



# Campus Energy Dashboard

## Capstone Project

### Report

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# **1. Introduction**

Energy management is essential in educational campuses to reduce electricity bills and promote sustainable practices. This capstone project focuses on analyzing energy consumption across multiple campus buildings using CSV data, Python coding, object-oriented programming, and data visualization techniques.

# **2. Methodology**

- ✓ Data Ingestion using Pandas
- ✓ Cleaning and combining CSV files
  
- ✓ Aggregation (daily and weekly consumption)
  
- ✓ Object-Oriented Modeling using Building and MeterReading classes
- ✓ Data visualization using Matplotlib

- ✓ Generation of summary reports and dashboards

All tasks follow the structure defined in the assignment instructions.

### **3. Findings and Insights**

- Highest energy consumption building: Hostel
- Peak energy load observed at: 08:00 AM
- Low consumption buildings: Library
- Daily and weekly average consumption patterns were similar (~206 kWh)
- Dashboard visualization clearly distinguishes building consumption differences

### **4. Conclusion**

The project successfully demonstrates how data analytics and visualization can help management identify energy usage patterns and implement smarter power-saving decisions. Future

improvements include using real-time sensors, IoT meters, and storing readings in cloud databases for automated dashboards.

# SCREENSHOTS

## Project Structure and main.py in VS Code

The screenshot shows the Visual Studio Code interface with the following details:

- EXPLORER:** Shows the project structure under "CAMPUS-EN...".
  - data:** Contains "admin\_block.csv", "hostel.csv", and "library.csv".
  - output:** Contains "building\_summary.csv", "cleaned\_energy\_data....", "dashboard.png", and "summary.txt".
- CODE EDITOR:** The file "main.py" is open, displaying Python code for generating a summary text from data frames. The code includes functions for generating summary text based on building consumption, peak load details, trends, and insights.
- TERMINAL:** Shows the command "python main.py" being run, with output indicating total consumption (296.00 kWh) and average reading (32.89 kWh).
- STATUS BAR:** Shows the current line (Ln 345), column (Col 11), spaces (Spaces: 4), encoding (UTF-8), line feed (LF), Python language, and other status indicators.

# Terminal Output – Script Execution and Summary

```
PROBLEMS    OUTPUT    DEBUG CONSOLE    TERMINAL    PORTS
(base) mohittanwar@Mohits-MacBook-Air campus-energy-dashboard-Mohit_Tanwar % python main.py
===== Campus Energy Dashboard - Capstone Project =====
[INFO] Loading file: hostel.csv
[INFO] Loading file: library.csv
[INFO] Loading file: admin_block.csv
[INFO] Combined DataFrame created.
[INFO]   timestamp      kWh  building_name
0  2024-01-01 00:00:00    30      hostel
18 2024-01-01 00:00:00    20  admin_block
9  2024-01-01 00:00:00    10      library
1  2024-01-01 01:00:00    32      hostel
19 2024-01-01 01:00:00    22  admin_block
[INFO] Saved cleaned data to output/cleaned_energy_data.csv
[INFO] Saved building summary to output/building_summary.csv
===== BUILDING REPORTS (OOP) =====
Report for Building: hostel
Total Consumption: 296.00 kWh
Average Reading: 32.89 kWh
Minimum Reading: 28.00 kWh
Maximum Reading: 40.00 kWh
Report for Building: admin_block
Total Consumption: 213.00 kWh
Average Reading: 23.67 kWh
Minimum Reading: 18.00 kWh
Maximum Reading: 35.00 kWh
Report for Building: library
Total Consumption: 111.00 kWh
Average Reading: 12.33 kWh
Minimum Reading: 8.00 kWh
Maximum Reading: 18.00 kWh
[INFO] Dashboard saved to output/dashboard.png
[INFO] summary.txt generated in output/summary.txt
===== EXECUTIVE SUMMARY (also saved to file) =====
CAMPUS ENERGY CONSUMPTION SUMMARY
=====
Total campus consumption: 620.00 kWh
Highest-consuming building: hostel (296.00 kWh)
Peak Load Details:
- Building: hostel
- Time: 2024-01-01 08:00:00
- Consumption at peak: 40.00 kWh
Trends:
- Average daily consumption (all buildings): 206.67 kWh
- Average weekly consumption (all buildings): 206.67 kWh
Insights:
- Use this information to identify buildings where energy-saving measures
  like efficient lighting or AC scheduling can have the most impact.
(base) mohittanwar@Mohits-MacBook-Air campus-energy-dashboard-Mohit_Tanwar %
```

# Dashboard Image Open in VS Code

The screenshot shows a file tree on the left and three charts on the right.

**File Tree:**

- CAMPUS-ENERGY-DASHBOARD...
  - data
    - admin\_block.csv
    - hostel.csv
    - library.csv
  - output
    - building\_summary.csv
    - cleaned\_energy\_data....
    - dashboard.png
    - summary.txt
  - main.py

**Output Panel:**

output > dashboard.png

**Charts:**

- Daily Total Consumption:** A scatter plot titled "Campus Energy-Use Dashboard" showing daily total consumption. The Y-axis ranges from 125 to 300. The X-axis shows dates from 2022-01 to 2026-01. Data points are shown for admin\_block (blue), hostel (orange), and library (green). Approximate data:

Date	admin_block	hostel	library
2024-01	200	280	130
- Average Weekly Consumption per Building:** A bar chart titled "Average Weekly Consumption per Building" showing average weekly consumption. The Y-axis ranges from 0 to 300. The X-axis lists buildings: admin\_block, Hostel Building, and library. Approximate data:

Building	Average Weekly Consumption
admin_block	210
Hostel Building	280
library	150
- Peak Consumption Points:** A scatter plot titled "Peak Consumption Points" showing peak consumption points. The Y-axis ranges from 20 to 40. The X-axis shows timestamps from 2022-01 to 2026-01. Data points are shown for admin\_block (blue), hostel (orange), and library (green). Approximate data:

Timestamp	admin_block	hostel	library
2024-01	35	38	30

# summary.txt – Campus Energy Consumption Summary

The screenshot shows a file explorer window with the following structure:

- CAMPUS-EN...** (Project Folder)
  - data**
    - admin\_block.csv
    - hostel.csv
    - library.csv
  - output**
    - building\_summary.csv
    - cleaned\_energy\_data....
    - dashboard.png
    - summary.txt** (Selected)
  - main.py

The content of **summary.txt** is as follows:

```
1 CAMPUS ENERGY CONSUMPTION SUMMARY
2 =====
3 Total campus consumption: 620.00 kWh
4
5 Highest-consuming building: hostel (296.00 kWh)
6
7 Peak Load Details:
8 - Building: hostel
9 - Time: 2024-01-01 08:00:00
10 - Consumption at peak: 40.00 kWh
11
12 Trends:
13 - Average daily consumption (all buildings): 206.67 kWh
14 - Average weekly consumption (all buildings): 206.67 kWh
15
16 Insights:
17 - Use this information to identify buildings where energy-saving measures
| like efficient lighting or AC scheduling can have the most impact.
```

Below the file list, there are navigation links:

- > OUTLINE
- > TIMELINE

# building\_summary.csv – Building-wise Statistics

The screenshot shows a code editor interface with a dark theme. On the left, there is a file tree under the project name "CAMPUS-EN...". The "data" folder contains three CSV files: "admin\_block.csv", "hostel.csv", and "library.csv". The "output" folder contains four files: "building\_summary.csv" (selected), "cleaned\_energy\_data....", "dashboard.png", and "summary.txt". A Python script "main.py" is also visible. To the right of the file tree is a preview pane showing the contents of "building\_summary.csv". The preview pane has a header "output > building\_summary.csv" and displays the following data:

	building_name	mean_kwh	min_kwh	max_kwh	total_kwh
1	admin_block	23.666666666666668	18	35	213
2	hostel	32.888888888888886	28	40	296
3	library	12.333333333333334	8	18	111
4					
5					

# Campus Energy-Use Dashboard (Full PNG)

