

# Simple Math Complicated Politics

Roger Pielke Jr.  
University of Colorado Boulder  
American Enterprise Institute, Washington, DC

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UTokyo – GraSPP – INPEX – IEEJ  
Tokyo, Japan

The poster is for a COP29 event. At the top, it says '#COP29' in large green letters. Below that, it lists dates: '2024年9月17日(火) 13:00-17:00' and '2024年9月13日(金) 正午'. The main title in Japanese is '不確実性を高める エネルギー安全保障と 地球温暖化をめぐる 国際情勢' (International Situation Surrounding Energy Security and Global Warming as Uncertainty Increases). A QR code is visible on the right side. At the bottom, there are logos for 'UTokyo', 'GraSPP', 'INPEX', and 'IEEJ'.



# Where do emissions come from?

People	Population	P
Engage in economic activity that	GDP per capita	GDP/P
Uses energy from	Energy intensity of the economy	TE/GDP
Carbon emitting generation	Carbon intensity of energy	C/TE

$$\text{Carbon emissions} = C = P * \frac{\text{GDP}}{P} * \frac{\text{TE}}{\text{GDP}} * \frac{C}{\text{TE}}$$

## The “Kaya Identity”



# Decarbonization defined

(1) Carbon emissions =  $C = \frac{P \times \text{GDP}}{P} * \frac{\text{TE} \times C}{\text{GDP} \times \text{TE}}$

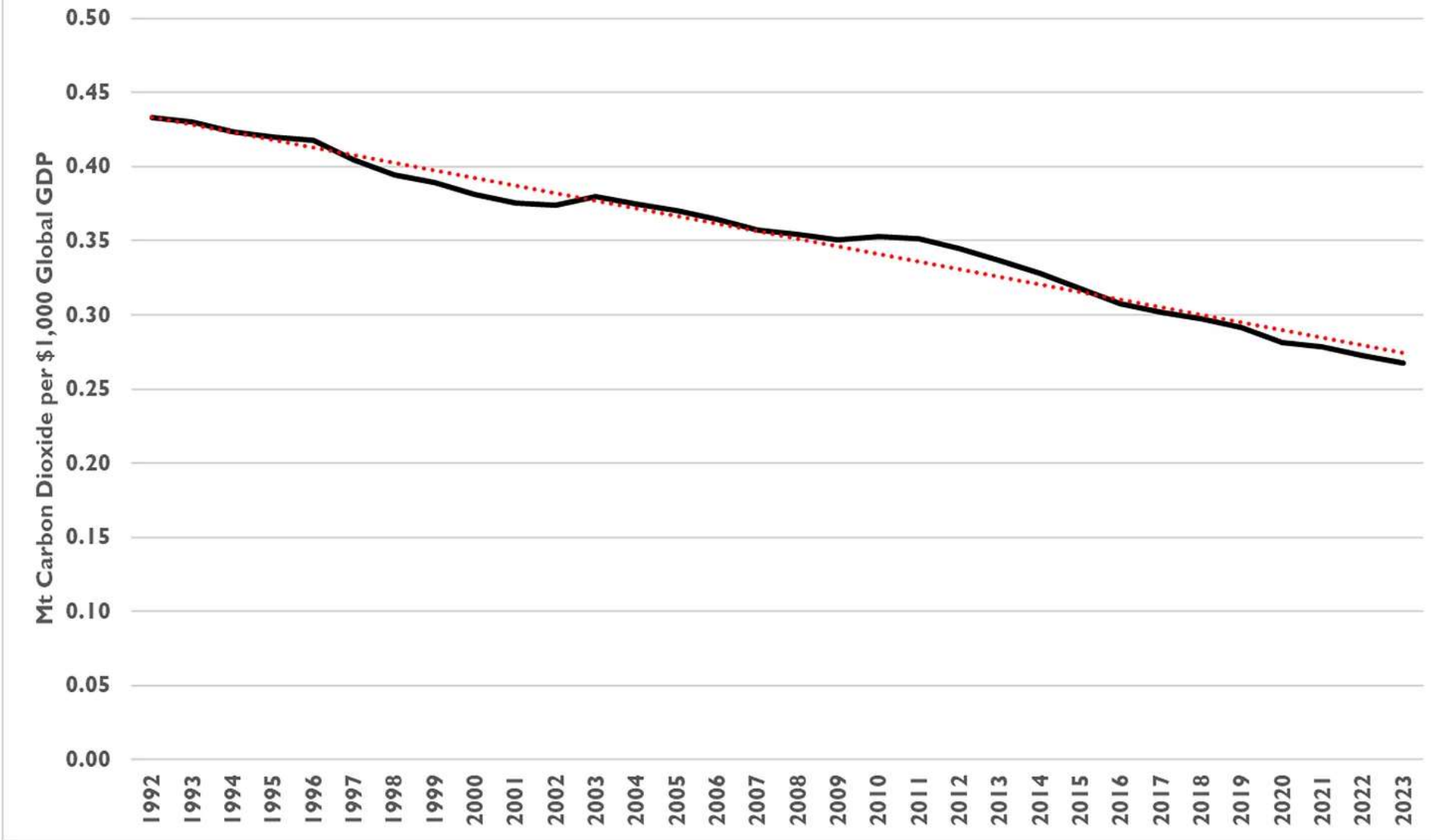
(2) Emissions = **GDP** × **Technology**

(3)  $\frac{\text{Emissions}}{\text{GDP}} = \text{Technology}$


A reduction in **this ratio** is called “decarbonization” and means that technologies are improving

# Decarbonization of the Global Economy: 1992 to 2023

Sources: Global Carbon Project, World Bank





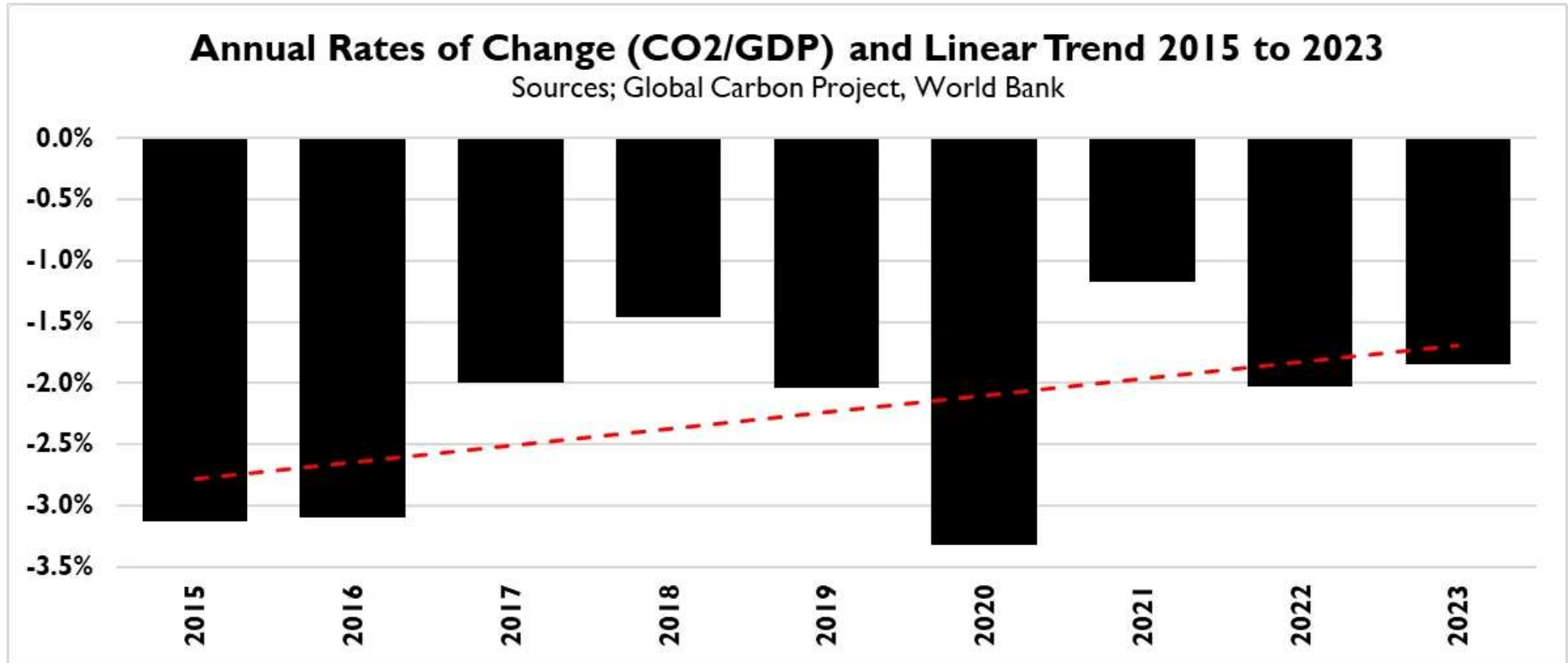
	Pre-Paris 2006-2014	Post-Paris 2015-2023	Pre- to Post-Paris Change in Annual Decarbonization Rate	Proportion of 2023 Global CO2 Emissions from Energy
UAE	-1.66%	1.32%	2.98%	0.8%
Brazil	-0.76%	2.15%	2.91%	1.3%
Saudi Arabia	-1.19%	1.46%	2.65%	1.8%
Japan	0.76%	2.80%	2.04%	2.9%
South Korea	1.79%	3.34%	1.55%	1.6%
Iran	-1.34%	0.04%	1.38%	1.9%
Germany	3.15%	4.34%	1.19%	1.6%
Turkey	1.09%	2.24%	1.15%	1.2%
India	0.57%	1.65%	1.08%	8.0%
Mexico	0.36%	0.88%	0.52%	1.4%
United Kingdom	4.32%	4.77%	0.45%	0.9%
Canada	2.13%	2.57%	0.44%	1.5%
Australia	2.99%	3.31%	0.32%	1.1%
United States	3.36%	3.39%	0.03%	13.2%
<b>World</b>	<b>1.98%</b>	<b>1.99%</b>	<b>0.01%</b>	<b>100%</b>
Poland	5.00%	4.33%	-0.67%	0.8%
South Africa	2.90%	1.42%	-1.48%	1.2%
Italy	4.12%	2.25%	-1.87%	0.9%
China	4.94%	2.94%	-2.00%	31.9%
Russia	3.70%	0.64%	-3.06%	4.6%
Indonesia	2.81%	-1.22%	-4.03%	2.0%



**Faster  
Decarbonization  
Post-Paris**



# Since Paris 2015 Slowing Global Decarbonization



# Since Paris 2015 Well Below Target Global Decarbonization

**Decarbonization Rates 2015 to 2023 (Black) & Rates Needed 2024-20250 (Red) to Achieve an 80% Reduction in Carbon Dioxide Emissions from Fossil Fuels by 2050**

2024-2050 at 3% annual global GDP growth

2024-2050 at 2% annual global GDP growth

2023

2022

2021

2020

2019

2018

2017

2016

2015

THB

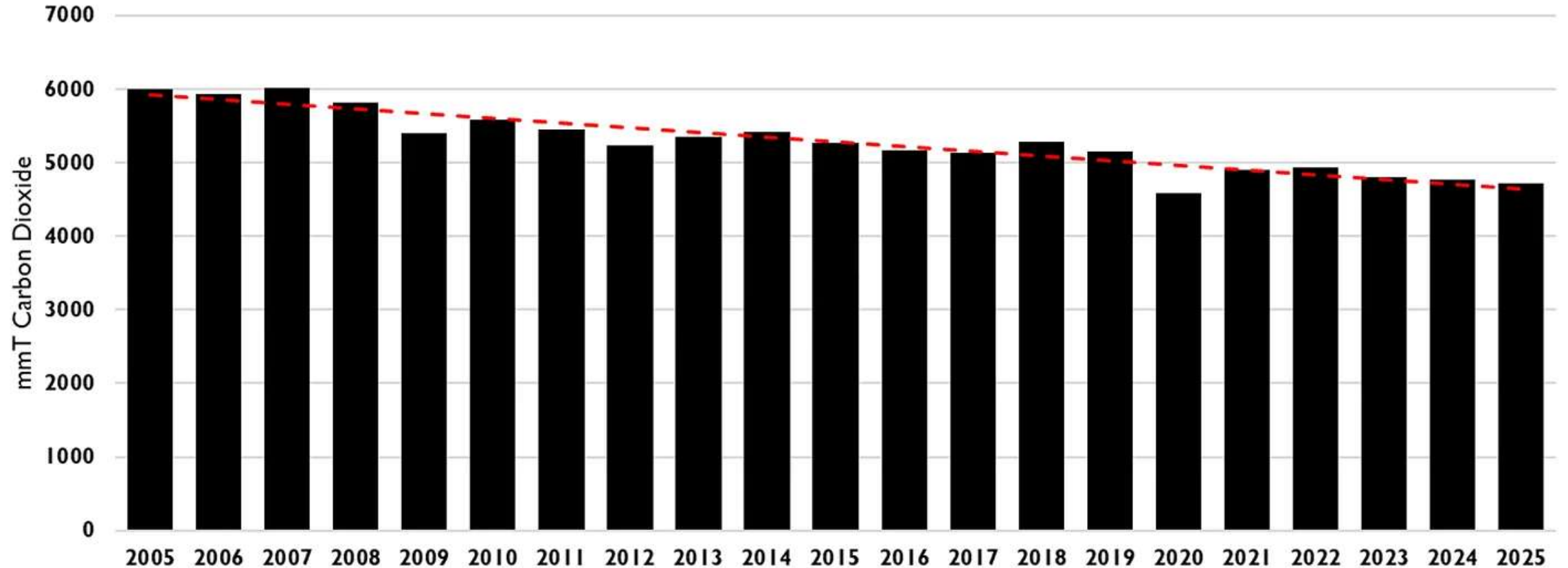
0.0% 1.0% 2.0% 3.0% 4.0% 5.0% 6.0% 7.0% 8.0% 9.0%



# Do US Presidents Matter for US Emissions Reductions?

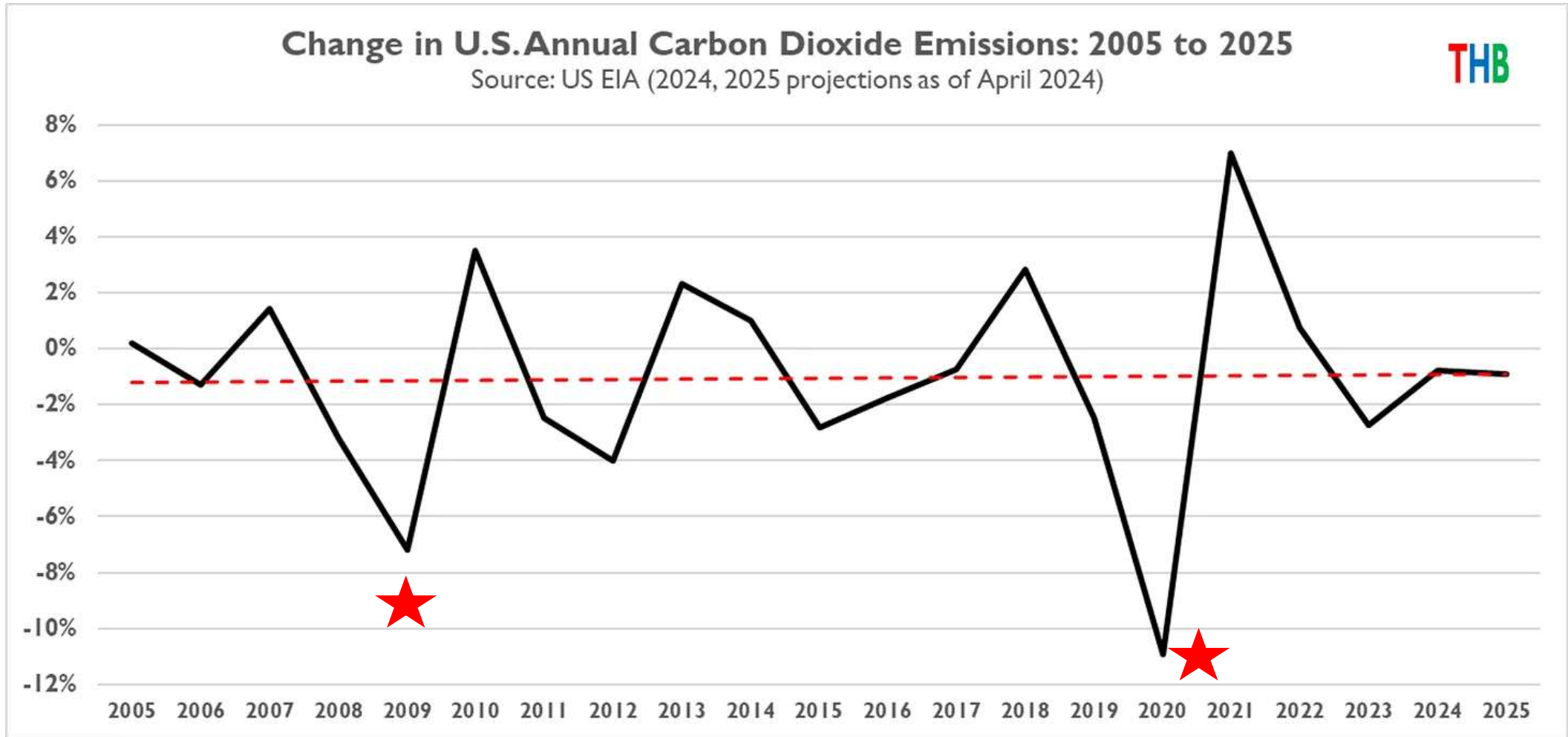
## U.S. Emissions of Carbon Dioxide from Fossil Fuels: 2005 to 2025:

Source: US EIA 2024 (2024, 2025 projections of April 2024)





# GFC and COVID-19 Matter Much More



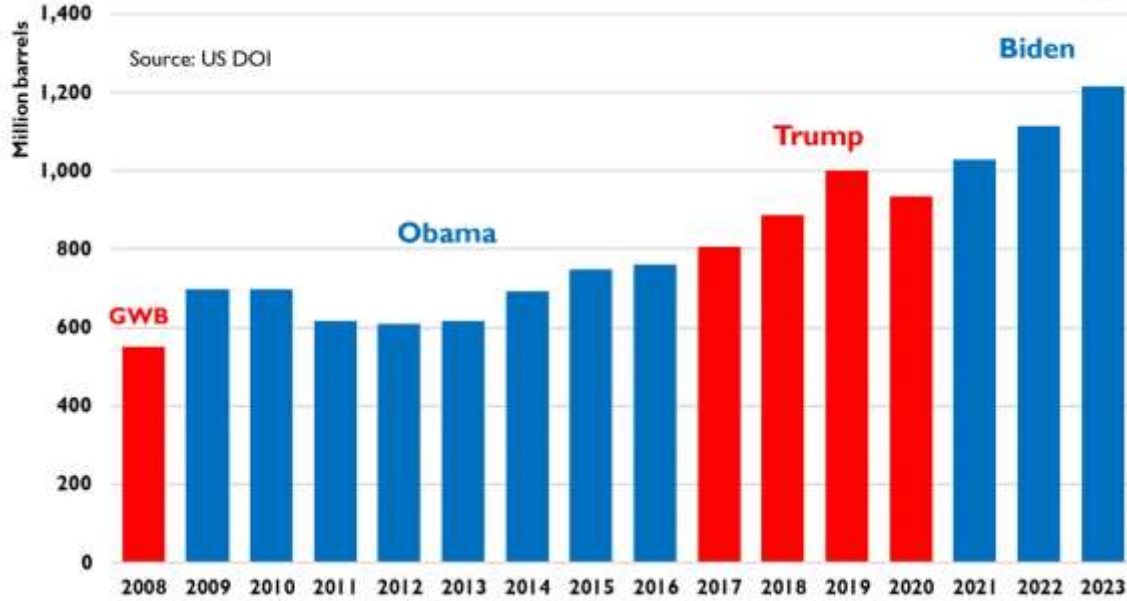
**Change in U.S. Annual  
Carbon Dioxide Emissions  
from Fossil Fuels: By  
President Since 2005**

Bush (2005--2009)	-1.0%
Obama (2009-2017)	-1.5%
Trump (2017-2021)	-3.0%
Biden (2021-2025)	1.6%
Overall (2005-2025)	-1.2%



### U.S. Oil Production on Federal Lands: 2008-2023

THB

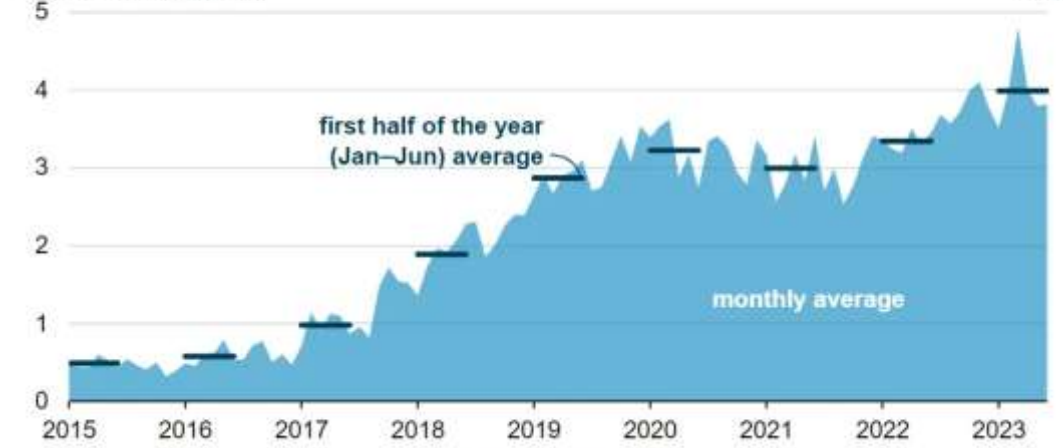


### U.S. crude oil exports reached a record high in first half of 2023

eia

#### U.S. crude oil exports (Jan 2015–Jun 2023)

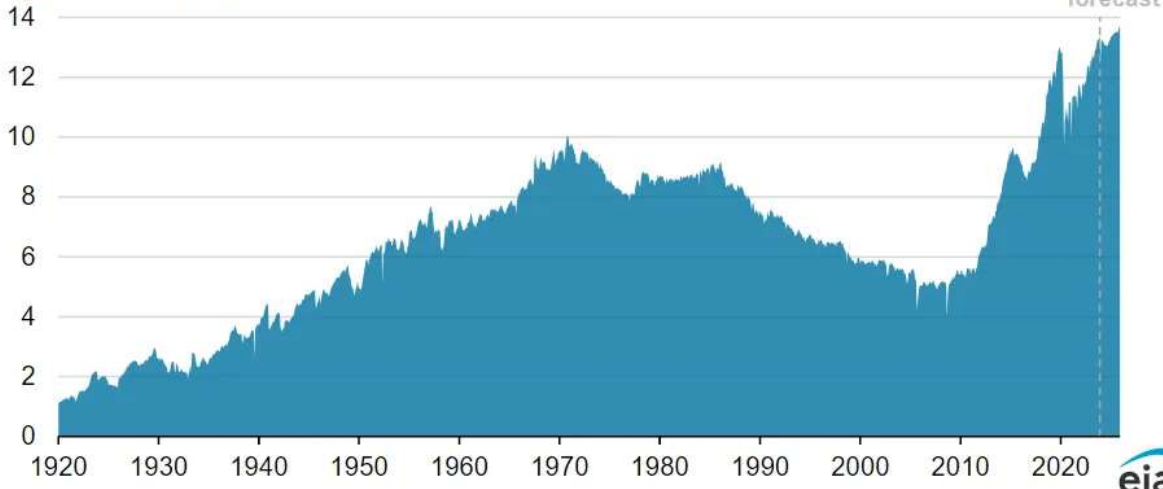
million barrels per day



Data source: U.S. Energy Information Administration, *Petroleum Supply Monthly*

### Monthly crude oil production, United States (Jan 1920–Dec 2025)

million barrels per day

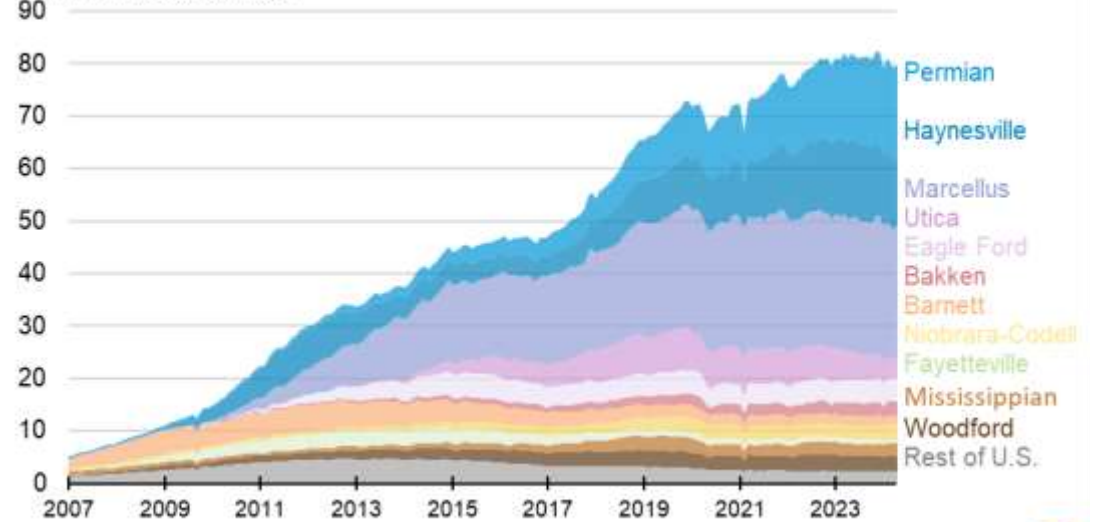


eia

Data source: U.S. Energy Information Administration, *Short-Term Energy Outlook*, February 2024

### Monthly U.S. dry shale natural gas production by formation

billion cubic feet per day



Data source: U.S. Energy Information Administration, *Short-Term Energy Outlook*, August 2024

eia

2023	Oil Exports 1000s B/day
US	9108
Saudi Arabia	8282
Russian Federation	6736
Canada	4836
West Africa	3285
North Africa	2025
Mexico	1271
Other Middle East (ex SA)	15018

# The US is the world's energy superpower

2023	LNG Exports BCM
US	114.4
Qatar	108.4
Australia	107.4
Russian Federation	42.7
Malaysia	36.3
Algeria	19.0
Nigeria	17.5
Indonesia	16.1
Oman	15.3
Papua New Guinea	11.5
Trinidad & Tobago	10.5

2023	Oil Production 1000s B/day
US	19358
Saudi Arabia	11389
Russian Federation	11075
Canada	5653
Iran	4662
Iraq	4355
China	4198
United Arab Emirates	3922
Brazil	3502
Kuwait	2908



# Thank You!

## Contact

[pielke@colorado.edu](mailto:pielke@colorado.edu)

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