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PPPA 6021: Data Visualization Using R  
Final Policy Brief  
May 8, 2023

## Carbon Pricing is a Tool, not a Panacea: Comparing Global Emissions between Countries With and Without Carbon Pricing Policies

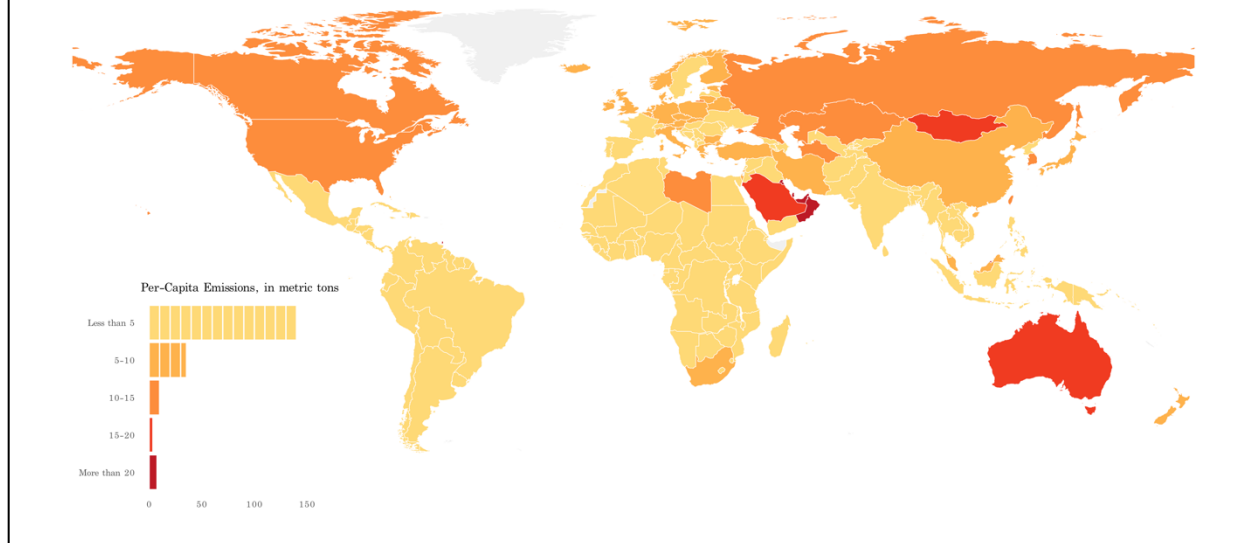
### **Introduction**

Carbon pricing policies are often presented as miracle policy tools to combat carbon emissions and climate change; economists argue that if policymakers can internalize the social costs of carbon emissions to markets, then consumption of fuel-intensive goods will decrease to optimal levels. This policy brief will examine the global effectiveness of carbon pricing policies, comparing countries that price carbon emissions to those that do not; for this brief, countries will be defined as “pricers” if they employ any carbon tax or emissions trading schemes policies in a given year.

Using country level pricing and emissions data for the years between 1989 and 2021, this policy brief finds that mid-level emitters are more likely to impose carbon pricing than low- or high-level emitters, and that pricers have more effectively lowered their emissions in the timeframe than non-pricers. However, a more granular perspective indicates that the imposition of carbon pricing does not distinctly lead to a decrease in emissions across pricing countries, suggesting that a more complex perspective is necessary to understand global emissions trends; this includes an understanding of how economic trends can impact emissions absent any policy interventions. The brief concludes that policymakers should not treat carbon pricing as a panacea for lowering emissions, but rather as a single policy tool. A nuanced approach to climate change policy instead requires a holistic understanding of how economic factors, policy, and resource portfolios contribute to emissions.

## Setting the Stage: Which Countries Have Carbon Pricing Policies

While most countries have lower per-capita emissions, the large emitters are developed, highly-populated, or centered in the Global North and Middle East  
 Countries by Per-Capita Emissions, 2021



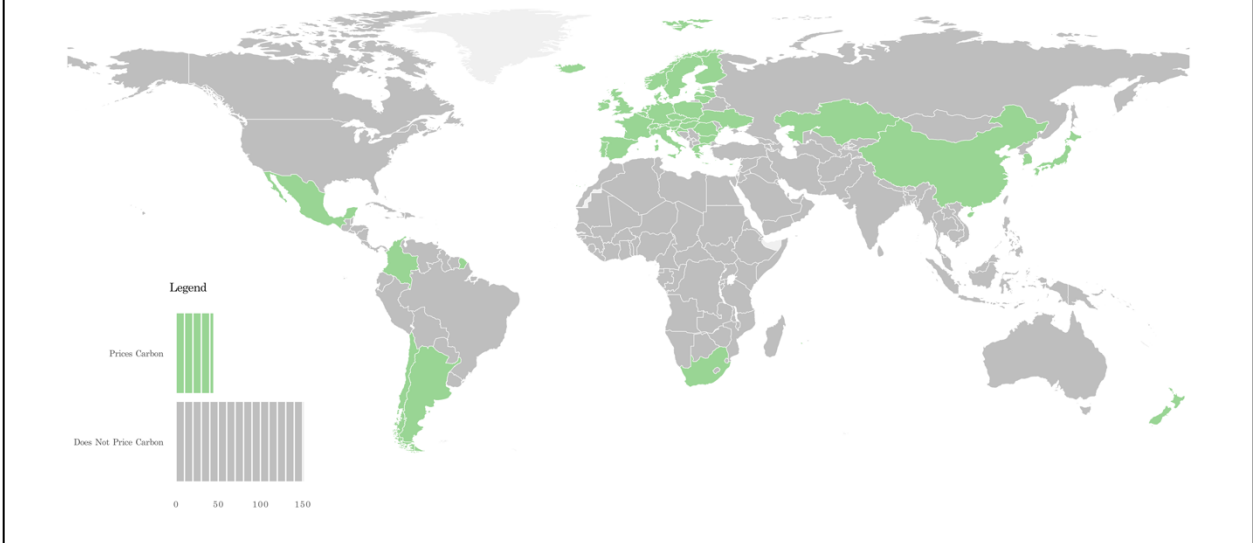
### *Emissions and Policies are Geographically Clustered*

Looking at the geographic distribution of per-capita emissions in 2021, it is evident that most countries emit at very low levels, usually below five metric tons. However, the dominant emitters include highly populated countries in North America, Europe, and Asia, as well as significantly high emitters in the Middle East. Due to their large populations, these countries contribute disproportionately to global emissions.

Shifting to the map of carbon pricing countries, it immediately stands out that European countries show substantially more interest in pricing emissions. Other pricing countries are scattered around the world, but include some significant population and geopolitical centers, such as China, Japan, South Africa, and Mexico.

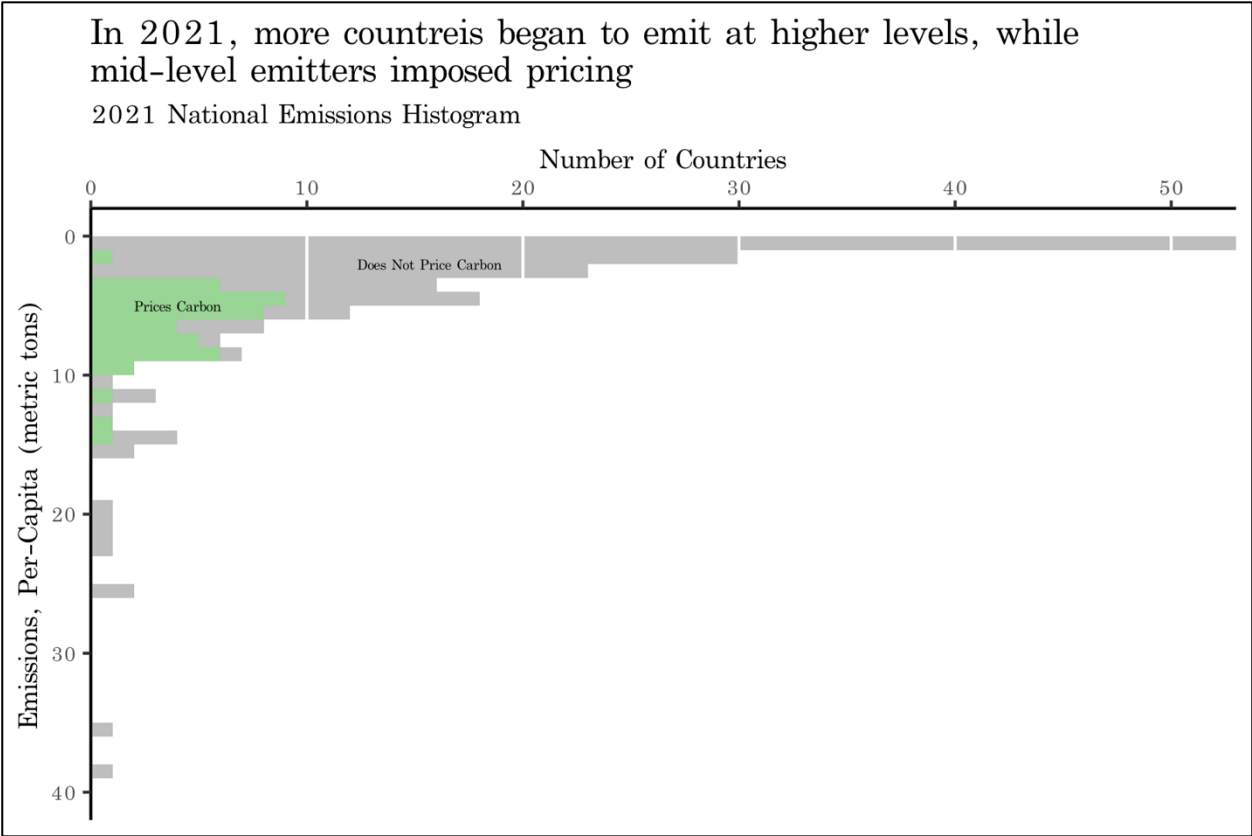
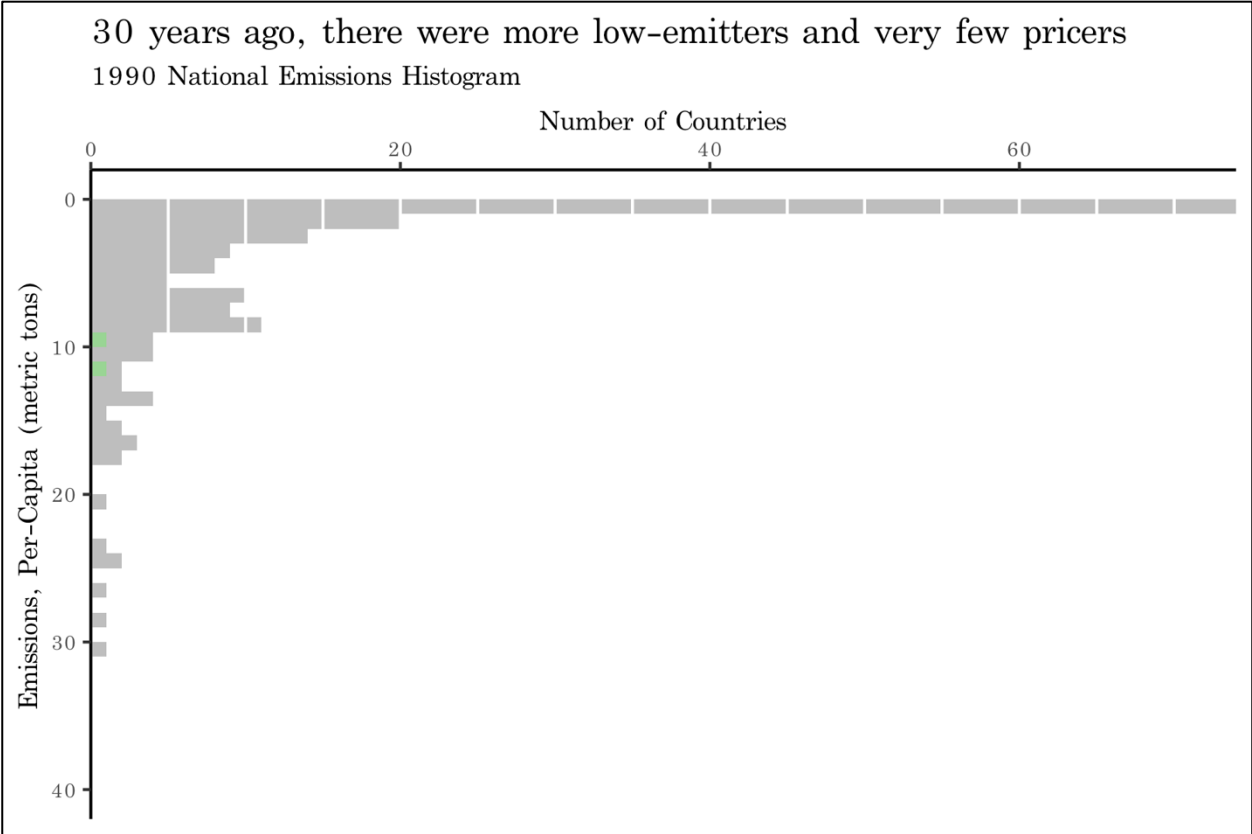
## Pricing countries are concentrated in Europe, and comprise only a fraction of global countries

Countries that Price Carbon, 2021

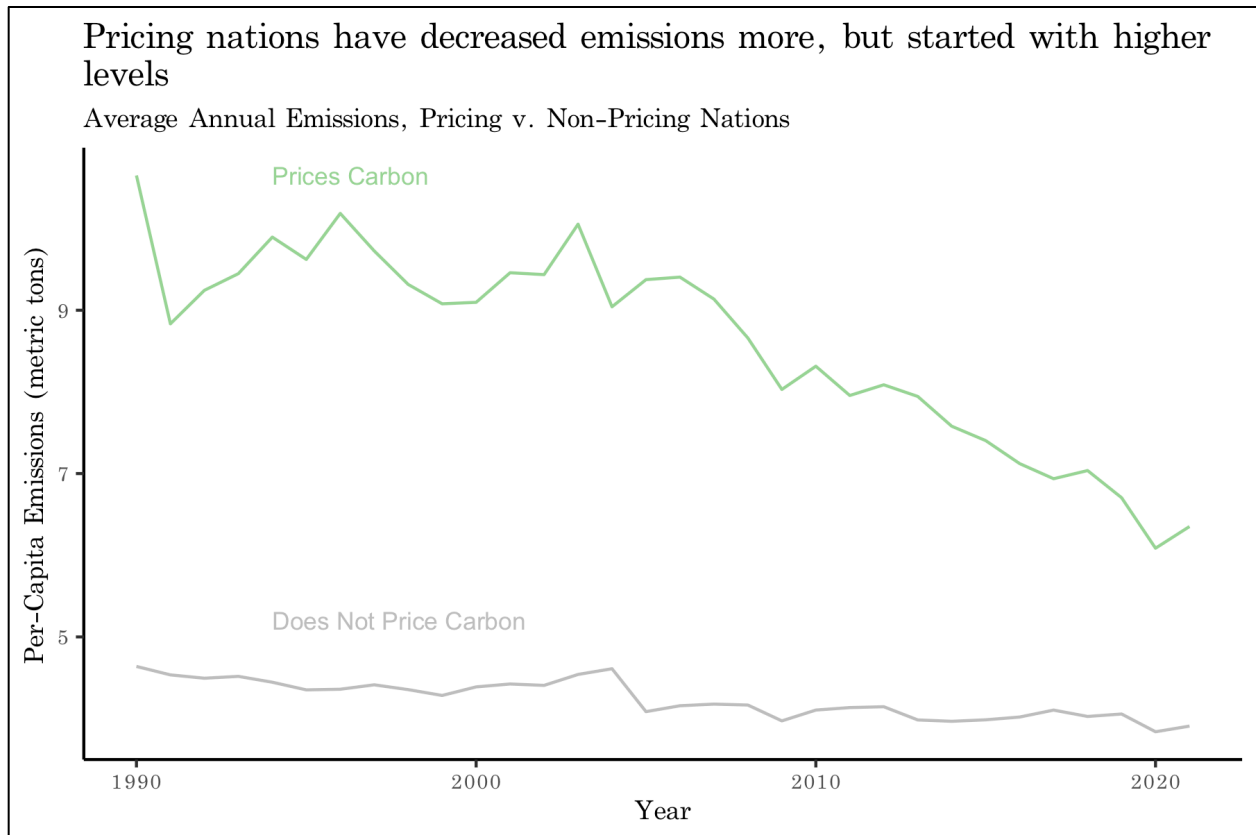


### *Mid-Level Emitters Are More Likely to Enact Carbon Pricing Policies, with a Changing Proportion Over Time*

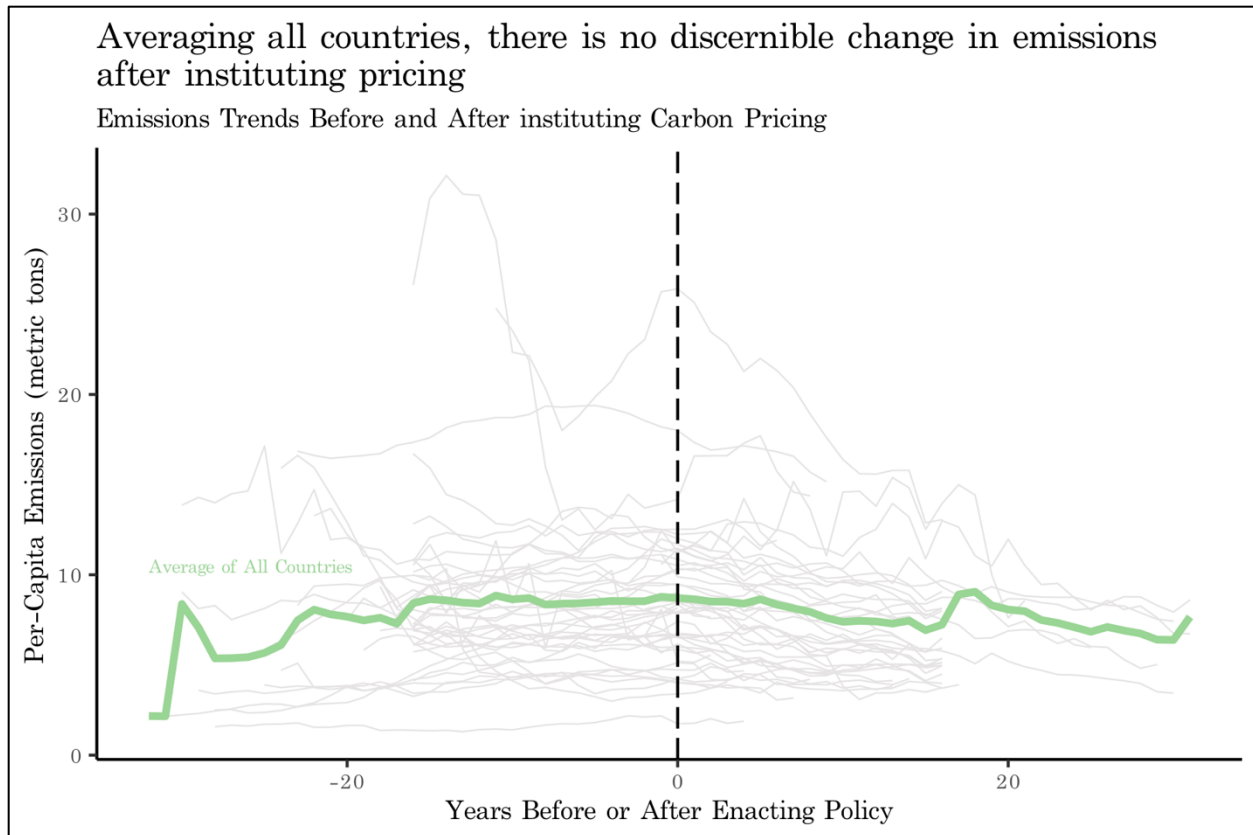
The two maps are effective at showing the geographic distribution of emissions and carbon pricing countries, but they fail to effectively show the overlap between these two characteristics. The following histograms display the global distribution of per-capita emissions in 1990 and 2021, highlighting the sub-distribution of countries that price carbon. These maps convey three main points. First, over time there has been a subtle flattening of the distribution of emitters, with fewer low-emitters and more mid-level emitters. Second, carbon pricing hardly had a global footprint in 1991, but by 2021 a significant number of countries had adopted policies. Lastly, the countries that price carbon are mostly mid-level emitters. This may reflect the desire of low-emitters not to inhibit development through fossil fuel exploitation, while high-emitters do not want to put additional costs on vital energy sources.



## How Effective are Carbon Pricing Policies: A Complicated Narrative



Comparing the emissions trajectories of countries that price carbon to those that do not, it appears that the pricers were much more effective at lowering their absolute level of emissions; they display a distinct downward trend in total emissions over the time period, whereas non-pricers remain relatively steady. However, pricing countries started with a much higher level of emissions, and while they have decreased their output, they have not yet reached the per-capita level that non-pricers exhibit.

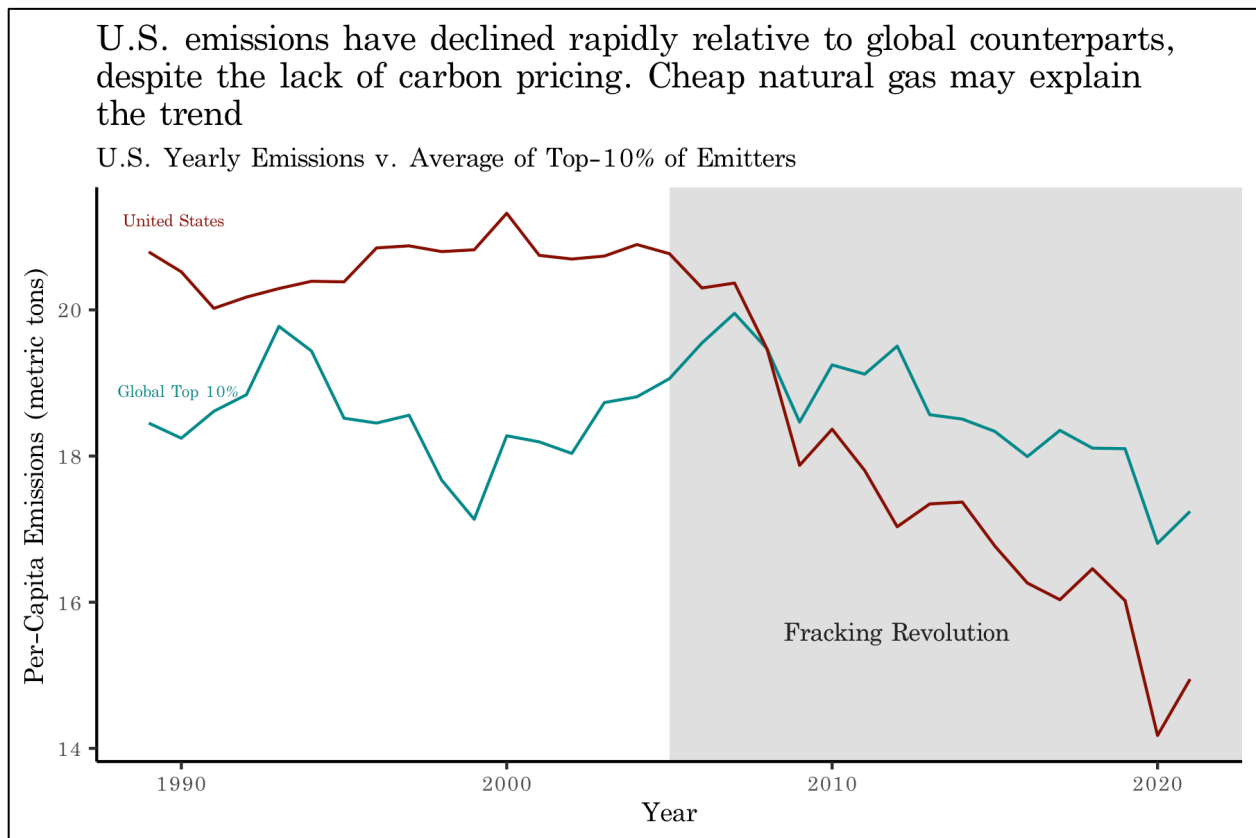


Paradoxically, when you plot average emissions for pricing countries before and after the year that its first carbon pricing policies were enacted, the data show no discernible change in trajectory or magnitude around the imposition of pricing policies. This observation suggests that carbon pricing itself is not uniquely contributing to the decrease in emissions across pricing countries; rather, those countries have likely taken several actions in the timeframe to lower their total emissions, including carbon pricing.

### **Conclusion and Policy Recommendation: Employing a Nuanced Perspective to Understand Global Emissions Trends**

The data has thus-far indicated that carbon pricing is not a panacea for lowering emissions; in countries with carbon pricing, a broader set of policy and economic factors likely contributed to the total decrease we see in total emissions over time. Time-series data in the

United States provides an example of how a country can markedly lower its emissions absent carbon pricing policies, solely due to economic trends.



This chart displays the trend of U.S. emissions relative to the global top-10% of emitters in 2021, in order to compare similar countries. It immediately stands out that the U.S. was able to reduce its emissions levels below its global counterparts in the period after 2005, the year that energy economists and policymakers identify as the beginning of the “Fracking Revolution”. With the new, less-expensive source of energy displacing relatively carbon-intensive coal in U.S. energy markets, the country was able to lower its emissions quickly, while similar countries without such rich natural resources remained relatively steady.

Policy Recommendation: These findings suggest that carbon pricing policies should not be treated as a silver-bullet for climate policy, but rather as a single tool in a menu of options for

policymakers to address carbon emissions. Carbon-pricing countries were able to decrease their emissions relative to non-pricers by a greater magnitude, but do not display any clear change in the aftermath of instituting carbon pricing specifically. This suggests that it may be an effective tool for lowering emissions in the long run, but only when used in tandem with other policies that directly address the makeup of energy systems, given that a country's fuel portfolio is ultimately the prime determinant of emissions.

### **Data Source Acknowledgements**

Carbon pricing data for this policy brief was sourced from Dolphin and Xiahou (2022). Emissions data came from Ritchie, Rose, and Rosado (2021) and published through *Our World in Data*. Population data for calculating per-capita emissions level came from the U.S. Census Bureau's International Programs Center. Maps were made with public-domain shapefiles sourced from *Natural Earth*.<sup>1</sup>

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<sup>1</sup> Made with Natural Earth. Free vector and raster map data @ [naturalearthdata.com](https://naturalearthdata.com).



## Works Cited

Dolphin, G., Xiahou, Q. World carbon pricing database: sources and methods. *Sci Data* 9, 573 (2022).

Hannah Ritchie, Max Roser and Pablo Rosado (2020) - "CO<sub>2</sub> and Greenhouse Gas Emissions".  
Published online at OurWorldInData.org. Retrieved from:  
'<https://ourworldindata.org/co2-and-greenhouse-gas-emissions>' [Online Resource].  
Underlying data retrieved from: <https://www.globalcarbonproject.org>.

U.S. Census Bureau; International Programs Center, International Database;  
<https://tinyurl.com/b9zvzsfr>.