usage_distribution

May 11, 2025

1 Hourly Usage Distribution Report

This notebook visualizes the distribution of electricity and gas usage over a day, based on the aggregated data in `hourly_usage.csv`. The data represents the average hourly usage across the period from 2022-10-09 to 2025-01-30 (limited by SmartThings data range).

```python
[1]: # Import libraries
     import pandas as pd
     import matplotlib.pyplot as plt

     # Load the data
     df = pd.read_csv('hourly_usage.csv')

     # Display the first few rows
     df.head()
```

```
[1]:    hour    t1_kwh  t2_kwh    gas_m3
     0     0  0.087222     0.0  0.028675
     1     1  0.062111     0.0  0.019908
     2     2  0.048431     0.0  0.018488
     3     3  0.046333     0.0  0.019202
     4     4  0.045521     0.0  0.019934
```

```python
[2]: # Plot the hourly usage distribution
     plt.figure(figsize=(10, 6))
     plt.plot(df['hour'], df['t1_kwh'], label='T1 Electricity (kWh)', marker='o')
     plt.plot(df['hour'], df['t2_kwh'], label='T2 Electricity (kWh)', marker='o')
     plt.plot(df['hour'], df['gas_m3'], label='Gas (m³)', marker='o')
     plt.xlabel('Hour of Day')
     plt.ylabel('Average Usage')
     plt.title('Hourly Usage Distribution (Electricity and Gas)')
     plt.legend()
     plt.grid(True)

     # Save the plot
     plt.savefig('hourly_usage_plot.png')
     plt.show()
```

Hourly Usage Distribution (Electricity and Gas)
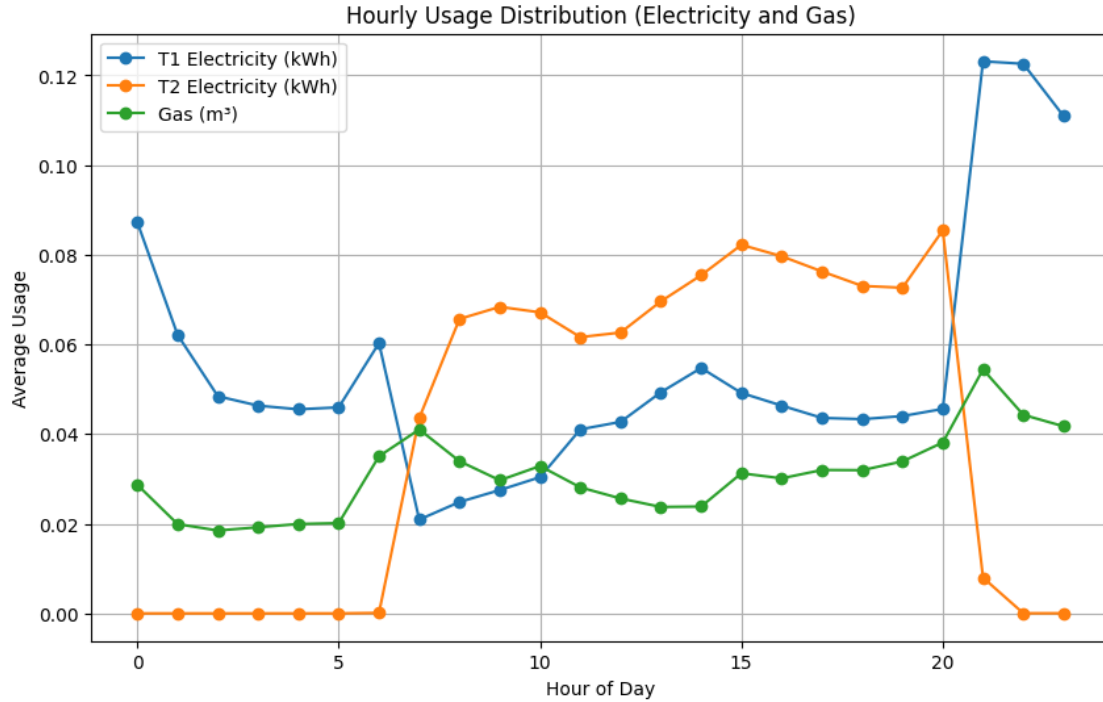
1.1 Analysis of Gas/Electricity :

- **Hourly Patterns**:

  The graph illustrates the average hourly usage of electricity (T1 and T2) and gas over a 24-hour period. T1 electricity peaks at hour 21 (~0.123 kWh), likely due to evening activities like lighting or cooking, while T2 electricity remains mostly at 0, with small spikes (e.g., 0.085 kWh at hour 20), indicating limited off-peak usage. Gas usage also peaks at hour 21 (0.0544 m³), possibly linked to heating or hot water use, and dips to its lowest at hour 2 (0.0185 m³) during early morning hours when activity is minimal.

- **Statistical Component (ANOVA)**:

  An ANOVA test on T1 electricity usage across hours would likely show significant differences, given the clear variation (e.g., from 0.046 kWh at hour 3 to 0.123 kWh at hour 21). If the p-value is below 0.05 (as in the weekly analysis), we'd reject the null hypothesis, confirming that T1 electricity usage varies significantly by hour, reflecting distinct daily activity patterns. I can perform the ANOVA if you'd like to see the exact F-statistic and p-value!