

ORIE 5741 Final Project: Natural Gas Price Forecasting

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Problem Statement

Natural gas accounts for one-fourth of the global energy demand and roughly one-third of the US energy demand. Accurately forecasting future prices is extremely valuable given the volatile nature of US natural gas market and the sheer amount of factors that lead to its price formation. Therefore, this project aims to predict the future price of the most commonly quoted price for natural gas, the Louisiana-based Henry Hub price, which is futures-traded on NYMEX.

Dataset Description

For this project, we will mainly use Bloomberg and the US Energy Information Administration (EIA) as data providers. This includes historical prices, natural gas storage levels, supply and demand dynamics, etc. This data is mainly quoted day-to-day and covers a period from the early 2000s to late 2022. In order to predict the Henry Hub spot price, we are using its past data and a wide range of relevant features.

These features can be classified as follows:

1. Pricing data:
 - Henry Hub Natural Gas Spot Price
 - Henry Hub Natural Gas Futures Price
2. Supply, demand, and storage data:
 - Natural Gas Production
 - Natural Gas Consumption
 - Natural Gas Imports/Exports
 - Natural Gas Storage Capacities
3. Economic indicators:
 - Consumer Price Index (CPI)
 - US Purchasing Managers Index (PMI)
 - S&P 500 Energy Index

This is a preliminary list of features and it is subject to change on further data analysis.

Significance of the Problem

There has been a growing interest in applying machine learning to natural gas trading to improve decision-making, optimize trading strategies, and reduce risk. Indeed, predicting natural gas prices is a challenging task due to the volatility and complexity of the natural gas market. Many factors can impact the price, including supply and demand dynamics, and economic indicators. There are also unexpected weather events or geopolitical crises that can cause prices to spike. Besides, the natural gas market is highly interconnected with other energy markets, such as oil and electricity. Changes in these markets can heavily impact prices in unexpected ways, making it difficult to forecast future price movements.

We intend to use different machine learning algorithms to analyze vast amounts of historical data and identify patterns and trends that indicate future price movements. This information can then be used to develop trading models that help traders make more informed decisions about when and how to buy and sell natural gas.