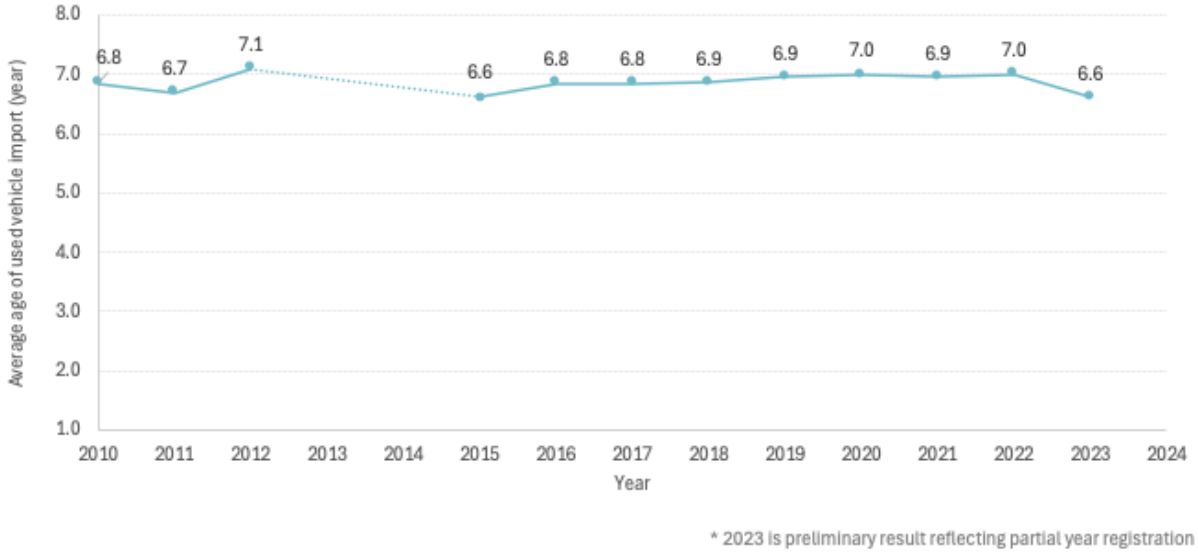
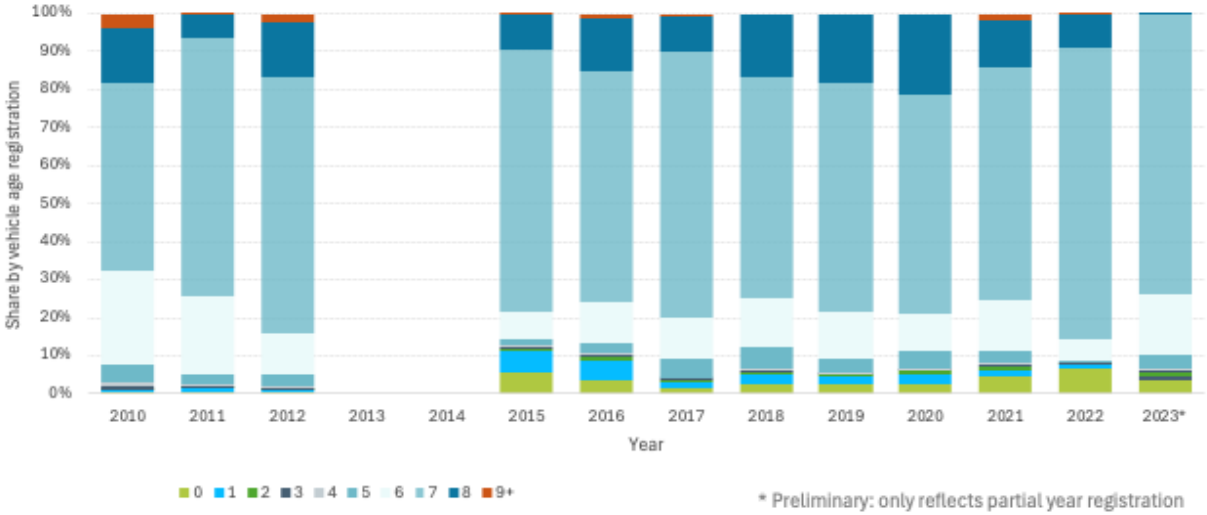


Figure 11, further breaks down the imported vehicle by age at first registration, including new vehicles showing age as zero. Vehicles with age less than 5 years account of around 10% of the total registration. The vast majority of vehicles are 7 years old at first registration, which is just within the 8-year import vehicle age limit.

Figure 11 Distribution of LDVs by Age (2010 - 2023)



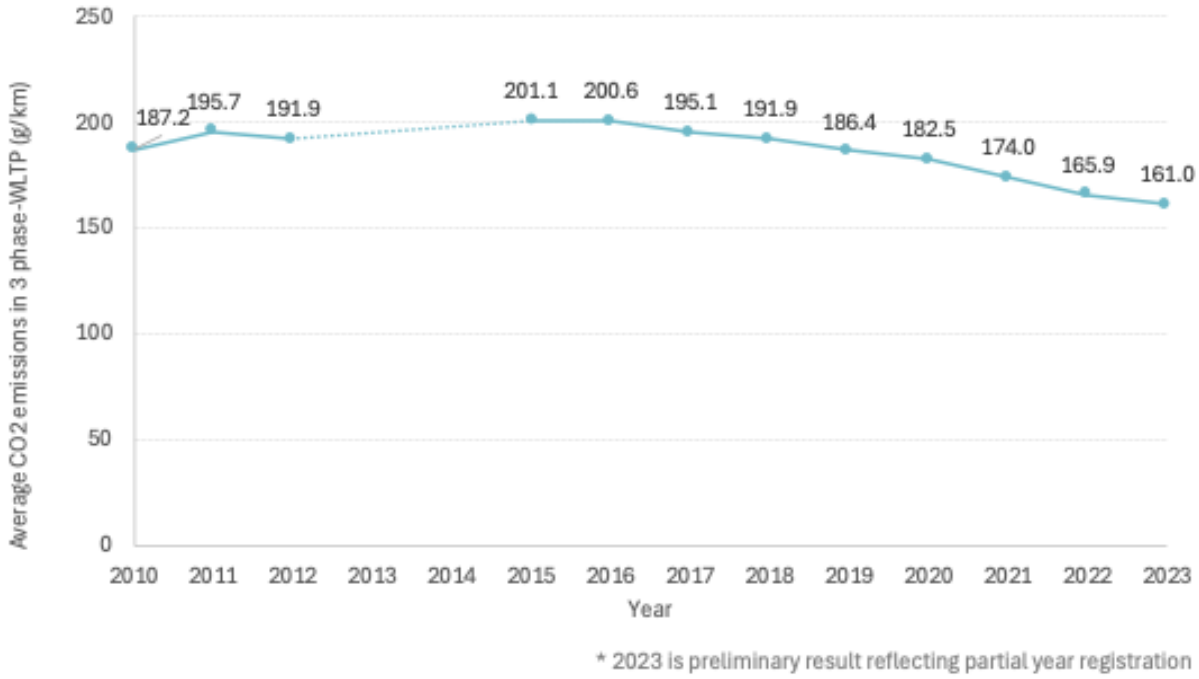
3.2 CO_2 Emissions

This section presents a data-driven analysis of carbon dioxide (CO_2) emissions from Kenya's light-duty vehicle fleet between 2010 and 2023. The focus is on comparing emissions from passenger and commercial vehicles, examining trends over time, and assessing how engine size and vehicle type influence average CO_2 output. Historical data (2010–2022) is used to highlight long-term trends and illustrate the evolution of vehicle attributes over time.

3.2.1 Average CO_2 Emission (gCO_2/km)

Figure 12 illustrates the annual trend in Kenya's average carbon dioxide (CO_2) emissions of newly registered vehicles. The values, expressed in grams of CO_2 per kilometre (gCO_2/km), reflect the environmental performance of the vehicle fleet over time. The average gCO_2/km rose from 187.2 gCO_2/km in 2010 to 201.1 gCO_2/km in 2015. From 2015 to 2023, the fleet average emissions dropped to 161.0 g/km.

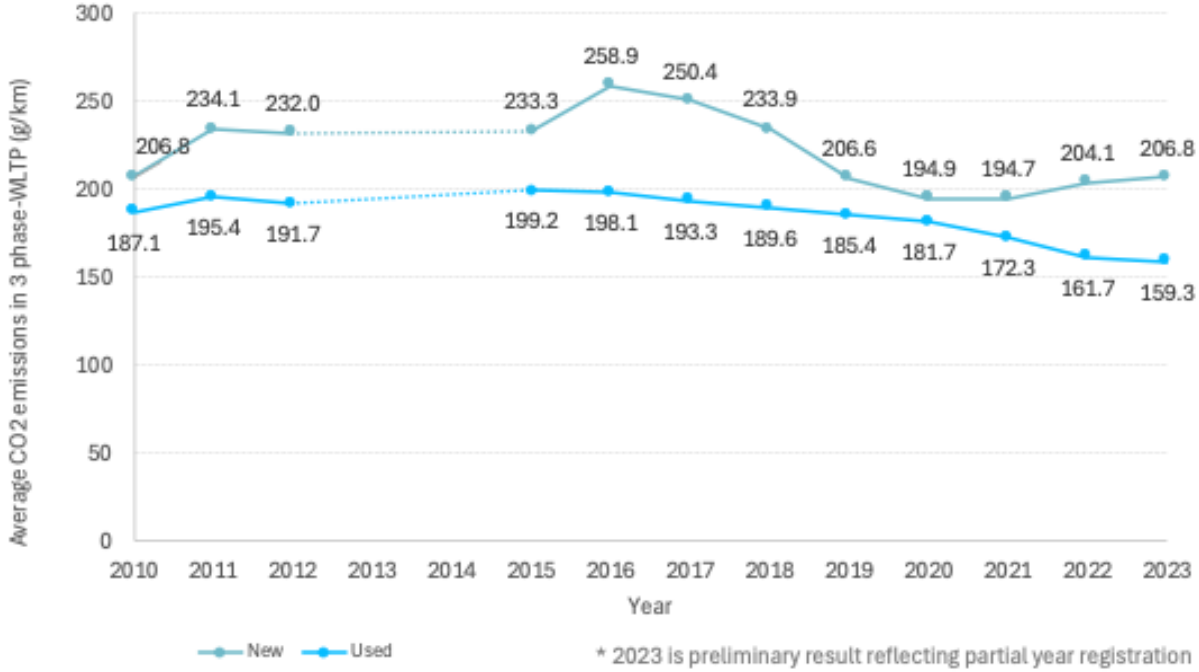
Figure 12 Average CO_2 Emission per year (gCO_2/km)



To better understand this trend, the study disaggregated emission data by key variable vehicle condition (new vs used), vehicle category (passenger vs light commercial), fuel type (petrol vs diesel), and age at import.

Figure 13 illustrates the trends in CO_2 emissions (g/km) for both new and used vehicles based on their year of registration. It is important to note the diverging trends in CO_2 emissions between new and used vehicles. Since the new vehicles only account for 0.6% to 9.8% of the total registration depending on the year, meaning around 500 to 7,500 registration per year, small changes in the imported new vehicle models would affect the fleet average CO_2 emissions. Thus, the fleet average CO_2 emissions of new vehicles shows more fluctuation compared to used vehicles.

Figure 13 CO_2 Emissions by Vehicle Condition



The new imported vehicles consistently showed higher CO_2 emissions compared to used vehicles. This is as expected as the average engine size of new vehicles are much larger than the used vehicles, which is usually correlated with higher CO_2 emissions. The fleet average CO_2 emission of used imported vehicles showed consistent decrease, especially since 2015. This is likely due to the spillover effect of the fuel economy standards adopted in Japan that pushed for technology advancement of the vehicles sold in Japan, which then was exported to Kenya as used vehicle after around 7 years of usage.

Figure 14 illustrates the trends in average CO_2 emissions for different vehicle categories in Kenya. It can be observed from the chart that LCVs have generally maintained higher CO_2 emission levels throughout the period. While they exhibit some fluctuations, the fleet average CO_2 emissions in 2023 (222.5 g/km) only had 1% reduction compared to the fleet average CO_2 emission 14 years ago in 2010 (225.6 g/km). Comparatively, the fleet average CO_2 emissions of PCs decreased from 184.3 g/km in 2010 to 154.5 g/km in 2023. Although there is a 30 g/km reduction in fleet average CO_2 emissions, it only equals to a 1.3% annual reduction when considering the 14-year time span.

Figure 14 CO_2 emission by Vehicle Category

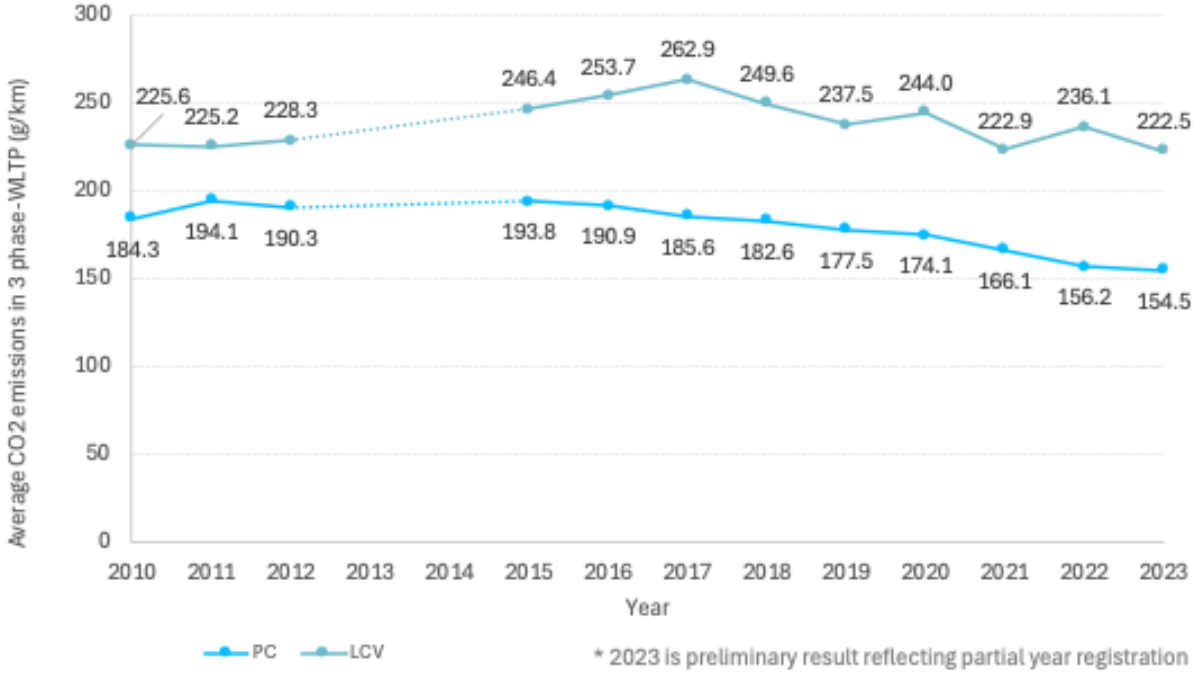
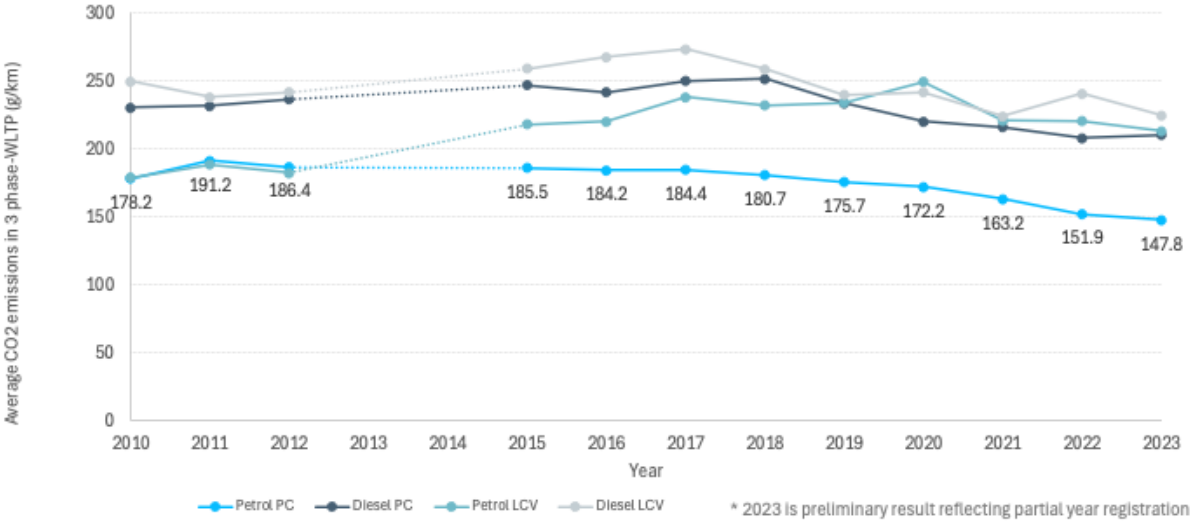


Figure 15 illustrates the trends in CO_2 emissions (g/km) for vehicles registered in Kenya, disaggregated by their primary fuel type (Diesel and Petrol) and vehicle type. For this analysis, we did not separate out hybrid vehicles from petrol or diesel vehicle analysis. The CO_2 emissions of hybrid vehicles (102-114 g/km under 3P-WLTP) registered were generally lower than the CO_2 emission of petrol and diesel vehicles, however, the registration of hybrid vehicles are extremely low (0 to 93 units per year), therefore are not separately discussed in this analysis. It is observed that diesel-powered vehicles consistently exhibit significantly higher average CO_2 emissions per kilometre compared to petrol-powered vehicles across almost the entire period. After the rapid increase of CO_2 emission of petrol LCVs from 2012 to 2015, their average CO_2 performance got to the similar level as diesel vehicles since 2019.

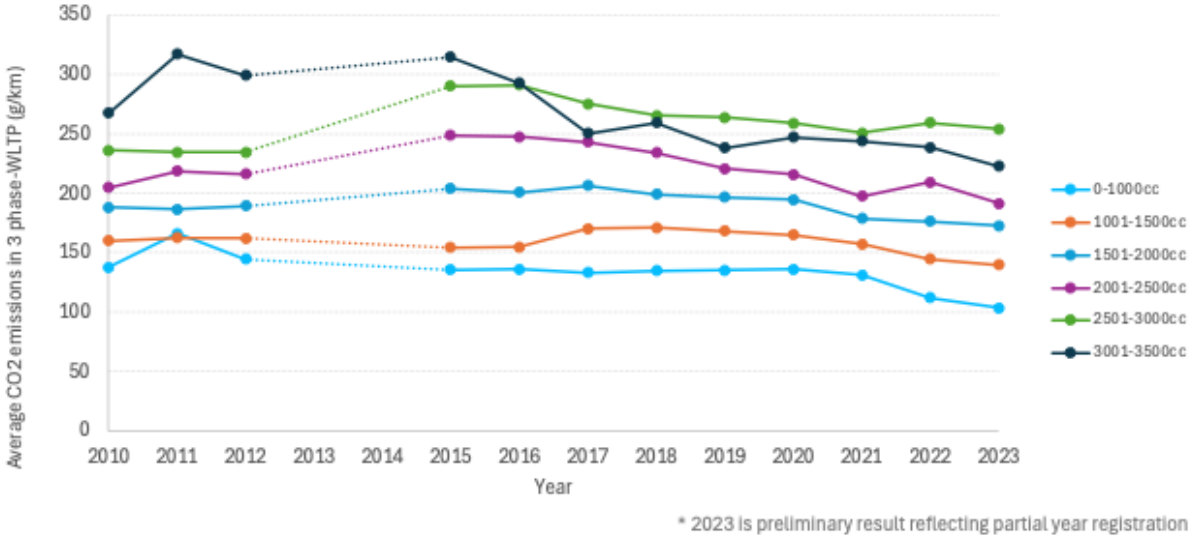
Figure 15 CO_2 Emission by Fuel Type



The data identifies that although diesel vehicles account for a smaller share of new registration in Kenya, these vehicles have higher CO_2 emissions per kilometre of driving. This warrants the development of policies targeting both petrol and diesel vehicle imports, usage, or incentivizing cleaner alternatives.

Figure 16 illustrates the average CO_2 emissions (g/km) for vehicles in different engine size categories over time. The chart reveals that the average CO_2 emission increase as the engine displacement gets larger. Vehicles with an engine below 1500cc maintain a relatively low average CO_2 emission profile compared to larger engine categories (e.g., 2001-2500cc, 2501-3000cc, and 3001-3500cc). Most categories showed a consistent downward trend in emissions over time, except for the 2501-3000cc category that fluctuated and showed a slight increase in 2023 compared to 2010 level.

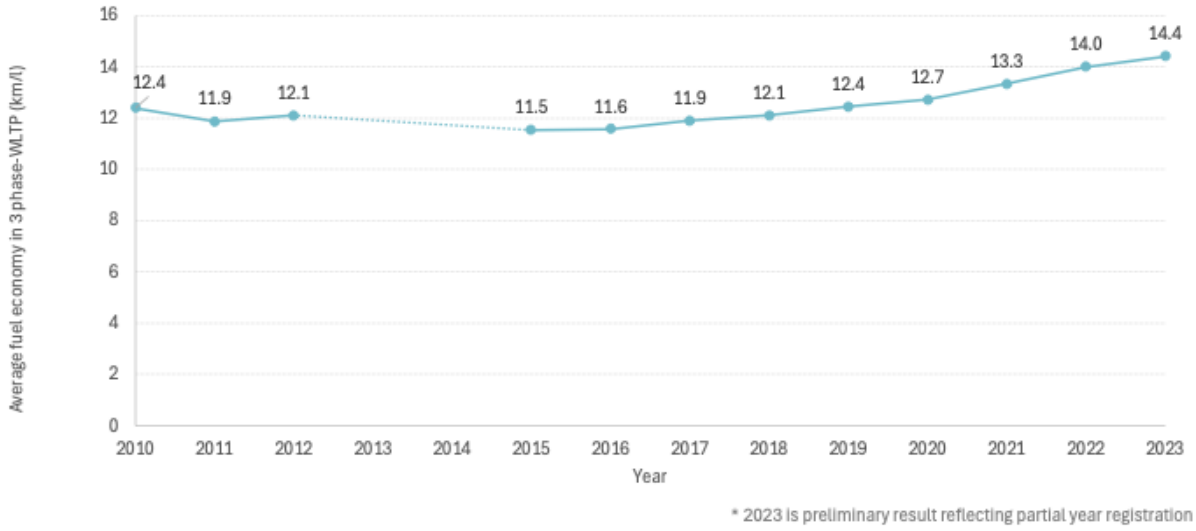
Figure 16 Average CO_2 Emission by Engine Size Category



3.3 Fuel Economy (km/litre)

Figure 17 on petrol equivalent fuel economy (km/l) presents the annual evolution of average fuel efficiency among registered vehicles from 2010 to 2023. Fuel economy, measured here as kilometres travelled per litre of petrol equivalent (km/l), provides a critical indicator of vehicle efficiency and directly influences fuel consumption costs, emissions, and environmental impact. From 2015 onwards, the graph shows gradual growth in fuel efficiency, climbing from 11.5 km/l to 14.4 km/L by 2023. The improvement aligns with the decrease of fleet average CO_2 emissions of the fleet.

Figure 17 Fuel Economy (km/l)



3.4 Summary and discussion

The analysis of Kenya's light-duty vehicle (LDV) fleet between 2010 and 2023 provides vital insights for policy, regulatory planning, and environmental decision-making. The vehicle registration landscape is marked by a heavy reliance on used vehicle imports, which account for over 90% of annual LDV inflows. This indicates that age limits on used vehicle imports have a considerable influence on import patterns, with vehicles typically selected just below the permitted age restriction. Consumers buying new vehicles in Kenya tend to choose more powerful vehicles with higher engine, as the average engine size of new vehicles are much higher than those of used vehicles. Therefore, the average CO_2 emissions of new vehicles registered in Kenya were much higher than used vehicles from 2010 to 2023.

From 2010 to 2023, the annual registration of LDVs were dominated by passenger cars with sales share between 85% to 96% and petrol vehicles with sales shared between 80% to 90%. The electric vehicle (EV) adoption remains minimal, with annual registrations increased from 8 units in 2018 to 55 in 2021. However, EVs still account for less than 0.06% of total LDV registrations.

In terms of engine size, the diesel vehicles have much larger engine compared to petrol vehicles for both PCs and LCVs. The 1,001–1,500 cc category has emerged as the most common engine size, reflecting a preference for compact, cost-efficient vehicles. There are some fluctuations in the fleet average engine size. The decrease from 2015 to 2020 (2,477 cc to 1,864 cc) is likely driven by the decrease of average petrol vehicle engine size, whereas the increase from 2020 and 2023 (1,864 cc to 2,034 cc) is likely driven by the increase share of diesel vehicles. The overall fleet average engine size was a decrease from 2010 to 2023 for all sub-types, including petrol PC, diesel PC, petrol LCV, and diesel LCV. This shows a trend of increasing preference for smaller engine vehicles.

The emissions profile of the fleet showed some improvement over time. The average gCO_2/km first rose from 187.2 gCO_2/km in 2010 to 201.1 gCO_2/km in 2015 and dropped to 161.0 gCO_2/km in 2023. The corresponding fleet average fuel economy

trend aligns with the CO_2 emission trend, which means that a decrease in CO_2 emission correspond to an increase in fuel economy. The breakdown analysis showed much higher CO_2 emissions of imported new vehicles compared to used vehicle imports. This is as expected as the average engine size of new vehicles are much larger than the used vehicles, which is usually correlated with higher CO_2 emissions.

The average CO_2 emission of LCVs are generally higher than PC CO_2 emissions. While the fleet average CO_2 emission of LCVs remains almost unchanged from 2010 to 2023, the fleet average CO_2 emissions of PCs decreased from 184.3 g/km in 2010 to 154.5 g/km in 2023, equals to a 1.3% annual reduction when considering the 14-year time span.

Considering the vast majority of vehicles registered are used vehicles and most of those were imported from Japan, the reduction in the fleet average CO_2 emissions is likely due to a combined impact of the decrease in engine size and the spillover effect of the fuel economy standards adopted in Japan, which pushed for technology advancement of the vehicles sold in Japan. Considering the average age of used vehicle at import is 7 years, used vehicle imported from 2010 to 2023 correspond to new vehicles sold in Japan from 2003 to 2016. However, the fleet average CO_2 emissions of PCs sold in Japan have an annual reduction of 3.2% from 2003 to 2016 (Yang & Rutherford, 2019), which is much faster than the average CO_2 decrease of PCs imported to Kenya. To accelerate the adoption of advanced technologies and faster decarbonization progress, Kenya needs to introduce regulations and policies that require and/or incentivize import of low-emission and more efficiency vehicles.

4 Policy Options

Kenya's ambition to decarbonize its road transport sector and improve vehicle efficiency requires a well-integrated policy framework informed by robust data. International experience shows that supply-side regulations, such as CO_2 emission/fuel economy standards and zero-emission vehicle (ZEV) mandates, and market-based instruments, such as carbon taxes and feebate systems can effectively reduce emissions and steer fleets toward cleaner technologies (ICCT, 2022; IEA, 2023). Even though, their successful implementation is heavily contingent on the availability and quality of underlying vehicle data collected through the registration, inspection, and importation processes.

4.1 CO_2 emission/Fuel economy Standards

CO_2 emission or fuel economy standards establishes maximum CO_2 emissions thresholds (g/km), maximum fuel consumption thresholds (litre per 100 km), or minimum efficiency thresholds (km per litre) to promote cleaner, more energy-efficient vehicles. These standards have long-term benefits for energy savings and climate mitigation. Kenya's vehicle data system currently records engine size, curb weight, and fuel type which are foundational elements for setting initial efficiency benchmarks. However, key variables such as make/model, fuel economy, and CO_2 emissions values remain incomplete. Along with the adoption of the CO_2 emission/fuel economy standards, the government should require the reporting of fuel economy and emissions data along with other key vehicle specification information at importation or sale. The agency also need to determine the test cycle(s) that vehicles should report the values under to determine compliance with the standards. These requirements would enable effective implementation and monitoring of the standards.

4.2 Zero-Emission Vehicle (ZEV) Mandates

ZEV mandates require that a defined proportion of new vehicle sales or imports be zero-emission (e.g., battery-electric or hydrogen fuel cell). This regulatory mechanism is adopted by China, United Kingdom, Canada, and California in the United States and considered by the major emerging markets (e.g., India, Chile). Given accelerated electrification would greatly contribute to carbon reduction of the transportation sector, adopting ZEV mandate aligns with Kenya's national decarbonization commitments (UNEP, 2021; ICCT, 2022). Compared with other policies, the implementation of ZEV mandates requires less data reporting. The key reported information include make and model, sales volumes, engine and fuel type (to determine electric vehicle type), and the registration year.

4.3 Carbon Tax

A carbon tax levies a charge on vehicles based on their tailpipe CO_2 emissions, thereby incentivizing low-emission alternatives. This system has been adopted in countries like South Africa and Sweden with demonstrable impact on emissions profiles (World Bank, 2023). Kenya currently lacks vehicle-specific CO_2 emissions data in its registration database. However, this gap should not delay the adoption of carbon pricing policies. A viable approach would be to mandate that importers or manufacturers provide validated emissions data (e.g., WLTP or JC08 values) at the

point of entry or registration. Such data could also be cross-referenced with international emissions databases to improve consistency. These measures would not only support carbon taxation but also strengthen Kenya's long-term vehicle data infrastructure.

4.4 Feebate Scheme

A feebate scheme combines financial penalties on high-emission vehicles (similar to a CO_2-based tax) with rebates for low-emission or electric alternatives. This market-based approach has proven effective in countries such as France and Sweden in shifting consumer behaviour toward cleaner technologies (IEA, 2023). The development of feebate program can follow the designs using international best practices even the baseline data is not perfect. During the implementation, importers are required to submit emissions and price data that are used to determine the fee or rebate level. Over time, digital sales tracking and enhanced registration requirements would support more precise calibration of the feebate system and ensure its long-term viability.

4.5 Supporting data reporting program

Each policy instrument described above presents a viable pathway to reduce emissions, improve energy efficiency, and drive Kenya's transition toward a sustainable transport future. However, the design and enforcement of these instruments need to be supported by a more comprehensive and uniform vehicle data collection system.

The government should require importers to report information on make/model, fuel economy, CO_2 emission, and other key vehicle specifications during import clearance. The data collection and matching in this analysis present an attempt to establish a complete database that include key information needed to develop fuel economy/ CO_2 emission policies. However, the government need to establish a uniform requirement to ensure consistency of the data over time. The government should also determine the test cycle(s) that the importers should use for reporting the fuel economy and CO_2 emission values, which would make it easier for the implementation of the standards and policies. Table 6 summarizes the major data gap we identified to support the implementation of relevant policies.

Table 6 Policy Options and Data Requirements

Policy Instrument	Essential Data Available	Critical Data Gaps
Carbon Tax	Condition, Curb Weight, Fuel Type, Engine Size	CO_2 g/km, Make/Model, Sales, Registration Year
Fuel Economy Standards	Condition, Fuel Type, Registration Year	CO_2 g/km, Price, Make/Model, Power, Sales Data
Feebate	Condition, Fuel Type, Engine Size	CO_2 g/km, Price, Make/Model, Sales, Registration Year
ZEV Mandate	Condition, Fuel Type, Engine Size	Make/Model, Sales Data, Registration Year

Source: Authors analysis based on the NTSA dataset

All information reported by importers should be integrated into NTSA's digital vehicle registration system in order to track compliance of the standards/mandate or support implementation of fiscal policies. Such effort also includes establishing a connected data pipeline between NTSA's registration database, Kenya Revenue Authority (KRA), and KenTrade's customs platform. These integrations will enable real-time tracking of vehicle flows into the country. To ensure cross-agency alignment, Kenya should formalize a national vehicle data governance framework covering:

- Clear mandates for NTSA, KRA, KEBS, EPRA, the Ministry of Energy and Petroleum, and Ministry of Transport
- Data standards, quality assurance mechanisms, and interoperability protocols
- Legal mechanisms for secure data sharing between agencies and with policy-relevant third parties

This governance framework should be implemented in parallel with policy reforms and ideally anchored in a legal or regulatory instrument. Establishing a national transport data coordination unit will help align data governance with Kenya's broader digital transformation strategy and ensure long-term system resilience.

The government can also develop a mandatory national vehicle labelling program for all newly imported and locally assembled vehicles. Labels should disclose information such as certified fuel economy (e.g., km/L), CO_2 emissions (g/km), fuel type and engine capacity, and other key vehicle specifications. This policy should be implemented concurrently with the development of data systems. The Kenya Bureau of Standards (KEBS) should lead the standardization process, ensuring harmonized formats and comparability. Labelling at the point of sale and registration will increase transparency, raise consumer awareness, and serve as a data source for fuel economy standards, feebate programs, and CO_2-based taxation.

5 Conclusions

This report provides a comprehensive technical assessment of Kenya's light-duty vehicle (LDV) fleet based on NTSA registration data from 2010 to 2023. The analysis aimed to generate data-driven insights into vehicle trends, fuel economy, and CO_2 emissions, and to review potential policy instruments such as carbon taxation, fuel economy standards, feebates, and ZEV mandates.

2010-2023 baseline analysis findings:

- The vehicle registration landscape is marked by a heavy reliance on used vehicle imports, which account for over 90% of annual LDV inflows. The average age for used imported LDVs stabled at around 7 years with 85% to 90% vehicles of 6 to 8 years when imported to Kenya.
- Consumers buying new vehicles in Kenya tend to choose more powerful vehicles with higher engine, as the average engine size of new vehicles are much higher than those of used vehicles.
- From 2010 to 2023, the annual registration of LDVs are dominated by passenger cars with sales share between 85% to 96% and petrol vehicles with sales shared between 80% to 90%.
- The EV adoption remains minimal, with annual registrations increased from 8 units in 2018 to 55 in 2021. However, EVs still account for less than 0.06% of total LDV registrations.
- The 1,001–1,500 cc category has emerged as the most common engine size, reflecting a preference for compact, cost-efficient vehicles. There are some fluctuations in the fleet average engine size. The overall fleet average engine size was a decrease from 2010 to 2023 for all sub-types, including petrol PC, diesel PC, petrol LCV, and diesel LCV. This shows a trend of increasing preference for smaller engine vehicles.
- While the fleet average CO_2 emission of LCVs remains almost unchanged from 2010 to 2023, the fleet average CO_2 emissions of PCs decreased from 184.3 g/km in 2010 to 154.5 g/km in 2023, equals to a 1.3% annual reduction when considering the 14-year time span.
- Considering the vast majority of vehicles registered are used vehicles and most of those were imported from Japan, the reduction in the fleet average CO_2 emissions is likely due to a combined impact of the decrease in engine size and the spillover effect of the fuel economy standards adopted in Japan, which pushed for technology advancement of the vehicles sold in Japan. Considering the average age of used vehicle at import is 7 years, used vehicle imported from 2010 to 2023 correspond to new vehicles sold in Japan from 2003 to 2016. However, the fleet average CO_2 emissions of PCs sold in Japan have an annual reduction of 3.2% from 2003 to 2016, which is much faster than the average CO_2 decrease of PCs imported to Kenya.
- To accelerate the adoption of advanced technologies and faster decarbonization progress, Kenya needs to introduce regulations and policies that require and/or incentivize import of low-emission and more efficiency vehicles.

Policy considerations:

- Kenya's ambition to decarbonize its road transport sector and improve vehicle efficiency requires a well-integrated policy framework informed by robust data. Based on the international experience, Kenya should consider adoption of supply-side regulations, such as CO_2 emission/fuel economy standards, and zero-emission vehicle (ZEV) mandates and market-based instruments, such as carbon taxes, and feebate systems, to reduce emissions and steer fleets toward cleaner technologies
- The design and enforcement of any policy instruments need to be supported by a more comprehensive and uniform vehicle data collection system. Kenya should consider:
    - Requiring importers to report information on make/model, fuel economy, CO_2 emission, and other key vehicle specifications during import clearance.
    - Integrating imported vehicle information into NTSA's digital vehicle registration system and formalizing a national vehicle data governance framework across NTSA, KRA, KEBS, EPRA, the Ministry of Energy and Petroleum, and Ministry of Transport
    - Developing a mandatory national vehicle labelling program for all newly imported and locally assembled vehicles.

6 References

- Ayetor, G. K., Oduro, S. D., & Boakye, D. (2021). Transport emissions in Africa: Challenges and opportunities. Journal of Cleaner Production, 306, 127315. https://doi.org/10.1016/j.jclepro.2021.127315
- Energy and Petroleum Regulatory Authority (EPRA). (2022). Kenya Energy & Petroleum Statistics Report.
- Global Fuel Economy Initiative. (2014). Final narrative report: Kenya. https://www.globalfueleconomy.org/media/461029/africa_erc-gfei-kenya-final-narative-report-23-07-2014-2.pdf
- Global Fuel Economy Initiative. (2020). Vehicle Efficiency and Electrification: A Global Status Report.
- Government of Kenya. (2005). Legal Notice No. 78 of 15th July 2005 – Road Vehicle Inspection Requirements. Nairobi: Government Printer.
- Government of Kenya. (2012). Integrated National Transport Policy 2009–2012. Nairobi: Ministry of Transport.
- Government of Kenya. (2019). The Energy Act, No. 1 of 2019. Nairobi: National Council for Law Reporting.
- Government of Kenya. (2020). Finance Act & National EV Roadmap Draft.
- ICCT. (2022). Real-world fuel consumption of LDVs. International Council on Clean Transportation.
- ICCT. (2022). Zero-emission vehicle policies and deployment in emerging markets. https://theicct.org/publication/global-zev-policies-mar22/
- International Council on Clean Transportation (2021). From laboratory to road: A 2021 update of official and real-world fuel consumption and CO_2 values for passenger cars in Europe. International Council on Clean Transportation. https://theicct.org/publication/from-laboratory-to-road-2021/
- International Council on Clean Transportation. (2023, December). Annual Report 2022. https://theicct.org/wp-content/uploads/2023/12/ICCT-Annual-Report-2022-Final.pdf
- International Energy Agency (IEA). (2022). Energy Efficiency 2022. https://www.iea.org/reports/energy-efficiency-2022
- International Energy Agency (IEA). (2023). CO_2 Emissions from Fuel Combustion: Overview. https://www.iea.org/reports/co2-emissions-in-2023.
- International Energy Agency (IEA). (2023). Global EV Outlook 2023: Catching Up with Climate Ambitions. https://www.iea.org/reports/global-ev-outlook-2023
- International Energy Agency (IEA). (2023). Tracking Transport 2023. https://www.iea.org/reports/tracking-transport-2023
- Kenya Association of Manufacturers (KAM). (2020). Automotive Sector Profile. Nairobi: KAM. https://kam.co.ke
- Kenya Bureau of Standards (KEBS). (2019). KS 1515:2019 – Code of Practice for Inspection of Road Vehicles. Nairobi: KEBS.

- Kühlwein, J., Miller, J., & Bandivadekar, A. (2020). Development of the Worldwide Harmonized Light Vehicles Test Procedure (WLTP). International Council on Clean Transportation.
- Ministry of Energy. (2020). Kenya National Energy Efficiency and Conservation Strategy (NEECS). Nairobi: Government of Kenya.
- NTSA. (2023). Kenya Vehicle Registration Dataset.
- NTSA. (2024). National Transport and Safety Authority Strategic Plan (2023–2027).
- National Transport and Safety Authority (NTSA). (2022). Motor Vehicle Registration Statistics. Nairobi: NTSA.
- Posada, F., Chambliss, S., & Blumberg, K. (2016). Africa Used Vehicle Project: Clean Vehicles for All. Washington, D.C.: ICCT. https://theicct.org/publication/africa-used-vehicle-imports-2016/
- Quality Inspection Services Japan (QISJ). (n.d.). Vehicle Inspection Verification Portal. https://www.qisjp.co.uk
- Tietge, U., Diaz, S., Mock, P., German, J., Bandivadekar, A., & Ligterink, N. (2019). From laboratory to road: A comparison of official and real-world fuel consumption and CO_2 values for cars in Europe and the United States. International Council on Clean Transportation. https://theicct.org/publication/from-laboratory-to-road-2019-update/
- United Nations Environment Programme (UNEP). (2020). Kenya Air Quality Profile. Nairobi: UNEP. https://www.unep.org/resources/report/kenya-air-quality-profile
- United Nations Environment Programme (UNEP). (2020). Used Vehicles and the Environment: A Global Overview of Used Light Duty Vehicles; Flow, Scale and Regulation.
- United Nations Environment Programme (UNEP). (2021). Electric Mobility: Africa Outlook and Global Lessons. https://www.unep.org/resources/report/ev-outlook-africa
- United Nations. (2022). Energy Efficiency for Sustainable Development. https://sdgs.un.org/goals/goal7
- WBCSD. (2004). Mobility 2030: Meeting the Challenges to Sustainability. World Business Council for Sustainable Development.
- World Bank. (2023). State and Trends of Carbon Pricing 2023.
- World Health Organization (WHO). (2019). Air Pollution in Africa. Geneva: WHO. https://www.who.int
- Yang, Z., & Bandivadekar, A. (2021). Technical Assessment of New Zealand's Vehicle Fuel Efficiency Standard. ICCT Working Paper.
- Yang, Z., & Rutherford, D. (2019). Japan 2030 fuel economy standards. ICCT Policy Update.

Appendices

Appendix A: Variable Definitions

The table below provides definitions and descriptions for each variable used in the vehicle dataset analysed in this report. The dataset contains 1,059,079 observations and 26 variables, representing vehicle registration records collected between 2010 and 2023.

Variable Name	Description	Data Type	Example / Notes
units	Number of vehicle units (typically 1 per record)	Integer	1
condition	Indicates whether the vehicle is new or used	Character	"NEW", "USED"
body_type	Vehicle body configuration	Character	"S.WAGON", "M.BUS/MATATU", "SALON"
vehicle_make	Manufacturer/brand of the vehicle	Character	"TOYOTA", "HONDA", "SUBARU"
vehicle_model	Specific model name of the vehicle	Character	"FORESTER", "CR-V", "A4"
chasis	Vehicle's chassis number	Character	Unique alphanumeric identifier
man_year	Year the vehicle was manufactured	Integer	2009, 2010
reg_year1	Year the vehicle was registered in Kenya	Integer	2010
fuel_type	Primary fuel used by the vehicle	Character	"PETROL", "DIESEL", "HYBRID", "ELECTRIC"
engine_size	Engine displacement in cubic centimetres (cc)	Integer	1500, 1980
vehicle_use	Intended use of the vehicle	Character	"PRIVATE", "PSV", "COMMERCIAL"
no_passengers	Official passenger carrying capacity	Numeric	5, 14
test_cycle	Emission test cycle used to derive CO_2 values	Character	"JC08", "NEDC", "CAFE", "WLTP"
CO_2_emission	Carbon dioxide emissions in grams per kilometre (original test cycle)	Numeric	173, 244
fuel_consumption	Fuel consumed in litres per 100 km (original test cycle)	Numeric	7.5, 10.2
wltp_gco_2	Harmonized CO_2 emissions using WLTP conversion (g/km)	Numeric	192, 254
fuel_economy	Fuel economy in kilometres per litre (km/l)	Numeric	10.97, 8.29
tare_weight	Weight of the vehicle without load (kg)	Numeric	1480, 1730
gross_weight	Total permissible weight including load (kg)	Numeric	1755, 2145
load_capacity	Maximum load the vehicle can carry (kg)	Numeric	275, 1100
vehicle_types	General vehicle category	Character	"MOTOR VEHICLE"
driver_side	Position of the steering wheel	Character	"RIGHT SIDE", "LEFT SIDE"
crsp	Vehicle's current retail selling price (KES)	Numeric	6,520,000
age	Vehicle age in years at time of analysis	Integer	0, 1, 5

depreciation	Estimated depreciation rate as a decimal	Character	"0.1", "0.05"
estimated_value	Estimated current vehicle value after depreciation (KES)	Numeric	5,868,000

Appendix B: Categorical Variables

Variable	Type	Sample Values
condition	Character	"NEW", "USED"
body_type	Character	"S.WAGON", "M.BUS/MATATU"
vehicle_make	Character	"TOYOTA", "HONDA", "SUBARU"
vehicle_model	Character	"FORESTER", "HIACE", "CR-V"
fuel_type	Character	"PETROL", "DIESEL", "HYBRID"
vehicle_use	Character	"PRIVATE", "PSV", "COMMERCIAL"
test_cycle	Character	"JC08", "NEDC", "WLTP"
vehicle_types	Character	"MOTOR VEHICLE"
driver_side	Character	"RIGHT SIDE", "LEFT SIDE"
depreciation	Character	"0.1", "0.05", "0.15"

Appendix C: Vehicle Classification Structure

This appendix outlines the classification structure applied to vehicles in the dataset, which was used to support segmentation in the analysis of emissions, fuel economy, and fleet characteristics. The classification categories are aligned with international norms and contextualized for Kenya's transport sector.

C.1 Classification by Vehicle Body Type

Vehicles were grouped into distinct body types based on NTSA registration records and standard vehicle design categories:

Body Type Category	Common Examples	Purpose
Saloon	Toyota Corolla, Nissan Sunny	Passenger car, private use
Station Wagon (S.WAGON)	Subaru Forester, Toyota Fielder	Passenger/utility, family vehicle
Pick-Up	Toyota Hilux, Isuzu D-Max	Commercial/light goods
Panel Van	Toyota Probox, Nissan Vanette	Delivery/logistics
Minibus/Matatu	Toyota Hiace, Nissan Caravan	Public transport
Bus/Coach	Isuzu, Hino buses	Mass transit, long-distance
Lorry/Truck	Mitsubishi Canter, Isuzu FRR	Heavy goods transport
SUV	Toyota RAV4, Honda CR-V	High-clearance personal use
Special Purpose Vehicle	Ambulance, Fire Truck	Emergency or specialized use

C.2 Classification by Engine Size

Engine size was used as a proxy for vehicle performance and efficiency. Vehicles were grouped into five categories:

Engine Size Range (cc)	Category Label	Use in Analysis
0–1000	Micro/Compact	Entry-level vehicles, fuel-efficient
1001–1500	Small Engine	Most common; preferred for fuel economy
1501–2000	Medium Engine	Balance of performance and efficiency
2001–3000	Large Engine	Higher emissions; mid-size SUVs, vans
>3000	Extra-Large Engine	High fuel consumption and emissions

C.3 Classification by Vehicle Type

Vehicle types were broadly grouped according to NTSA's designation to distinguish light-duty vehicles (LDVs) from other categories:

Vehicle Type	Definition
Light-Duty Vehicle (LDV)	Passenger cars, pick-ups, SUVs, vans with GVW < 3,500 kg
Heavy-Duty Vehicle (HDV)	Trucks, buses, trailers with GVW ≥ 3,500 kg
Two/Three Wheelers	Motorcycles, tuk-tuks (excluded from LDV analysis)

C.4 Classification by Fuel Type

Fuel type is a key variable for emissions and efficiency analysis:

Fuel Type	Variants Included
Petrol	Regular petrol vehicles
Diesel	Diesel-fueled vehicles
Hybrid	Petrol/Electric hybrids (e.g., Prius)
Electric	Battery Electric Vehicles (BEVs)
Others	LPG, CNG, or unspecified alternatives

Note: Classifications were harmonized and validated during the data cleaning process to ensure consistency across records and alignment with analysis needs (see Chapter 3 for methodology).

C.5 Electric Vehicle (EV) Registration Status in Kenya (2012–2023)

Year	New EVs Registered	Key Interventions and Market Developments
2012–2017	≤ 2 per year	Introduction of one-off pilot electric cars (e.g., VW e-Golf, Nissan Leaf) primarily by tech enthusiasts, private importers, and academic research institutions.
2018	8	Nopea Ride launches Kenya's first EV taxi fleet using Nissan Leafs and installs two AC public charging stations in Nairobi.
2019	17	The **Finance Act 2019** reduces excise duty on fully electric vehicles from 20% to 10%, lowering the landed cost of a used Nissan Leaf by approximately Kes 380,000.
2020	32	EV uptake improves due to COVID-era freight discounts and the growth of solar-powered home charging solutions, making EVs cost-effective for high-mileage urban drivers.
2021	55	A record spike in EV registrations driven by: (i) **pilot programs** by BasiGo and Roam (electric buses), and (ii) bulk leasing imports by **Drive Electric**; 77% CAGR (2018–21).
2022	25	Global semiconductor shortages and Kes depreciation widen the EV–ICE cost gap, slowing new registrations despite increasing interest.
2023	27	Market rebounds with **Moja EV** and ride-hailing aggregators introducing models like **Neta V** and **Skyworth EVs**, despite rising freight and importation costs.

Appendix D: List of International Data Sources

To address gaps in the NTSA registration dataset—particularly in fuel economy, CO_2 emissions, and engine performance attributes—verified international databases were consulted. These sources provided standardized vehicle-level data aligned with globally recognized driving test cycles, enabling harmonized analysis across Kenya's diverse vehicle fleet:

Country / Region	Data Source	Website / Access Point	Key Data Provided
Australia	Green Vehicle Guide	https://www.greenvehicleguide.gov.au	Fuel consumption, CO_2 emissions, model data
Austria	Autoverbrauch	https://www.autoverbrauch.at	Fuel efficiency and environmental performance
Brazil	Programa Brasileiro de Etiquetagem	https://www.gov.br/inmetro	Fuel labels, energy efficiency ratings
Canada	Fuel Consumption Ratings Tool	https://vehicles.nrcan.gc.ca	CO_2 g/km, fuel economy (L/100km, mpg)
Chile	Indicadores de Consumo y Emisiones Vehiculares	https://vehiculoeficiente.cl	Fuel and emissions data by make and model
China	中国汽车能源消耗量查询 (*Vehicle Energy Consumption Lookup*)	https://www.miit.gov.cn	Fuel economy test results (Chinese cycles)
European Union	EU CO_2 Monitoring Database	https://www.eea.europa.eu	CO_2 emissions from new passenger vehicles
France	Carburant et émissions de CO_2	https://www.ademe.fr	Fuel use and CO_2 by model
Germany	DENA Pkw-Label	https://www.pkw-label.de	German vehicle CO_2/emission labeling
India	Fuel Economy Declaration Database	https://www.beeindia.gov.in	Manufacturer-declared fuel economy
Japan	自動車燃費一覧 (*Automobile Fuel Economy List*)	https://www.mlit.go.jp	JC08 and WLTP emissions/fuel data
Mexico	Portal de Indicadores de Eficiencia Energética y Emisiones Vehiculares	https://www.ecovehiculos.gob.mx	CO_2/fuel economy labels by vehicle type
New Zealand	Energy Efficiency and Conservation Authority (EECA)	https://www.energywise.govt.nz	Vehicle fuel consumption and cost estimates
Saudi Arabia	Vehicle Energy Efficiency Portal	https://www.sls.gov.sa	CO_2 and fuel economy under GCC standards
Singapore	OneMotoring Fuel Cost Calculator	https://onemotoring.lta.gov.sg	Estimated annual fuel costs and efficiency
South Korea	소비자 연비 정보 (*Consumer Fuel Economy Info*)	https://www.mot.go.kr	Korean fuel economy test data
United Kingdom	VCA – Vehicle Certification Agency	https://carfueldata.vehicle-certification-agency.gov.uk	CO_2, mpg, WLTP test values by model
United States	FuelEconomy.gov	https://www.fueleconomy.gov	Fuel economy, CO_2, and tax ratings

Source: Authors Analysis

As a federally owned enterprise, GIZ supports the German Government in achieving its objectives in the field of international cooperation for sustainable development.

Published by:

Deutsche Gesellschaft für
Internationale Zusammenarbeit (GIZ) GmbH

Registered offices
Bonn and Eschborn, Germany

Friedrich-Ebert-Allee 36+40
53113 Bonn, Germany
T +49 61 96 79-0
F +49 61 96 79-11 15

E info@giz.de
I www.giz.de

Author/Responsible/Editor, etc.:

Authors: Ayub Gitau, Michael Ojudi, James Nyang'aya, Robert Mathenge, George Kibuku, Daniel Okoth, Jonathan Githiga, Nairobi/ Zifei Yang, Alexander Tankou, Washington, D.C/ Editors: Verena Knöll, Robert Njoroge, Nairobi.

Design/layout, etc.:

Verena Knöll, Nairobi

Photo credits/sources:

Cover Page:
Engin Akyurt on Unsplash
GIZ / James Ochweri

Printing and distribution:

GIZ, IMPROVE, Nairobi, Kenya

Kenya 2025

Deutsche Gesellschaft für
Internationale Zusammenarbeit (GIZ) GmbH

Registered offices
Bonn and Eschborn

Friedrich-Ebert-Allee 32 + 36
53113 Bonn, Germany
T +49 228 44 60-0
F +49 228 44 60-17 66

Dag-Hammarskjöld-Weg 1-5
65760 Eschborn, Germany
T +49 61 96 79-0
F +49 61 96 79-11 15

E info@giz.de
I www.giz.de
I www.changingtransport.org