Visualizing World's Contribution to Climate Change (Greenhouse Gases Emission)

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Introduction

Climate change is global issue that has been affecting the world for decades. It has been a challenge for the world to undo what we they done to the environment. The introduction of modern industrialization has been the main cause of the production of these greenhouse gases[1]. This led to the increase in the surface temperature of the earth and emits infrared radiation which prevents the earth from cooling down[2], resulting in an increase in heat waves, rainfall and extreme climate events.

We hope to raise awareness on the world's contribution in greenhouse gases emission and the effort needed to cut these emission to decline climate change and global warming. We have built a visualization of the top 10 greenhouse gases emitters (per capita) in 2022.
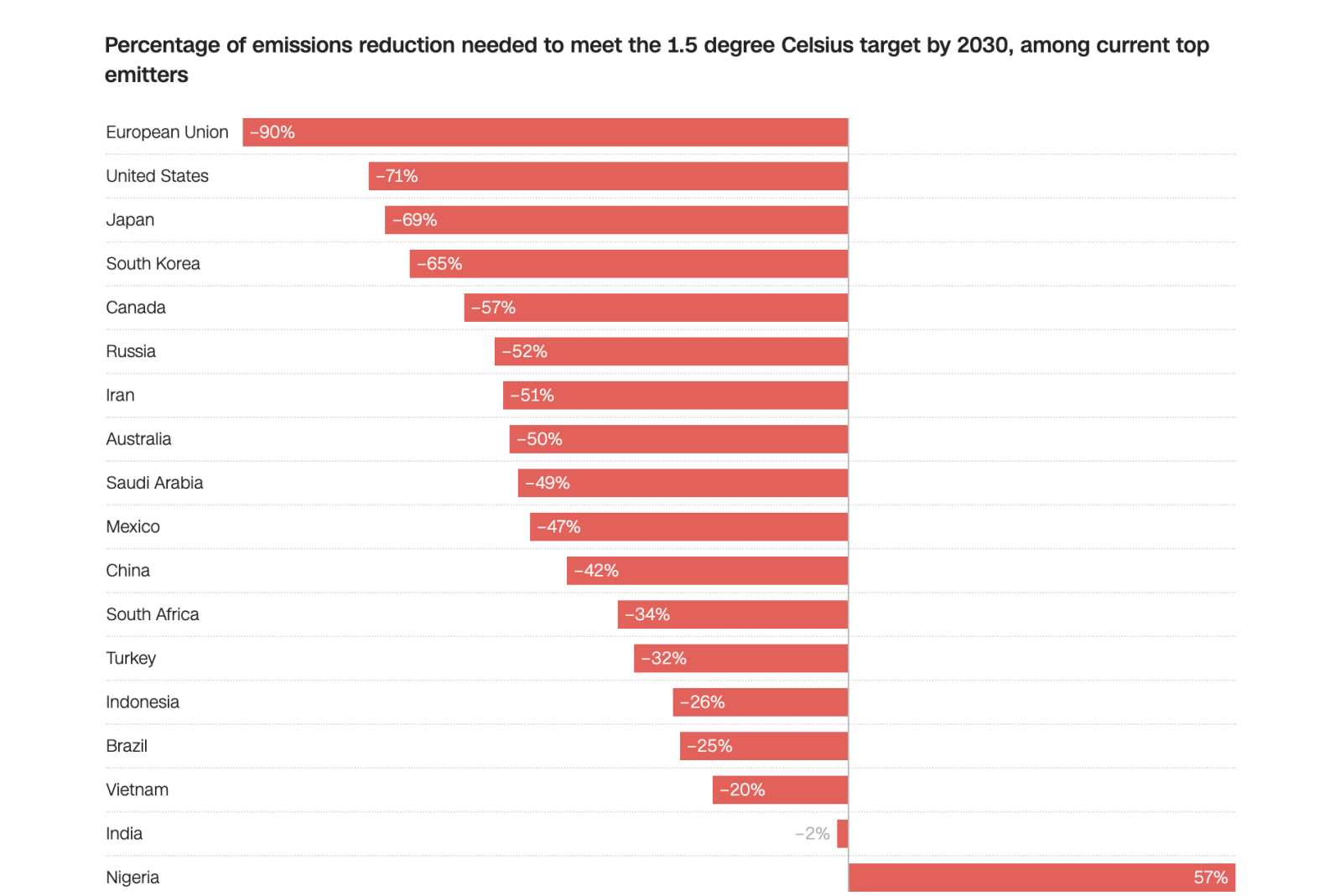
Previous Visualization

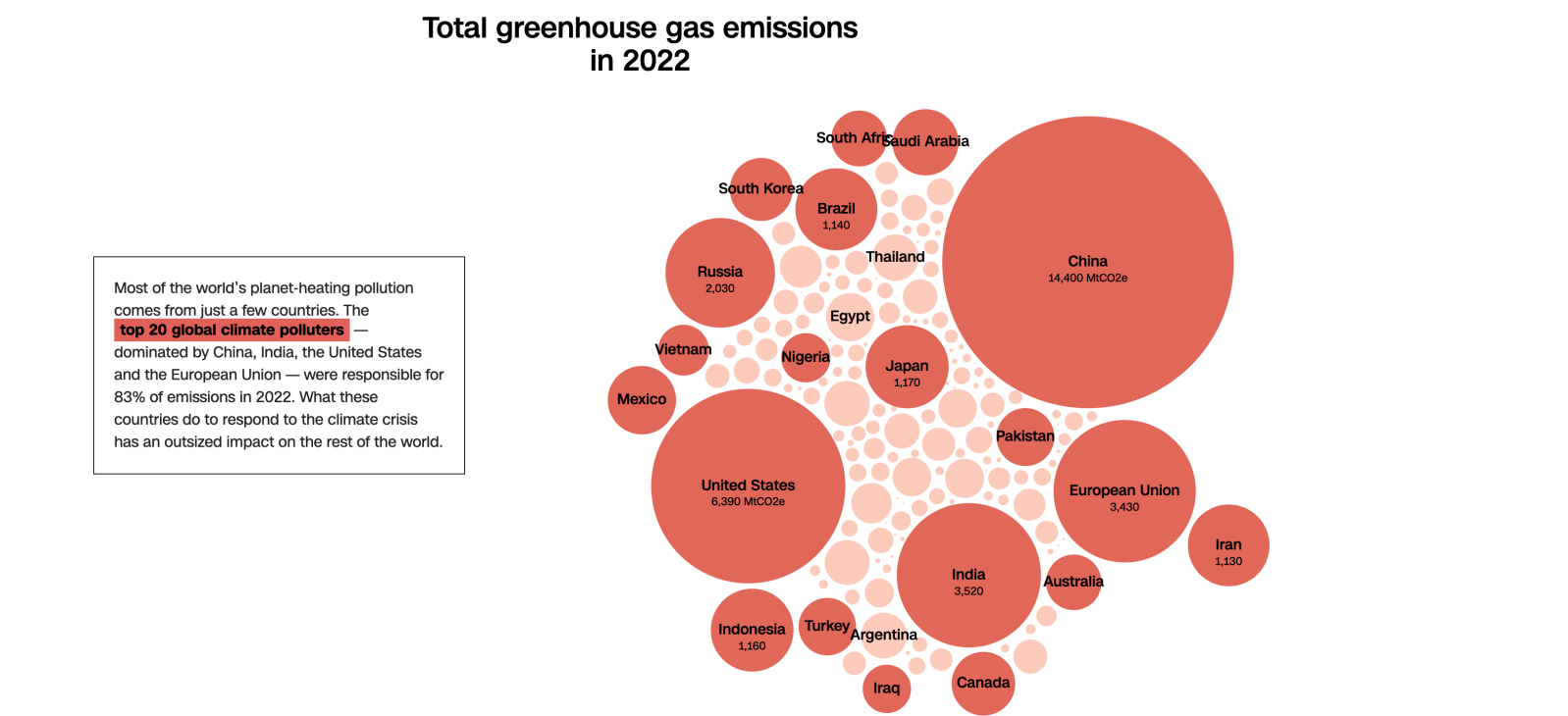Figure 1: Percentage of emissions reduction needed by 2030, among current top emitters

Figure 2: Total greenhouse gas emissions by country in 2022

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[1]Jeeven Ravi et al., "Identification of Greenhouse Gases Emission Thorough Exploration of The Emission from Different Sectors" 2020 6th International Conference on Computing Engineering and Design (ICCED), 2020, pp. 1-7

[2]M. Tavassoli et al., "Comparison of effective greenhouse gases and global warming" 2023 8th International Conference on Technology and Energy Management (ICTEM), 2023, pp 1-5

Appreciated Aspects

- The use of a dynamic bubble chart to emphasize on rankings to visualize on the leading countries' emission contributions in 2022
- The timeline graph shown in the visualization makes use of future predictions by 2030 to show the CO2 estimated emissions by country. The height of the charts albeit difficult to see due to the CSS, is to scale for their specific unit.
- The visualization uses different hues of the same red colour to describe the intensity of the data.
- Shows metric and amount of greenhouse gas emitted by countries outside of the top 20 when bubble is hovered.
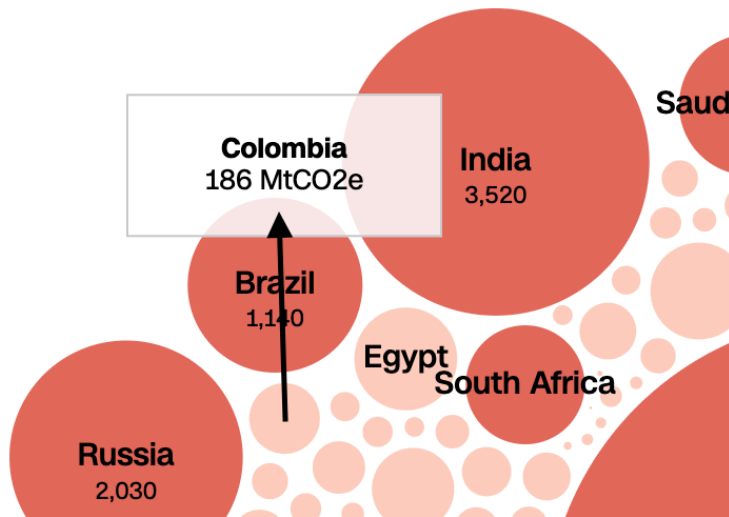

Figure 3: Zoomed in screenshot of the bubble chart when hovered over to show metric and amount of greenhouse gas emitted by country outside of the top 20

Suggested Improvements

1. *More numerical figures and labels* could be used with the bubble chart and graphs to convey the content more effectively at a glance.
2. *Provide a legend* for the bubble chart to show the size of the bubble represents the amount of emissions.
3. *Use the choropleth map* to show top 10 emitters of the world.
4. *Provide a line to map* the country labels and the emitted amount to the respective country in the choropleth map.
5. *Use a bubble plot* to represent the recommended emission reduction for the top 10 country

Implementation

Data

- Data on CO2 and Greenhouse Gas Emissions by Our World in Data[3]
- Annual Greenhouse Gas Emissions by Our World in Data[4]
- Greenhouse Gases Per Capita by Our World in Data[5]

Software

We used the Quarto publication framework and the R programming language, along with the following third-party packages:

- *tidyverse* for data transformation, including *ggplot2* for visualization.

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[3]https://github.com/owid/co2-data?tafb=readme-ov-file
[4]https://ourworldindata.org/grapher/total-ghg-emissions?tab=table
[5]https://ourworldindata.org/grapher/per-capita-ghg-emissions?tab=table

- *rnaturalearth* for the chrolopleth map.
- *ggrepel* provides geoms for overlapping text labels.
- *ggtext*
- *htmltools*
- *sf*
- *knitr* for dynamic document generation.

Improved Visualization

Per Capita Greenhouse Gas Emissions in 2022
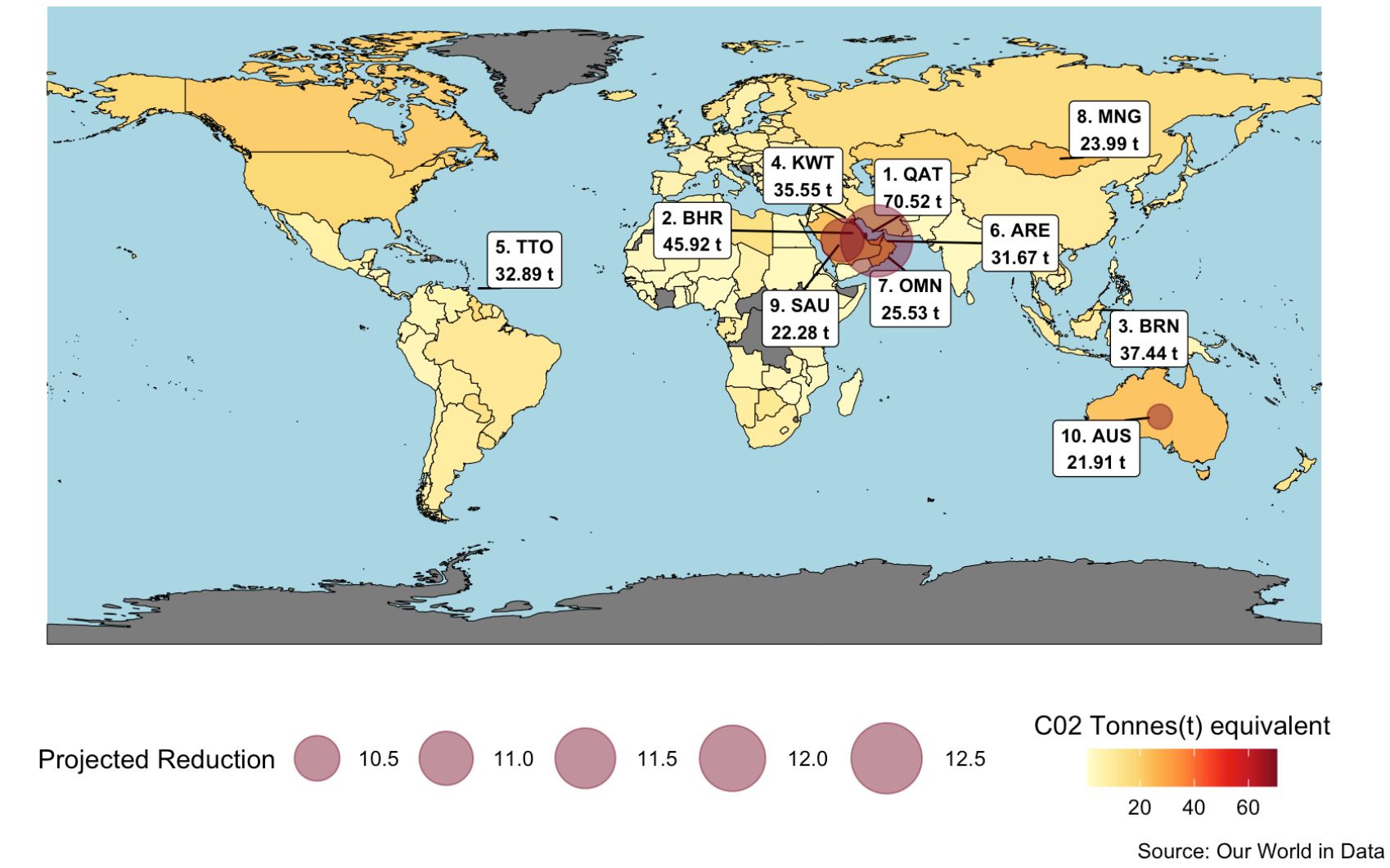Top 10 Emitters

Figure 4: Combined total emission per capital & amount of recommended reduction of greenhouse gases.

Further Suggestions For Interactivity

Conclusion

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to be filled later