

CO₂ Emissions Analysis Report

Introduction

This report presents an analytical overview of vehicle CO₂ emissions and fuel efficiency using a dataset comprising over 7,000 entries spanning seven years. Understanding emissions and fuel efficiency patterns is crucial for guiding environmental policies, vehicle manufacturing decisions, and consumer awareness regarding vehicle environmental impacts.

Objective

- To identify the top contributors to vehicular CO₂ emissions.
 - To determine which vehicles and fuel types offer the highest fuel efficiency.
 - To examine the relationship between fuel type and CO₂ emissions.
 - To offer insights that can guide sustainable vehicle choices.
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Methodology

- **Data Source:** The dataset was downloaded from Kaggle, a popular online platform for datasets and competitions.
- **Data Cleaning:** The dataset was checked for missing values, duplicates, and inconsistent formatting. Null values were handled appropriately, and data types were standardized for accuracy in analysis.
- **Data Extraction:** Data was retrieved from the **CO₂ Emissions Canada** dataset using structured SQL queries.
- **Filtering:** Top vehicles and significant fuel types were selected based on emission rates and fuel consumption values.

- Analysis Tools: SQL Server Management Studio (SSMS) for querying, and Power BI for visualization.
 - Criteria: Focus was on top emissions, top fuel efficiency, fuel-type influence, and average emissions patterns.
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Key Findings

Top 10 Vehicles with Highest CO₂ Emissions

An analysis of the top 10 vehicles with the highest recorded CO₂ emissions revealed that luxury and performance cars dominate the list:

Make	Model	Vehicle Class	CO ₂ Emissions (g/km)
BUGATTI	Chiron	TWO-SEATER	522
BUGATTI	Chiron	TWO-SEATER	522
BUGATTI	CHIRON	TWO-SEATER	522
LAMBORGHINI	Aventador Roadster	TWO-SEATER	493
LAMBORGHINI	Aventador Roadster	TWO-SEATER	493
FORD	E350 WAGON	VAN - PASSENGER	488
LAMBORGHINI	Aventador Coupe	TWO-SEATER	487
LAMBORGHINI	Aventador Coupe	TWO-SEATER	485
MERCEDES-BENZ	AMG G 65	SUV - STANDARD	476
MERCEDES-BENZ	AMG G 65	SUV - STANDARD	473

Insight:

- High-performance sports vehicles and large luxury SUVs are responsible for the highest CO₂ emissions.

Fuel-Efficient Vehicles Based on Fuel Consumption

The analysis identified the most fuel-efficient vehicles based on combined, city, and highway fuel consumption rates:

Make	Model	City (L/100km)	Combined (L/100km)	Highway (L/100km)
HYUNDAI	IONIQ Blue	4.20	4.10	4.00
HYUNDAI	IONIQ Blue	4.20	4.10	4.00
HYUNDAI	IONIQ BLUE	4.20	4.10	4.00
HYUNDAI	IONIQ BLUE	4.20	4.10	4.00
HYUNDAI	IONIQ	4.20	4.20	4.20

Insight:

- The Hyundai IONIQ series shows exceptional fuel efficiency, especially for city and highway driving.

Vehicles with the Average CO₂ Emissions

The vehicles with the highest average CO₂ emissions across all models include:

Model	Average CO ₂ Emissions (g/km)
Chiron	522
E350 WAGON	488
AMG G 65	472
Aventador Roadster	465
AVENTADOR S ROADSTER	464

Insight:

- Consistent with the top 10 list, high-end performance and SUV models dominate the high average emission categories.

How Fuel Type Affects CO₂ Emissions

The average CO₂ emissions by fuel type revealed:

Fuel Type	Average CO ₂ Emissions (g/km)
E	275
Z	266
D	237
X	235
N	213

Insight:

- Vehicles running on Fuel Type 'E' (likely premium fuel or electric hybrids depending on the dataset coding) recorded the highest average emissions.

Fuel Type with the Highest Fuel-Efficient Cars

An analysis of fuel efficiency based on fuel consumption showed:

Fuel Type	Combined Fuel Consumption (L/100km)
E	26.10
E	26.10

Insight:

- Fuel Type 'E' appeared again, but in this context, certain vehicles using Fuel Type 'E' also consume the most fuel, indicating variations within the same fuel type category.

Overall Summary

- **Sports cars and luxury SUVs** contribute the highest levels of CO₂ emissions.
 - **Hyundai IONIQ models** are leaders in fuel efficiency.
 - **Fuel Type E** shows mixed performance: highest emissions on average but also includes vehicles with the highest fuel consumption.
 - **Vehicle class and fuel type** are critical factors in understanding environmental impact.
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