Residential EV Charging: Data Analysis for Apartment Managers

Executive Summary

This project investigates **electric vehicle (EV) charging behavior** in apartment buildings, focusing on shared charging port utilization. Using actual charging session data and SQL analysis, the study identifies garages with the most demand, highlights potential congestion periods, and provides actionable insights for property managers to optimize port assignments and improve resident satisfaction.

Project Objectives

- Determine which garages/buildings have the largest number of unique users for shared charging stations.
- Analyze charging session patterns to inform infrastructure or policy improvements.
- Support apartment managers in allocating EV charging resources effectively.

Technologies & Tools Used

- **Database:** PostgreSQL (`charging_sessions` table)
- **Analysis Platform:** Jupyter Notebook (`notebook.ipynb`)
- **Key SQL Skills:** Aggregation, filtering, DISTINCT counts, group ordering

Dataset Description

Table: `charging_sessions`

Column	Description
`garage_id`	Identifier for the garage/building
`user_id`	Identifier for the individual user

`user_type`	'Shared' or 'Private' station type
`start_plugin`	Datetime when session started
`start_plugin_hour`	Hour session started (military time)
`end_plugout`	Datetime when session ended
`end_plugout_hour`	Hour session ended
`duration_hours`	Session duration (hours)
`el_kwh`	Electricity used (kWh)
`month_plugin`	Month when session started
`weekdays_plugin`	Day of week session started

Approach & Methodology

1. **User Count per Garage:**
    - Counted unique users for each garage where the charging station is shared.
    - Ranked garages by the number of unique users.
2. **SQL Example:**

```
SELECT
  garage_id,
  COUNT(DISTINCT user_id) AS num_unique_users
FROM charging_sessions
WHERE user_type = 'Shared'
GROUP BY garage_id
ORDER BY num_unique_users DESC;
```

Results & Key Insights

Garage ID	Unique Users (Shared)
Bl2	18
AsO2	17
UT9	16
AdO3	3
MS1	2
SR2	2
AdA1	1
Ris	1

- **Garage Bl2** had the highest number of unique shared station users, followed closely by AsO2 and UT9.
- The significant drop-off after the top three garages suggests potential congestion in these buildings or greater EV adoption.

Additional Analysis (From Notebook)

- Session start hours and weekdays were also analyzed (see notebook) to identify peak times.
- Example: Highest simultaneous sessions frequently occurred on Sundays at 17:00, and Fridays/Thursdays late afternoon.

Challenges & Solutions

Challenge	Solution
Small garage user base in some buildings	Focused on shared user patterns for clear recommendations.
Mixed data types (private/shared)	Filtered only for 'Shared' stations when analyzing congestion.

Conclusion

Certain garages—especially Bl2, AsO2, and UT9—see far more shared charging demand, meaning **EV owners in these locations may face more competition for charging ports**. Apartment managers of these buildings should consider adding more stations or introducing reservation systems to enhance resident satisfaction.

Next Steps & Recommendations

- **Monitor high-usage garages** for wait times and user complaints.
- **Add more ports or scheduling policies** in high-demand garages (Bl2, AsO2, UT9).
- **Continue analysis** of charging duration and time-of-day peaks to optimize resource planning.
- **Survey residents** in top garages to gather qualitative feedback on EV charging access.

See the Jupyter notebook (notebook.ipynb) for full queries, visualizations, and further breakdowns. Ready to support data-driven decisions in EV-friendly apartment communities!