

Greenhouse Gas Emissions Footprint Analysis Across Supply Chain Sectors in America

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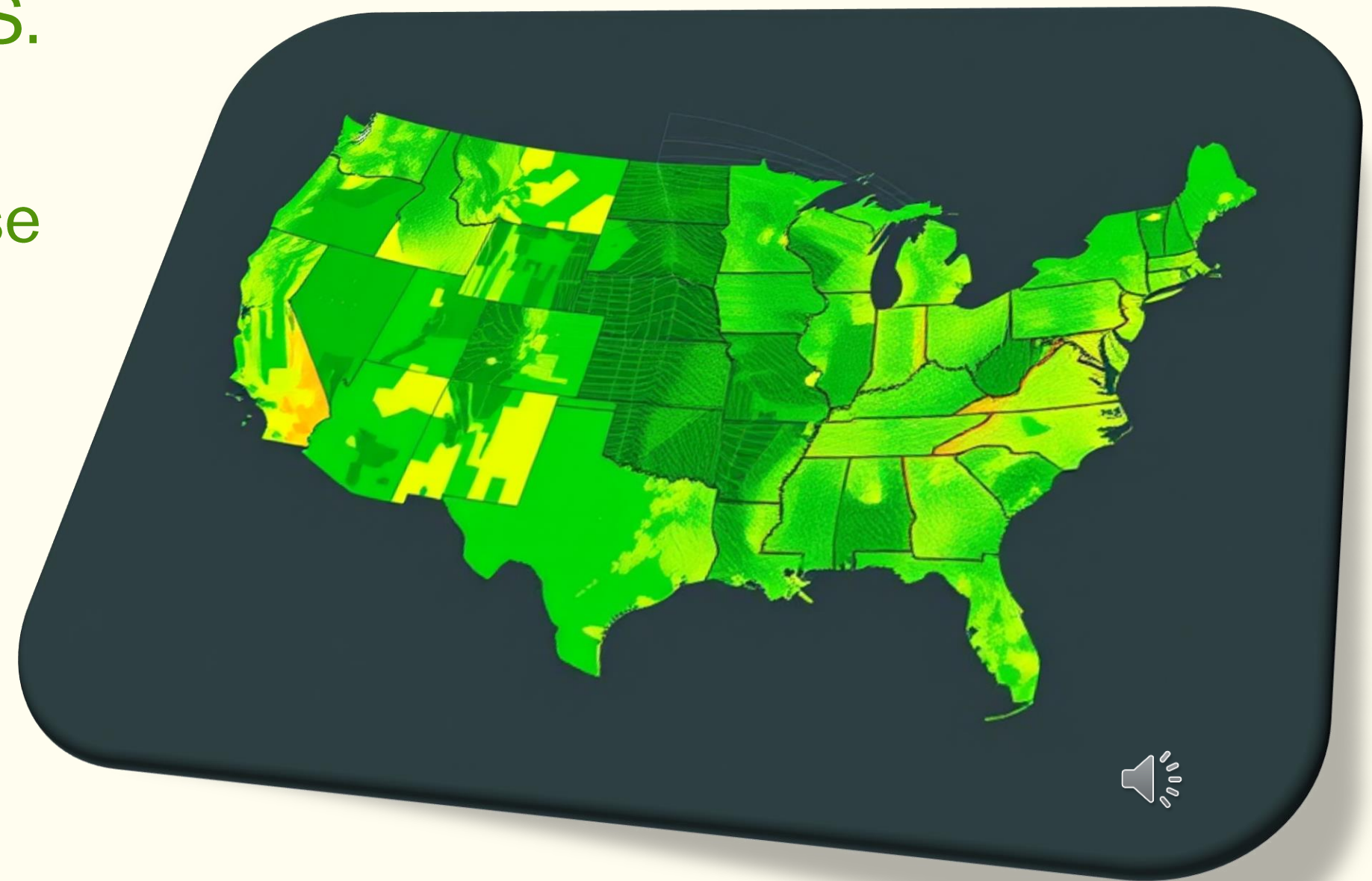
Overview

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Introduction

- **Vision :** Explore sector-specific greenhouse gas emission trends in the U.S. supply chain.
- **Research Question:** How do greenhouse gas emissions footprints vary across different supply chain sectors in the U.S.?
- **Relevance:** Highlight the importance of targeted decarbonization strategies in achieving climate goals



Datasets

Comprehensive datasets spanning 1990–2022:

- Supply Chain Greenhouse Gas Emission Factors v1.3 by NAICS-6 ^[1]
- Emission Factors for US Industries and Commodities ^[2]
- Transportation-Related Greenhouse Gas Emissions ^[3]
- Domestic Freight Transportation Emissions ^[4]

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Dataset Name	Data Type	Focus Areas
GHG Factors by NAICS-6	CSV	Industry-level emissions
GHG Factors for Industries & Commodities	CSV	Commodity-level emissions
Transportation GHG Emissions	XLSX	Transportation sector
Freight Transportation Emissions	CSV	Freight logistics emissions

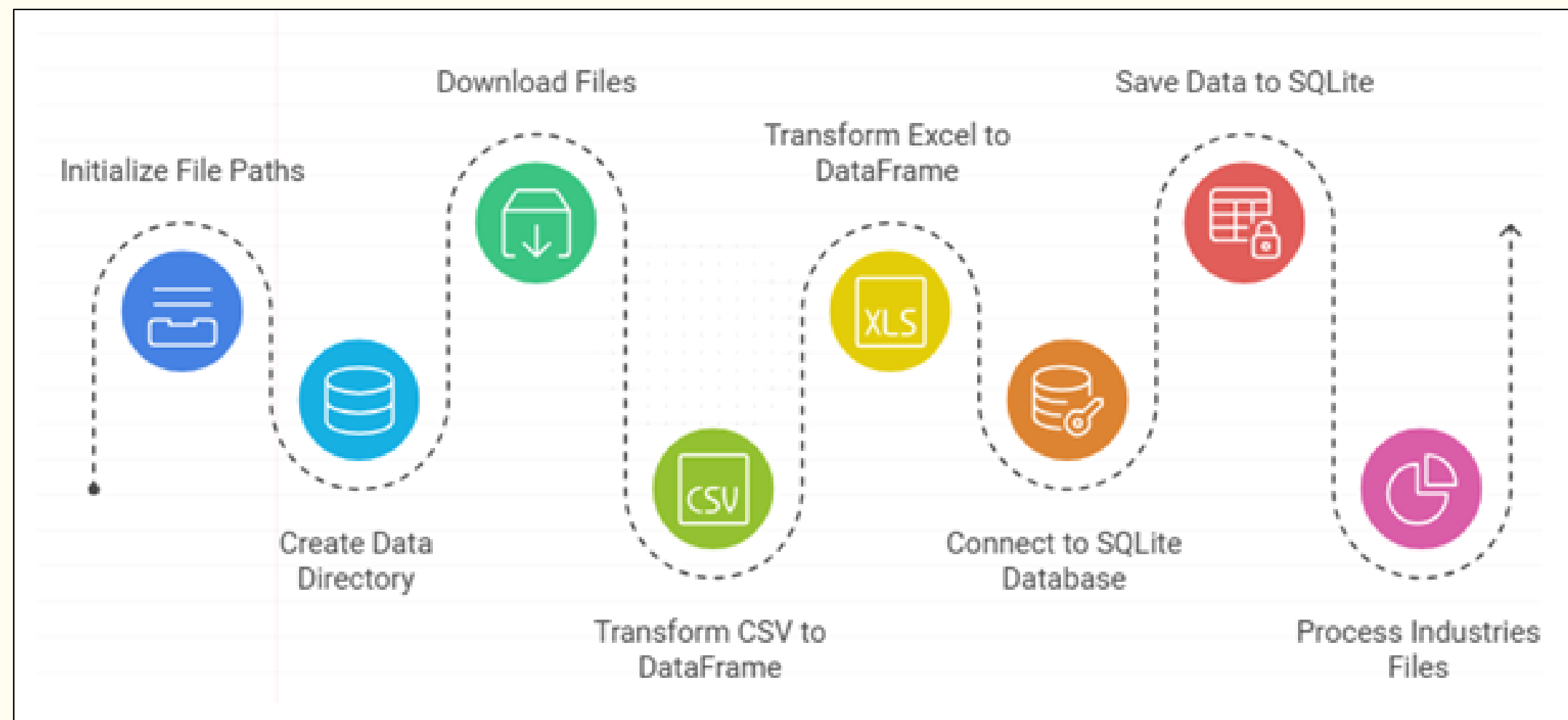


Pipeline

ETL process:

- Extraction: Automated dataset download using Python.
- Transformation: Cleaning (handling missing data, standardizing units).
- Loading: Data storage in SQLite databases (emission.db and insights.db).

Challenges and Solutions: For managing the temporary storage of downloaded files, Mention the flag-based caching approach to optimize file storage



Database Schema

- The *insights.db* database acts as the primary data sink, where all final, transformed, and processed data is loaded and stored.
- This database is built using SQLite, which is a lightweight, serverless database engine widely used for its simplicity and reliability



Methodology

Objectives:

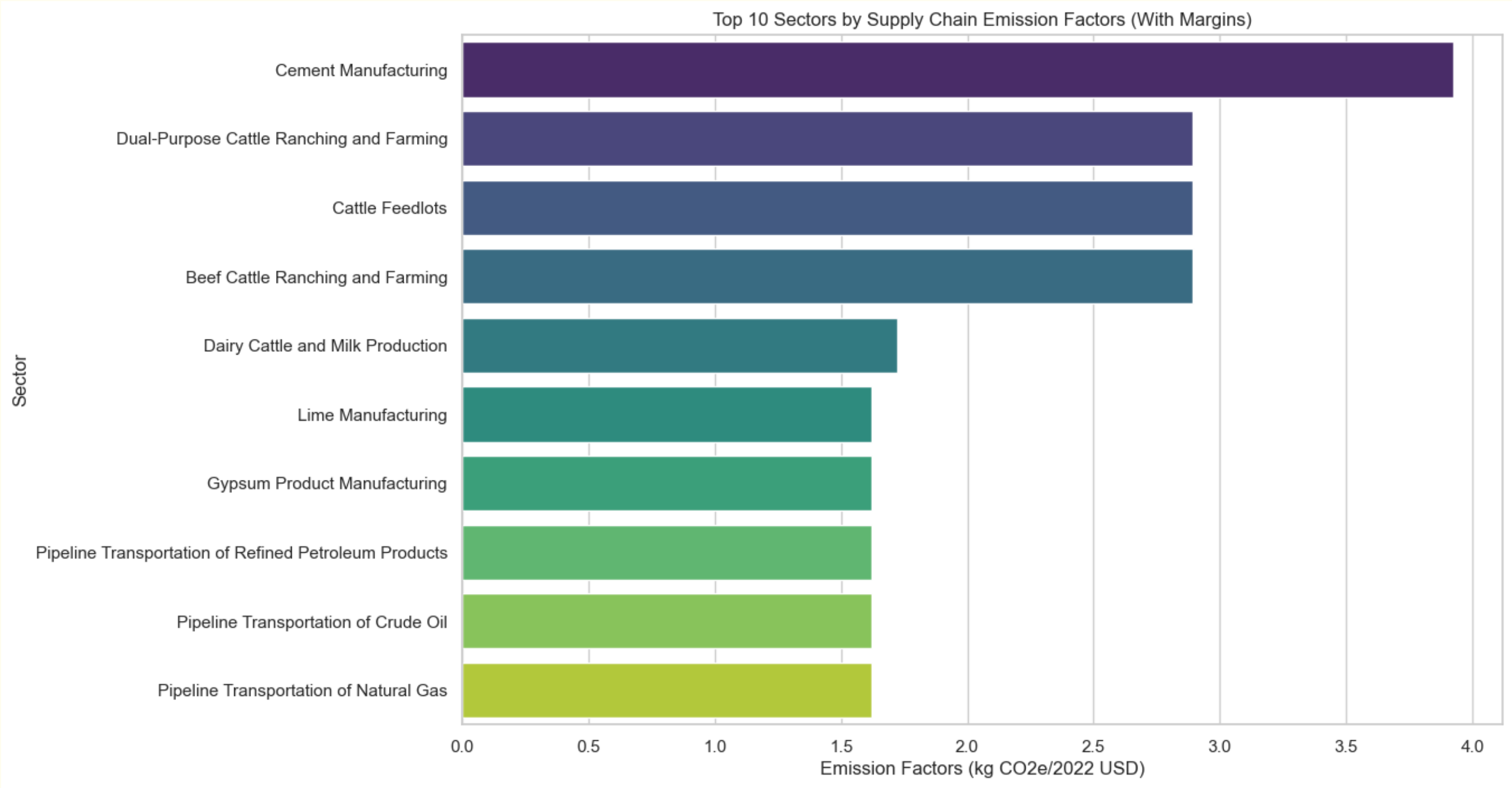
- Identifying high-emission sectors.
- Examining sector-specific contributions.
- Investigate temporal GHG trends.
- Correlation analysis of emissions factors.
- Explore sector- and commodity-level emissions.

Tools: Python libraries like pandas, matplotlib, seaborn



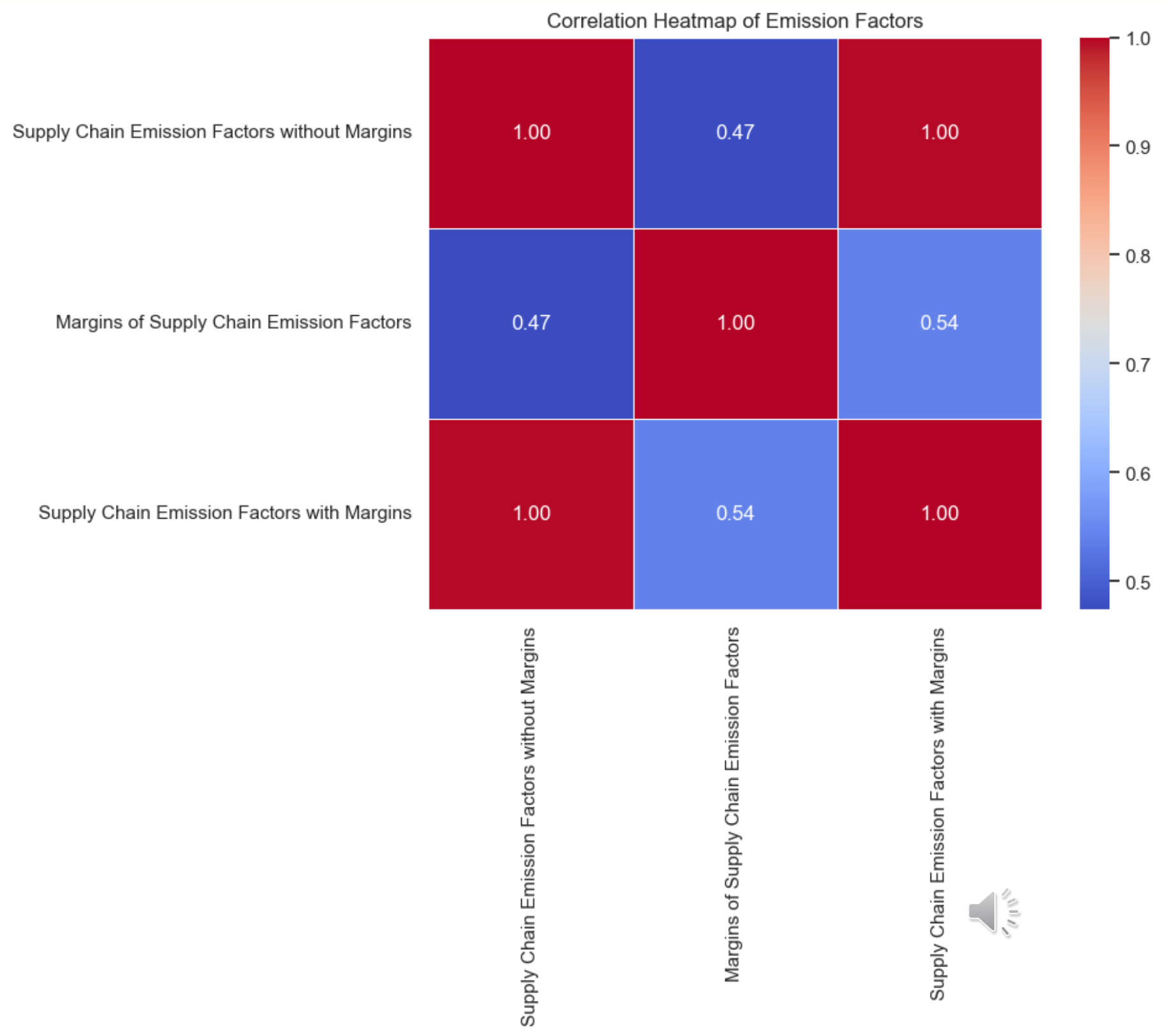
Analysis [1]

Sector Variability : Cement Manufacturing is the most carbon-intensive sector (3.79 kg/2022 USD).



Analysis [2]

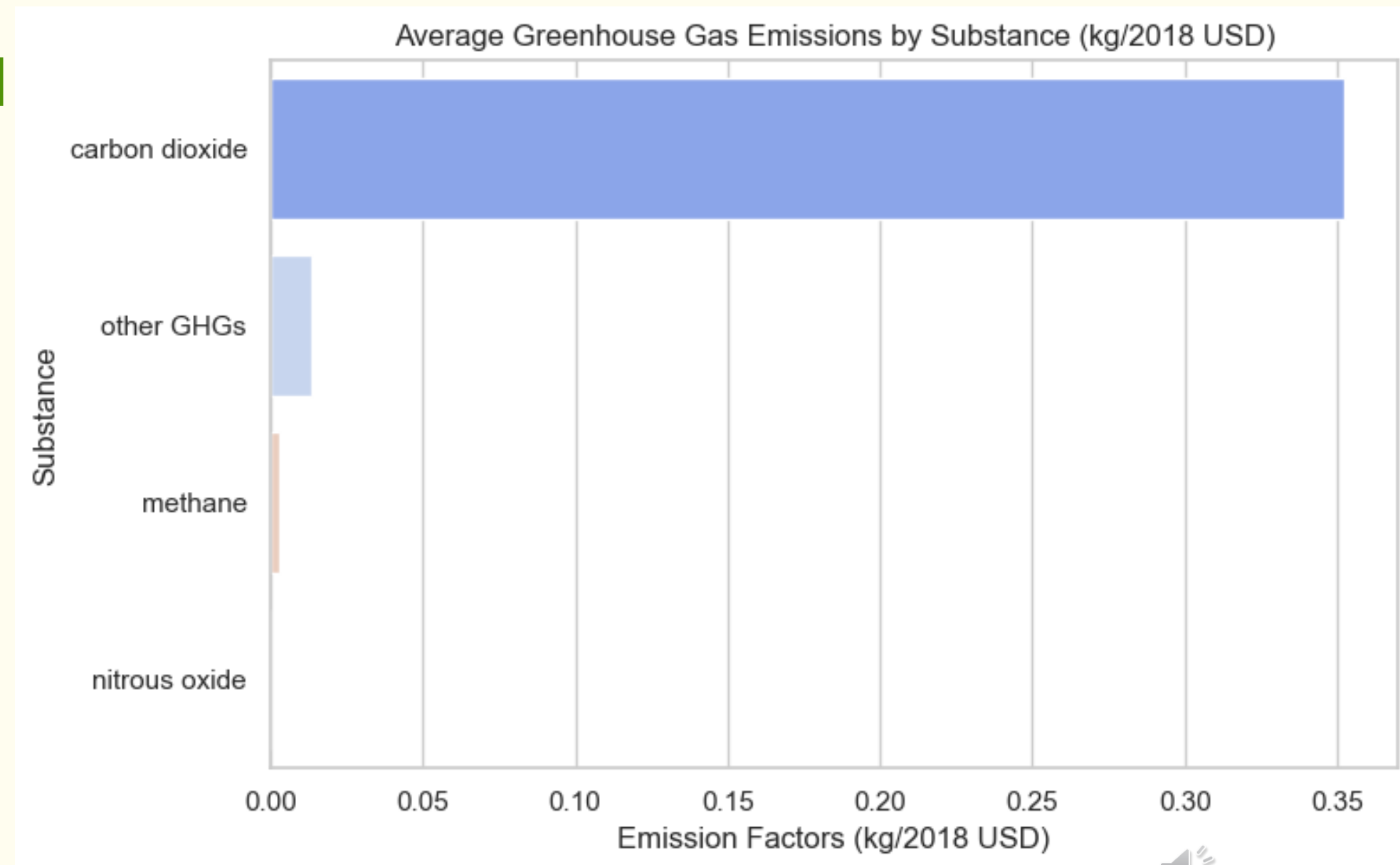
Correlation Among Emission Factors :
Strong positive correlation between emissions with and without margins where margin-driven sectors amplify emissions.



Analysis ^[3]

Temporal Trends and Substance-Level Emissions:

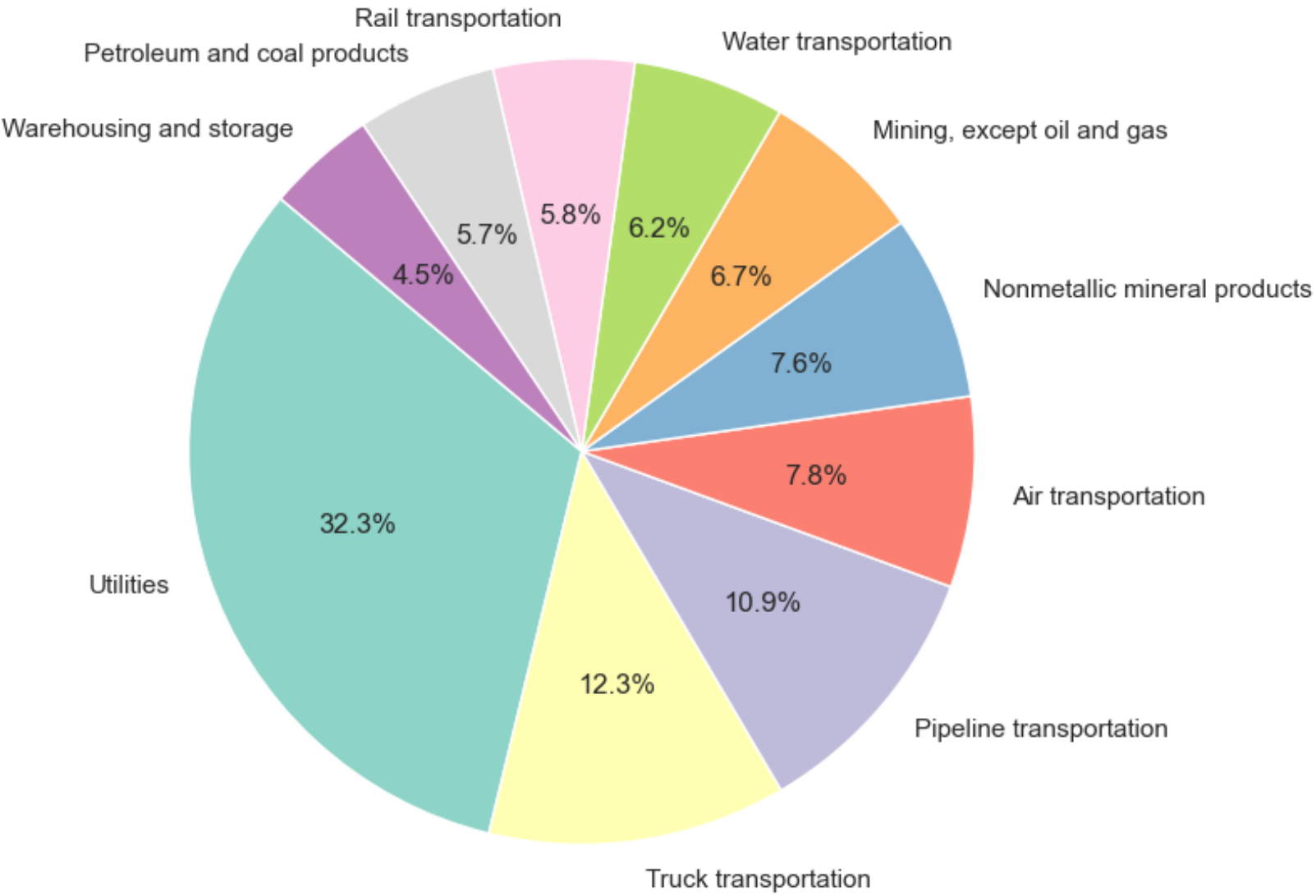
- Peaks in emissions (2007), dips during 2008 financial crisis and COVID-19 (2020).
- CO₂ dominates emissions (0.352 kg/2022 USD)



Analysis [4]

Industry Contributions to Emissions: Utilities, Truck Transportation, and Pipeline Transportation are the leading sectors contributing to greenhouse gas emissions.

Proportion of Supply Chain Emission Factors by Industry (Top 10 Industries)



Conclusion

- High-Emission Sectors: Cement, Utilities, and Transportation lead emissions.
- Sector Variability: Smaller industries also contribute significantly.
- Economic Sensitivity: Emissions dip during crises but rebound quickly.
- CO2 Dominates: CO2 is the primary greenhouse gas emitted.
- Few Outliers: A small number of sectors drive most emissions.

Embrace Change for
a Greener Future

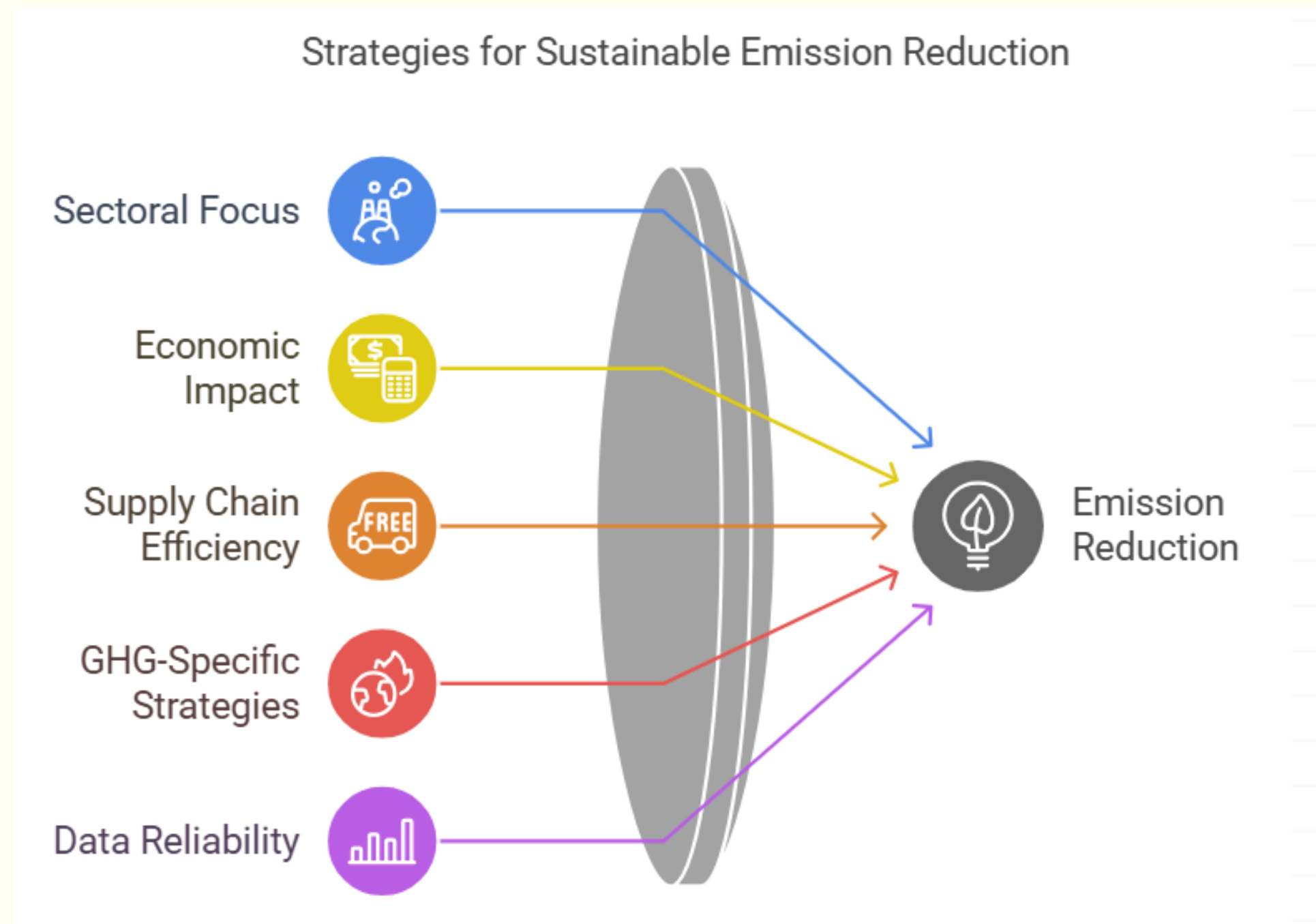


Recommendations:

- Focus on High-Emission Sectors
 - Incorporate Supply Chain Margins
 - Targeted Mitigation
- Invest in Renewable Energy

Future Scope

Considering the insights roadmap should be build up in following aspect :



References

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Thank You!