PROBLEM STATEMENT

Comprehensive Analysis of Norway's Automobile Market Trends

Project Objective:
To conduct a thorough analysis of Norway's automobile market using SQL by examining trends in car sales, environmental impact, and market share. This project will involve working with three datasets: car sales by make, car sales by model, and car sales by month. Through this analysis, we aim to identify key market drivers, uncover sales trends, and provide actionable insights for stakeholders such as car manufacturers, policymakers, and dealerships.

Business Questions to Address:
The project will cover the following categories, with specific SQL queries addressing each question.

1. Identify the top 5 car makes based on total sales quantity across all years.

2. Find the total sales quantity for each car make, broken down by year.

3. List the top 3 car models for each car make, sorted by sales quantity.

4. Determine the year with the highest total car sales and the corresponding quantity.

5. Calculate the average CO2 emissions for each year and compare emissions from diesel and gasoline cars.

6. Identify the top 5 car makes contributing to the lowest average CO2 emissions over the years.

7. Determine the percentage of electric cars sold each year compared to total car sales.

8. List all models containing the word "Electric" in their name, along with their total sales.

9. Retrieve sales data for models from car makes "Tesla" and "Volkswagen."

10. Identify the top 5 car models with the highest quantity sold in a single year.

11. Calculate the year-on-year growth rate in car sales for each year.

12. Analyze the monthly sales trend for electric vehicles, identifying peak and low sales months.

13. Determine the car makes with the highest sales growth between two consecutive years.

14. Calculate the percentage of imported cars out of total sales for each year.

15. Identify years where imported car sales exceeded 20% of total sales.

16. Count the number of NULL values in the columns `used_YOY` and `Quantity_Electric` and replace missing values in these columns with "na" for further analysis.

17. Find the make with the highest sales and list all models for that make, sorted by sales.

18. Perform a window function to calculate the cumulative total sales for each year.

19. Join the make and model datasets to create a consolidated table, showing total sales for each make and its top-selling model.

20. Classify car sales for each make into categories based on total sales quantity as "Low" (<500), "Medium" (500–1000), or "High" (>1000).

21. Identify models that had a sales increase of over 100% in any year compared to the previous year.

22. Find the make with the highest total sales for each year.

23. Classify diesel car sales by profitability level, considering `diesel_share` as a proxy for profitability (Low: <25%, Medium: 25%-50%, High: >50%).

24. For each year, classify the sales trend of electric vehicles as "Growth," "Decline," or "Stable" based on a comparison with the previous year.

INTERPRETATIONS OF THE SOLUTIONS

Q1: Identify the top 5 car makes based on total sales quantity across all years.

Interpretation: Top 5 cars are Volkswagen, Toyota, Volvo, Ford, and BMW. Volkswagen has sold the highest number of cars, 206,667 units, nearly 20% more than Toyota, 52% more than Volvo and Ford, and 75% more than BMW. Volvo and Ford are giving tough competition to each other, with Ford just 224 units behind Volvo.

Q2: Find the total sales quantity for each car make, broken down by year.

Interpretation: The result provides a comprehensive overview of all car makes, detailing the quantity sold within a specific year along with the corresponding brand names. This information helps in understanding the annual sales performance and the market presence of each car brand.

Q3: List the top 3 car models for each car make, sorted by sales quantity.

Interpretation: The top 3 car models are the Mercedes-Benz A-Klasse, Audi A6, and Audi Q3. Among these, the Audi A3 leads with 218 units sold, followed by the Mercedes-Benz A-Klasse with 184 units and the Audi A6 with 131 units. These figures highlight the strong demand for premium car models, with Audi dominating the sales in this category.

Q4: Determine the year with the highest total car sales and the corresponding quantity.

Interpretation: The year 2016 was the highest-selling year, with total sales reaching 154,603 units, followed by the years 2013, 2014, and 2015. However, despite the success of 2016, there was a sudden drop in sales in 2017, decreasing by 91.5%.

Q5: Calculate the average CO_2 emissions for each year and compare emissions from diesel and gasoline cars.

Interpretation: The highest carbon emissions were recorded in 2007, with an average of 159 units. A noticeable trend shows that gasoline cars produce more CO2 compared to diesel cars. Additionally, there is a year-on-year decline in carbon emissions, likely due to increased awareness about environmental concerns and a rise in the sales of electric cars.

Q6: Identify the top 5 car makes contributing to the lowest average CO_2 emissions over the years.

Interpretation: The top 5 cars with the lowest carbon emissions are DS, Polaris, Dacia, Tazari, and Tesla. Among these, DS has the lowest carbon emissions, which may be attributed to the high sales of their hybrid models.

Q7: Determine the percentage of electric cars sold each year compared to total car sales.

Interpretation: From 2007 to 2010, there were no sales of electric cars. However, in 2011, 1,996 units were sold, accounting for approximately 1.44% of the total sales. Following this, there was a consistent progression in electric car sales, with a minimum growth of 1.2% each year until 2015.

Q9: Retrieve sales data for models from car makes "Tesla" and "Volkswagen".

Interpretation: The sales data for models from car makes "Tesla" and "Volkswagen" are respectively Tesla Model X   238 units, Tesla Model S 11096 units, Volkswagen Touran 3346 units, Volkswagen up! 7434 units, Volkswagen Polo 12132 units, Volkswagen Tiguan 21413 units, Volkswagen Passat 40575 units, Volkswagen Golf 85787units

Q10: Identify the top 5 car models with the highest quantity sold in a single year.

Interpretation: The top 5 car models that sold the highest number of units in a single year include Volkswagen, which achieved its peak sales in 2015 with an impressive 16,388 units sold. This remarkable performance highlights Volkswagen's strong market demand and its ability to dominate the automotive industry during that year.

Q11: Calculate the year-on-year growth rate in car sales for each year.

Interpretation: There was a continuous decline in car sales during 2008 and 2009, with drops of 14% and 10%, respectively. However, in 2010, sales rebounded with a significant increase of 29%, and this growth trend continued steadily until 2016. Unfortunately, in 2017, car sales experienced a dramatic decline of approximately 91%, marking a significant downturn in the market.

Q12: Analyze the monthly sales trend for electric vehicles, identifying peak and low sales months.

Interpretation: Every year, the highest number of car units are sold in March, while September sees the lowest sales. This spike in March sales could be attributed to the impact of Good Friday, which might drive an increase in consumer activity during that month.

Q13: Determine the car makes with the highest sales growth between two consecutive years.

Interpretation: The result provides the growth rate between two consecutive years for each car brand. For instance, BMW experienced a growth rate of 16.5% during the specified period.

This analysis highlights the year-on-year performance of different brands, allowing for a deeper understanding of their market dynamics and growth trends over time.

Q14: Calculate the percentage of imported cars out of total sales for each year.

Interpretation: Between 2007 and 2010, car imports accounted for 20% to 25% of total sales. After 2012, the import percentage steadily decreased each year, while car sales continued to rise until 2016. This trend suggests that more manufacturing plants may have been established in Norway, reducing the reliance on imports and boosting local production.

Q15: Identify years where imported car sales exceeded 20% of total sales.

Interpretation: Between 2007 and 2013, car imports consistently accounted for more than 20% of total sales, with the exception of 2011. Starting in 2014, there was a noticeable decline in the percentage of imported cars, which steadily decreased year after year. This trend indicates a shift towards reduced dependency on imports, potentially driven by the expansion of local manufacturing capabilities or changes in market dynamics.

Q17: find the make with the highest sales and list all models for that make, sorted by sales.

Interpretation: With this concept, one can identify the highest sales of a particular model, along with the corresponding timeframes, including both years and months. This approach allows for a detailed analysis of sales trends over time, helping to pinpoint peak sales periods and understand the model's performance in different time intervals.

Q18: Perform a window function to calculate the cumulative total sales for each year.

Interpretation: The cumulative sales of all brands over a span of 10 years total 1,347,250 units. This figure represents the combined sales across all brands during this period, offering a comprehensive view of the market's overall performance.

Q19: Join the make and model datasets to create a consolidated table, showing total sales for each make and its top-selling model.

Interpretation: Using this SQL concept, we can identify both the make and model of cars by joining relevant datasets. This will allow us to create a consolidated table that shows the total sales for each make, along with its top-selling model. By leveraging SQL's JOIN operations and aggregate functions, we can efficiently combine data and generate insights about sales performance across different car brands and models.

Q20: Classify car sales for each make into categories based on total sales quantity as 'Low' (<500), 'Medium' (500–1000), or 'High' (>1000).

Interpretation: There are 30 car brands that sold fewer than 500 units, so they are categorized as "low." Additionally, 5 car brands sold between 500 and 1,000 units, placing them in the "medium" category. The brands that sold more than 1,000 units are categorized as "high." This categorization helps in analyzing sales performance and understanding the market distribution across different car brands.

Q21: Identify models that had a sales increase of over 100% in any year compared to the previous year.

Interpretation: More than 100 car models experienced a sales increase of over 100% compared to the previous year. For example, the Audi A3 sold 1,953 units in 2013, compared to 963 units in the previous year. This represents a growth of 990 units, highlighting a significant year-on-year increase in demand for this model. Such trends indicate strong market performance and consumer preference for specific models during the analyzed timeframe.

Q22: Find the make with the highest total sales for each year.

Interpretation: The makes with the highest total sales for each year are Toyota and Volkswagen. Toyota achieved the highest total sales in 2007 and 2009, while Volkswagen led in sales from 2008 and from 2010 to 2017. This trend highlights Toyota's strong performance in certain years and Volkswagen's consistent dominance in the subsequent years.

Q23: Classify diesel car sales by profitability level, considering diesel_share as a proxy for profitability (Low: <25%, Medium: 25%-50%, High: >50%).

Interpretation: Between 2007 and 2012, the diesel share was considered high, consistently making up more than 50% of total sales. However, from 2013 to 2017 (with a few exceptions), the diesel share decreased to a medium level. This decline may be attributed to the growing awareness of electric cars, as seen in the increased demand for electric vehicles after 2012. The shift in consumer preference towards more environmentally friendly options likely contributed to this reduction in diesel car sales.

Q24: For each year, classify the sales trend of electric vehicles as 'Growth,' 'Decline,' or 'Stable' based on a comparison with the previous year.

Interpretation: The sales trend of electric vehicles remained at zero between 2007 and 2010. However, from 2011 to 2015, there was a noticeable increase in the demand for electric cars. After 2015, the demand began to decline, with a significant drop in 2016 and 2017. This decrease in demand during these years could be due to various factors, such as market saturation, shifts in consumer preferences, or changes in government incentives for electric vehicle adoption.