Electricity Demand Analysis Report

1. Introduction

This report presents an exploratory data analysis (EDA) of the electricity demand dataset. The goal is to id

2. Data Overview

The dataset includes the following key attributes:

- Electricity demand: Power consumption over time
- RRP (Regional Reference Price): Pricing structure based on demand
- Weather factors: Temperature, solar exposure, and rainfall
- Special events: Holidays and school days

Missing Data:

- solar_exposure: 1 missing value
- rainfall: 3 missing values
- These missing values may require imputation to improve forecasting models.

3. Demand & Pricing Analysis

- Demand exhibits periodic fluctuations, with peaks observed during certain hours, days, and months.
- High demand often correlates with higher RRP, indicating price surges during peak usage periods.
- Hourly demand trends show significant variation, requiring dynamic pricing strategies.

Business Impact & Recommendations:

- Optimizing peak pricing strategies: High-demand periods can inform electricity providers to adjust pricing
- Enhancing energy distribution planning: Identifying peak demand periods ensures better resource allocati
- Weather-based forecasting: Temperature has a direct impact on demand, suggesting predictive models s

4. Correlation Analysis

- Electricity demand is positively correlated with temperature, meaning that higher temperatures increase p

- Moderate correlation between RRP and demand suggests that price changes are influenced by usage pa

- Weather factors like solar exposure and rainfall may have indirect effects on demand trends.

5. Weather Impact on Demand

- Higher temperatures result in increased electricity usage, likely due to cooling requirements.

- Seasonal variations affect power consumption, requiring seasonal adjustments in forecasting models.

6. Special Events Impact

- Holidays generally show lower demand, while school days contribute to higher consumption.

- Event-based adjustments in forecasting models can enhance accuracy.

Business Impact & Recommendations:

- Adjust energy distribution for special events: Lower demand during holidays suggests shifting energy reso

- School-day-specific pricing adjustments: Higher demand during school days can be leveraged for custom

7. Anomaly Detection

- Extreme demand spikes were detected using Z-score analysis.

- Possible causes: Unexpected weather conditions, operational issues, or major social events.

- Actionable recommendation: Incorporate anomaly detection mechanisms in forecasting models.

Business Impact & Recommendations:

- Early identification of demand spikes: Helps in preventing grid failures and ensuring supply stability.

- Develop anomaly-handling models: Reducing the impact of unexpected demand fluctuations on pricing.

8. Feature Engineering for Forecasting

To improve forecasting accuracy, the following features were created:

- Time-based features: Hour, Day of the Week, Month, and Year.

- Lag features: Demand values shifted by 1 and 7 time steps to capture temporal dependencies.

Feature Suggestions for Modeling:

Feature	Justification
Hour	Captures hourly variations in electricity demand
DayOfWeek	Helps identify demand patterns on specific weekdays
Month	Seasonal variations in demand trends
Year	Captures long-term trends and changes in electricity consumption
demand_Lag_1	Helps capture short-term dependencies in demand
demand_Lag_7	Weekly demand patterns for better forecasting

9. Conclusion & Recommendations

- Consider imputing missing values to ensure data completeness.

- Leverage temperature and seasonal patterns to improve demand prediction.

- Integrate event-based adjustments in forecasting models.

- Use anomaly detection techniques to handle outliers effectively.

- Develop a machine learning model incorporating engineered features for better accuracy.

This analysis provides a foundation for optimizing electricity demand forecasting and pricing strategies. Fu