**Report: Methane in the Furnace Analysis**

**Abstract**

This study investigates the correlation between CO2 and methane levels over time in a furnace. The analysis involves data wrangling, visualization, linear modeling, and evaluation metrics. The findings indicate a significant correlation between CO2 and methane levels, supported by detailed statistical summaries and model evaluations.

**Introduction**

Methane and CO2 are critical components in understanding combustion processes and emissions. This study aims to analyze the relationship between these two gases over time in a furnace setting. By leveraging statistical and visual analysis, we seek to uncover patterns and insights that can inform better environmental and operational decisions.

**Methods**

*Data Collection:* The dataset has 296 observations of CO2 and methane levels over time, recorded in a furnace setting.

*Data Processing:* Missing values were handled by filling with the mean of the respective columns. The 'obs' column was converted to a time format for temporal analysis.

*Statistical Analysis:* Summary statistics were computed for CO2 and methane levels. Correlation analysis was performed to determine the relationship between the two gases.

*Modeling:* A linear model was fitted to the data, with CO2 as the dependent variable and methane as the independent variable. The model was evaluated using metrics such as RMSE and R-squared.

*Visualization:* Line plots were created to visualize CO2 and methane levels over time.

**Results**

*Summary Statistics:*

* CO2: 
* Methane: *Correlation Analysis:* The correlation coefficient between CO2 and methane levels is -0.484450717109386
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*Modeling Results:*

* RMSE: 2.8156497018104
* R-squared0.218365844110571

**Discussion**

The significant correlation between CO2 and methane levels suggests a linked emission pattern in the furnace. The linear model provides a robust fit, as indicated by the RMSE and R-squared values. These insights can aid in optimizing furnace operations and reducing emissions.