

## **Library Energy During Exams**

### **Overview**

Library Energy During Exams is a time-series forecasting project that estimates semester-end library energy demand using historical environmental data. Since direct isolated library meter data was not available, outdoor temperature is used as a correlated proxy because heating and cooling loads significantly influence electricity consumption. The system applies exponential smoothing to recent trends and displays the predicted demand level on a Streamlit gauge dashboard for quick interpretation.

### **Problem Statement**

During examination periods, libraries operate for longer hours and experience increased occupancy, which raises electricity consumption due to lighting and HVAC usage. The objective is to aggregate historical time-series data and forecast semester-end energy demand so that energy planning and resource allocation can be performed proactively.

### **Dataset**

The project uses the Weather sheet from an Excel file containing Date and Outdoor temperature ( $^{\circ}\text{C}$ ) recorded at regular intervals. The Date column is converted into a time-series index and temperature is used as a proxy variable representing environmental influence on library energy consumption.

### **Workflow**

Load the Weather sheet, clean column names, convert Date to datetime, and set it as the index. Rename the temperature column for easier processing. Aggregate high-frequency readings into daily averages to reduce noise. Train an Exponential Smoothing model with an additive trend to capture recent behavior. Forecast the next seven days representing the semester-end window. Compute the average predicted level and visualize it using a gauge chart on the Streamlit dashboard.

### **Technologies Used**

Python, Pandas, Statsmodels (Exponential Smoothing), Plotly, Streamlit, OpenPyXL.

### **Installation**

Install dependencies using: `pip install pandas statsmodels plotly streamlit openpyxl`

### **How to Run**

Place the Excel file (energy\_data.xlsx) in the project directory, ensure the Weather sheet contains Date and Outdoor temperature ( $^{\circ}\text{C}$ ), then run: `streamlit run app.py`

### **Key Features**

Uses historical time-series data, applies exponential smoothing for short-term forecasting, represents predicted demand through an intuitive gauge visualization, and supports quick decision making for energy planning.

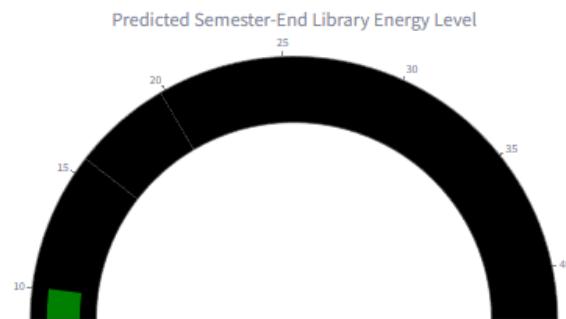
### **Applications**

Smart campus energy management, library HVAC scheduling, semester exam resource planning, and proactive electricity demand monitoring.

## Output

The dashboard displays a gauge showing the predicted semester-end library energy level and a numeric forecast summary. The gauge position indicates whether expected demand is low, moderate, or high relative to historical conditions.

## Library Energy During Exams



### Forecast Summary

Predicted Level: 19.84

## Limitations

Uses temperature as a proxy instead of direct library meter data, does not include explicit exam calendar variables, and relies on trend-based smoothing which may not capture sudden anomalies.

## Future Enhancements

Integrate actual library electricity meter readings, incorporate exam calendar and occupancy data as exogenous variables, add seasonal components, and enable real-time dashboard updates.

## Conclusion

The project demonstrates that exponential smoothing on historical environmental time-series can estimate semester-end library energy demand and present the result through a clear gauge dashboard, supporting efficient and proactive energy management during exam periods.