

Capstone Two Project Proposal

Forecasting CO₂ Emission Trends: A Data-Driven Policy Support Tool for Climate Action

1. Problem Statement Formation

Global climate policy relies on a country's ability to reduce CO₂ emissions in line with international targets such as the Paris Agreement. However, it is unclear which countries are on track to meet their reduction goals and what macroeconomic or demographic factors influence success. This capstone project aims to develop a data-driven approach to forecast national CO₂ emission trends and identify key correlating variables to inform future environmental policy decisions.

2. Context

Climate change mitigation is a global priority, with many countries pledging emission reductions through national climate strategies. Yet, actual performance against these pledges varies widely. Governments and NGOs need tools to help evaluate which nations are reducing emissions effectively and understand why others are lagging. Identifying these patterns can guide technical assistance, funding, and enforcement efforts in climate programs.

3. Criteria for Success

- Data acquisition and preprocessing from a clean, trusted dataset
- Time series forecasting of emissions for selected countries
- Identification of key features that correlate with CO₂ reduction success
- Delivery of clear visualizations and insights
- Final outputs: Well organized GitHub repo, executive-style slide deck, and concise analytical report

4. Scope of the Solution Space

- **Included:** Exploratory data analysis, correlation analysis, feature selection, time series modeling, clustering countries by emission performance
- **Excluded:** Deep learning models, real-time climate simulation

5. Constraints

- Limited granularity of data: national-level only, no city-level data
- Potential gaps in economic or energy-use data for certain countries
- Project must be completed on a deadline, so model complexity will be balanced with interpretability and speed

6. Stakeholders

- **Primary Stakeholders:**
 - Environmental policy researchers and advisors
 - Government climate planning agencies
 - NGOs focused on climate change
- **Secondary Stakeholders:**
 - Students/educators in environmental science
 - Journalists covering global climate trends
 - Renewable energy investors

7. Data Sources

- **Main Dataset:**
 - Our World in Data: CO₂ and Greenhouse Gas Emissions (<https://github.com/owid/co2-data>)
 - Includes national-level CO₂ emissions, GDP, energy use, population, and more