Analysing the daily flow and storage of Gas in France

Introduction:

In recent times, the importance of analysing and monitoring the usage of energy resources has increased significantly, especially when it comes to the sustainable and reliable energy systems. Understanding the analysis and monitoring the daily flows and storage is crucial for optimizing management, enhancing the supply security and making informed decisions as well. This project uses the highly trusted data available by the France government about their daily flow and storage of gas. The primary objective of this project is to make a comprehensive analysis on the flow pattern as looking in those insights will surely help in understanding the approach of managing the gas resources, planning for future demands and enhancing the overall energy strategy of the country.

Used Data:

In the analysis of this daily gas flow and gas storage in France, there are two datasets used and sourced from the official government portals of France. The data portal has undergone a thorough pipeline process to ensure the suitability of data available for analysis.

Dataset 1: Daily Gas Stock Data

Description and Structure: The dataset records the daily end-of-day gas stock levels, sharing the amount of gas available in the storage facilities, that is important for understanding storage capacity and utilization trends.

Source:https://www.data.gouv.fr/fr/datasets/stock-quotidien-dans-les-stockages-de-gaz-a-partir-de-novembre-2010/

Format: Tabular

Dataset 2: Daily Gas Flow Rate Data

Description and Structure: This dataset indicates the movement of gas into (injection) and out of (withdrawal) the storage facilities, providing insight into daily operational dynamics and supply-demand balancing in the gas network.

Source:https://www.data.gouv.fr/fr/datasets/debit-quotidien-des-stockages-de-gaz-a-partir-de-novembre-2010/

Format: Tabular

Data Pipeline and Output

The data pipeline involves following steps to prepare for further analysis:

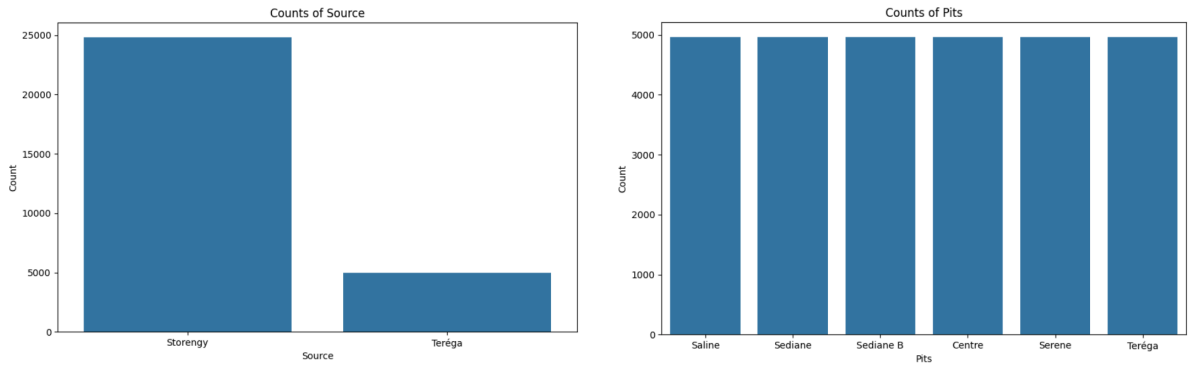
1. **Data Extraction:** Data is downloaded from the official sources of France Government portals.
2. **Data Cleaning:** This step includes handling missing values as the data was complete it wasn't required, correcting the column names by translating them from french to english as the raw data wasn't available in english.
3. **Data Transformation:** Both the datas were checked for the formats and required transformation if required in further integrations.
4. **Data Integration:**Both the datasets were integrated on the behalf of intersecting date, source and pits to have a clear and relevant data to be processed for analysis.

Compliance with Data Licenses

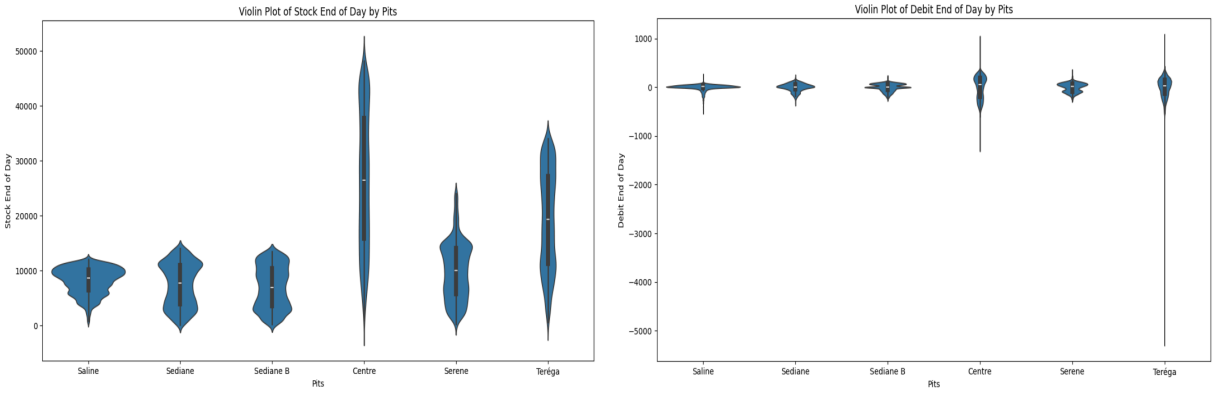
Both datasets are provided under the Licence Ouverte / Open Licence version 2.0. By adhering to this licensing requirements, the project ensures legal compliance and contributes to the open data community, facilitating further research and development.

Analysis:

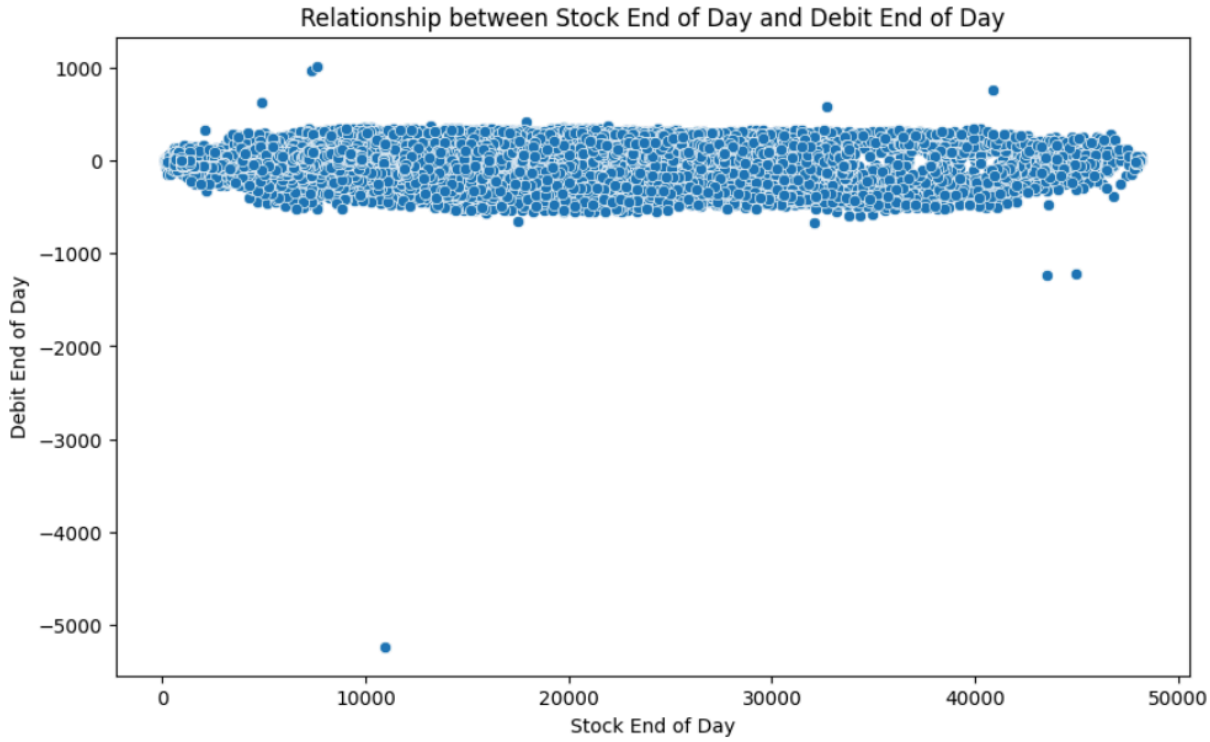
Initially, the data is loaded for the further analysis meanwhile by importing the necessary libraries like sqlite3, pandas, matplotlib and seaborn for various purposes in the further proceedings. After the completion of loading and import, The main columns of final combined dataset that are shown to execute are Date, Source, Pits, Stock_end_of_day, Debit_end_of_day. Various graphs are generated for the purpose of getting an insightful analysis from the data that we are using by considering various factors of counts, data density, correlation between both and time series from Nov. 2010 to current times.



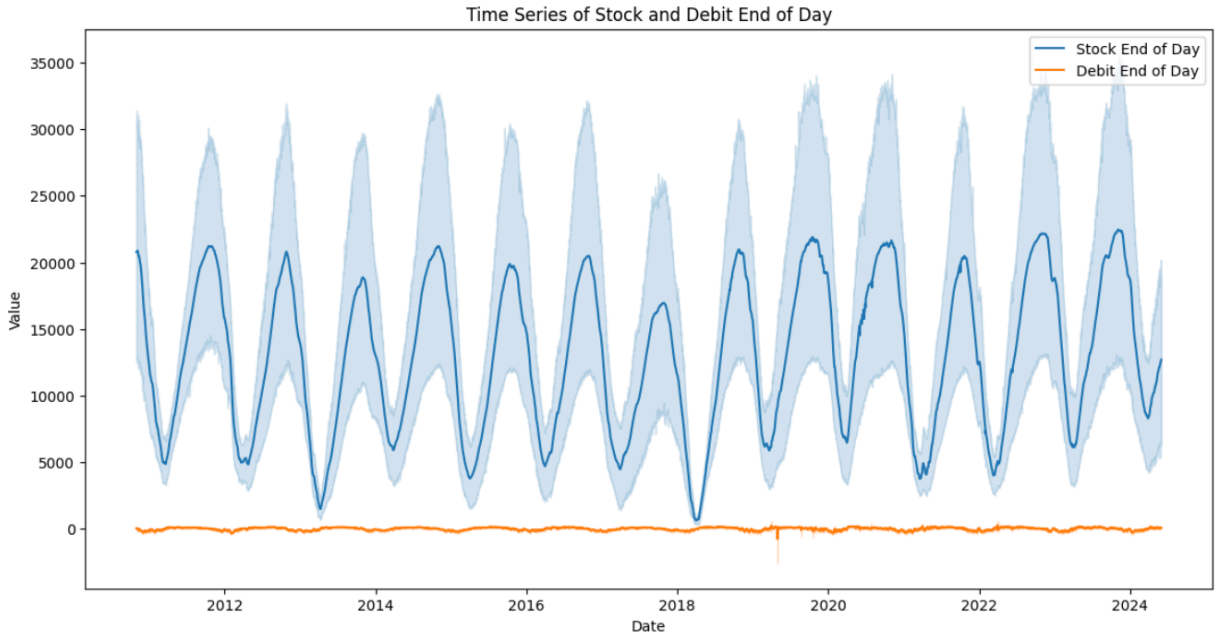
Firstly, the bar graphs are generated to note the count of various sources and pits of gas management in France. Which shares the insight that Storengy has more count than Terega in Sources whereas Pits are almost similar in count.



Nextly, the Violin plots are generated to check the spread of values with respect to various pits for Stock and Debit End of Day, main reason to use this method is to get the insights about the variability and the distribution of data points in accordance of values. The stock end of day values are variable and range differently for each pit whereas the values of debit end of day are mostly near to very lesser extent as compared to stock.



Further Proceeded with the Scatterplot for the Relationship between Stock End of Day and Debit End of Day, to understand how is the correlation between both of the factors. This scatterplot shows a very less correlation in terms of values to each other as maybe there is a huge scale difference in Stock and Debit of gas.



And Lastly, a time series graph of stock and debit of gas is generated to understand their values with respect to the time frame of years ranging from Nov. 2010 - May 2024. The graph shows that there is a significant fluctuation in the stock end of day whereas there is a stable line of graph for debit end of day. This is because of the managing and operations to stock up the gas during various time and the debit is almost similar for more than a decade.

Conclusions:

This project shares the analysis of daily flow and storage of Gas in France. As the above graphs shows how the whole management of energy distribution is working in the country to provide the most efficient application and supply security as well from almost last 15 years.

Few limitations and uncertainties are also considerable to check or get deeper into especially the factors of more correlations in the stock and debit of gas moreover how big fluctuations, major difference in the stock, can be normalised with respect to the market situation for most efficient results to imporve the risk management in future.