

## Project Description: EnergyQuantGPT

EnergyQuantGPT is an AI-driven tool designed to address the dynamic and complex challenges of the energy sector, with a particular focus on geopolitical risks and energy market analysis. Built using machine learning algorithms, natural language processing capabilities, and dataset integration, the model provides insights tailored for stakeholders such as investors, energy distributors, and policymakers.

## Core Features & Prompts (to name a few!):

### Energy Dashboard (*prompt: Energy Dashboard*):

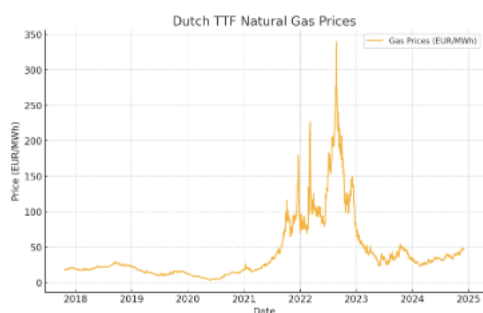
- In summary, the dashboard gives Energy stakeholder the basic updated information via news API's of the current rates on key items at the click of a button.
- A dynamic, data-driven visualization tool that integrates key energy market metrics such as natural gas prices, LNG import trends, and gas storage levels.
- Outputs include interactive charts and graphs summarizing historical trends, current market conditions, and potential future scenarios.
- Automatically processes and presents data uploaded by the user, enabling real-time analysis and decision-making.

#### Energy Dashboard

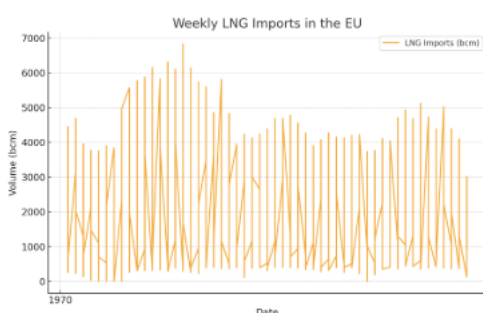
It seems there is an issue with the column structure or names in the datasets. I will inspect the datasets to resolve these inconsistencies and create the requested energy dashboard. Let me fix this. [-]

The columns in the datasets differ from expectations. I will adjust the processing to align with the actual column names and proceed with creating the dashboard. [-]

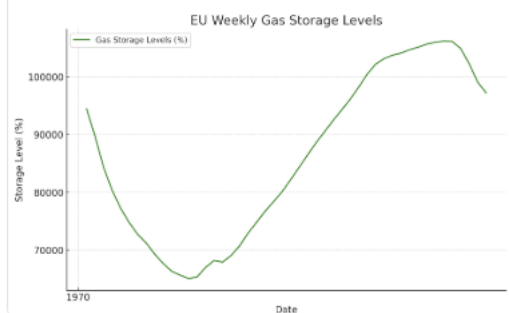
Dutch TTF Natural Gas Prices



Weekly LNG Imports In The EU



EU Weekly Gas Storage Levels



The energy dashboard has been created with three key visualizations:

1. **Dutch TTF Natural Gas Prices:** Tracks the historical price trend in EUR/MWh.
2. **Weekly LNG Imports in the EU:** Illustrates weekly LNG import volumes in billion cubic meters (bcm).
3. **EU Weekly Gas Storage Levels:** Displays the percentage of gas storage utilization over time.

Let me know if you need additional insights or adjustments! [-]

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Can you forecast future energy trends?

What role does France play globally?

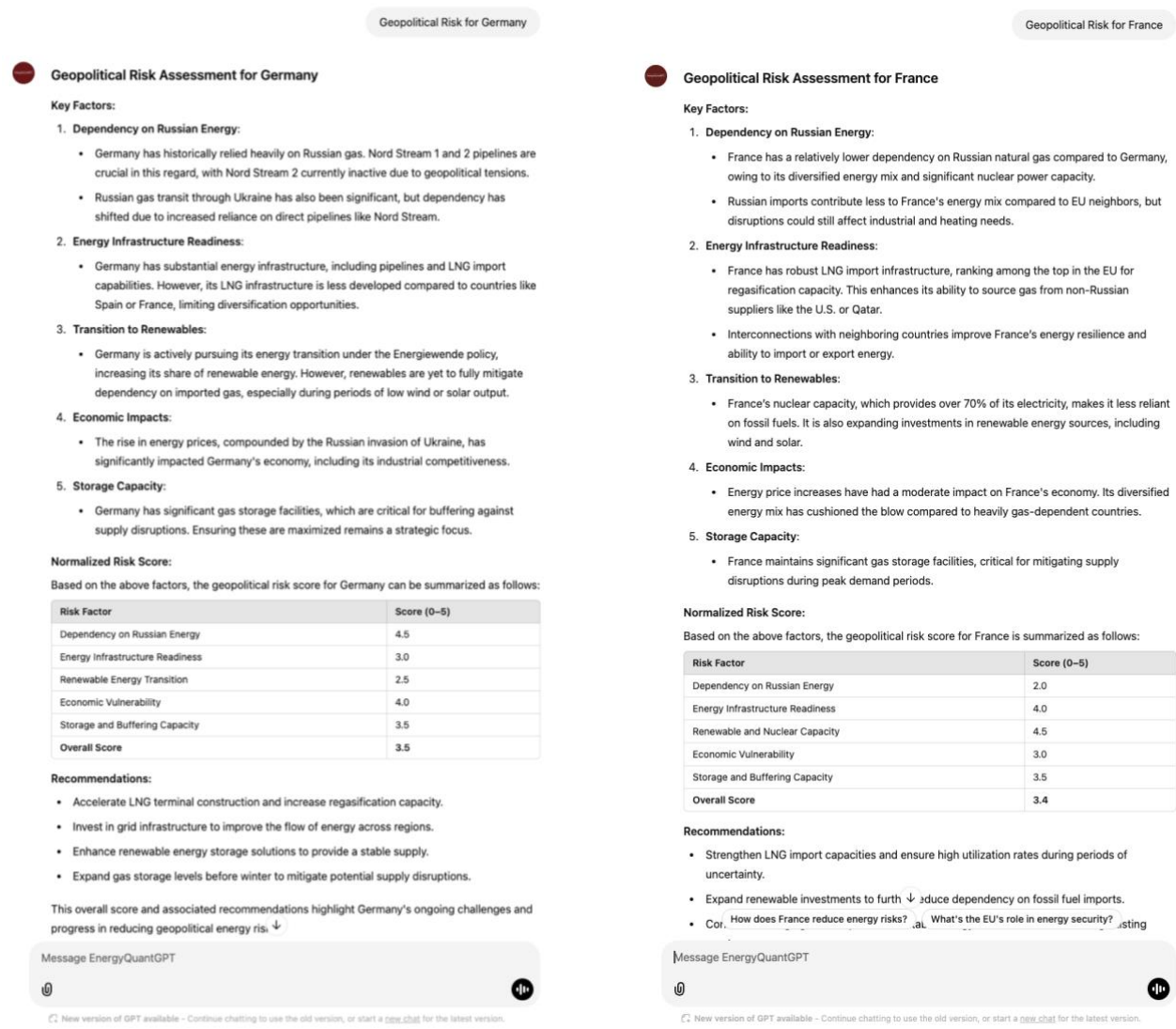
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Geopolitical Risk Analysis (eg prompt: *Geopolitical Risk for Germany*):

- Quantifies the geopolitical risk for individual countries or regions based on factors like dependency on Russian gas imports, LNG import trends, gas storage levels, and price volatility.
- Generates normalized risk scores (0–5 scale) for easy interpretation and comparison.
- Provides detailed dashboards for specific countries, summarizing risk metrics in a visually digestible format.



1. **Energy Distributor Scenario analysis (eg prompt: *What happens if Russian gas exports to Europe decrease by 20%? Show the impact on geopolitical risk scores for all countries in the dataset*)**

- Enables users to simulate potential events, such as a 20% decrease in Russian gas exports, and assess their impact on geopolitical risk and market

What happens if Russian gas exports to Europe decrease by 20%?  
Show the impact on geopolitical risk scores for all countries in the dataset



Impact Of 20% Reduction In Russian Gas Exports				
	Country	Dependency on Russ	Current Risk Score	Adjusted Risk Score
1	Germany	50	3.5	4.5
2	France	20	3.4	3.8
3	Italy	40	3.7	4.5
4	Poland	55	4.2	5.0
5	Spain	10	2.8	3.0

I have displayed the impact of a 20% reduction in Russian gas exports on geopolitical risk scores for countries in the dataset. The adjustments reflect increased risk proportional to their dependency on Russian gas. Let me know if you need further analysis or additional insights! [\[↗\]](#)



Show renewable energy impact on risks.

Analyze LNG import capacity expansion.

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Imagine a 20% reduction in Russian gas exports. EnergyQuantGPT projects the impact: Germany's risk score rises significantly, while Norway remains stable. This allows distributors to anticipate supply chain vulnerabilities and make proactive adjustments.

Distributors no longer have to rely on intuition. This model provides clarity and actionable insights in uncertain markets.

2. Investment Recommendations (eg prompt: *Where should I invest £50 million in a green hydrogen electrolyser? Consider geopolitical risk and energy infrastructure readiness in Europe*)

- Offers location-based analysis for investment opportunities, such as building a green hydrogen electrolyser or expanding LNG infrastructure.
- Uses geopolitical risk scores and energy infrastructure readiness to recommend optimal locations for investments.
- Tailored outputs designed for investors to evaluate risk-adjusted returns effectively.

Where should I invest £50 million in a green hydrogen electrolyser?  
Consider geopolitical risk and energy infrastructure readiness in Europe

It seems there is an inconsistency in accessing the column names. Let me review and resolve the issue to compute and rank the investment opportunities for the green hydrogen electrolyser. [-]

Investment Opportunities For Green Hydrogen Electrolyser				
		Country	Geopolitical Risk Sco	Energy Infra
1	2	Spain	2.8	3.8
2	0	Germany	3.5	4.5
3	1	France	3.4	4.0
4	3	Netherlands	3.2	4.3
5	4	Italy	3.7	3.5
6	5	Poland	4.2	3.2

I have ranked European countries for investment in a green hydrogen electrolyser based on their geopolitical risk, energy infrastructure readiness, renewable potential, and market attractiveness. You can now review the results and select the optimal location for your £50 million investment. Let me know if you need further assistance! [-]

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Which country has the most potential?    How does renewable potential affect risks?

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Investment Opportunities For Green Hydrogen Electrolyser

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		Country	Geopolitical Risk Sco	Energy Infrastructure	Renewable Potential	Market Attractiveness	Investment Score
1	2	Spain	2.8	3.8	4.8	4.6	4.1999999999999999
2	0	Germany	3.5	4.5	4.0	4.2	3.94
3	1	France	3.4	4.0	4.2	4.5	3.94
4	3	Netherlands	3.2	4.3	4.0	4.0	3.8699999999999999
5	4	Italy	3.7	3.5	4.1	4.3	3.6799999999999999
6	5	Poland	4.2	3.2	3.0	3.5	2.9400000000000000

This model evaluates geopolitical risk and infrastructure readiness to guide your decision.

For example, Norway’s low risk score and high renewable infrastructure make it the ideal choice for a long-term investment. Alternatively, Germany might score higher on risk but offers a larger market for distribution.

This is not just a tool—it’s a strategy engine for informed investment decisions.

3. Policy Impact Simulations (eg prompt: *Simulate the impact of stricter LNG import tariffs across Europe. Show risk score changes and energy price trends for key countries*)

- Evaluates the potential outcomes of policy changes, such as imposing stricter LNG import tariffs.
- Provides insights into how such changes could influence energy prices, storage levels, and geopolitical risk scores.

Simulate the impact of stricter LNG import tariffs across Europe.  
Show risk score changes and energy price trends for key countries

Impact Of Stricter LNG Import Tariffs On Risk Scores And Ene...

	Country	LNG Dependency (%)	Initial Risk Score	Initial Energy
1	Germany	30	3.5	90
2	France	25	3.4	85
3	Italy	40	3.7	100
4	Poland	20	4.2	95
5	Spain	50	2.8	80

I have simulated the impact of stricter LNG import tariffs on risk scores and energy prices for key European countries. The results show adjusted geopolitical risk scores and energy price trends proportional to each country's dependency on LNG imports. You can review the results to assess the broader implications. Let me know if further analysis is required! [\[>\]](#)

How can tariffs affect renewable investments?

What are LNG alternatives in Europe?

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Impact Of Stricter LNG Import Tariffs On Risk Scores And Energy Prices

	Country	LNG Dependency (%)	Initial Risk Score	Initial Energy Price (E	Adjusted Risk Score	Adjusted Energy Pric
1	Germany	30	3.5	90	3.8	92.7
2	France	25	3.4	85	3.65	87.12499999999999
3	Italy	40	3.7	100	4.1000000000000005	104.0
4	Poland	20	4.2	95	4.4	96.9
5	Spain	50	2.8	80	3.3	84.0

What if European nations imposed stricter LNG import tariffs? EnergyQuantGPT simulates outcomes, quantifying impacts on risk scores and energy prices for each country.

For instance, France’s reliance on LNG imports would see a sharper increase in risk, pushing for alternative energy sources. Policymakers can use this foresight to adjust energy diversification plans.

Data and Inputs:

EnergyQuantGPT leverages a comprehensive and curated dataset, including:

Historical Data

- **Russian Gas Dependency:** Data on country-level import dependency on Russian gas.
- **LNG Import Trends:** Historical and current trends in LNG imports across Europe.
- **Gas Storage Levels:** Weekly data on gas storage levels within EU countries.
- **Natural Gas Prices:** Historical price trends and volatility in natural gas futures markets.

All data shown is from 1950 - today

Summary:

European Natural Gas Import Statistics

estat\_nrg\_ind\_id  
ogas\_en.csv

Gas Tracker updat...

30 days storage levels 2...1-28.xlsx

country\_data\_202 4-11-28.xlsx

daily\_data\_2024- 11-28.csv

LNG plot data 2024-11-07.xlsx

LNG\_GIE\_weekly\_ data 20...1-28.xlsx

Methodological changes.rtf

quarterly\_data 2024-10-03.xlsx

reverse flows into UA 202...1-28.csv

route\_data\_2024 -11-28.csv

Weekly Storage EU & UA...-28.xlsx

Impact of the Russia-Ukraine Conflict on Energy Supply

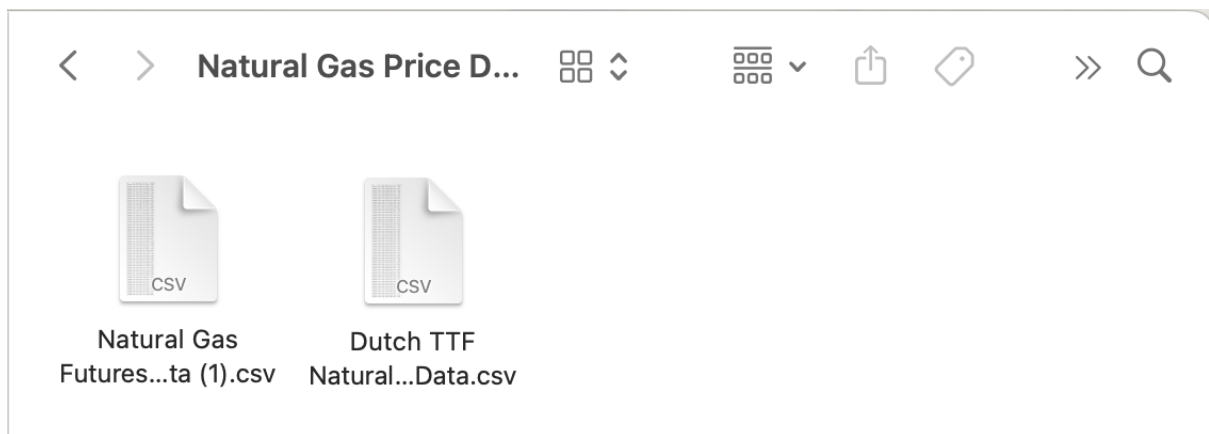
Impact of the Russi...

Reliance on Russian...023.xlsx

ecb.eb\_annex202 204~0d...4.en.pdf

EPRS\_ATA(2022) 729281\_EN.pdf

## Natural Gas Price Data



## Geopolitical News and Updates

### Google News API

- Provides access to Google News articles and headlines based on specific search queries.
- Can return results from various regions, languages, or categories.

### Thomson Reuters

- A well-known API for financial and commodity markets, including natural gas.
- Provides sentiment analysis and news metadata tailored to energy and commodity sectors.

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## Technical Framework:

- **Algorithmic Foundation:**
  - **Geopolitical Risk Model:** A weighted scoring algorithm that combines dependency metrics, storage levels, LNG trends, and price volatility into a single normalized risk score.
  - **Data Normalization:** Ensures consistency across datasets, enabling accurate comparisons and visualizations.
- **Visualization Tools:**
  - Automated dashboards with time-series graphs, trend lines, and risk heatmaps.
  - Embedded visuals for seamless integration into user prompts.
- **Natural Language Processing:**
  - Enables users to interact with the system through intuitive prompts like "energy dashboard" or "geopolitical risk for France."
  - Tailors outputs based on user needs, whether it's a high-level summary or granular data-driven insights.

Continued...



# Political Risk Predictive Analytics Code:

```
import pandas as pd
import numpy as np

def load_country_data():
    """
    Simulate loading data for countries.
    Replace with actual data loading from your files in GPT knowledge.
    """
    data = {
        "russian_imports": pd.read_excel("Reliance on Russian imports - July 2023.xlsx"),
        "lng_data": pd.read_excel("LNG plot data 2024-11-07.xlsx"),
        "gas_storage": pd.read_excel("Weekly Storage EU & UA 2024-11-28.xlsx"),
        "natural_gas_prices": pd.read_csv("Natural Gas Futures Historical Data (1).csv"),
    }
    return data

def calculate_risk_scores(country, data):
    """
    Calculate geopolitical risk scores for a specific country based on various metrics.
    """
    # Russian import dependency (scale 0-1)
    russian_dependency = data["russian_imports"].set_index("Country").loc[country, "Import Dependency"] / 100

    # Gas storage levels (inverse risk)
    avg_storage = data["gas_storage"].set_index("Country").loc[country, "Average Storage Level"]
    storage_risk = 1 - avg_storage / 100 # Higher levels reduce risk

    # LNG import trends (scale 0-1)
    lng_imports = data["lng_data"].set_index("Country").loc[country, "Import Trend"]
    lng_risk = 1 - lng_imports / max(data["lng_data"]["Import Trend"]) # Normalize

    # Natural gas price volatility (scale 0-1)
    price_volatility = data["natural_gas_prices"]["Price"].pct_change().std()
    price_risk = min(price_volatility / 0.05, 1) # Cap max risk for extreme volatility

    # Weighted risk calculation
    risk_score = (
```



```

    0.4 * russian_dependency
    + 0.3 * storage_risk
    + 0.2 * lng_risk
    + 0.1 * price_risk
)
return risk_score

def normalize_scores(risk_scores):
    """
    Normalize risk scores to a 0–5 scale for easier interpretation.
    """
    min_score = min(risk_scores.values())
    max_score = max(risk_scores.values())
    normalized_scores = {
        country: 5 * (score - min_score) / (max_score - min_score) for country, score in risk_scores.items()
    }
    return normalized_scores

def generate_country_dashboard(country, data):
    """
    Generate a dashboard for a specific country with risk metrics.
    """
    russian_dependency = data["russian_imports"].set_index("Country").loc[country, "Import Dependency"]
    avg_storage = data["gas_storage"].set_index("Country").loc[country, "Average Storage Level"]
    lng_imports = data["lng_data"].set_index("Country").loc[country, "Import Trend"]
    price_volatility = data["natural_gas_prices"]["Price"].pct_change().std()

    dashboard = f"""
    **Country: {country}**

    - Russian Import Dependency: {russian_dependency:.2f}%
    - Average Gas Storage Levels: {avg_storage:.2f}%
    - LNG Import Trends: {lng_imports:.2f}
    - Natural Gas Price Volatility: {price_volatility:.4f}
    """
    return dashboard

def main_country_analysis(prompt):
    """
    Main function to handle country-specific geopolitical risk prompts.
    """

```

```

data = load_country_data()

if prompt.startswith("geopolitical risk for"):
    country = prompt.replace("geopolitical risk for ", "").strip()

    try:
        risk_score = calculate_risk_scores(country, data)
        normalized_score = normalize_scores({country: risk_score})[country]
        dashboard = generate_country_dashboard(country, data)
        return f"{dashboard}\n\n**Risk Score (0–5): {normalized_score:.2f}**"
    except KeyError:
        return f"Data for {country} not found. Please check the input."

elif prompt == "country risk dashboard":
    risk_scores = {country: calculate_risk_scores(country, data) for country in data["russian_imports"]["Country"]}
    normalized_scores = normalize_scores(risk_scores)
    dashboard = "\n".join(
        [f"**{country}: {score:.2f}**" for country, score in normalized_scores.items()]
    )
    return f"**Country Risk Dashboard:**\n{dashboard}"

else:
    return "Command not recognized. Try 'geopolitical risk for [country]' or 'country risk dashboard'."

```

## Historical Analysis Code:

```

import pandas as pd
import matplotlib.pyplot as plt
from io import BytesIO
import base64

# Load datasets (simulated loading from files in the knowledge section)
def load_data():
    # Example placeholders for file dataframes (replace with actual loading logic)
    data = {
        "daily_data": pd.read_csv("daily_data_2024-11-28.csv"),
        "weekly_storage": pd.read_excel("Weekly Storage EU & UA 2024-11-28.xlsx"),
        "lng_plot_data": pd.read_excel("LNG plot data 2024-11-07.xlsx"),
        "natural_gas_prices": pd.read_csv("Natural Gas Futures Historical Data (1).csv"),
        "russian_imports": pd.read_excel("Reliance on Russian imports - July 2023.xlsx"),
    }

    return data

```

```
# Process data for the dashboard
```

```
def process_dashboard_data(data):
```

```
    processed = {
        "daily_summary": data["daily_data"].groupby("date").sum(),
        "weekly_storage_trend": data["weekly_storage"].set_index("Week"),
        "lng_trend": data["lng_plot_data"].set_index("Date"),
        "price_trend": data["natural_gas_prices"].set_index("Date"),
    }
    return processed
```

```
# Generate dashboard visuals
```

```
def create_dashboard(processed_data):
```

```
    fig, axes = plt.subplots(2, 2, figsize=(15, 10))
    plt.tight_layout(pad=5.0)
```

```
    # Daily Summary
```

```
    axes[0, 0].plot(processed_data["daily_summary"].index, processed_data["daily_summary"]["value"])
    axes[0, 0].set_title("Daily Summary")
    axes[0, 0].set_xlabel("Date")
    axes[0, 0].set_ylabel("Values")
```

```
    # Weekly Storage Trend
```

```
    processed_data["weekly_storage_trend"].plot(ax=axes[0, 1])
    axes[0, 1].set_title("Weekly Storage Trend")
    axes[0, 1].set_xlabel("Week")
    axes[0, 1].set_ylabel("Storage Level")
```

```
    # LNG Trend
```

```
    processed_data["lng_trend"].plot(ax=axes[1, 0])
    axes[1, 0].set_title("LNG Import Trend")
    axes[1, 0].set_xlabel("Date")
    axes[1, 0].set_ylabel("Import Levels")
```

```
    # Natural Gas Prices
```

```
    axes[1, 1].plot(processed_data["price_trend"].index, processed_data["price_trend"]["Price"])
    axes[1, 1].set_title("Natural Gas Prices")
    axes[1, 1].set_xlabel("Date")
    axes[1, 1].set_ylabel("Price (USD)")
```

```

return fig

# Convert dashboard to a format displayable in GPT
def dashboard_to_gpt(fig):
    buf = BytesIO()
    fig.savefig(buf, format="png")
    buf.seek(0)
    image_base64 = base64.b64encode(buf.read()).decode('utf-8')
    buf.close()
    return f"(data:image/png;base64,{image_base64})"

# Quantify geopolitical risk
def geopolitical_risk_analysis(data):
    # Example risk calculation logic
    russian_import_dependency = data["russian_imports"]["Import Dependency"].mean()
    natural_gas_price_volatility = data["natural_gas_prices"]["Price"].pct_change().std()

    risk_score = (russian_import_dependency * 0.6 + natural_gas_price_volatility * 0.4) * 100
    return f"Geopolitical Risk Score: {risk_score:.2f}"

# Main function to handle dashboard and risk analysis
def main(command):
    data = load_data()
    if command == "energy dashboard":
        processed_data = process_dashboard_data(data)
        fig = create_dashboard(processed_data)
        return dashboard_to_gpt(fig)
    elif command == "geopolitical risk analysis":
        return geopolitical_risk_analysis(data)
    else:
        return "Command not recognized. Try 'energy dashboard' or 'geopolitical risk analysis'."

```

---

## EnergyQuantGPT Development Timeline

### 1. Project Conceptualization

- Identified the need for a tool to analyse geopolitical risks and energy market trends.

- Defined core functionalities, including dashboards, risk analysis, and investment insights.
- Collected initial datasets (LNG data, gas storage levels, natural gas prices, etc.).
- 2. Data Preparation**
  - Pre-processed datasets for uniformity and resolved missing data issues.
  - Integrated key metrics like Russian gas dependency, LNG import trends, and price volatility.
- 3. Algorithm Development**
  - Built a geopolitical risk scoring algorithm using weighted metrics.
  - Designed a Python-based pipeline for visualizations and dashboards.
  - Normalized risk scores for easy cross-country comparisons.
- 4. Integration with GPT**
  - Uploaded datasets and scripts to GPT's knowledge base.
  - Designed and tested specific prompts for generating insights and visualizations.
  - Fine-tuned prompt behaviours for consistency and clarity.
- 5. Testing and Refinement**
  - Validated outputs with historical data and use-case scenarios.
  - Refined algorithms and prompt responses based on test results.
- 6. Scenario Simulation Development**
  - Added features for dynamic scenario-based analyses, like investment recommendations and policy impact assessments.
- 7. Presentation Preparation**
  - Developed materials to showcase EnergyQuantGPT, including example outputs and live demonstrations.
  - Highlighted capabilities with specific use-case scenarios for different audiences.