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ELECTRIC VEHICLE SALES ANALYTICS USING MYSQL



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INTRODUCTION

This project demonstrates my ability to design, implement, and analyze a data warehouse in MySQL using an Electric Vehicle (EV) Sales dataset. The purpose of this project is to showcase practical SQL skills, data modeling expertise, and the ability to generate business insights from raw data.

The dataset contains EV sales information across different states, years, vehicle categories, and classes. To analyze this data effectively, I designed a star schema with one fact table and multiple dimension tables. The process involved:

Data Staging – Loading the raw dataset into a staging table.

Data Modeling – Creating dimension tables for Date, State, and Vehicle, and a fact table `fact_ev_sales`.

ETL Process – Transforming and populating dimensions and fact tables from the staging data.

SQL Analysis – Writing queries using joins, aggregations, window functions, ranking, and stored procedures to extract meaningful insights.

Through this project, I was able to identify key trends in EV adoption, analyze market share by vehicle type, study year-over-year growth, and highlight top-performing states.

The project not only emphasizes my SQL development skills but also demonstrates my capability to link technical analysis with real-world business insights and recommendations — a crucial skill for data analyst and business intelligence roles.





PROJECT OBJECTIVE

- To design a Star Schema data warehouse in MySQL
- To apply ETL processes for structured analysis
- To perform advanced SQL analysis (aggregations, window functions, stored procedures)
- To generate business insights and recommendations for EV adoption

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WHAT IS THE TOTAL NUMBER OF ELECTRIC VEHICLES SOLD ACROSS ALL YEARS?

SELECT

```
FORMAT(SUM(EV_Sales_Quantity), 0) AS `Total Vehicle Sold`
```

FROM

```
fact_ev_sales;
```

Total Vehicle Sold

3,593,811

 **Insight:** Over 3.59 million EVs sold in total, reflecting India's strong momentum toward electric mobility.





HOW HAVE EU SALES TRENDED ON A YEARLY BASIS?

```
SELECT  
    d.Year,  
    FORMAT(SUM(s.EV_Sales_Quantity), 0) AS `Total Vehicle Sold`  
FROM  
    fact_ev_sales AS s  
        JOIN  
    dim_date AS d USING (date_id)  
GROUP BY d.Year  
ORDER BY d.Year ASC;
```

	Year	Total Vehicle Sold
▶	2014	2,392
	2015	7,805
	2016	49,855
	2017	87,420
	2018	130,254
	2019	166,819
	2020	124,684
	2021	331,498
	2022	1,024,723
	2023	1,525,179
	2024	143,182

 **Insight:** EV sales surged from 2.3K in 2014 to 1.5M in 2023, with a slight dip in 2024 indicating market stabilization after rapid growth.



WHICH STATES CONTRIBUTE THE MOST TO EV ADOPTION (TOP 5 STATES BY TOTAL SALES) ?

```
with Rnk as (SELECT s.state_name,  
SUM(EV_Sales_Quantity) AS total_sales,  
dense_rank() over( order by SUM(EV_Sales_Quantity) desc) as Rank_State  
FROM fact_ev_sales f  
JOIN dim_state s ON f.state_id = s.state_id  
GROUP BY s.state_name  
ORDER BY total_sales DESC)  
  
select state_name as State_Name,  
Format((total_sales),0) as Total_Sales, Rank_State  
from Rnk  
where Rank_State <= 5;
```

	State_Name	Total_Sales	Rank_State
▶	Uttar Pradesh	732,074	1
	Maharashtra	401,535	2
	Karnataka	315,498	3
	Delhi	268,538	4
	Rajasthan	228,573	5

 **Insight:** Uttar Pradesh leads EV adoption with 7.3 lakh sales, followed by Maharashtra and Karnataka as key growth hubs.



WHICH STATES ARE LAGGING IN EV ADOPTION (BOTTOM 5 STATES BY TOTAL SALES) ?

```
with Rnk as (SELECT s.state_name,
SUM(EV_Sales_Quantity) AS total_sales,
dense_rank() over( order by SUM(EV_Sales_Quantity) asc) as Rank_State
FROM fact_ev_sales f
JOIN dim_state s ON f.state_id = s.state_id
GROUP BY s.state_name
ORDER BY total_sales DESC)

select state_name as State_Name,
Format((total_sales),0) as Total_Sales, Rank_State
from Rnk
where Rank_State <= 5
order by Rank_State asc;
```

State_Name	Total_Sales	Rank_State
Sikkim	4	1
Arunachal Pradesh	40	2
Nagaland	52	3
Ladakh	88	4
Andaman & Nicobar Island	202	5

💡 Insight: Northeastern states like Sikkim and Arunachal Pradesh show minimal EV adoption, highlighting the urgent need for charging infrastructure, policy incentives, and consumer awareness to drive penetration.



WHAT ARE THE MONTHLY SALES TRENDS, AND DO ANY SEASONAL PATTERNS EMERGE ?

```
SELECT CONCAT(d.year, ' - ', d.month_name) AS period,
       format(SUM(f.ev_sales_quantity),0) AS monthly_sales,
       format(LAG(SUM(f.ev_sales_quantity)) OVER (ORDER BY d.year, d.Start_of_Month),0)
          AS prev_month_sales,
       concat(ROUND(((SUM(f.ev_sales_quantity) -
                      LAG(SUM(f.ev_sales_quantity)) OVER (ORDER BY d.year, d.Start_of_Month))
                     / LAG(SUM(f.ev_sales_quantity)) OVER (ORDER BY d.year, d.Start_of_Month)) * 100, 2), "%")
          AS mom_growth
  FROM fact_ev_sales f
 JOIN dim_date d ON f.date_id = d.date_id
 GROUP BY d.year, d.month_name, d.Start_of_Month
 ORDER BY d.year, d.Start_of_Month;
```

period	monthly_sales	prev_month_sales	mom_growth
2014-jan	232	NULL	NULL
2014-feb	171	232	-26.29%
2014-mar	220	171	28.65%
2014-apr	252	220	14.55%
2014-may	186	252	-26.19%
2014-jun	149	186	-19.89%
2014-jul	199	149	33.56%
2014-aug	180	199	-9.55%
2014-sep	168	180	-6.67%
2014-oct	188	168	11.90%
2014-nov	210	188	11.70%
2014-dec	237	210	12.86%
2015-jan	174	237	-26.58%
2015-feb	182	174	4.60%
2015-mar	222	182	21.98%
2015-apr	175	222	-21.17%
2015-may	195	175	11.43%
2015-iun	287	195	47.18%



Insight: EV sales showed strong month-on-month volatility, peaking during Mar–May 2023 amid high demand, before stabilizing in early 2024 as market growth normalized.



WHAT IS THE YEAR-OVER-YEAR GROWTH RATE OF EU SALES ?

```
SELECT d.year, format(SUM(f.ev_sales_quantity),0) AS total_sales,
       LAG(format(SUM(f.ev_sales_quantity),0)) OVER (ORDER BY d.year) AS prev_year,
       concat(ROUND(((SUM(f.ev_sales_quantity) - LAG(SUM(f.ev_sales_quantity)) OVER (ORDER BY d.year))
                     / LAG(SUM(f.ev_sales_quantity)) OVER (ORDER BY d.year)) * 100, 2), "%") AS growth_percent
  FROM fact_ev_sales f
 JOIN dim_date d ON f.date_id = d.date_id
 GROUP BY d.year
 ORDER BY d.year;
```

year	total_sales	prev_year	growth_percent
2014	2,392	NULL	NULL
2015	7,805	2,392	226.30%
2016	49,855	7,805	538.76%
2017	87,420	49,855	75.35%
2018	130,254	87,420	49.00%
2019	166,819	130,254	28.07%
2020	124,684	166,819	-25.26%
2021	331,498	124,684	165.87%
2022	1,024,723	331,498	209.12%
2023	1,525,179	1,024,723	48.84%
2024	143,182	1,525,179	-90.61%

 **Insight:** EV sales grew exponentially till 2023, peaking at 15.25 lakh units, driven by rising adoption and policy support — but witnessed a sharp 90% drop in 2024, indicating possible data lag or market correction.



HOW DO DIFFERENT VEHICLE CATEGORIES (2W, 3W, 4W, ETC.) CONTRIBUTE TO OVERALL EV ADOPTION ?

```
SELECT v.vehicle_category, format(SUM(f.ev_sales_quantity),0) AS total_sales,  
      concat(ROUND(SUM(f.ev_sales_quantity) * 100.0 /  
                  (SELECT SUM(ev_sales_quantity) FROM fact_ev_sales), 2), "%") AS percent_share  
FROM fact_ev_sales f  
JOIN dim_vehicle v ON f.vehicle_id = v.vehicle_id  
GROUP BY v.vehicle_category  
ORDER BY SUM(f.ev_sales_quantity) DESC;
```

vehicle_category	total_sales	percent_share
2-Wheelers	1,808,105	50.31%
3-Wheelers	1,620,310	45.09%
4-Wheelers	149,775	4.17%
Others	8,612	0.24%
Bus	7,009	0.20%



 **Insight:-** 2-Wheelers lead India's EV adoption with a 50% market share, closely followed by 3-Wheelers at 45%. Together, they dominate 95% of total EV sales, highlighting strong demand in personal and commercial mobility segments, while 4-Wheelers and buses remain niche contributors.



WHICH STATES DEMONSTRATE THE HIGHEST GROWTH MOMENTUM IN EU ADOPTION EACH YEAR (TOP 3 STATES PER YEAR) ?

```
SELECT year, state_name, format(total_sales,0) as total_sales
FROM (
    SELECT d.year, s.state_name, SUM(f.ev_sales_quantity) AS total_sales,
           dense_rank() OVER (PARTITION BY d.year ORDER BY SUM(f.ev_sales_quantity) DESC) AS rn
    FROM fact_ev_sales f
    JOIN dim_date d ON f.date_id = d.date_id
    JOIN dim_state s ON f.state_id = s.state_id
    GROUP BY d.year, s.state_name
) ranked
WHERE rn <= 3;
```

 **Insight:** Uttar Pradesh has consistently maintained the top position in EV sales since 2016, showing strong and sustained market adoption. Maharashtra and Karnataka have emerged as major contributors in recent years, forming the top 3 states in India's EV ecosystem by 2023. However, 2024 shows a temporary dip across all major states, indicating a possible market correction or transition phase..

year	state_name	total_sales
2014	Maharashtra	905
2014	Karnataka	601
2014	Tamil Nadu	196
2015	Delhi	3,565
2015	Maharashtra	1,015
2015	Uttar Pradesh	1,012
2016	Delhi	21,688
2016	Uttar Pradesh	15,310
2016	Rajasthan	3,996
2017	Uttar Pradesh	40,649
2017	Delhi	18,042
2017	West Bengal	4,455
2018	Uttar Pradesh	53,212
2018	Delhi	20,961
2018	Bihar	8,469
2019	Uttar Pradesh	55,796
2019	Delhi	23,222
2019	West Bengal	13,533
2020	Uttar Pradesh	31,264
2020	Bihar	12,447



WHICH STATES CONSISTENTLY underperform in EV ADOPTION EACH YEAR (BOTTOM 3 STATES PER YEAR) ?

```
SELECT year, state_name, format(total_sales,0) as total_sales
FROM (
    SELECT d.year, s.state_name, SUM(f.ev_sales_quantity) AS total_sales,
           dense_rank() OVER (PARTITION BY d.year ORDER BY SUM(f.ev_sales_quantity) asc) AS rn
    FROM fact_ev_sales f
    JOIN dim_date d ON f.date_id = d.date_id
    JOIN dim_state s ON f.state_id = s.state_id
    GROUP BY d.year, s.state_name
) ranked
WHERE rn <= 3;
```

year	state_name	total_sales
2014	Himachal Pradesh	1
2014	Meghalaya	1
2014	Sikkim	1
2014	Assam	2
2014	West Bengal	2
2015	Arunachal Pradesh	0
2015	Andaman & Nicobar Island	0
2015	Ladakh	0
2015	Meghalaya	0
2015	Mizoram	0
2015	Tripura	0
2015	Manipur	0
2015	Nagaland	1
2015	Chandigarh	2
2015	DNH and DD	2
2015	Sikkim	2
2016	Andaman & Nicobar Island	0
2016	Ladakh	0

 **Insight:** Northeastern and small Union Territories show gradual EV adoption, with states like Arunachal Pradesh, Nagaland, and Andaman & Nicobar Islands beginning to record consistent but low sales post-2020, indicating early-stage market penetration.



BUSINESS INSIGHTS & RECOMMENDATIONS

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- 1. Steady Growth:** EV sales have shown strong year-over-year growth, signaling rising adoption.
 - 2. Regional Leaders:** A few states (e.g., Delhi, Karnataka, Maharashtra) drive the majority of sales → opportunity to replicate their policies in lagging states.
 - 3. Underperforming States:** States consistently at the bottom indicate untapped markets. Targeted subsidies and infrastructure development can help.
 - 4. Category Insights:** 2W and 3W vehicles dominate → highlighting affordability and urban use cases. 4W EV adoption remains slower, requiring incentives.
 - 5. Policy Recommendation:** Focus on charging infrastructure expansion, localized incentives, and public-private partnerships to drive adoption.
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