🌍 Climate Change Analysis Report

# Project Title:

Global Temperature Rise and Greenhouse Gas Trend Forecast (1983–2050)

# Prepared by:

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# Tools Used:

Python, Pandas, Matplotlib, Seaborn, Scikit-learn

# Objective

To analyze the historical relationship between greenhouse gases (CO₂ and CH₄) and global temperature anomalies, and predict future temperature changes using trend forecasting and regression modeling.

# Datasets Used

All datasets were sourced from NASA's Global Climate Change Portal.  
- co2.txt: Monthly atmospheric CO₂ levels (ppm) [1958–2024]  
- methane.txt: Monthly atmospheric CH₄ levels (ppb) [1983–2024]  
- temparature.txt: Annual global temperature anomalies (°C) [1880–2024]

# Data Processing Steps

1. Loaded datasets using pandas with appropriate delimiters and headers.  
2. Filtered and cleaned the data (removed missing or invalid values).  
3. Converted monthly CO₂ and CH₄ data to yearly averages.  
4. Merged all datasets on year for common analysis window (1983–2024).  
5. Created visualizations to show the trend of CO₂, CH₄, and temperature.

# Exploratory Data Analysis

CO₂ Levels (ppm): Steady rise from ~340 ppm in 1983 to ~425 ppm in 2024.

CH₄ Levels (ppb): Increased from ~1630 ppb in 1983 to ~1930 ppb in 2024.

Temperature Anomalies (°C): Increased from ~0.2°C in 1983 to 1.29°C in 2024.

# Correlation Analysis

|  |  |
| --- | --- |
| Variables | Correlation Coefficient (r) |
| CO₂ & Temp | 0,98 |
| CH₄ & Temp | 0.95 |
| CO₂ & CH₄ | 0.99 |

# Predictive Modeling

Model Used: Linear Regression  
- Features: CO₂ and CH₄ levels  
- Target: Temperature anomaly (°C)  
- Model performance: High R² Score and low MSE

# Future Forecast (2025–2050)

|  |  |  |  |
| --- | --- | --- | --- |
| Year | CO₂ (ppm) | CH₄ (ppb) | Predicted Temp (°C) |
| 2025 | 427 | 1940 | 1.33 |
| 2030 | 440 | 1980 | 1.45 |
| 2040 | 460 | 2050 | 1.67 |
| 2050 | 480 | 2120 | 1.90 |

# Key Insights

- CO₂ and CH₄ levels show a strong linear growth.  
- There is a direct relationship between GHG levels and global warming.  
- Without mitigation, temperature will likely exceed 2°C anomaly by 2050, worsening climate risk

# Technologies Used

|  |  |
| --- | --- |
| Tool | Purpose |
| Pandas | Data loading & preprocessing |
| Matplotlib/Seaborn | Visualizations |
| Scikit-learn | Regression modeling |
| Jupyter | Code development and reporting |

# Suggestions for Future Work

- Add more gases like N₂O for deeper analysis.  
- Apply non-linear models (e.g., Random Forest, SVR).  
- Build a Streamlit dashboard for real-time interactivity.  
- Integrate sea level, ice sheet loss, and deforestation metrics.

# References

- NASA Global Climate Change: https://climate.nasa.gov