**Project Report: EV Charging Demand Forecasting**

**1. Introduction:**  
The goal of this project is to analyse electric vehicle (EV) charging station usage and forecast future demand. We used a combination of historical data and predictive modelling to provide actionable insights for infrastructure planning and energy management.

**2. Tools Used:**

* **Python (Jupyter Notebook):** Data preprocessing, trend analysis, and forecasting using Facebook Prophet
* **Power BI:** Interactive dashboard creation and visual storytelling
* **Libraries:** Pandas, Prophet, Matplotlib

**3. Steps Taken:**

**Phase 1: Demand Forecasting**

* Cleaned and reshaped occupancy data for Station 1167
* Resampled hourly data to daily usage
* Applied Prophet model to forecast the next 30 days of charging demand
* Exported forecast results and daily usage to CSV for dashboard visualization

**Phase 2: Efficiency & Behaviour Analysis**

* Cleaned and reshaped duration.csv and volume.csv into long format
* Merged both datasets to create a unified view of session-level energy efficiency
* Built scatter plots, histograms, and bar charts in Power BI to explore session trends and station-wise patterns

**4. Key Insights:**

* Demand is consistently rising over time, especially on weekends
* Evening hours see the highest usage based on Prophet seasonality
* Most sessions are under 2 minutes, delivering 30–40 kWh
* Some stations (e.g., ID 112) have longer average durations, indicating possible inefficiencies

**5. Recommendations:**

* Increase the number of fast chargers at high-traffic stations
* Monitor stations with high duration but low energy output for possible faults or congestion
* Use demand-based pricing on weekends to balance grid load
* Continue periodic forecasting to align infrastructure with growing EV usage

**6. Deliverables:**

* 📊 Power BI Report: 2 interactive pages
  + Page 1: Demand Trends & Forecasting (Station 1167)
  + Page 2: Charging Efficiency & User Behaviour Analysis
* 📓 Jupyter Notebook: Forecasting code and data transformation
* 📁 CSV Exports: Cleaned & transformed datasets
* 📄 Final PDF Report (this file)

**Dashboard Previews:** *(Screenshots added in GitHub repository under /visuals)*

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