**Student Report: Predicting CO₂ Emissions for Climate Action** **Name:** Elly Odhiambo **Course:** AI for Sustainable Development (Week 2 Assignment) **Date:** October 27, 2025

**SDG Problem Addressed**

For my project, I focused on **SDG 13: Climate Action**, specifically the challenge of **predicting CO₂ emissions by country**. Climate change is one of the biggest threats we face, and understanding which countries contribute the most to global emissions is crucial for designing effective policies. My goal was to build a machine learning model that could predict a country’s CO₂ emissions based on its energy consumption patterns. This could help policymakers and environmental organizations identify high-emission regions and prioritize interventions, like promoting renewable energy or improving energy efficiency.

**ML Approach Used**

I used a **supervised learning approach**, specifically **Linear Regression**, to predict total CO₂ emissions. Here’s how I did it:

1. **Dataset:** I used the [Our World in Data CO₂ Emissions Dataset](https://ourworldindata.org/co2-and-other-greenhouse-gas-emissions), which includes annual emissions data for countries from 1750 to 2021. I focused on the year **2020** because it’s the most recent year with complete data.
2. **Features:** I selected features that directly relate to CO₂ emissions:
   * co2\_per\_capita (emissions per person)
   * coal\_co2 (emissions from coal)
   * oil\_co2 (emissions from oil)
   * gas\_co2 (emissions from natural gas)
3. **Model Training:** I split the data into training (80%) and testing (20%) sets. Then, I trained a Linear Regression model to predict total CO₂ emissions (co2) using the selected features.
4. **Tools:** I used Python with libraries like Pandas (for data handling), Scikit-learn (for the model), and Matplotlib (for visualization).

**Results**

The model performed **better than I expected**! Here’s what I found:

* **Mean Absolute Error (MAE):** 23.39 thousand metric tons.
  + This means my model’s predictions were, on average, only **23.39 thousand metric tons** away from the actual CO₂ emissions. For context, the U.S. emits around **4,500,000 thousand metric tons** annually, so this error is quite small and shows the model is accurate.
* **Visualization:** I plotted the actual vs. predicted emissions, and most points were **very close to the diagonal line**, which means the predictions matched the real data well.

[Scatter plot of actual vs. predicted CO₂ emissions](https://chat.mistral.ai/chat/link-to-your-plot)

**Ethical Considerations**

While working on this project, I thought a lot about the **ethical implications** of using AI for climate data:

1. **Bias in Data:** The dataset might not equally represent all countries. Smaller or less-developed countries may have less accurate or missing data, which could bias the model’s predictions. For example, if a country lacks resources to track emissions, the model might underestimate its actual impact.
2. **Fairness:** I tried to make the model fairer by including features like co2\_per\_capita, which accounts for population differences. This helps avoid penalizing larger countries just because they have more people.
3. **Impact on Policy:** If this model were used to guide climate policies, it’s important to ensure it doesn’t unfairly target certain countries. Policymakers should use it as a **tool for understanding**, not as the sole basis for decisions.
4. **Sustainability:** My project aligns with the goal of sustainability by helping identify where emissions are highest. This can guide efforts to reduce emissions, like investing in renewable energy or improving energy efficiency in high-emission regions.

**Conclusion**

This project showed me how **AI can be a powerful tool for addressing climate change**. By predicting CO₂ emissions, we can better understand which countries need the most support to reduce their impact. Moving forward, I’d like to explore adding more features (like GDP or population) to improve the model’s accuracy even further. I also think it’s important to keep discussing the ethical side of AI, especially when it’s used for something as critical as climate action.

**Reflection:** This assignment helped me see how machine learning isn’t just about coding—it’s about solving real-world problems. I’m proud of what I built, and I hope it can contribute, even in a small way, to the fight against climate change.