AtliQ_Motors_EV_Projects_BigQuery

```sql
--Q1. Top and Bottom 3 makers for FY 2023 and FY 2024 with rank_category
WITH maker_sales AS (
  SELECT
    maker,
    fiscal_year,
    SUM(electric_vehicles_sold) AS total_vehicles_sold
  FROM
    `vast-maxim-442101-d8.EV.makers` AS m
  JOIN
    `vast-maxim-442101-d8.EV.dim_date` AS d
  ON
    m.date = d.date
  WHERE
    m.vehicle_category = '2-Wheelers' AND fiscal_year IN (2023, 2024)
  GROUP BY
    maker, fiscal_year
),
ranked_makers AS (
  SELECT
    maker,
    fiscal_year,
    total_vehicles_sold,
    ROW_NUMBER() OVER (PARTITION BY fiscal_year ORDER BY total_vehicles_sold DESC) AS
top_rank,
    ROW_NUMBER() OVER (PARTITION BY fiscal_year ORDER BY total_vehicles_sold ASC) AS
bottom_rank
  FROM
    maker_sales
),
formatted_output AS (
  SELECT
    fiscal_year,
    maker,
    total_vehicles_sold,
    'Top 3' AS rank_category
  FROM
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    ranked_makers
  WHERE
    top_rank <= 3
  UNION ALL
  SELECT
    fiscal_year,
    maker,
    total_vehicles_sold,
    'Bottom 3' AS rank_category
  FROM
    ranked_makers
  WHERE
    bottom_rank <= 3
)
SELECT
  fiscal_year,
  maker,
  total_vehicles_sold,
  rank_category
FROM
  formatted_output
ORDER BY
  fiscal_year, rank_category, total_vehicles_sold DESC;



--Q2. Identify the top 5 states with the highest penetration rate in 2-wheelers and
4-wheelers in FY 2024
WITH penetration_rate AS (
  SELECT
    s.state,
    CONCAT(ROUND(SUM(CASE WHEN s.vehicle_category = '2-Wheelers' THEN
s.electric_vehicles_sold ELSE 0 END) /
                SUM(CASE WHEN s.vehicle_category = '2-Wheelers' THEN
s.total_vehicles_sold ELSE 0 END) * 100, 2), '%') AS penetration_rate_2w,
    CONCAT(ROUND(SUM(CASE WHEN s.vehicle_category = '4-Wheelers' THEN
s.electric_vehicles_sold ELSE 0 END) /
                SUM(CASE WHEN s.vehicle_category = '4-Wheelers' THEN
s.total_vehicles_sold ELSE 0 END) * 100, 2), '%') AS penetration_rate_4w
  FROM
    `vast-maxim-442101-d8.EV.state` AS s
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  JOIN
    `vast-maxim-442101-d8.EV.dim_date` AS d
  ON
    s.date = d.date
  WHERE
    d.fiscal_year = 2024
  GROUP BY
    s.state
)
SELECT
  state,
  penetration_rate_2w,
  penetration_rate_4w
FROM
  penetration_rate
ORDER BY
  GREATEST(CAST(SUBSTR(penetration_rate_2w, 1, LENGTH(penetration_rate_2w) - 1) AS
FLOAT64),
           CAST(SUBSTR(penetration_rate_4w, 1, LENGTH(penetration_rate_4w) - 1) AS
FLOAT64)) DESC
LIMIT 5;



--3. List the states with negative penetration (decline) in EV sales from 2022 to
2024?
WITH state_sales AS (
  SELECT
    s.state,
    s.vehicle_category,
    ROUND(SUM(CASE WHEN d.fiscal_year = 2022 THEN s.electric_vehicles_sold ELSE 0 END)
/
          SUM(CASE WHEN d.fiscal_year = 2022 THEN s.total_vehicles_sold ELSE 0 END) *
100, 2) AS penetration_rate_2022,
    ROUND(SUM(CASE WHEN d.fiscal_year = 2023 THEN s.electric_vehicles_sold ELSE 0 END)
/
          SUM(CASE WHEN d.fiscal_year = 2023 THEN s.total_vehicles_sold ELSE 0 END) *
100, 2) AS penetration_rate_2023,
    ROUND(SUM(CASE WHEN d.fiscal_year = 2024 THEN s.electric_vehicles_sold ELSE 0 END)
/
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          SUM(CASE WHEN d.fiscal_year = 2024 THEN s.total_vehicles_sold ELSE 0 END) *
100, 2) AS penetration_rate_2024
  FROM
    `vast-maxim-442101-d8.EV.state` AS s
  JOIN
    `vast-maxim-442101-d8.EV.dim_date` AS d
  ON
    s.date = d.date
  WHERE
    d.fiscal_year IN (2022, 2023, 2024)
  GROUP BY
    s.state, s.vehicle_category
),
declined_states AS (
  SELECT
    state,
    vehicle_category,
    penetration_rate_2022,
    penetration_rate_2023,
    penetration_rate_2024,
    CASE
      WHEN penetration_rate_2023 < penetration_rate_2022 THEN 'Declined 2022-2023'
      WHEN penetration_rate_2024 < penetration_rate_2023 THEN 'Declined 2023-2024'
      ELSE 'No Decline'
    END AS decline_status
  FROM
    state_sales
)
SELECT
  state,
  vehicle_category,
  CONCAT(penetration_rate_2022, '%') AS penetration_rate_2022,
  CONCAT(penetration_rate_2023, '%') AS penetration_rate_2023,
  CONCAT(penetration_rate_2024, '%') AS penetration_rate_2024,
  decline_status
FROM
  declined_states
WHERE
  decline_status != 'No Decline'
ORDER BY
  state, vehicle_category;
```

```sql
--Q4. Quarterly sales trends for the top 5 EV makers (4-wheelers) from 2022 to 2024
WITH top_makers AS (
  SELECT
    maker,
    SUM(electric_vehicles_sold) AS total_sales
  FROM
    `vast-maxim-442101-d8.EV.makers` AS m
  JOIN
    `vast-maxim-442101-d8.EV.dim_date` AS d
  ON
    m.date = d.date
  WHERE
    m.vehicle_category = '4-Wheelers' AND d.fiscal_year BETWEEN 2022 AND 2024
  GROUP BY
    maker
  ORDER BY
    total_sales DESC
  LIMIT 5
)
SELECT
  m.maker,
  d.fiscal_year,
  d.quarter,
  SUM(m.electric_vehicles_sold) AS sales_volume
FROM
  `vast-maxim-442101-d8.EV.makers` AS m
JOIN
  `vast-maxim-442101-d8.EV.dim_date` AS d
ON
  m.date = d.date
JOIN
  top_makers
ON
  m.maker = top_makers.maker
GROUP BY
  m.maker, d.fiscal_year, d.quarter
ORDER BY
  d.fiscal_year, d.quarter;
```

```sql
-- Q5. Comparison of EV sales and penetration in Delhi vs Karnataka for FY 2024
SELECT
  s.state,
  CONCAT(CAST(ROUND(SUM(s.electric_vehicles_sold) / 1000, 1) AS STRING), 'K') AS
total_ev_sales,
  CONCAT(ROUND(SUM(s.electric_vehicles_sold) / SUM(s.total_vehicles_sold) * 100, 2),
'%') AS penetration_rate
FROM
  `vast-maxim-442101-d8.EV.state` AS s
JOIN
  `vast-maxim-442101-d8.EV.dim_date` AS d
ON
  s.date = d.date
WHERE
  d.fiscal_year = 2024 AND s.state IN ('Delhi', 'Karnataka')
GROUP BY
  s.state;



--Q6. CAGR in 4-wheelers for the top 5 makers from 2022 to 2024
WITH maker_sales AS (
  SELECT
    m.maker,
    SUM(CASE WHEN d.fiscal_year = 2022 THEN m.electric_vehicles_sold ELSE 0 END) AS
sales_2022,
    SUM(CASE WHEN d.fiscal_year = 2023 THEN m.electric_vehicles_sold ELSE 0 END) AS
sales_2023,
    SUM(CASE WHEN d.fiscal_year = 2024 THEN m.electric_vehicles_sold ELSE 0 END) AS
sales_2024,
    SUM(CASE WHEN d.fiscal_year BETWEEN 2022 AND 2024 THEN m.electric_vehicles_sold
ELSE 0 END) AS total_ev_sold
  FROM
    `vast-maxim-442101-d8.EV.makers` AS m
  JOIN
    `vast-maxim-442101-d8.EV.dim_date` AS d
  ON
    m.date = d.date
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  WHERE
    m.vehicle_category = '4-Wheelers' AND d.fiscal_year BETWEEN 2022 AND 2024
  GROUP BY
    m.maker
  HAVING
    sales_2022 > 0 AND sales_2023 > 0 AND sales_2024 > 0
)
SELECT
  maker,
  CONCAT(CAST(ROUND(total_ev_sold / 1000, 0) AS INT64), 'K') AS EV_sold,
  CONCAT(ROUND((POW(sales_2024 / sales_2022, 1 / 2) - 1) * 100, 2), '%') AS CAGR
FROM
  maker_sales
ORDER BY
  CAGR DESC
LIMIT 5;



--Q7. Top 10 states with highest CAGR from 2022 to 2024
WITH state_sales AS (
  SELECT
    s.state,
    SUM(CASE WHEN d.fiscal_year = 2022 THEN s.total_vehicles_sold ELSE 0 END) AS
sales_2022,
    SUM(CASE WHEN d.fiscal_year = 2023 THEN s.total_vehicles_sold ELSE 0 END) AS
sales_2023,
    SUM(CASE WHEN d.fiscal_year = 2024 THEN s.total_vehicles_sold ELSE 0 END) AS
sales_2024,
    SUM(CASE WHEN d.fiscal_year BETWEEN 2022 AND 2024 THEN s.total_vehicles_sold ELSE
0 END) AS total_vehicles_sold
  FROM
    `vast-maxim-442101-d8.EV.state` AS s
  JOIN
    `vast-maxim-442101-d8.EV.dim_date` AS d
  ON
    s.date = d.date
  WHERE
    d.fiscal_year IN (2022, 2023, 2024)
  GROUP BY
    s.state
```

```sql
  HAVING
    sales_2022 > 0 AND sales_2024 > 0
)
SELECT
  state,
  CONCAT(CAST(ROUND(total_vehicles_sold / 1000, 0) AS INT64), 'K') AS
total_vehicles_sold,
  CONCAT(ROUND((POW(sales_2024 / sales_2022, 1 / 2) - 1) * 100, 2), '%') AS CAGR
FROM
  state_sales
ORDER BY
  CAST(SUBSTR(CAGR, 1, LENGTH(CAGR) - 1) AS FLOAT64) DESC
LIMIT 10;



--Q8. Identify peak and low season months for EV sales from 2022 to 2024
WITH monthly_sales AS (
  SELECT
    EXTRACT(YEAR FROM d.date) AS year,
    EXTRACT(MONTH FROM d.date) AS month,
    SUM(s.electric_vehicles_sold) AS total_ev_sales
  FROM
    `vast-maxim-442101-d8.EV.state` AS s
  JOIN
    `vast-maxim-442101-d8.EV.dim_date` AS d
  ON
    s.date = d.date
  WHERE
    d.fiscal_year BETWEEN 2022 AND 2024
  GROUP BY
    year, month
)
SELECT
  CONCAT(CAST(year AS STRING), '-', LPAD(CAST(month AS STRING), 2, '0')) AS
month_year,
  CONCAT(CAST(ROUND(total_ev_sales / 1000, 1) AS STRING), 'K') AS total_ev_sales
FROM
  monthly_sales
ORDER BY
  total_ev_sales DESC;
```

```sql
--Q9. Project EV sales for top 10 states by penetration rate for 2030
WITH state_sales AS (
  SELECT
    s.state,
    ROUND(SUM(CASE WHEN d.fiscal_year = 2022 THEN s.electric_vehicles_sold ELSE 0 END)
/
          SUM(CASE WHEN d.fiscal_year = 2022 THEN s.total_vehicles_sold ELSE 0 END) *
100, 2) AS penetration_rate_2022,
    ROUND(SUM(CASE WHEN d.fiscal_year = 2023 THEN s.electric_vehicles_sold ELSE 0 END)
/
          SUM(CASE WHEN d.fiscal_year = 2023 THEN s.total_vehicles_sold ELSE 0 END) *
100, 2) AS penetration_rate_2023,
    ROUND(SUM(CASE WHEN d.fiscal_year = 2024 THEN s.electric_vehicles_sold ELSE 0 END)
/
          SUM(CASE WHEN d.fiscal_year = 2024 THEN s.total_vehicles_sold ELSE 0 END) *
100, 2) AS penetration_rate_2024,
    SUM(CASE WHEN d.fiscal_year = 2022 THEN s.electric_vehicles_sold ELSE 0 END) AS
sales_2022,
    SUM(CASE WHEN d.fiscal_year = 2023 THEN s.electric_vehicles_sold ELSE 0 END) AS
sales_2023,
    SUM(CASE WHEN d.fiscal_year = 2024 THEN s.electric_vehicles_sold ELSE 0 END) AS
sales_2024
  FROM
    `vast-maxim-442101-d8.EV.state` AS s
  JOIN
    `vast-maxim-442101-d8.EV.dim_date` AS d
  ON
    s.date = d.date
  WHERE
    d.fiscal_year IN (2022, 2023, 2024)
  GROUP BY
    s.state
  HAVING
    sales_2022 > 0 AND sales_2023 > 0 AND sales_2024 > 0
),
projected_sales AS (
  SELECT
    state,
```

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    CONCAT(ROUND((penetration_rate_2024 + penetration_rate_2023 +
penetration_rate_2022) / 3, 2), '%') AS avg_penetration_rate,
    ROUND((POW(sales_2024 / sales_2022, 1 / 2) - 1) * 100, 2) AS CAGR,
    ROUND(sales_2024 * POW(1 + (POW(sales_2024 / sales_2022, 1 / 2) - 1), 6), 0) AS
projected_sales_2030
  FROM
    state_sales
)
SELECT
  state,
  avg_penetration_rate AS penetration_rate,
  CONCAT(ROUND(CAGR, 2), '%') AS CAGR,
  CONCAT(ROUND(projected_sales_2030 / 1000000, 2), 'M') AS projected_sales_2030
FROM
  projected_sales
ORDER BY
  CAST(SUBSTR(CAGR, 1, LENGTH(CAGR) - 1) AS FLOAT64) DESC
LIMIT 10;



--Q10. Calculate revenue growth for 2-wheelers and 4-wheelers (2022 vs 2024, 2023 vs
2024)
WITH revenue_data AS (
  SELECT
    m.vehicle_category,
    d.fiscal_year,
    SUM(m.electric_vehicles_sold) AS total_units_sold,
    SUM(m.electric_vehicles_sold) *
      CASE
        WHEN m.vehicle_category = '2-Wheelers' THEN 85000
        WHEN m.vehicle_category = '4-Wheelers' THEN 1500000
      END AS total_revenue
  FROM
    `vast-maxim-442101-d8.EV.makers` AS m
  JOIN
    `vast-maxim-442101-d8.EV.dim_date` AS d
  ON
    m.date = d.date
  WHERE
    d.fiscal_year IN (2022, 2023, 2024)
```

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  GROUP BY
    m.vehicle_category, d.fiscal_year
)
SELECT
  vehicle_category,
  CONCAT(CAST(ROUND(SUM(CASE WHEN fiscal_year = 2022 THEN total_revenue ELSE 0 END) /
1e6, 2) AS STRING), 'M') AS revenue_2022,
  CONCAT(CAST(ROUND(SUM(CASE WHEN fiscal_year = 2023 THEN total_revenue ELSE 0 END) /
1e6, 2) AS STRING), 'M') AS revenue_2023,
  CONCAT(CAST(ROUND(SUM(CASE WHEN fiscal_year = 2024 THEN total_revenue ELSE 0 END) /
1e6, 2) AS STRING), 'M') AS revenue_2024,
  CONCAT(ROUND(((SUM(CASE WHEN fiscal_year = 2024 THEN total_revenue ELSE 0 END) -
                 SUM(CASE WHEN fiscal_year = 2022 THEN total_revenue ELSE 0 END)) /
                 SUM(CASE WHEN fiscal_year = 2022 THEN total_revenue ELSE 0 END)) *
100, 2), '%') AS growth_2022_to_2024,
  CONCAT(ROUND(((SUM(CASE WHEN fiscal_year = 2024 THEN total_revenue ELSE 0 END) -
                 SUM(CASE WHEN fiscal_year = 2023 THEN total_revenue ELSE 0 END)) /
                 SUM(CASE WHEN fiscal_year = 2023 THEN total_revenue ELSE 0 END)) *
100, 2), '%') AS growth_2023_to_2024
FROM
  revenue_data
GROUP BY
  vehicle_category;
```