Boiler Efficiency Dashboard

DATA-DRIVEN APPROACH FOR MONITORING AND OPTIMIZATION

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INDEX

INTRODUCTION

- Boilers are essential for industrial operations, producing steam for various utilities.
- Efficient operation reduces fuel cost, emissions, and operational risks.
- Real-time analysis of efficiency is often missing in traditional setups.

OBJECTIVE / PROBLEM STATEMENT

- Manual logs provide limited insight into daily efficiency trends.
- Need for a tool that offers automated, visual analysis of boiler performance.
- Bridge the gap between raw data and actionable insights.

DATASET

- Two Excel files were used:
  - Fuel Data: Contains steam generated and fuel consumed per day.
  - Parameter Data: Contains per-minute readings of temperature, pressure, O_2 levels, etc.

METHODOLOGY / WORKING

- Filtering: Only data between 7:00 AM – 7:00 PM considered.
- Efficiency Formula:

Efficiency Calculation Formula

$$\textbf{Boiler Efficiency} = \left(\frac{\text{Steam Generated (in MT)}}{\text{Fuel Consumed (in MT)}} \right) \times \left(\frac{610}{3600} \right)$$

Where:

- **Steam Generated (MT):** Quantity of steam produced by the boiler per day.
- **Fuel Consumed (MT):** Amount of fuel consumed by the boiler per day.
- **610** = Approximate **enthalpy of steam** in kcal/kg.
- **3600** = **Calorific value (CV)** of the fuel used, in kcal/kg.

VISUALIZATION & FEATURES

- Line Chart: Boiler efficiency trend over days.
- Bar Chart: Daily efficiency color-coded by bucket.
- Boxplots: Parameter variation across efficiency buckets.
- Export Options: Download data as CSV, plots as PNG.

KEY INSIGHTS / OUTPUT ACCURACY

- Low-efficiency days identified clearly using visual indicators.
- Parameter distribution varies significantly across efficiency buckets.
- High oxygen levels observed during low-efficiency days.
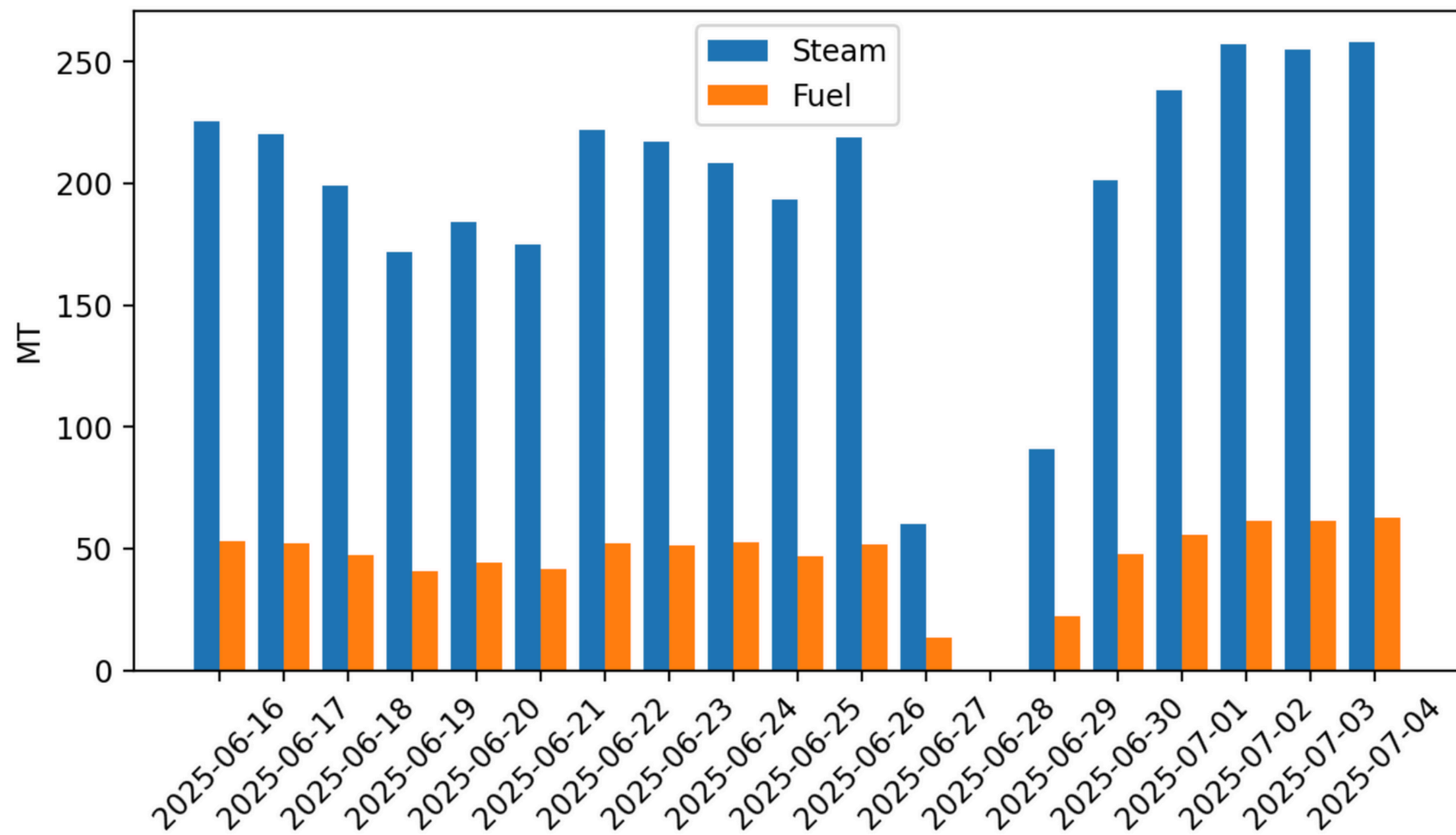- Dashboard ensures accurate, data-backed insights.
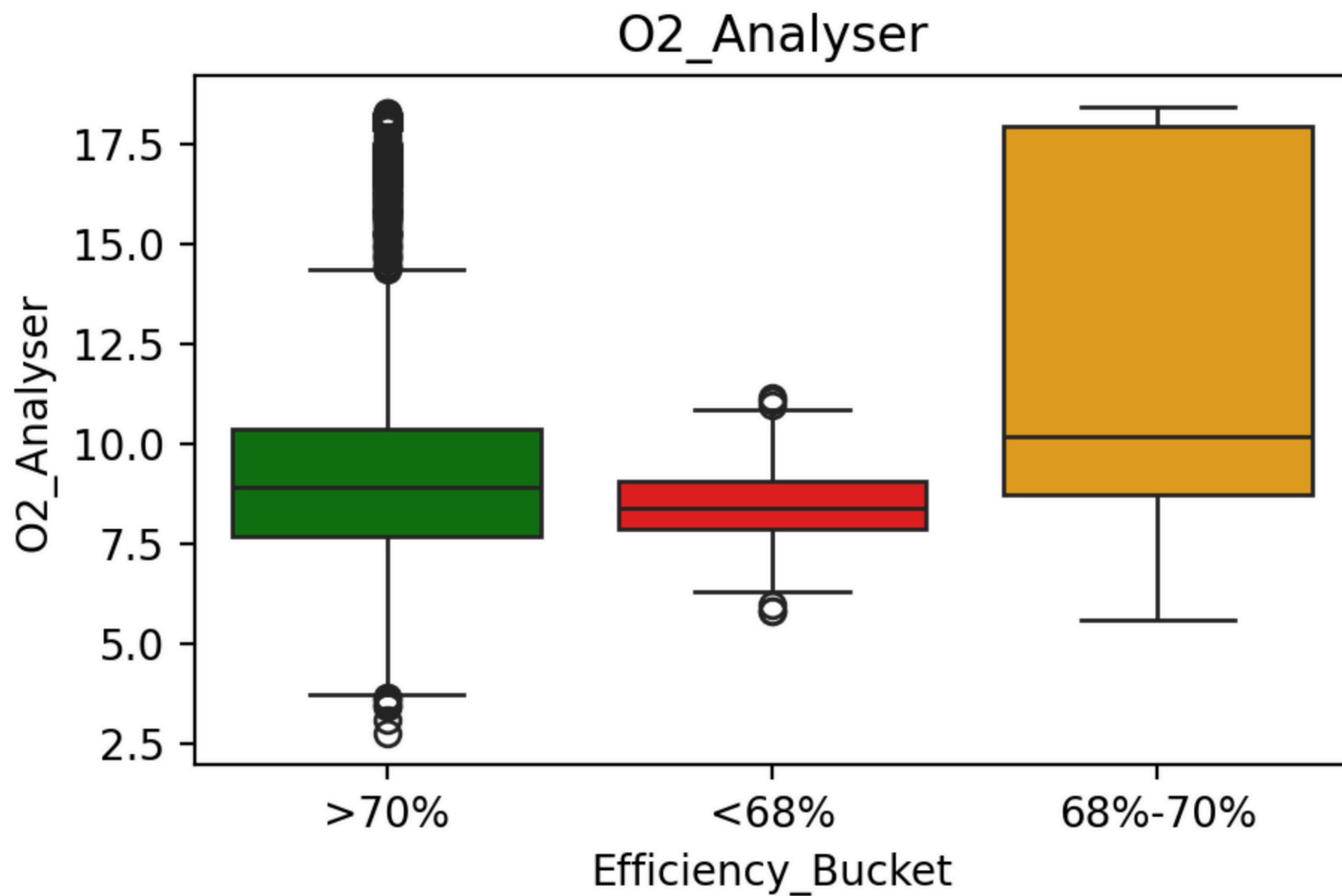
CONCLUSION

- Enabled automation in efficiency tracking.
- Simplified decision-making for boiler operators.
- Foundation laid for real-time dashboards and alert mechanisms.

Daily Efficiency Buckets
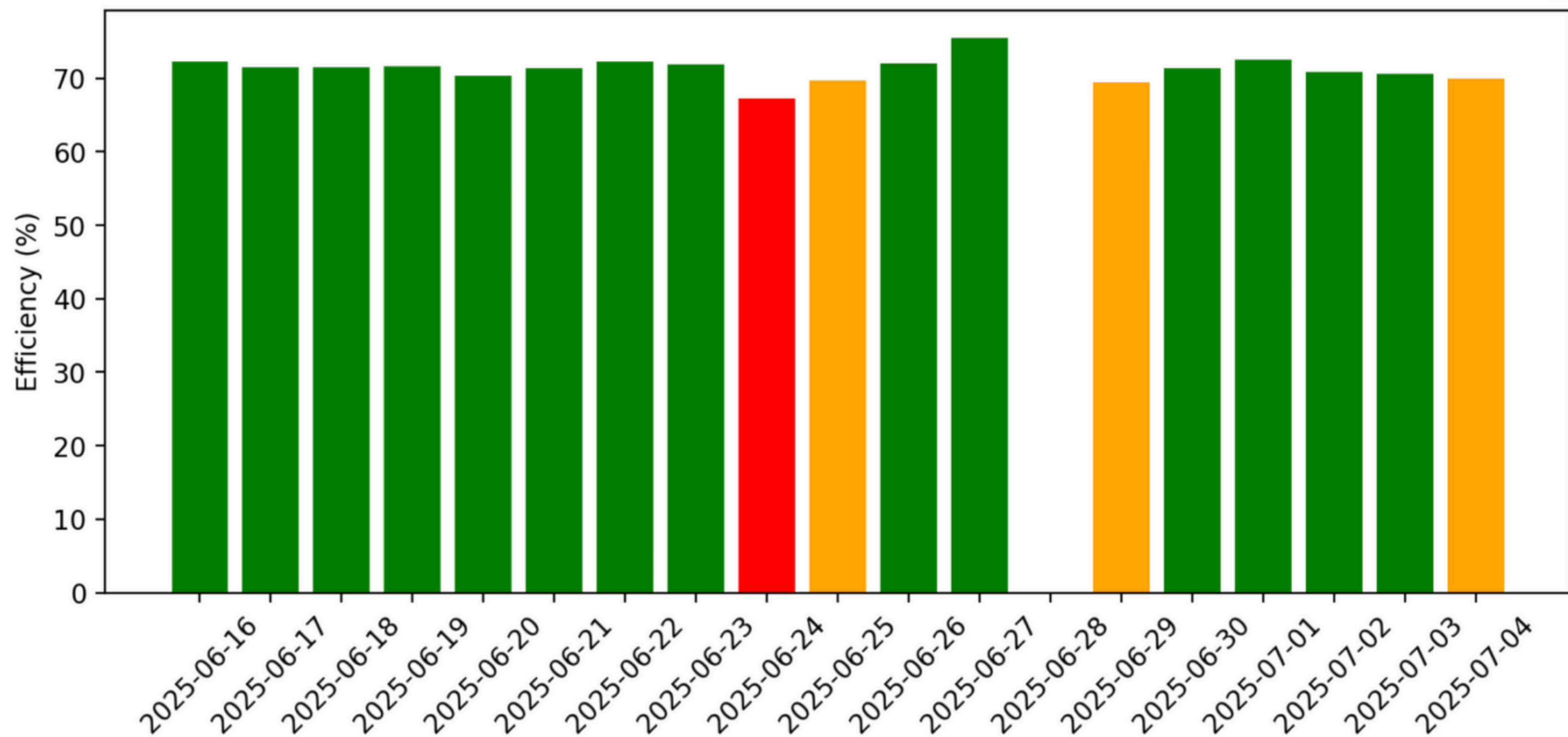
📦 **Steam vs Fuel (Bar Chart)**

O2_Analyser

📈 Boiler Efficiency Over Time