Pickering Energy Partners

The U.S. Needs A Larger Energy Boat...Right Now!

Dan Romito – Managing Director, June 2025

Speaker Introduction

Expertise Centers On Energy Policy, Capital Markets & Regulatory

Dan Romito

Dan Romito is a Managing Director at Pickering Energy Partners, overseeing the Consulting & Advocacy practice

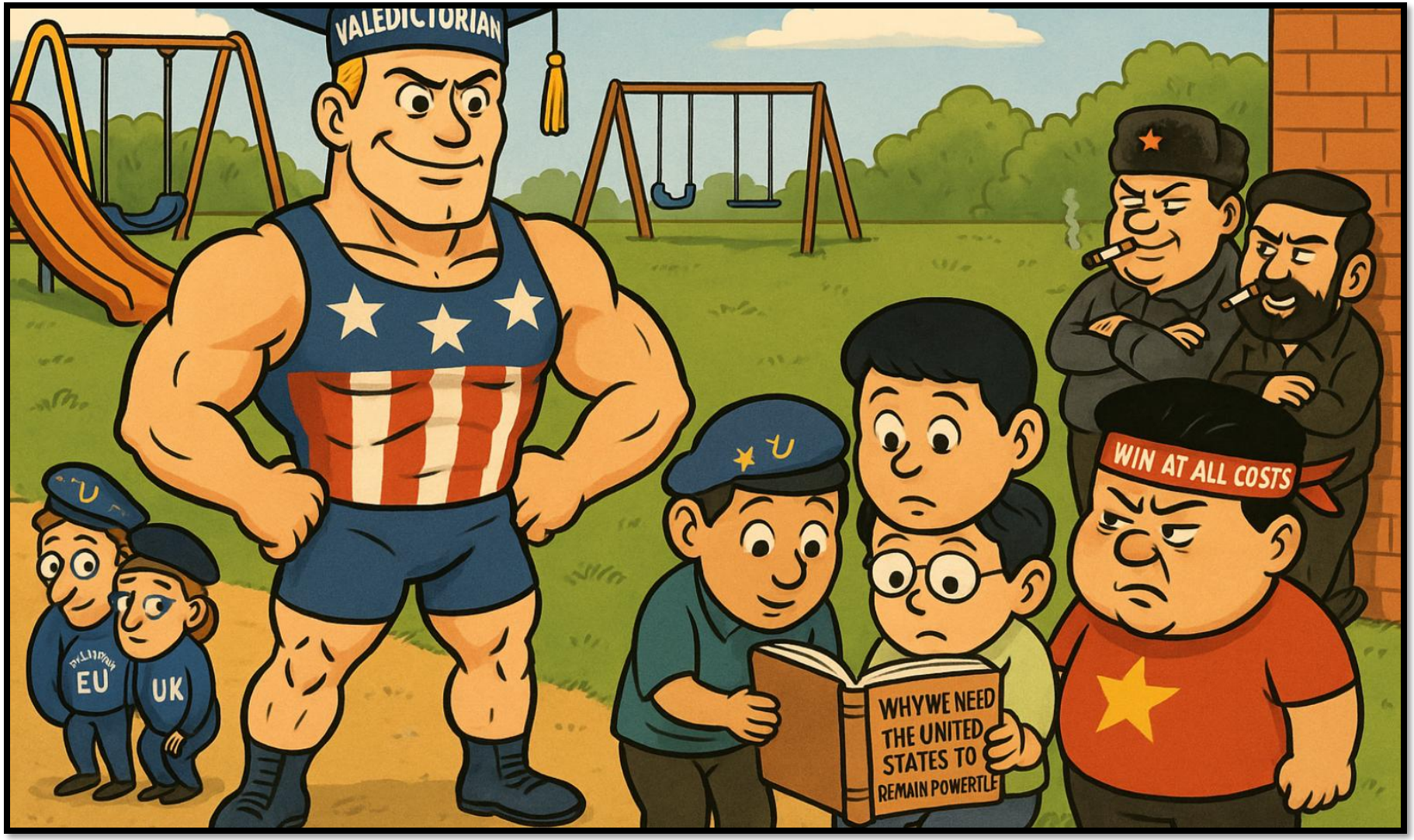
- Dan's career has centered on helping over 250 capital-intensive businesses efficiently navigate the ever-evolving capital markets and global regulatory landscape.
- Has authored over seventy publications on Energy Policy, Sustainability, ESG, Investor Behavior, and Shareholder Activism, which have been featured in Harvard Business Review, the Harvard Law School Forum on Corporate Governance, CNBC, Bloomberg, TD Ameritrade Network and Hart Energy
- Dan is the author of *The Radical Middle – How Fossil Fuels & Renewables Can Collaborate On The Future Of Energy* & the host of the *PetroNoia* podcast
- Dan sits on the IPAA Capital Markets Committee, the Advisory Committee for PRAGMA, serves as an Advisory Board Member for Marquette University's Sustainability Lab, and is an adjunct professor at Marquette University
- He received a BA from the University of Chicago, an MBA in Finance from DePaul University, and was working on his MS in Mathematics from the University of Chicago before COVID-19 (he became a proverbial drop-out)

Pickering Energy Partners | Nasdaq | The University of Chicago | Marquette University – Be the Difference. | PRAGMA

Introduction:

We Must Reintroduce Logic, Pragmatism, & Common Sense Into The Global Energy Debate

America Should Not Apologize **To Anyone** For Being The Best



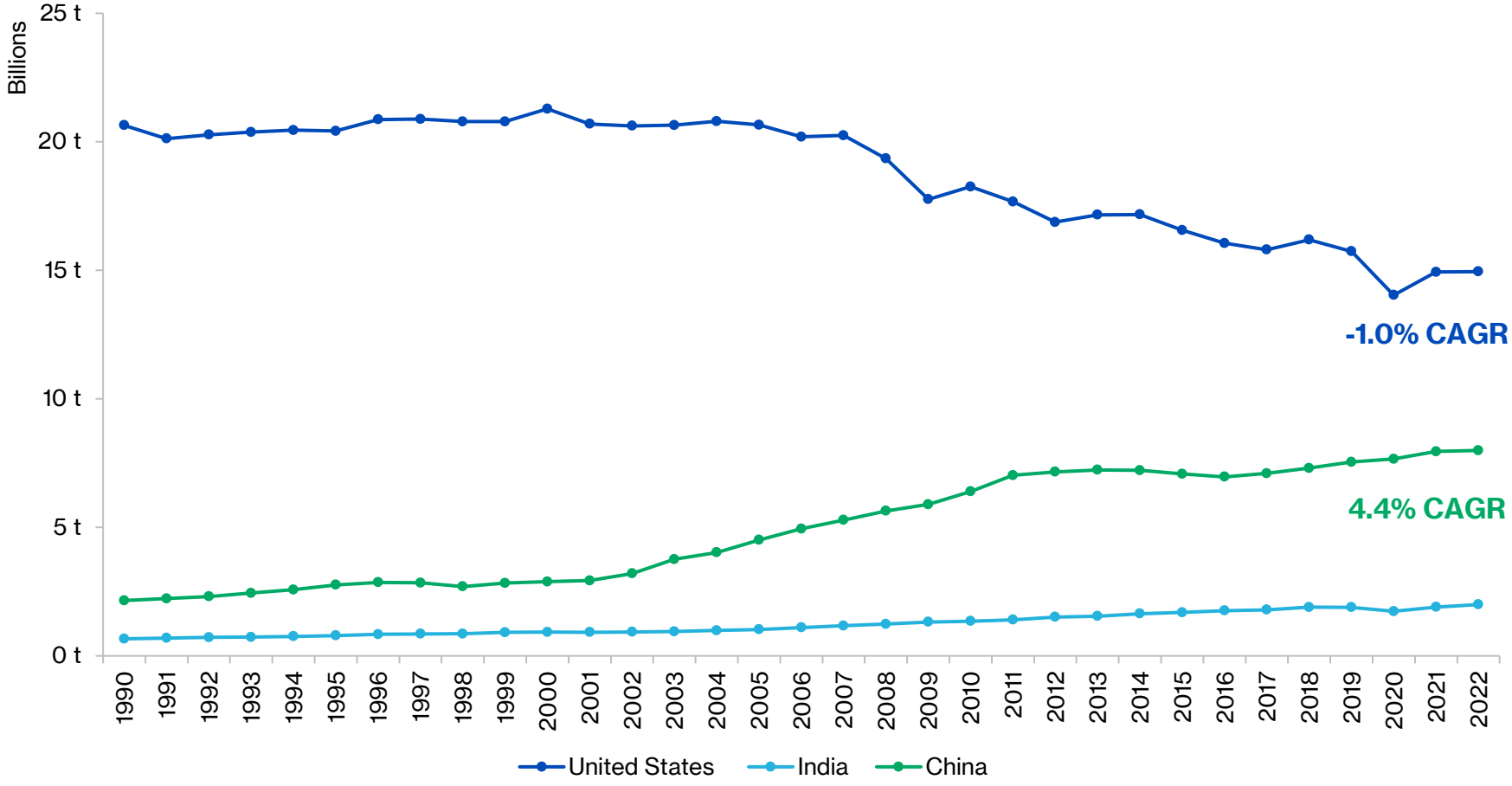
Level Setting:

The United States Boasts The Single Most Impressive Emissions Profile On The Planet

U.S. CO_2 Emissions/Capita Have Been Cut By **One-Third** Since 1990

Per capita CO_2 emissions

Carbon dioxide (CO_2) emissions from fossil fuels and industry. Land-use change is not included.

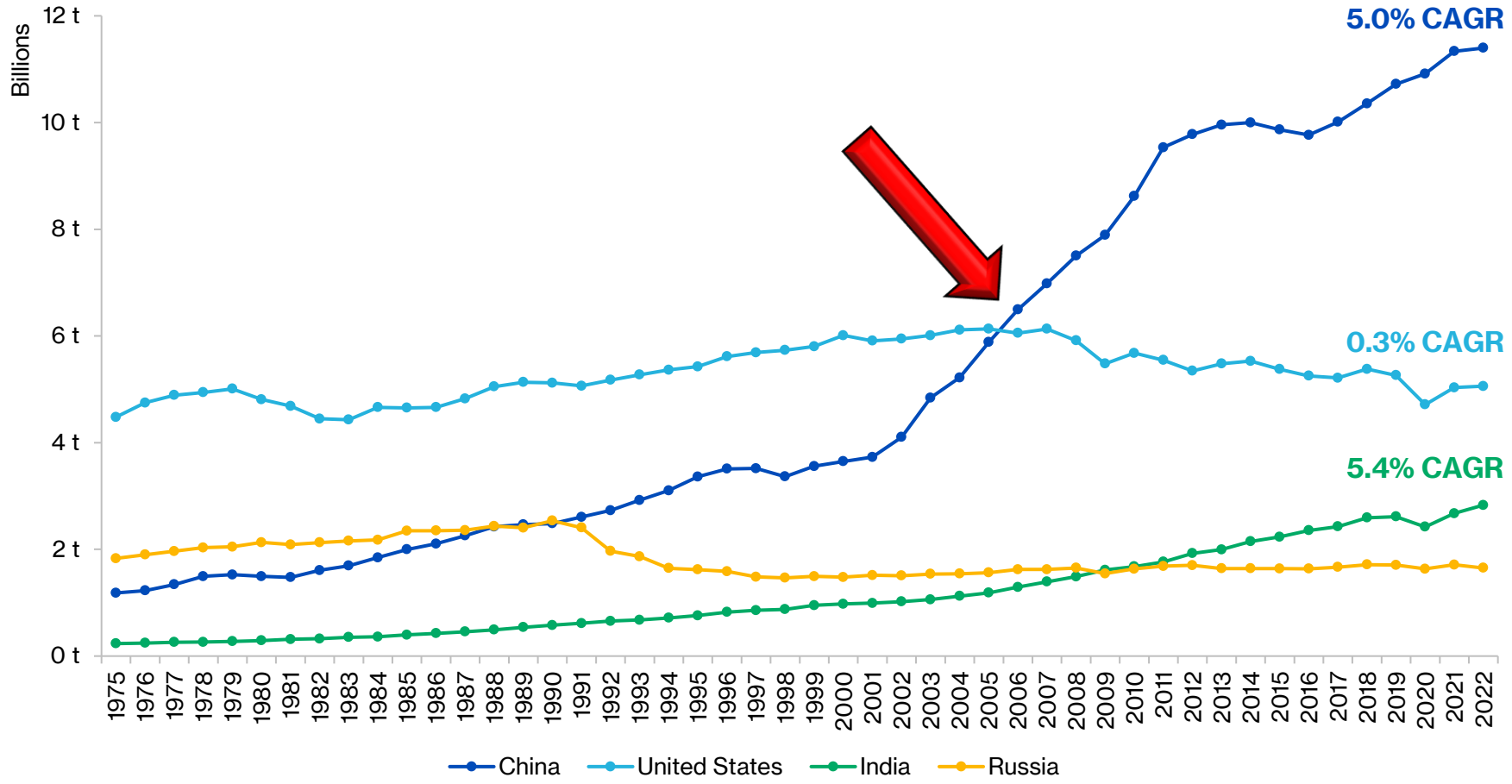


Data source: Global Carbon Budget (2023); Population based on various sources (2023) – Learn more about this data
OurWorldInData.org/co2-and-greenhouse-gas-emissions | CC BY

U.S. Annual CO_2 Emissions Have **Remained Flat** Since 1975

Annual CO_2 Emissions

Carbon dioxide (CO_2) emissions from fossil fuels and industry. Land-use change is not included



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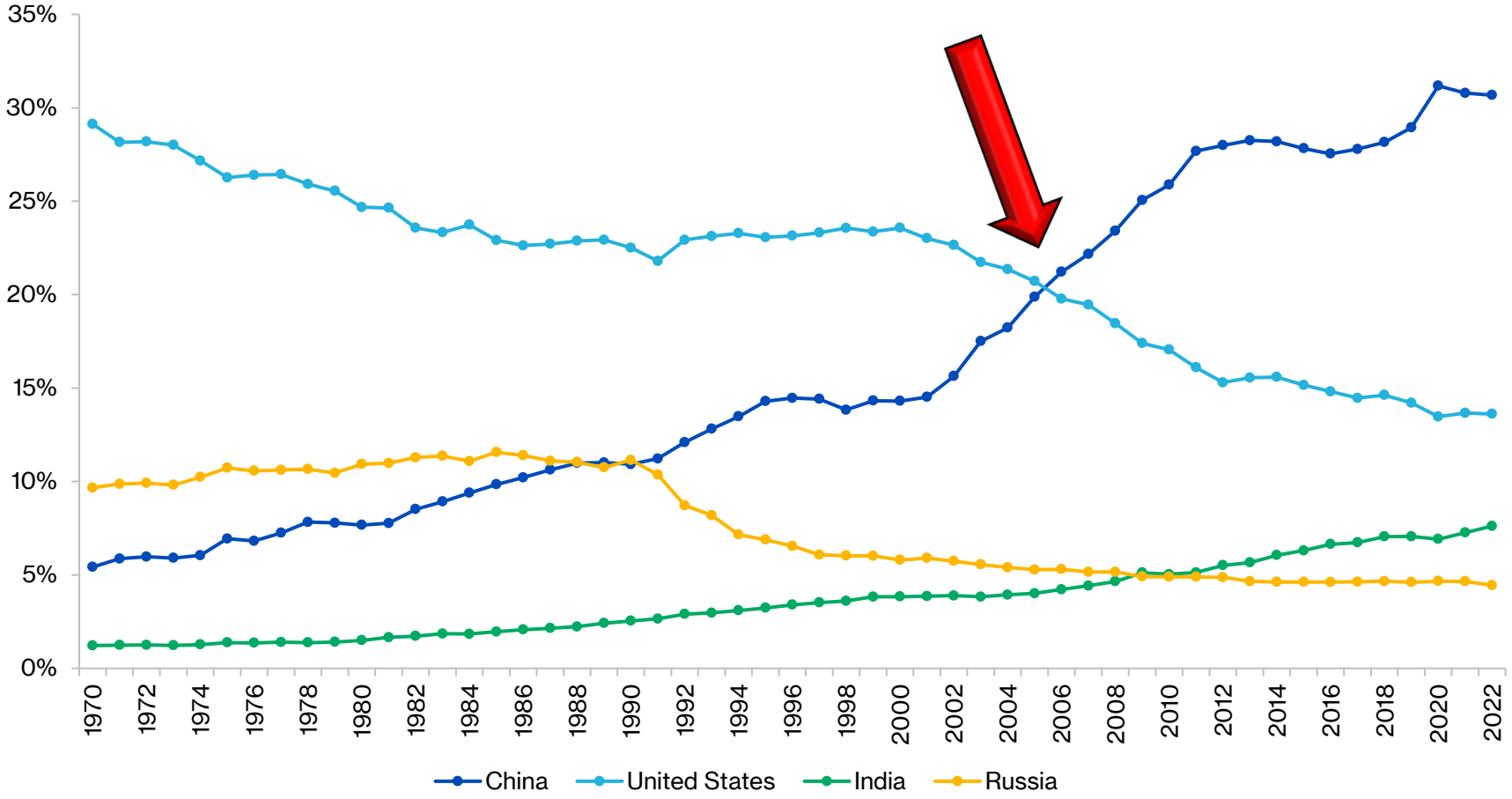
Data source: Global Carbon Budget (2023)

OurWorldInData.org/co2-and-greenhouse-gas-emissions | CC BY

China's Global Share Of CO_2 Emissions Have **DOUBLED** Since 2000

Share of global CO_2 emissions

Carbon dioxide (CO_2) emissions from fossil fuels and industry. Land-use change is not included.



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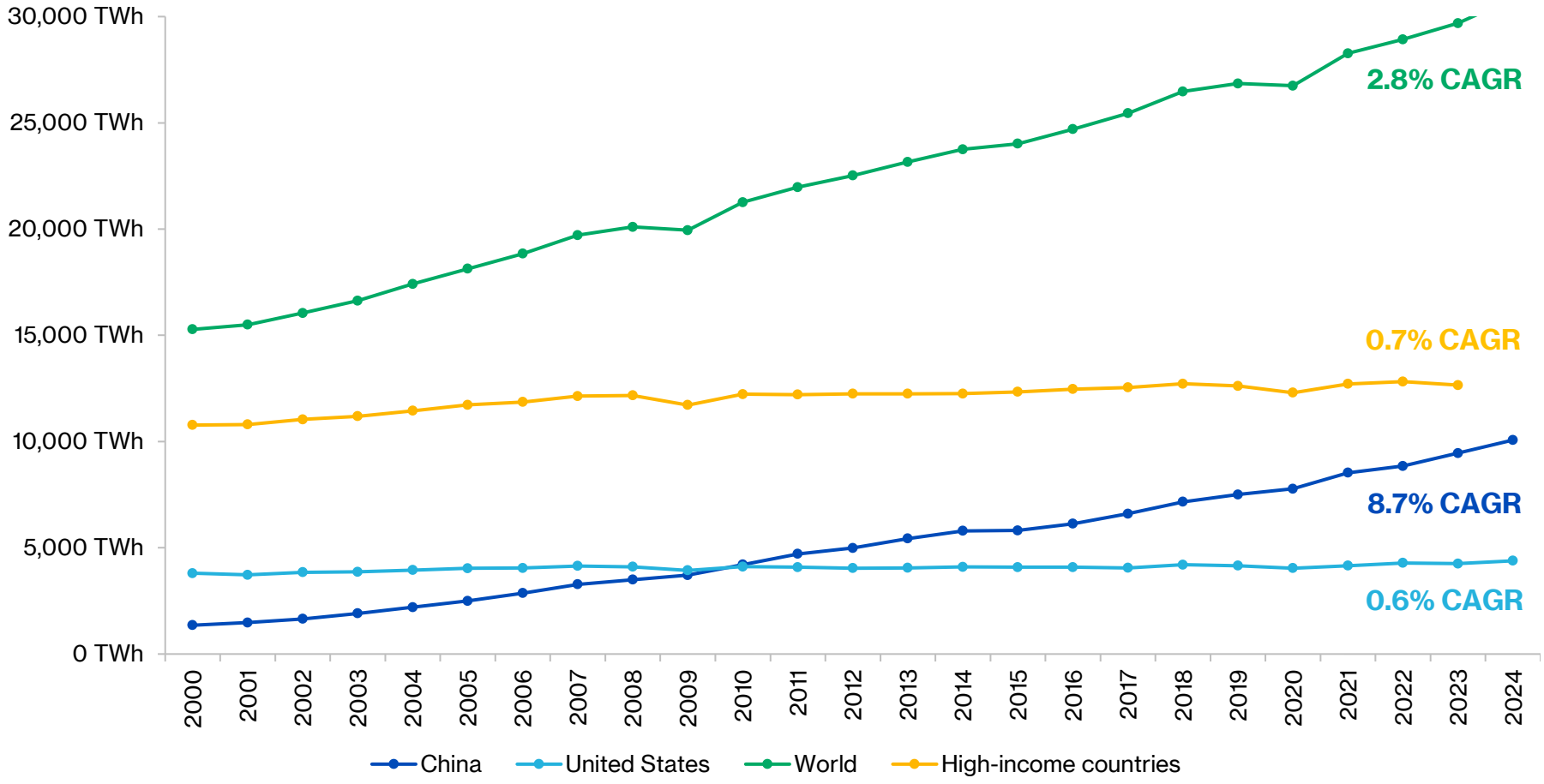
Data source: Global Carbon Budget (2023)

OurWorldInData.org/co2-and-greenhouse-gas-emissions | CC BY

The **Developing World** Is Generating All The "New" Electricity

Electricity generation

Total electricity generated in each country or region, measured in terawatt-hours.



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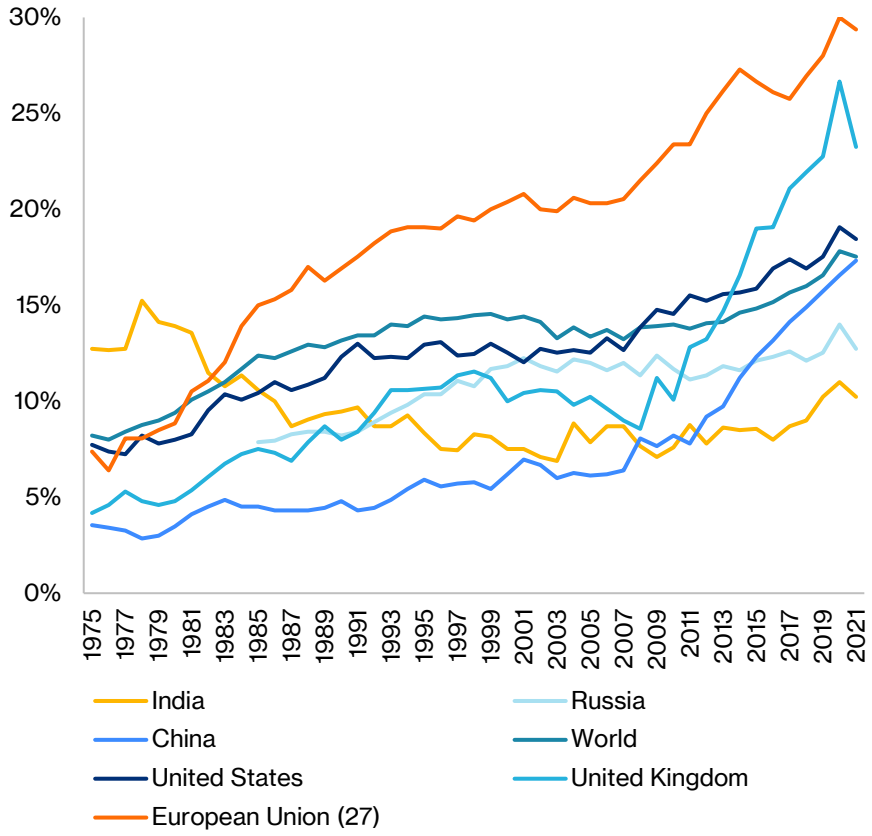
Data source: Ember (2025); Energy Institute - Statistical Review of World Energy (2024) – Learn more about this data
OurWorldinData.org/energy | CC BY

Global Natural Gas Use Up ~3.5x Since 1975 With **One Glaring Exception**

Share of primary energy from low-carbon sources

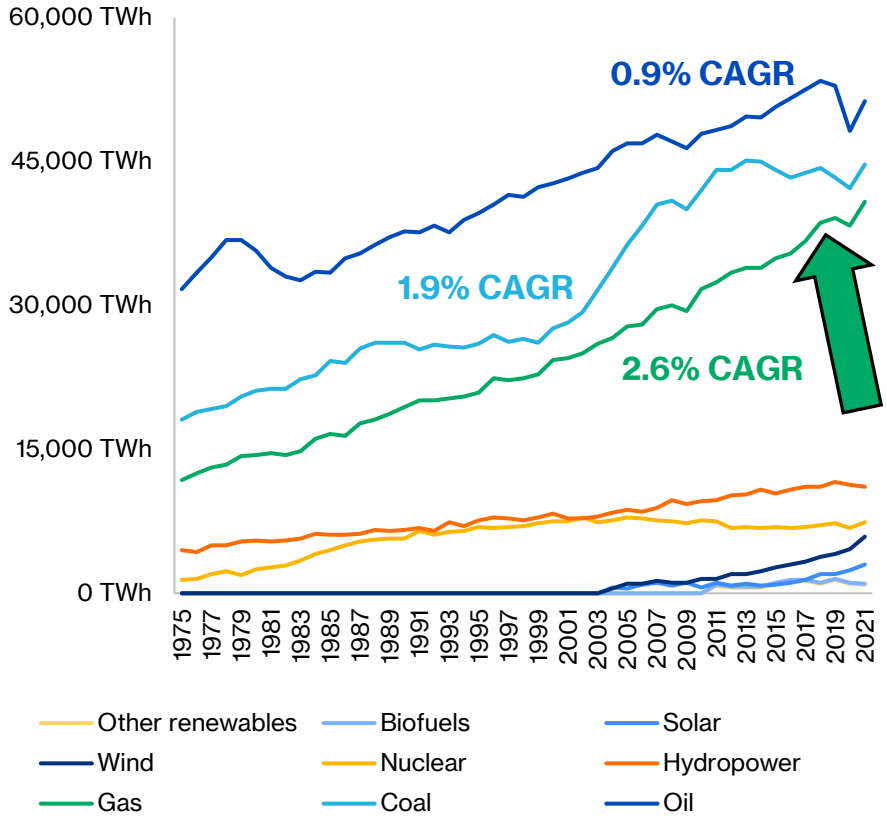
Low-carbon energy is defined as the sum of nuclear and renewable sources. Renewable sources include hydropower, solar, wind, geothermal, wave and tidal and bioenergy. Traditional biofuels are not included



Source: Our World in Data based on BP Statistical Review of World Energy (2022)
Note: Primary energy is calculated using the 'substitution method', which accounts for the energy production inefficiencies of fossil fuels.
OurWorldInData.org/energy

Primary energy consumption by source, World

Primary energy is shown based on the 'substitution' method which takes account of inefficiencies in energy production from fossil fuels

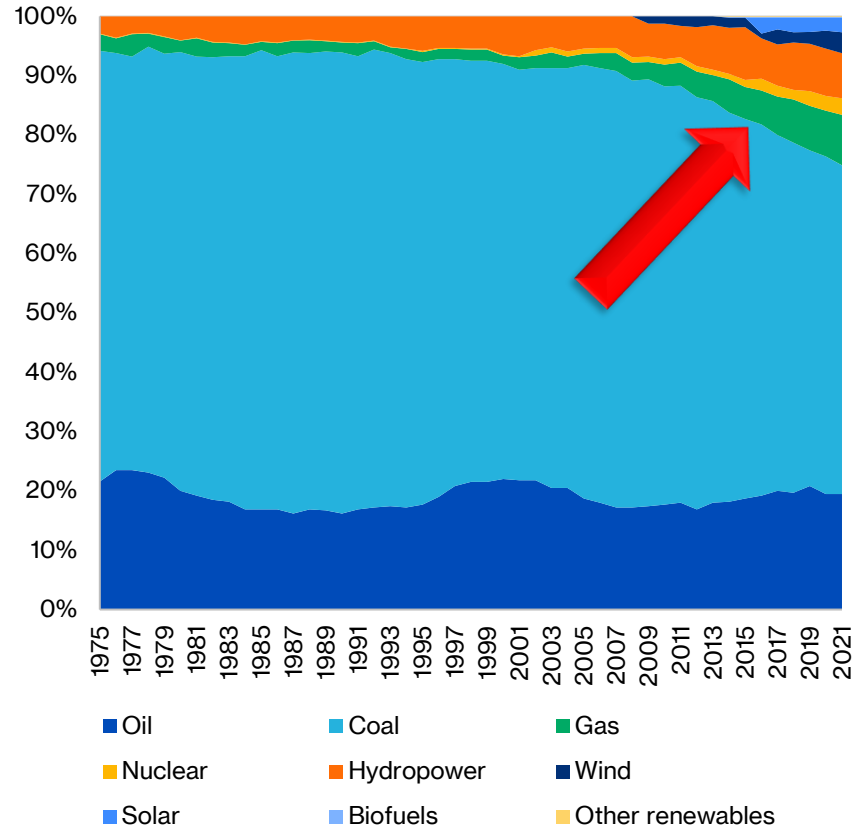


Source: Our World in Data based on BP Statistical Review of World Energy
OurWorldInData.org/energy

China Is **NOT** Going Renewable, And They Barely Utilize Natural Gas

Energy consumption by source, China

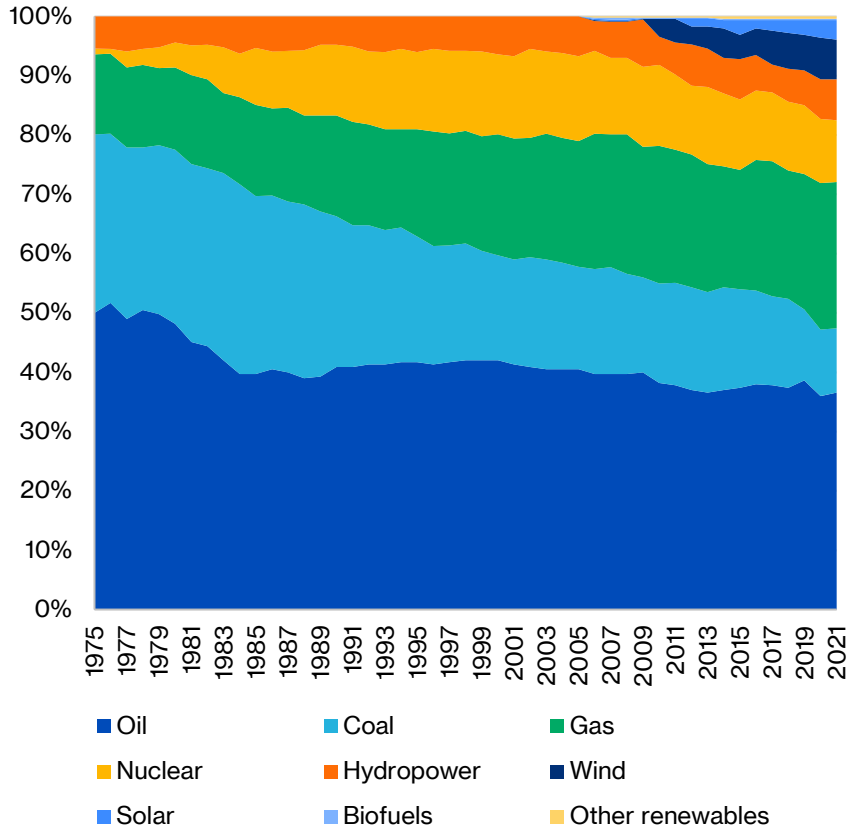
Primary energy consumption is measured in terawatt-hours (TWh). Here an inefficiency factor (the 'substitution' method) has been applied for fossil fuels, meaning the shares by each energy source give a better approximation of final energy consumption



Source: BP Statistical Review of World Energy
Note: 'Other renewables' includes geothermal, biomass and waste energy
OurWorldInData.org/energy

Energy consumption by source, European Union

Primary energy consumption is measured in terawatt-hours (TWh). Here an inefficiency factor (the 'substitution' method) has been applied for fossil fuels, meaning the shares by each energy source give a better approximation of final energy consumption

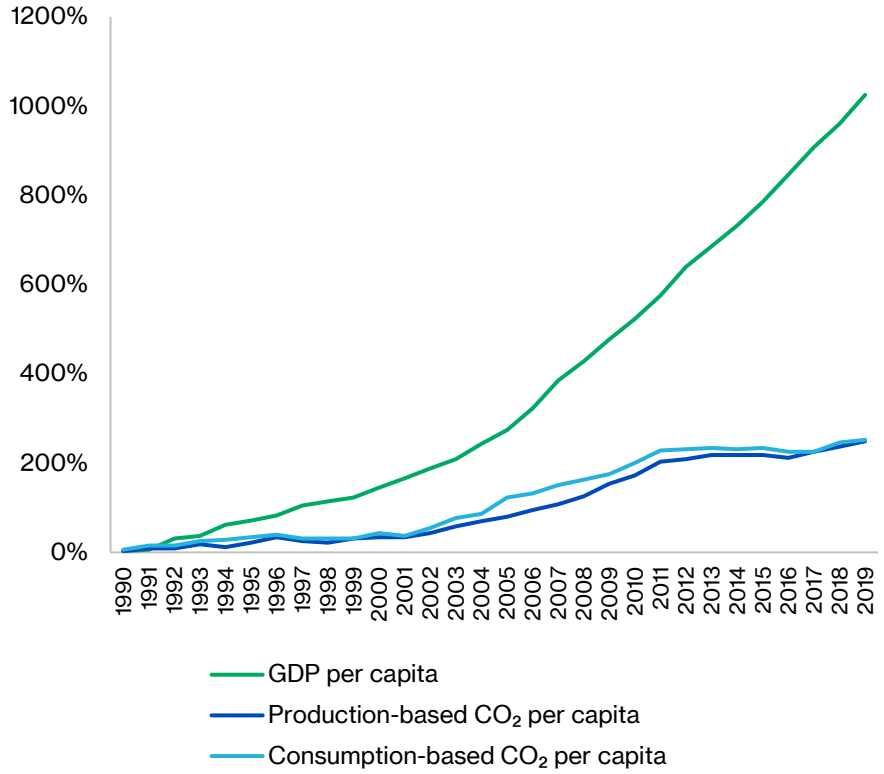


Source: BP Statistical Review of World Energy
Note: 'Other renewables' includes geothermal, biomass and waste energy
OurWorldInData.org/energy

China & India GDP v. CO_2 Emissions Growing **Proportionally** Since 1990

Change in per capita CO_2 emissions and GDP, China

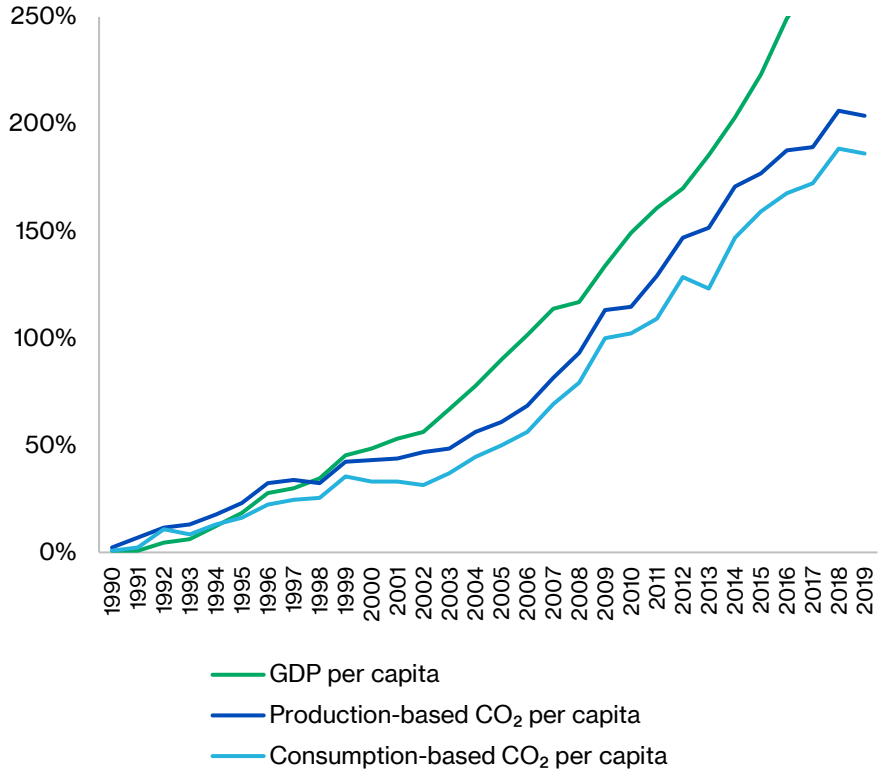
Consumption-based emission are national emission that have been adjusted for trade. This measures fossil fuel and industry emissions. Land use change is not included.



Source: Data complied from multiple sources by World Bank, Our World in Data based on the Global Carbon Project
Note: GDP figures are adjusted for inflation.
OurWorldInData.org/co2-and-greenhouse-gas-emission

Change in per capita CO_2 emissions and GDP, India

Consumption-based emission are national emissions that have been adjusted for trade. This measures fossil fuel and industry emissions. Land use change is not included.

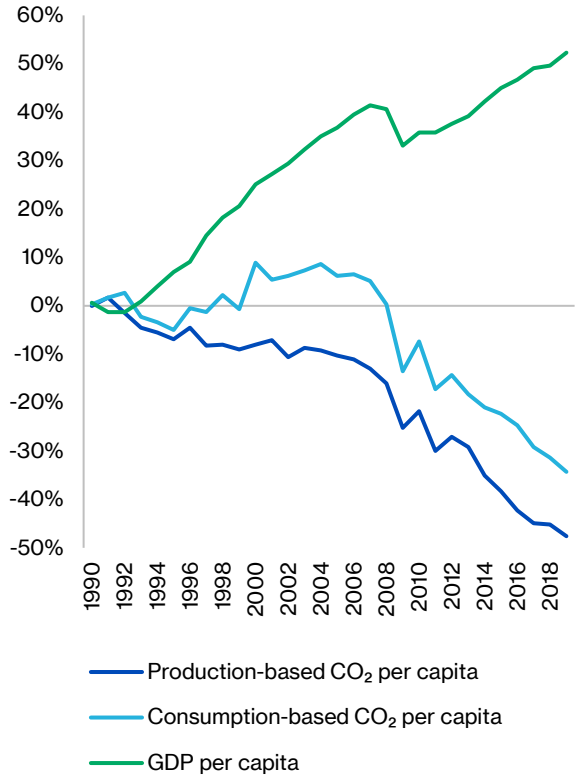


Source: Data complied from multiple sources by World Bank, Our World in Data based on the Global Carbon Project
Note: GDP figures are adjusted for inflation.
OurWorldInData.org/co2-and-greenhouse-gas-emission

Western Economies Have Been Decoupling For The **Last Thirty Years**

Change in per capita CO_2 emissions and GDP, United Kingdom

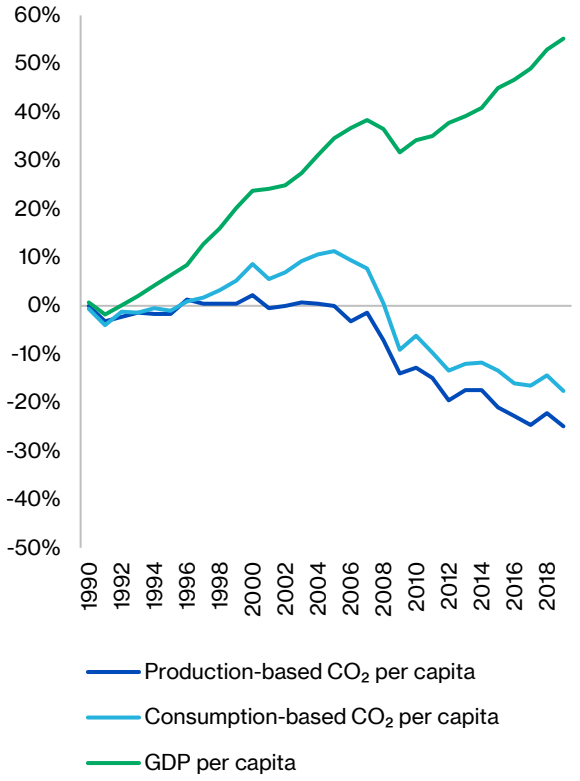
Consumption-based emissions are national emissions that have been adjusted for trade. This measures fossil fuel and industry emissions. Land use change is not included.



Source: Data compiled from multiple sources by World Bank, Our World in data based on the global carbon project
Note: GDP figures are adjusted for inflation.
OurWorldInData.org/co2-and-greenhouse-gas-emission

Change in per capita CO_2 emissions and GDP, United States

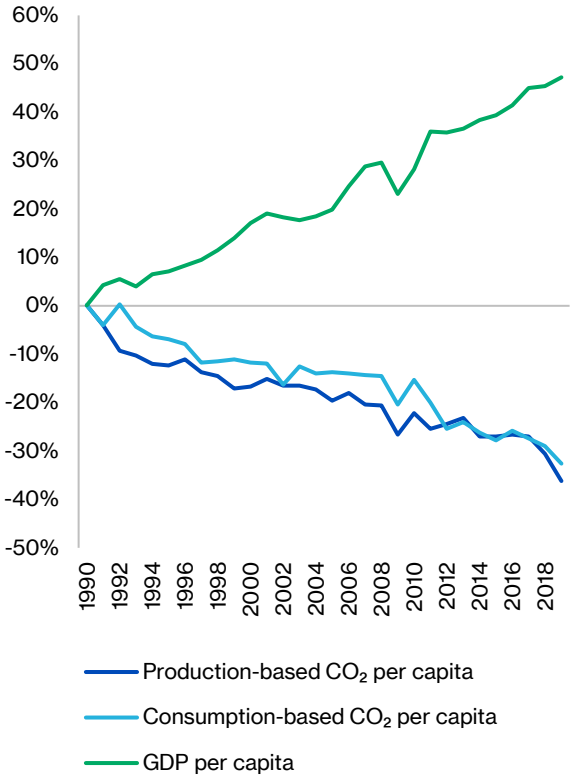
Consumption-based emissions are national emissions that have been adjusted for trade. This measures fossil fuel and industry emissions. Land use change is not included.



Source: Data compiled from multiple sources by World Bank, Our World in data based on the global carbon project
Note: GDP figures are adjusted for inflation.
OurWorldInData.org/co2-and-greenhouse-gas-emission

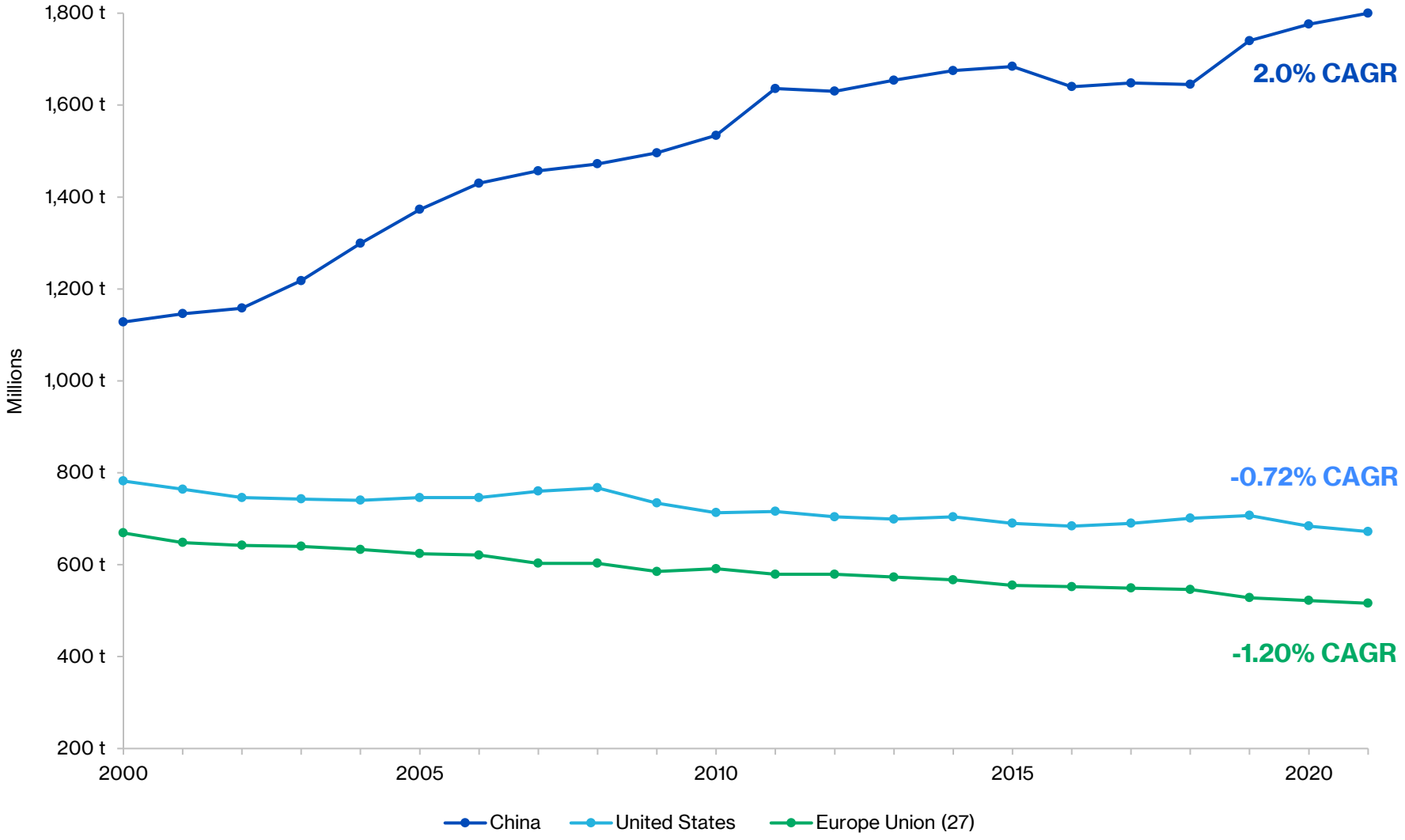
Change in per capita CO_2 emissions and GDP, Germany

Consumption-based emissions are national emissions that have been adjusted for trade. This measures fossil fuel and industry emissions. Land use change is not included.



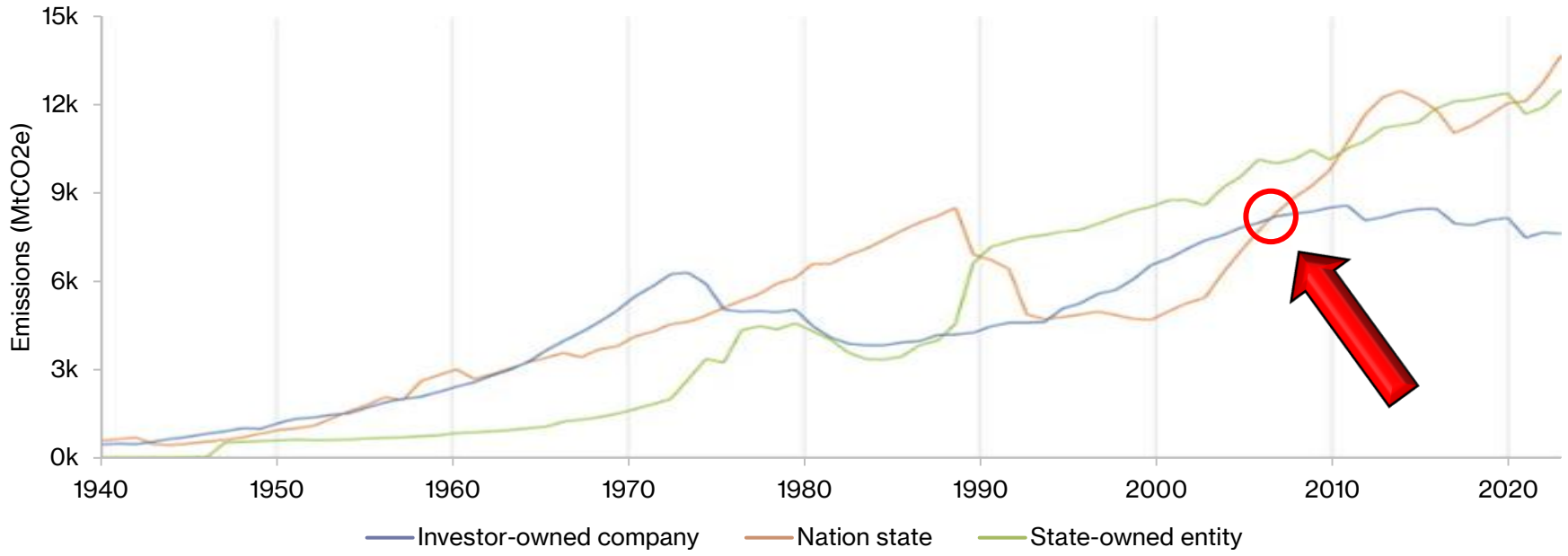
Source: Data compiled from multiple sources by World Bank, Our World in data based on the global carbon project
Note: GDP figures are adjusted for inflation.
OurWorldInData.org/co2-and-greenhouse-gas-emission

China Emits ~2.5x More **Methane** Than The United States



https://ourworldindata.org/grapher/methane-emissions?tab=chart&time=1985..latest&region=NorthAmerica&country=USA~CHN~OWID_EU27

Nation-State & SOE Emissions Have Surpassed Investor-Owned CO_2



The five largest nation-states (by population)	The five largest SOEs in the world	The five largest investor-owned companies in the world (by revenue)
India (1.5B)	Industrial & Commercial Bank of China	Walmart ($650B USD)
China (1.4B)	China Construction Bank	Amazon ($575B USD)
United States (345M)	Agricultural Bank of China	Apple ($383B USD)
Indonesia (283M)	State Grid Corporation of China	UnitedHealth ($372B USD)
Pakistan (250M)	Saudi Aramco	Berkshire Hathaway ($364B USD)

80 Percent of Global CO2 Emissions Come From Just 57 Companies, Report Shows | Smithsonian (smithsonianmag.com)

The Tech Bros Will Determine The Future Strength Of The U.S. Economy

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The S&P 500 Is Dominated By Technology's "Magnificent Seven"

The Magnificent Seven accounts for approximately:

- Roughly one-third of the S&P 500's market cap
- 30% of the S&P 500's aggregated profits
- 5Y return of the S&P 500 = 92%
- 5Y return, ex-Magnificent Seven = 72%
- Smaller constituents of the S&P 500 generally range from $8B to $10B in market capitalization
- The average market size of Apple, Microsoft, Nvidia, Amazon, Alphabet, Meta, and Tesla sits at ~$2 *trillion*

S&P 500 Sector Weights (Late 2024)

Sector	Approximate Weight
Information Technology	31.3%
Energy	3.4%

Source: Visual Capitalist, 2024 sector performance data.

The Information Technology sector's market cap is roughly **nine times larger** than that of the Energy sector within the S&P 500

Top 10 S&P 500 Companies By Decade

1990	% of Index
IBM	2.9%
ExxonMobil	2.9%
GE	2.3%
Philip Morris International	2.2%
Shell	1.9%
Bristol Myers Squibb	1.6%
Merck	1.6%
Walmart	1.6%
AT&T	1.5%
Coca-Cola	1.4%

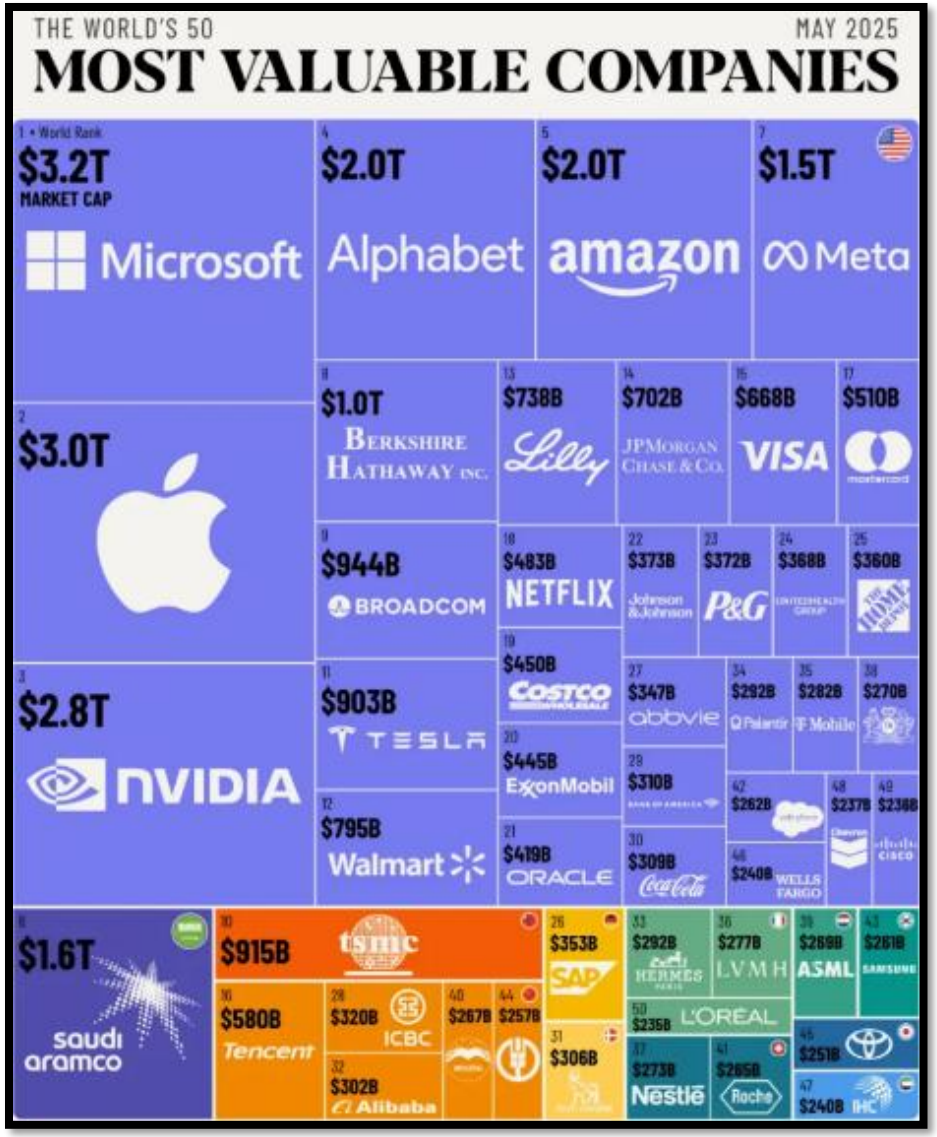
2000	% of Index
GE	4.1%
ExxonMobil	2.6%
Pfizer	2.5%
Cisco	2.4%
Citi	2.2%
Walmart	2.0%
Microsoft	2.0%
AIG	2.0%
Merck	1.8%
Intel	1.7%

2010	% of Index
ExxonMobil	3.2%
Apple	2.6%
Microsoft	1.8%
GE	1.7%
Chevron	1.6%
IBM	1.6%
P&G	1.6%
AT&T	1.5%
Johnson&Johnson	1.5%
JPMorganChase	1.5%

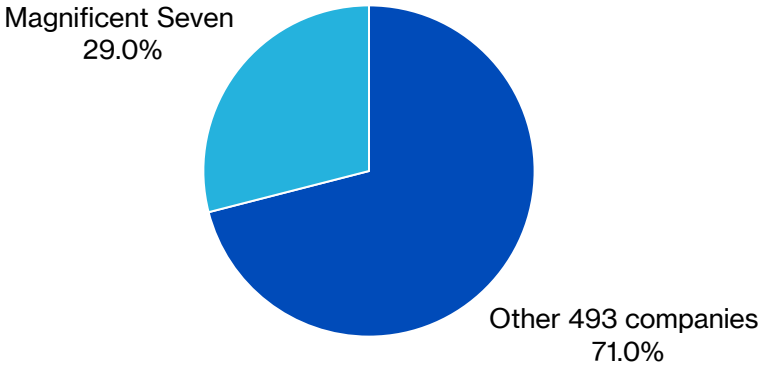
2024	% of Index
Apple	7.0%
NVIDIA	6.4%
Microsoft	6.4%
Alphabet	6.2%
Amazon	3.8%
Meta	2.4%
Lilly	1.8%
Broadcom	1.6%
Tesla	1.4%
JPMorganChase	1.2%

By market cap on Dec 31. Source: Statista, Data is Beautiful, RIAA, IFPI, Goldman Sachs Global Investment Research; Pickering internal research

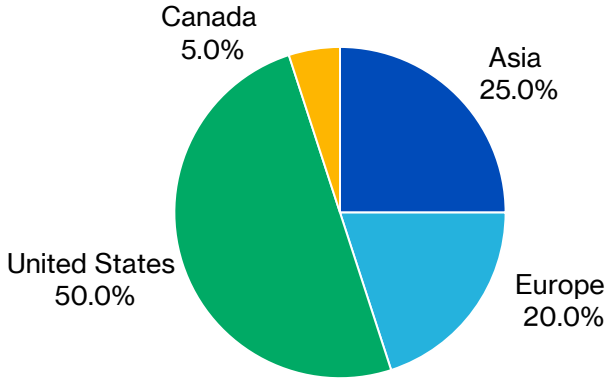
1.5% of S&P 500 ***Companies*** Account For ~55% Of Daily Performance



Market Cap Share of the Magnificent Seven vs. Rest of the S&P 500



Revenue Breakdown of the Magnificent Seven by Region

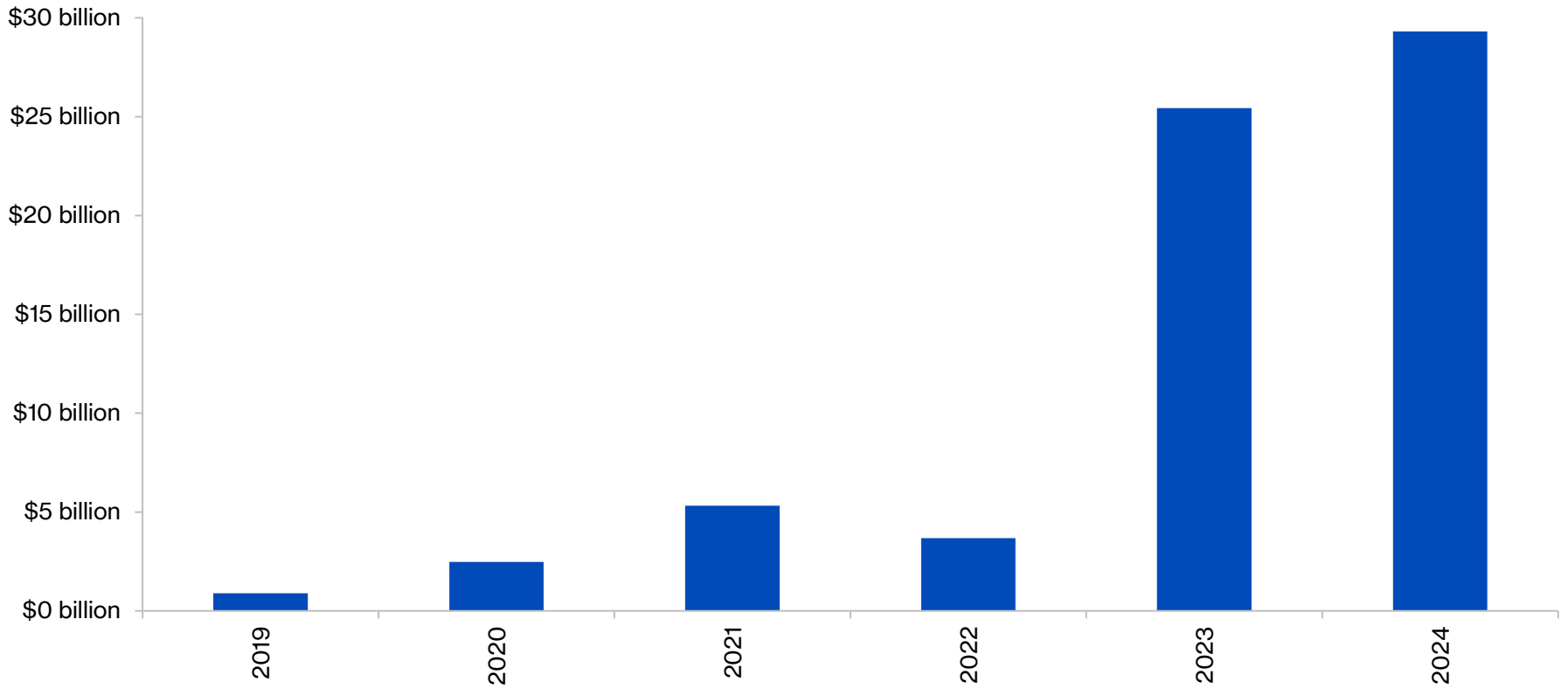


The World's 50 Most Valuable Companies (May 2025) - Voronoi

Generative AI Investment Has Grown **> 6x** In Less Than Four Years

Global Investment In Generative AI

Generative AI refers to AI systems that can create new output, such as images, text, or music, based on patterns learned from existing data.



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Data source: Quid via AI Index Report (2025); U.S. Bureau of Labor Statistics (2025) – Learn more about this data
Note: This data is expressed in constant 2021 US$. Inflation adjustment is based on the US Consumer Price Index (CPI).
OurWorldinData.org/artificial-intelligence | CC BY

Private Market Investment Heavily Concentrated On Generative AI

Key 2024 Investment Totals

Sector	US 2024 private-market investment	% of all US VC/PE	How it stacks up vs. AI
Artificial intelligence	$109.1 B (private AI investment)	≈52 % of all US venture dollars	–
Financial services (Fintech)	$50.7 B (VC + PE + M&A)	≈24 %	AI ≈ 2.1 × larger
Core Industrials[1]	≈$53 B (VC only, est.)[2]	≈25 %	AI ≈ 2.0 × larger
Consumer-facing tech[2]	≈$31 B (VC only, est.)[2]	≈15 %	AI ≈ 3.5 × larger

* Numbers refer to private-market flows (venture, growth PE, and sector M&A where indicated), not public-market stock purchases or corporate CAPEX. The baseline for "all US VC" is the $209 B raised across every US sector in 2024.

1. **AI has become the single largest destination for US risk capital.** Stanford's AI Index tallies **$109B** in US private AI investment for 2024, up ~22% YoY and equal to **about half of every venture dollar deployed nationwide.**
2. **Fintech is still big, but AI is now roughly double its size.** KPMG's Pulse of Fintech reports US fintech investment at $50.7B, encompassing venture rounds, growth equity, and strategic M&A. The figure is barely half of what flowed into AI.
3. **Industrial-tech deal flow has rebounded, yet remains only ~25% of AI.** PitchBook/Dealroom data list 2024 global VC for transportation, energy, robotics, and semiconductors at **$92.5B**. Because the US captured ~57% of all global VC (209 B of 368 B) , that yields an estimated **$53B** domestic figure.
4. **Consumer-oriented tech rounds are the smallest of the buckets.** Summing VC categories such as food, media, gaming, travel, etc., gives **$54.6B** globally. Applying the same 57% US share implies about **$31B,** or barely a third of AI's haul.

WHY AI DWARFS THE OTHER SECTORS

- **Megadeals dominate:** Five US AI companies (Databricks, OpenAI, xAI, Waymo, Anthropic) alone absorbed **> $32 B** in 2024, skewing capital toward the field.
- **Cross-sector pull:** AI underpins products in fintech, industrial automation, consumer apps, and even health, so many "tech" checks are being relabeled as AI.
- **Productivity thesis:** Investors view generative and autonomous systems as horizontal platforms with TAMs that eclipse single-industry solutions, warranting outsized bets.

What Will *Efficiently* Power The Generative AI Economy?

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The AI Economy Will Need An Exponentially Greater Amount Of Power

ChatGPT is probably using more than **half a million kilowatt-hours** of electricity to respond to some 200 million requests **per day**.

Assuming the average US household uses ~30 kilowatt-hours daily, ChatGPT uses **more than 17,000 times** the amount of electricity

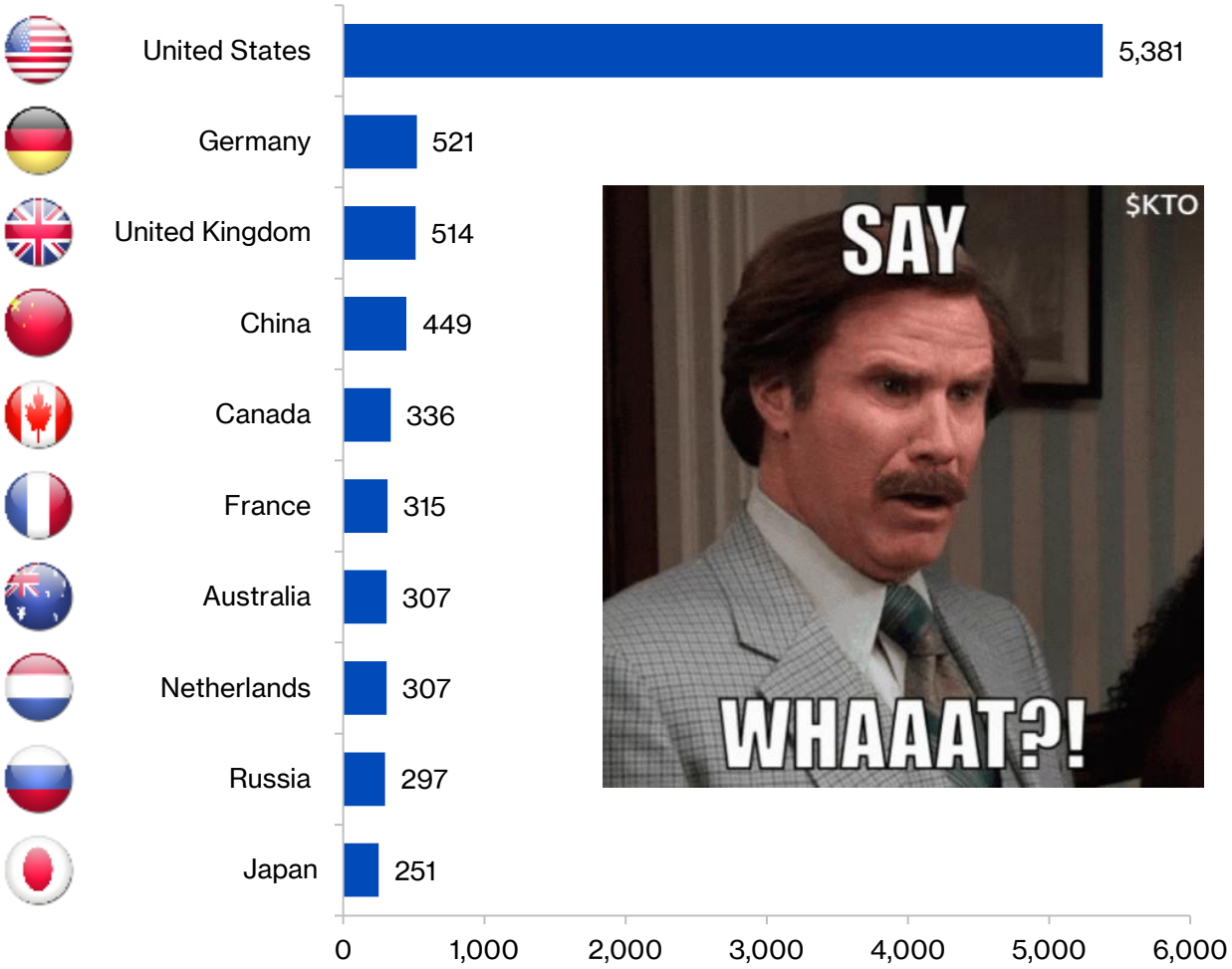
By 2027, the entire AI sector could be using a staggering **85 to 134 terawatt-hours annually**, which would essentially be 50% of **ALL global** electricity consumption (1TW = 1M kilowatts)

https://www.theverge.com/24066646/ai-electricity-energy-watts-generative-consumption

https://www.energy.gov/energysaver/cost-charge-electric-vehicle-explained#:~:text=If%20using%20an%20EV%2C%20which,cost%20nearly%20%2460%20per%20month.

“Hyper-Scale” Data Centers Powering AI Consume ~50 MW Annually

Leading countries by number of data centers as of March 2024



135 terawatt-hours is equivalent to 135M kilowatt hours, which is over **12,000x the electricity** consumed by one household

Tokyo, population ~37M, consumed ~285M kilowatt hours of electricity in 2022

On an annual basis, the upper end of electricity demand forecasted to power generative AI is the same amount of power that would **power Tokyo for 173 days**

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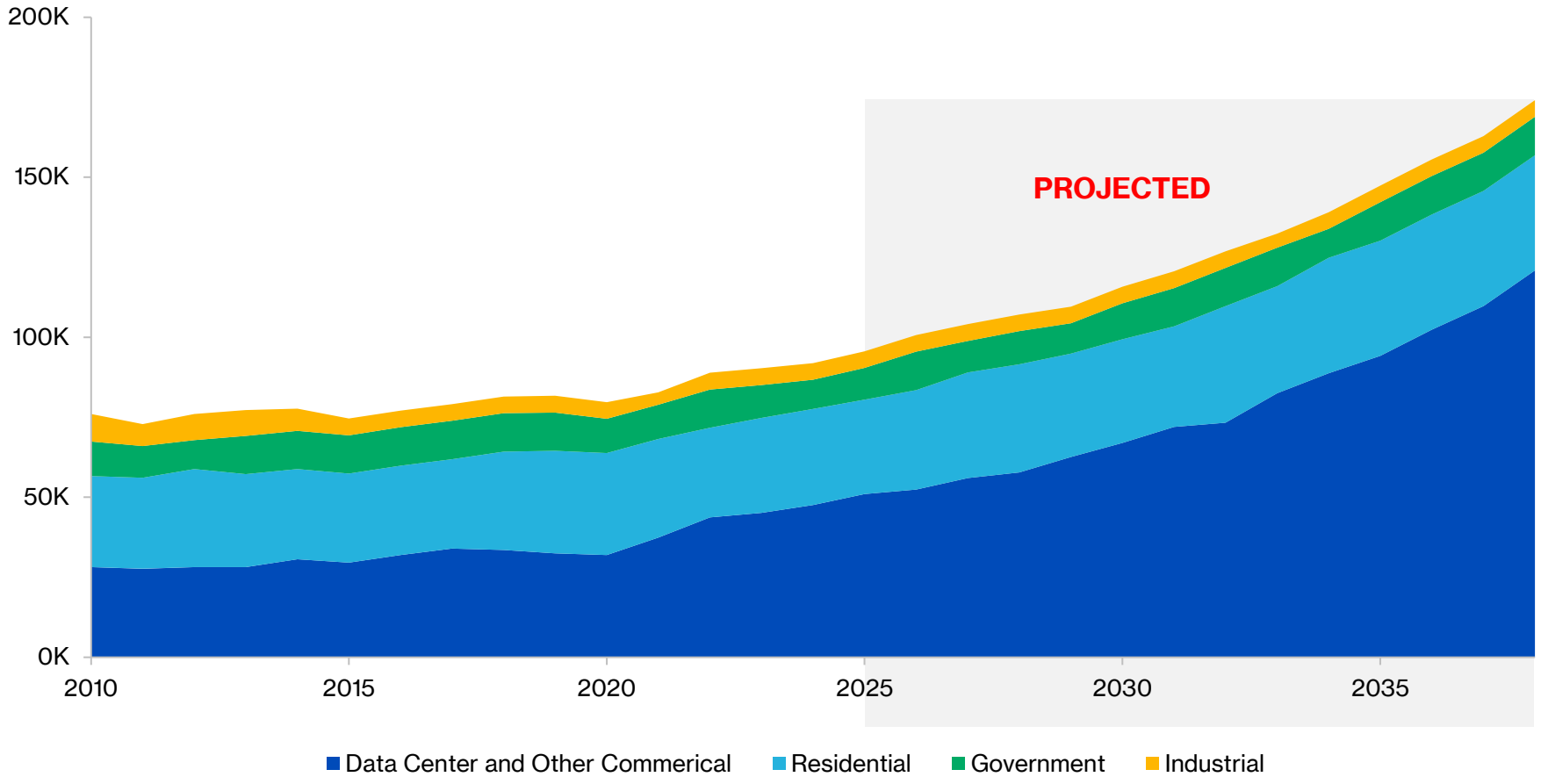
Source - https://www.statista.com/statistics/1228433/data-centers-worldwide-by-country/

Data Centers Will Create An Exponential Increase In Energy Demand

Data centers expected to drive "stratospheric" energy demand in Virginia

Dominion Energy customer demand in Virginia, in gigawatt hours



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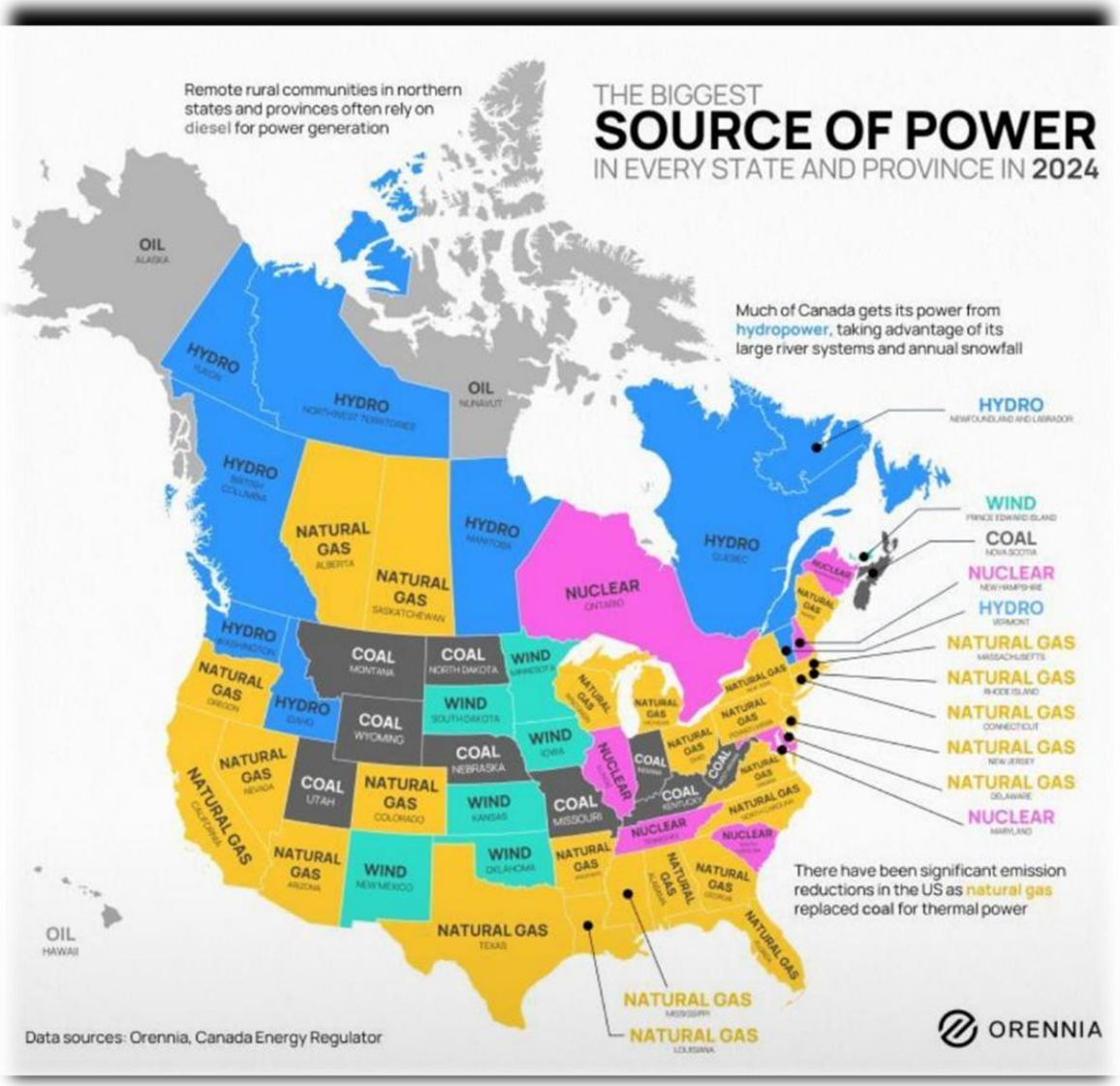
Why invest in the data center economy | McKinsey

Source: Dominion Energy's Virginia Electric and Power Company Integrated Resources Plan

Natural Gas **Already** Dominates The Energy Mix In The United States…



Virginia Currently Provides Case Study For An A.I.-Centric Energy Mix

- MIT studies have highlighted that a single data center can consume the equivalent electricity of **50,000 homes**
- In most data centers today, cooling accounts for over **40% of electricity usage.**
- U.S. National Security Agency (NSA) data centers can guzzle **seven million gallons of water DAILY**

About 70% of the world's internet traffic, at some point, makes it through Ashburn, Virginia

Utility-Scale Net Electricity Generation (share of total)	Virginia	U.S. Average	Period
Petroleum-Fired	0.3%	0.3%	Dec-23
Natural Gas-Fired	**59.6%**	42.2%	Dec-23
Coal-Fired	1.8%	16.2%	Dec-23
Nuclear	30.8%	19.9%	Dec-23
Renewables	8.1%	20.9%	Dec-23

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The Staggering Ecological Impacts of Computation and the Cloud | The MIT Press Reader
https://www.eia.gov/state/data.php?sid=VA
https://www.eia.gov/electricity/monthly/epm_table_grapher.php?t=table_1_01

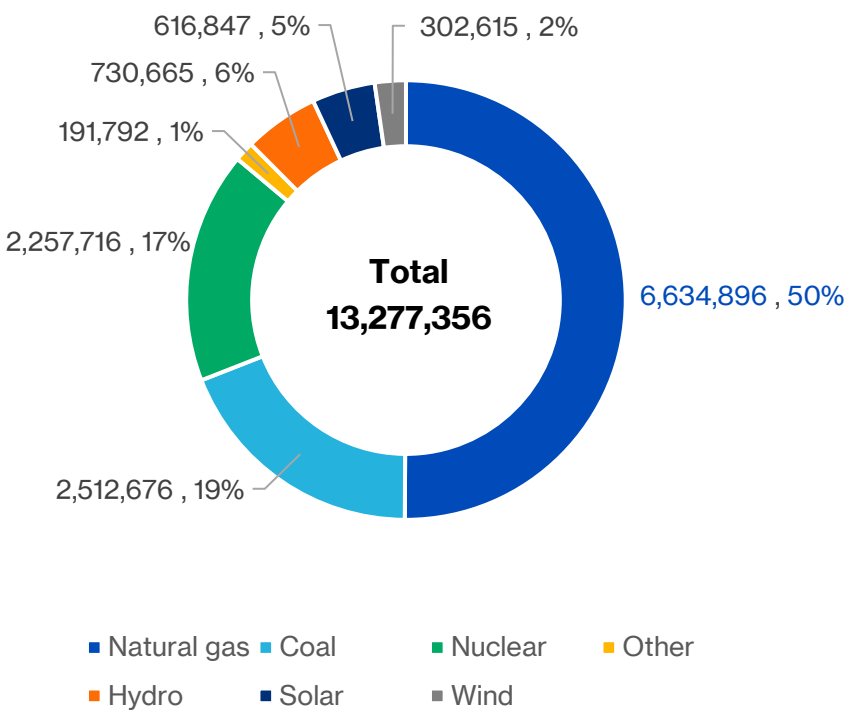
The Reliance On Natural Gas Skyrockets During “Tough Times”

With July 2024 heatwaves, the US probably’ saw the highest natural gas generation in history, EIA says

The spike in natural gas-fired generation on July 9, 2024, was because of both high temperatures across most of the country and a steep drop in wind generation.

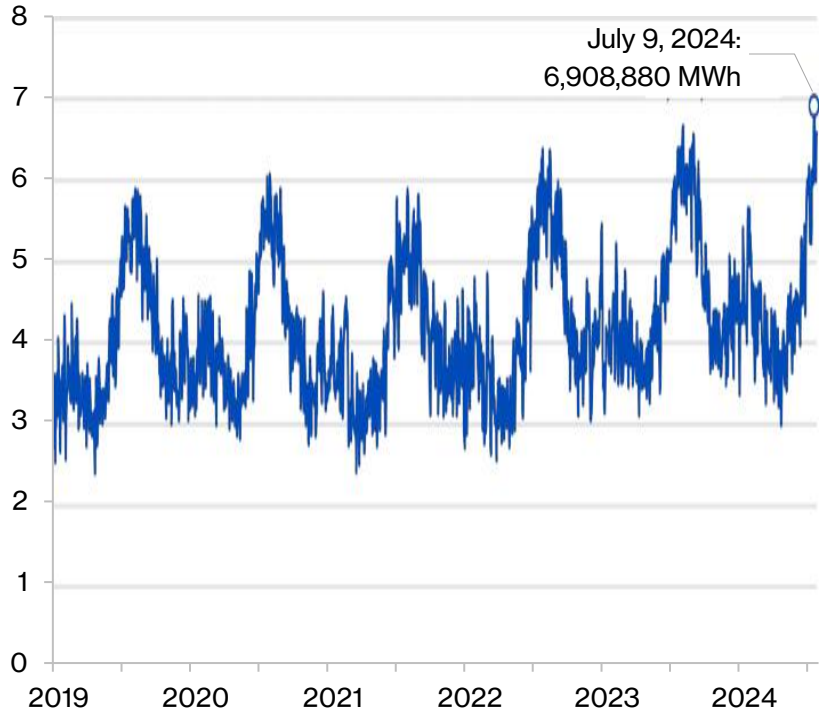
U.S. daily generation mix 7/23/2024, Eastern Time

In MWh



Daily Natural gas electricity in the Lower 48 states (Jan 1, 2019 – July 16, 2024)

In million MWh



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Data source U.S. Energy Information Administration

Relying Solely On Solar & Wind Electricity Generation Is **Fantasy Land**

Existing U.S. Energy Mix	Existing Energy Mix (%)	Electricity Generated Today (kWh)	Virginia Energy Mix (%)	Electricity Generated Today (kWh)	Aspirational Energy Mix (%)	Electricity Generated Today (kWh)
Natural Gas	43%	1,806,000,000,000	60%	5,040,000,000,000	10%	840,000,000,000
Nuclear	19%	798,000,000,000	30%	2,520,000,000,000	10%	840,000,000,000
Coal	16%	672,000,000,000	0%		0%	
Wind	10%	420,000,000,000	5%	420,000,000,000	40%	3,360,000,000,000
Hydropower	6%	252,000,000,000	0%		0%	
Solar	5%	210,000,000,000	5%	420,000,000,000	40%	3,360,000,000,000
Biomass	2%	42,000,000,000	0%		0%	
Total	**100%**	**4,200,000,000,000**	**100%**	**8,400,000,000,000**	**100%**	**8,400,000,000,000**

- The National Renewable Energy Laboratory estimates that ~22,000 square miles of solar panel-filled land, or the size of Lake Michigan, is needed to power the entire U.S. at ***current*** electricity demand
- Assuming the U.S. can achieve 20% efficiency (which is aggressive), this land footprint can be reduced to ~10,000 square miles, or the size of Lake Erie
- To facilitate an 80% solar/wind energy mix and meet the demand created by generative AI, **the U.S. needs to increase current solar/wind electricity generation by ~91x**

Pickering Energy Partners

Source - PEP Consulting analysis extrapolates electricity generated by source, data derived from the EIA website
How Much Land is Needed to Power the U.S. with Solar? (visualcapitalist.com)

The U.S. **CANNOT** Compete Without Increasing Natural Gas & Nuclear

Existing U.S. Energy Mix	Existing Energy Mix (%)	Electricity Generated Today (kWh)	Virginia Energy Mix (%)	Virginia Electricity Generated – AI (kWh)
Natural Gas	43%	1,806,000,000,000	60%	5,040,000,000,000
Nuclear	19%	798,000,000,000	30%	2,520,000,000,000
Coal	16%	672,000,000,000	0%	
Wind	10%	420,000,000,000	5%	420,000,000,000
Hydropower	6%	252,000,000,000	0%	
Solar	5%	210,000,000,000	5%	420,000,000,000
Biomass	2%	42,000,000,000	0%	
Total	**100%**	**4,200,000,000,000**	**100%**	**8,400,000,000,000**

Northern Virginia is home to **10M square feet (about 69 Costcos)** of data center space, spread across 118 data centers, with an additional 43 potential sites marked for growth

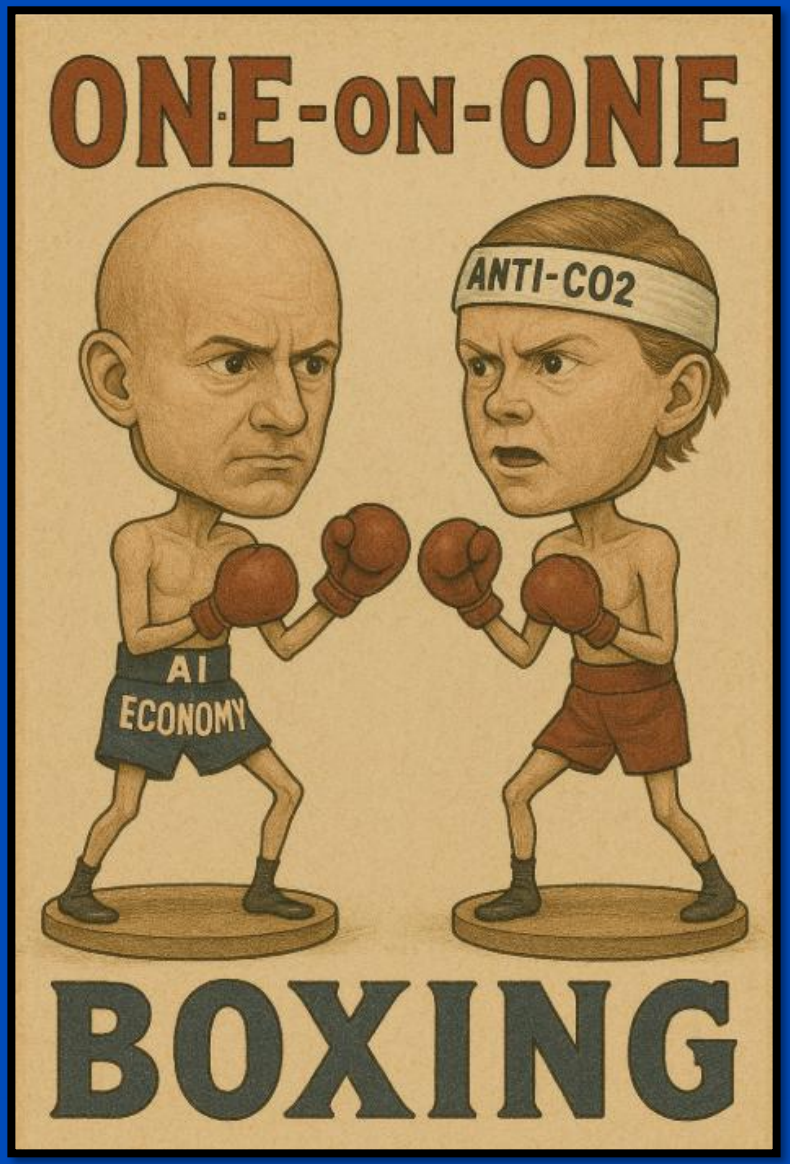
Virginia's energy mix currently provides "data center alley" electricity prices that are **~30% cheaper** than the national average

If the U.S. adopted the energy mix displayed by Virginia, we would need **3X the electricity generated** from natural gas

Pickering Energy Partners

Source - PEP Consulting analysis extrapolates electricity generated by source based on U.S. EIA data
https://lightyear.ai/blogs/ashburn-colocation-data-center-alley

The AI Economy And Emissions Management Are In Direct Competition With Each Other



Power Demand And Emissions Are The AI Economy's Juxtaposition

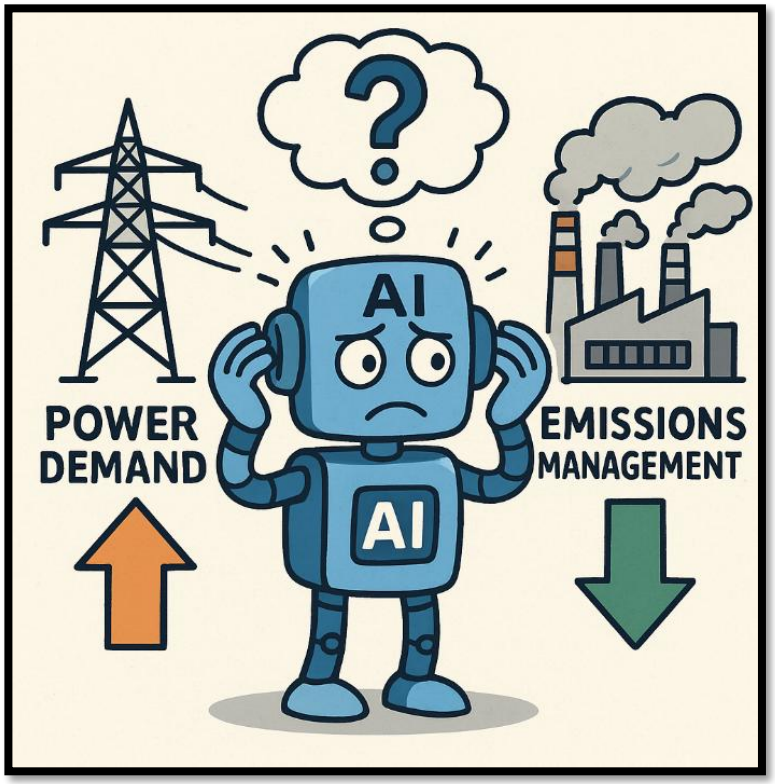
Tech sector emissions and energy use growing with the rise of AI

June, 2025

Tech giants' carbon emissions up 150% with AI growth

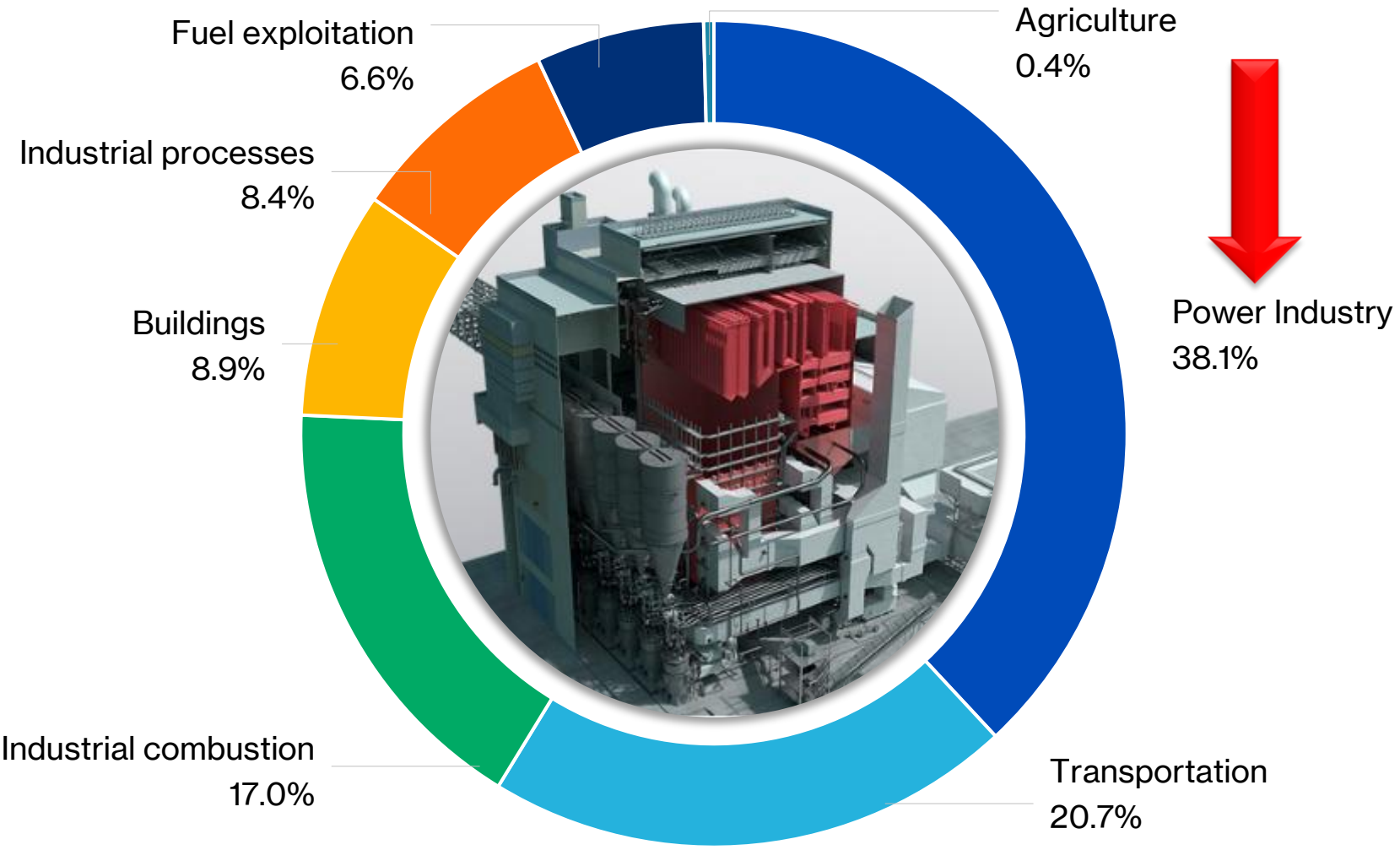
Companies such as Amazon, Microsoft, Alphabet, and Meta have experienced a surge in their global indirect emissions.

June 9, 2025



The **Power Industry** Overwhelmingly Dominates Global CO_2 Emissions

Distribution of Carbon Dioxide Emissions Worldwide in 2023



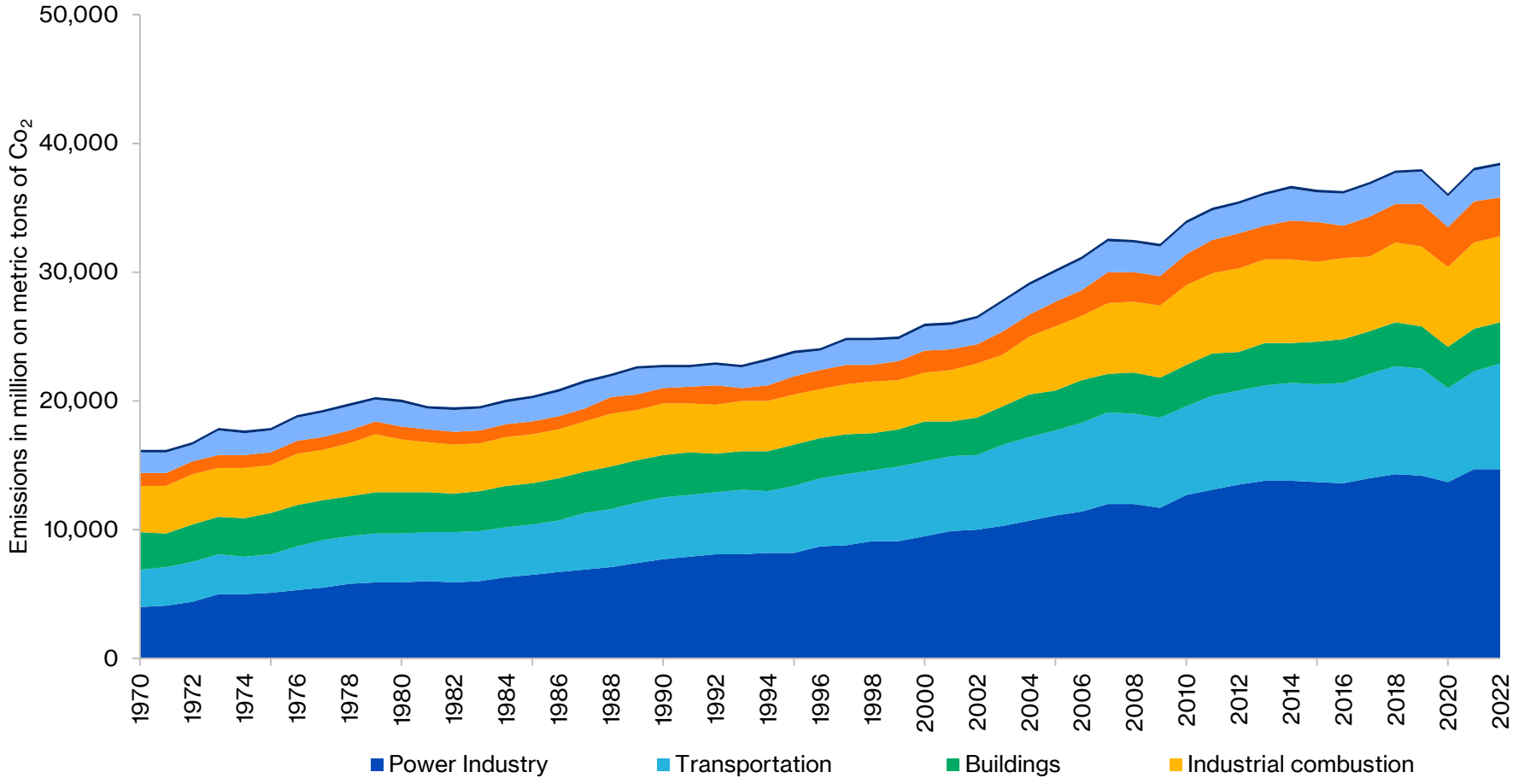
Pickering Energy Partners

https://www.statista.com/statistics/1129656/global-share-of-co2-emissions-from-fossil-fuel-and-cement/#:~:text=The%20power%20industry%20was%20by,at%20just%20over%2020%20percent.

Global CO_2 Emissions From Power Industries Have **Doubled** Since 2000

Global Carbon Dioxide Emissions From 1970 To 2022 By Sector

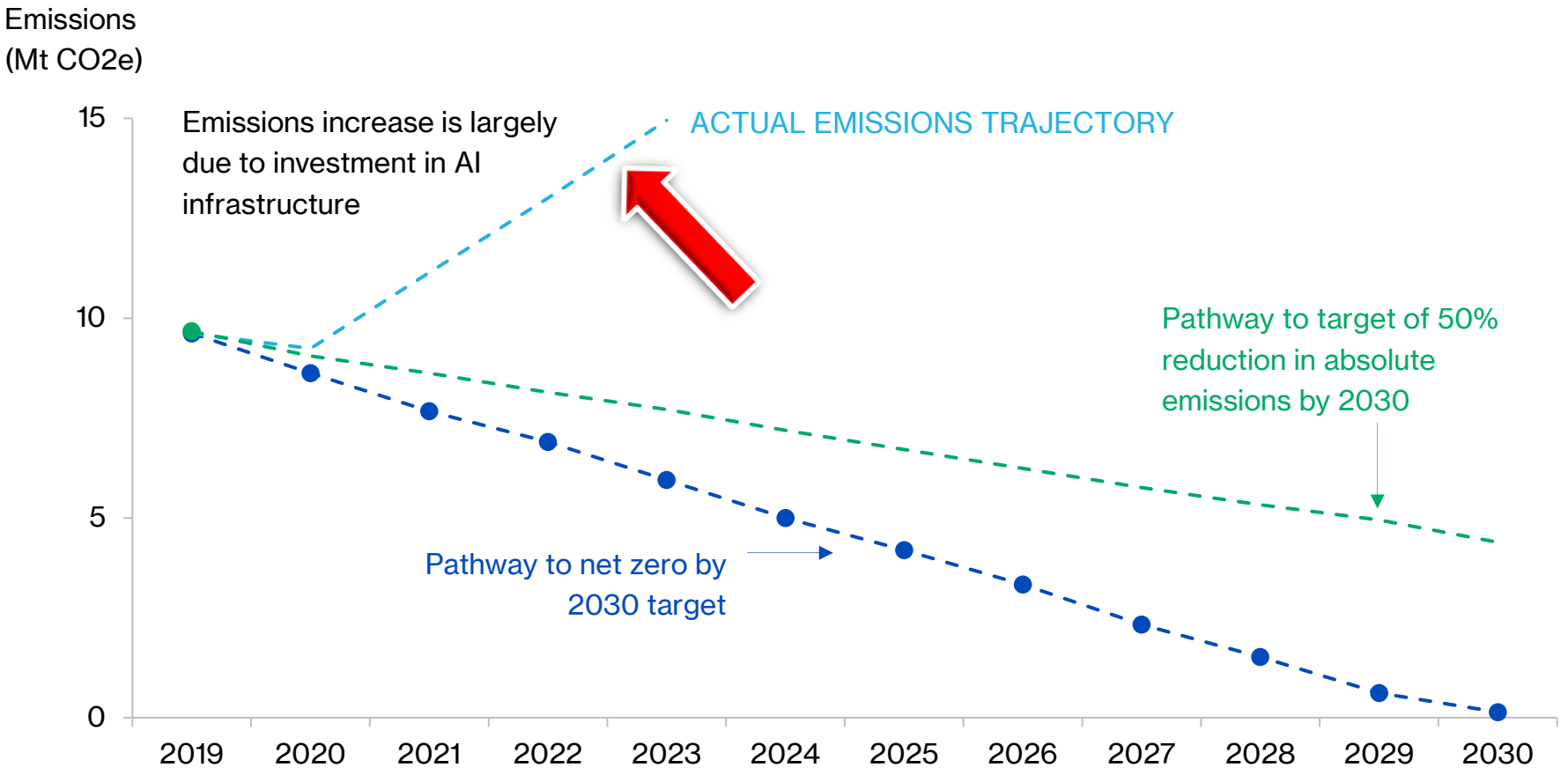
(in million metric tons of carbon dioxide)



There Exists An Immense Emissions Delta Between Goals And Reality

Google Is No Longer Claiming To Be Carbon Neutral

But Is Still Aiming To (Somehow) Reach Net-Zero Carbon Emissions By 2030



Pickering Energy Partners

Google Is No Longer Claiming to Be Carbon Neutral - Bloomberg

Chart adapted from Bloomberg Green; Data source: Google (Scope 1, 2 and 3 emissions)

Achieving Net Zero "Organically" Grows Increasingly Unlikely

ALL Companies Will Miss Net Zero Goals Without At Least Doubling Rate of Carbon Emissions Reductions by 2030

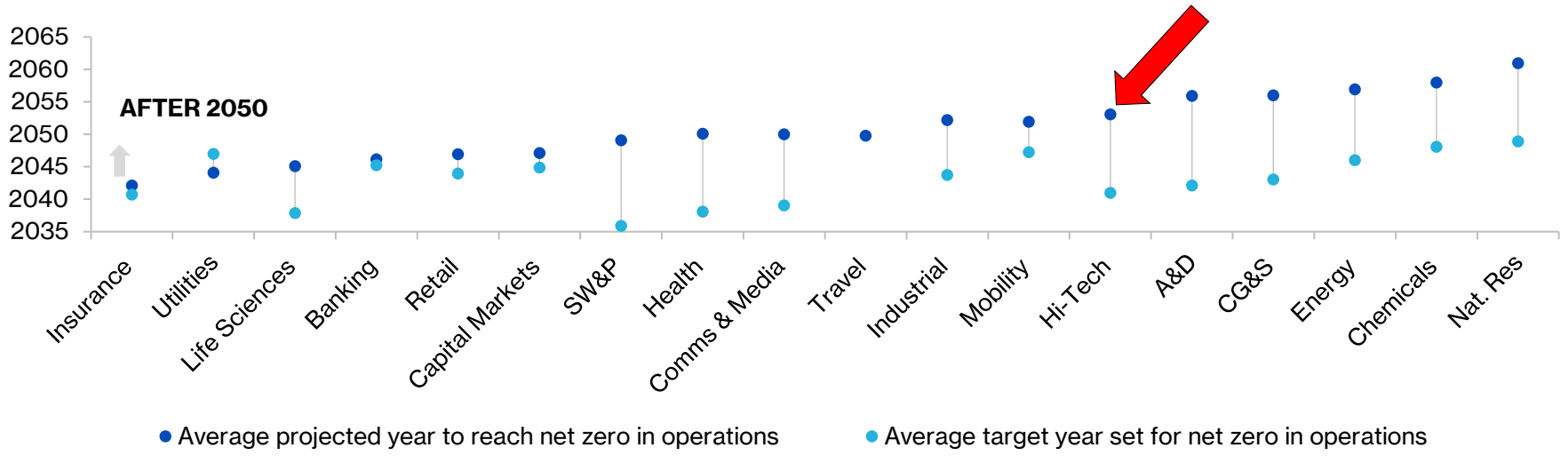
More than one-third of the world's largest companies have a Net Zero commitment, but **93% of them will fail** to achieve their goals if they do not at least double the pace of emissions reduction by 2030

Many industries are not on track to meet net zero by 2050 and need to accelerate

Even on a consensus pathway, in which projected emissions reduction speeds double over the next decade, many industries will still fail to meet net zero by 2050.

Net Zero by Industry

Emissions scope 1 & 2 - consensus pathway scenario for an average company projected year of achievement



If We Don't Act Now, Poor Energy Decisions Will Have Serious Consequences In The Not-Too-Distant Future

Electricity Demand In The United States Is About To Get Crazy

Climate & Energy | Grid & Infrastructure | Coal | Gas | Clean Energy

US power use to reach record highs in 2024 and 2025 -EIA

Reuters

March 12, 2024 2:41 PM CDT · Updated 10 days ago

The “New Economy” Will Unequivocally Require More **RELIABLE** Power

TECHNOLOGY | ARTIFICIAL INTELLIGENCE | KEYWORDS: CHRISTOPHER MIMS

AI Is Ravenous for Energy. Can It Be Satisfied?

The revolution in artificial intelligence may soon require more electricity than all electric vehicles combined

The New York Times

A.I. Could Soon Need as Much Electricity as an Entire Country

Behind the scenes, the technology relies on thousands of specialized computer chips.

Bloomberg US Edition

● Live Now Markets Economics Industries Tech AI Politics Wealth Pursuits Opinion Businessweek Equality **Green**

Green
New Energy

Artificial Intelligence Is Booming—So Is Its Carbon Footprint

Greater transparency on emissions could also bring more scrutiny

https://www.wsj.com/tech/ai/ai-energy-consumption-fc79d94f
https://spectrum.ieee.org/ai-energy-consumption

People Who Do Not Understand Energy Have Created Energy Chaos

The US Is Not Prepared for the AI Electricity Demand Shock

BY BARAK ORBACH and ELI ORBACH *September 12, 2024*

Share

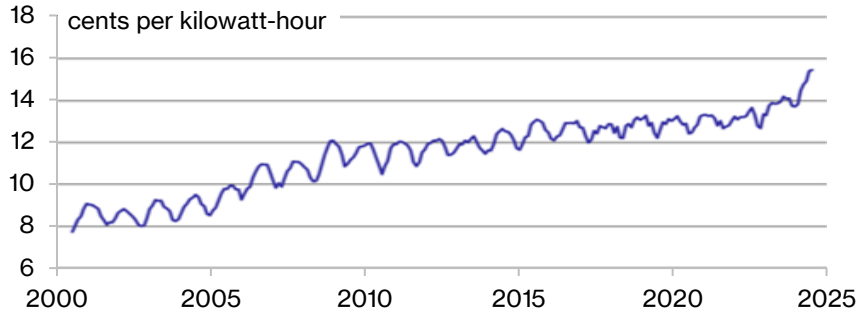
Play Stupid Energy Games...Win Stupid Energy Prizes

Cost of residential electricity

Data source: Energy Information Administration

Average cost of residential electricity in the US

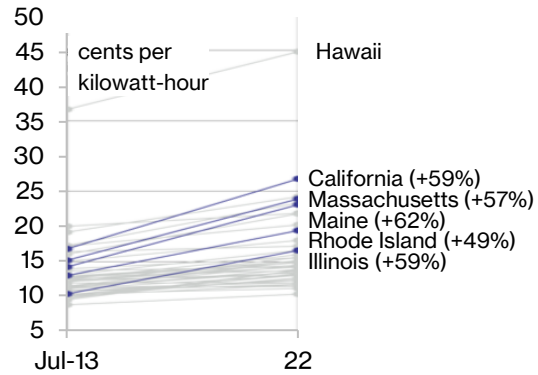
Electricity prices typically peak during summer months, and the cost of electricity was 11.5% higher in July 2024



Data source: Energy Information Administration

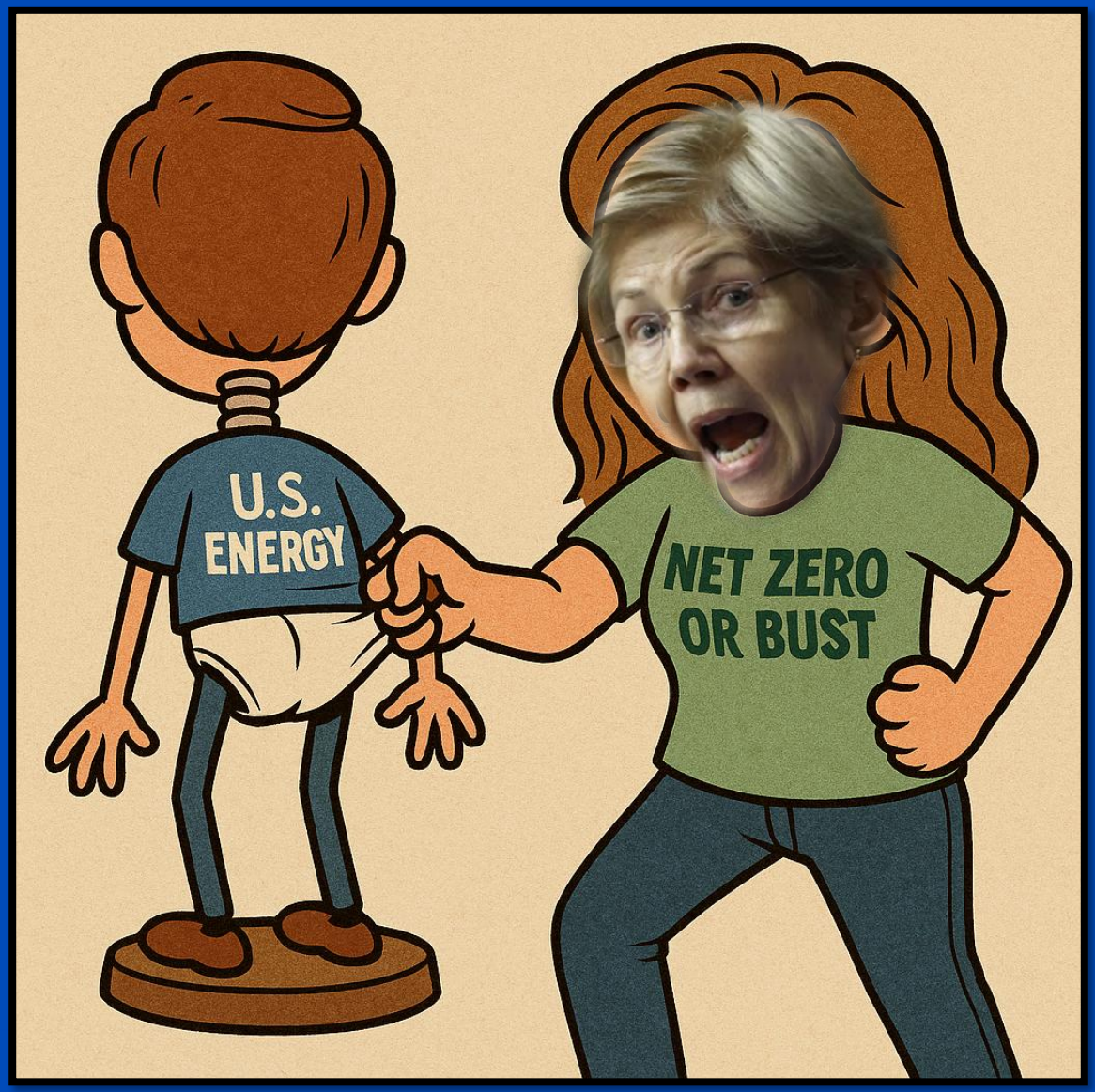
Where the cost of residential electricity has increased most over the past decade

Note: Highlighted lines represent states with the greatest percent change in electricity cost in cents. per kilowatthour between July 2013 and July 2022



Data source: Energy Information Administration

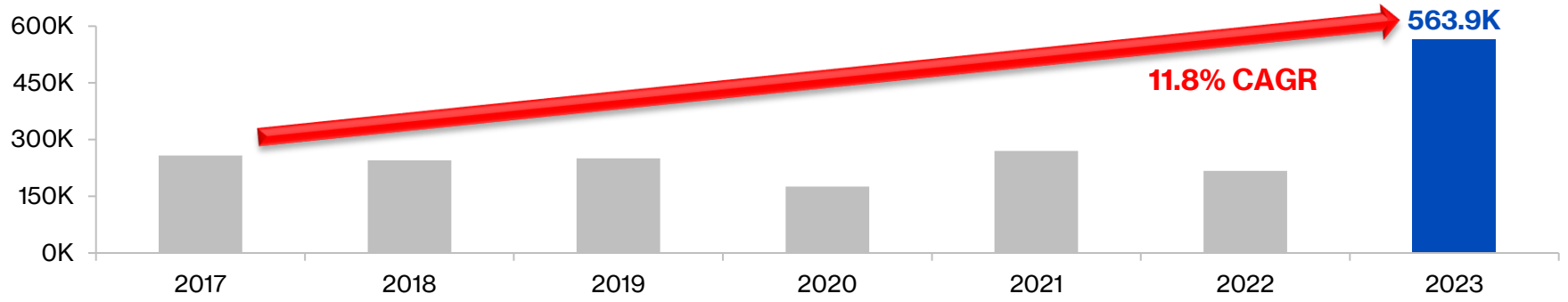
The “Leftovers” From Prior U.S. Energy Policies Undermine Future Economic Prosperity And Geopolitical Stability



The Existing U.S. Grid Will Struggle To Meet Projected Power Demand

Projected new energy demand in North America will double

9Y growth forecast of demand for new electricity in gigawatt hours

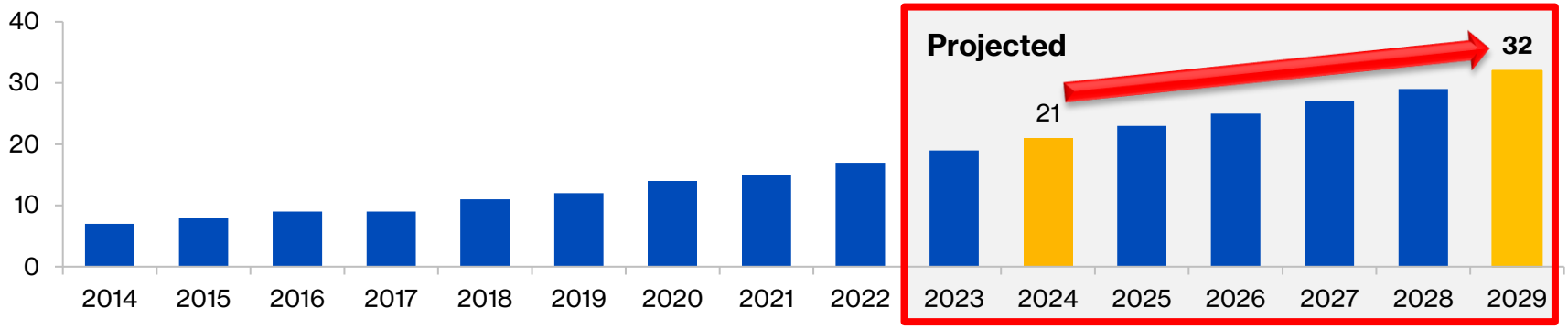


Data covers U.S., Canada and part of Baja California, Mexico

Source: North American Electric Reliability Corp. Long Term Reliability Assessment

U.S. data centers will drastically tax the power grid

Data center energy demand, in ***gigawatts***. Each gigawatt is roughly the amount of power generated by a large nuclear plant



Source: McKinsey and Company, January 2023

How Much Power Is 1GW?

2.469 Million Photovoltaic (PV) Panels

310 Utility-Scale Wind Turbines

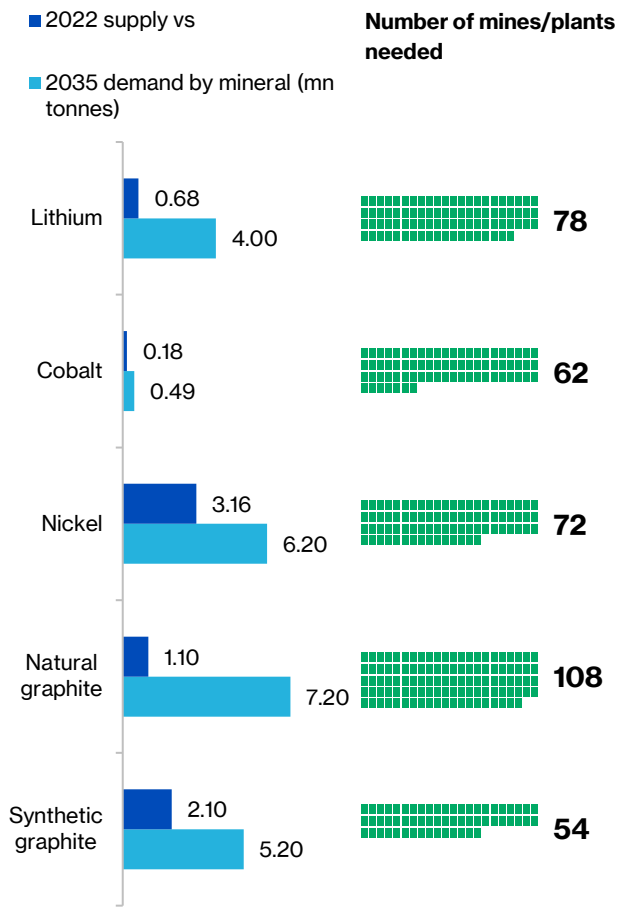
100 Million LED Bulbs

9,090 Nissan Leafs

https://www.energy.gov/eere/articles/how-much-power-1-gigawatt

For The Love Of God – "Renewables" ARE **NOT** GREEN

The critical minerals needed to meet global battery demand by 2035



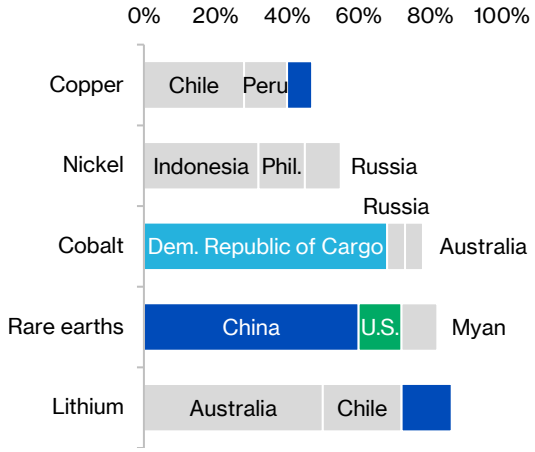
Source: Benchmark Mineral Intelligence

2022 Key Transition Metals Production By Source Country - The Public Tends To Underestimate Concentrations

	Copper	Nickel	Lithium	Cobalt	Graphite
1	Chile	Indonesia	Australia	Congo	China
2	Peru	Philippines	Chile	Indonesia	Mozambique
3	DRC	Russia	China	Russia	Madagascar
4	China	New Caledonia	Argentina	Australia	Brazil
5	USA	Australia	Brazil	Canada	South Korea
Top 5%	58%	76%	98%	84%	95%

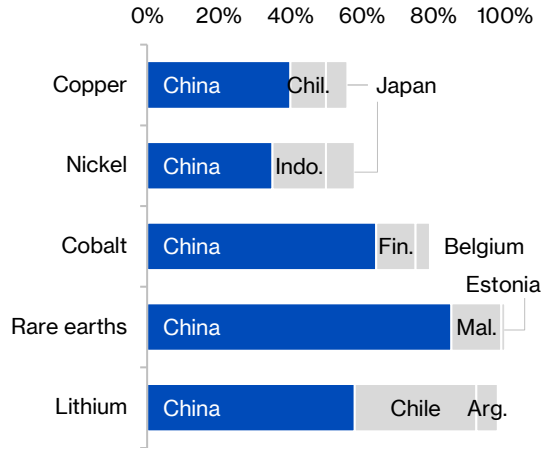
Where Clean Energy Metals Are Produced

Production of key mineral resources is highly concentrated today. Charts show top three producers.



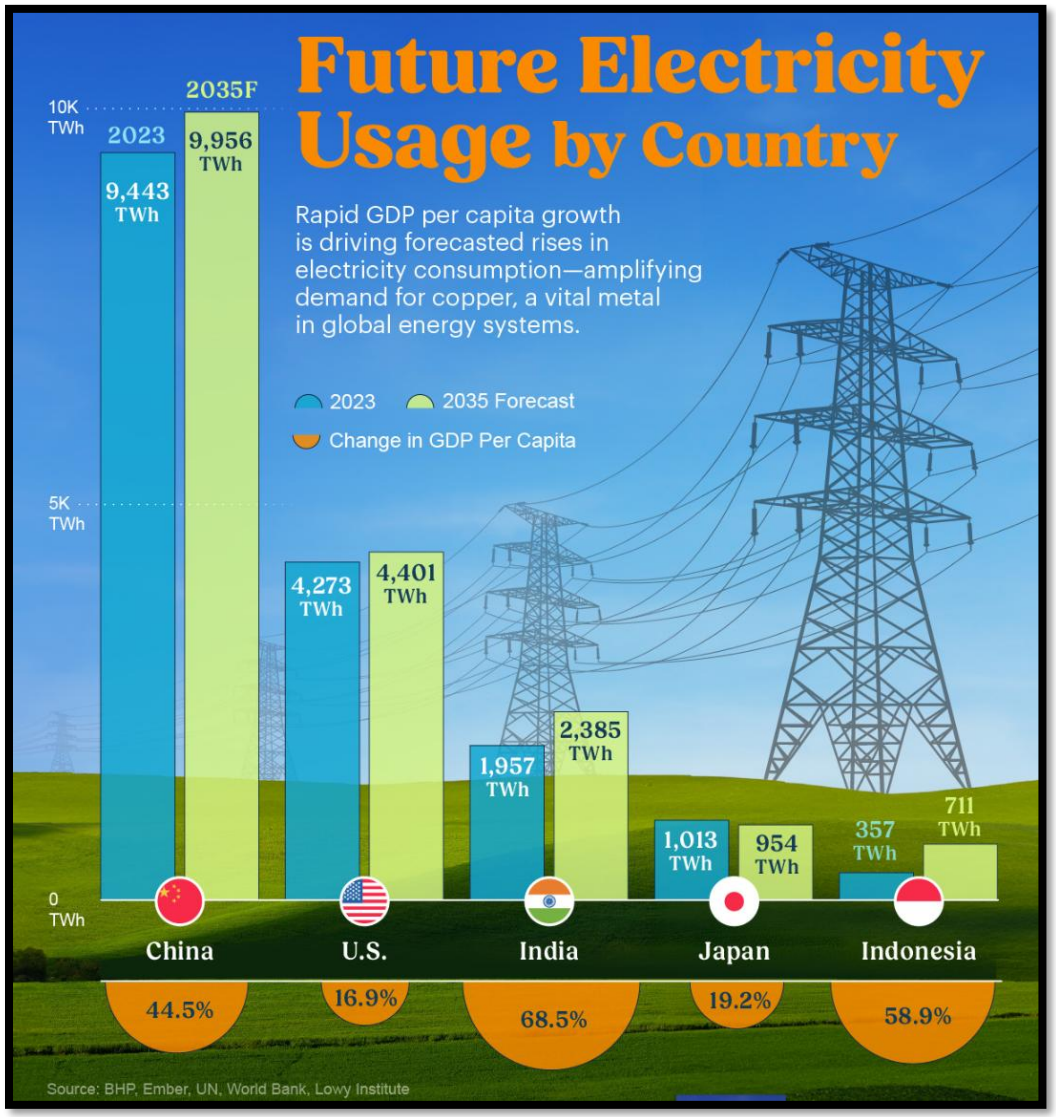
And Where They Are Processed

China dominates the refining and processing of key metals.



Source: International Energy Agency By The New York Times

Forecasted Electricity Demand Presents The Ultimate Copper Conundrum



- **The U.S.** will see demand rise from **4,273 TWh** to **4,401 TWh,** an increase of **128 TWh**, enough to charge more than **2 billion** Tesla Model 3s.
- 1 TWh = 1,000,000,000 kWh
- Copper's unmatched electrical conductivity makes it the metal of choice for virtually **every part of the power system.**
- From high-voltage transmission lines to the wiring in homes and electric vehicles, copper is essential for transporting electricity.
- As countries expand their grids and invest in clean energy, demand for copper is expected to climb sharply.
- Renewable technologies like wind and solar require up to **five times more copper** than traditional power sources
- Electric vehicles use up to **four times more copper** than internal combustion engines.

Today's Mining Base Barely Covers ¾'s Of The Copper Needed By 2030

Critical minerals constraints are a wake-up call on energy security

Markets alone will not ensure secure a reliable supply of key materials needed for high-tech industries, says IEA chief Fatih Birol

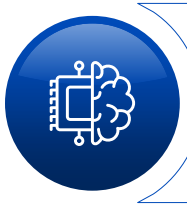
CBRE Underscores The Market's Struggle To Secure **RELIABLE** Energy

Supply in primary markets **increased by 491.5 MW (12%)** in H1 2023 compared to H2 2022 and 738.2 MW (19.2%) year-over-year.

A lack of readily available power and extended lead times for critical pieces of electrical infrastructure is delaying construction timelines.

Most major markets are grappling with **severe power constraints**

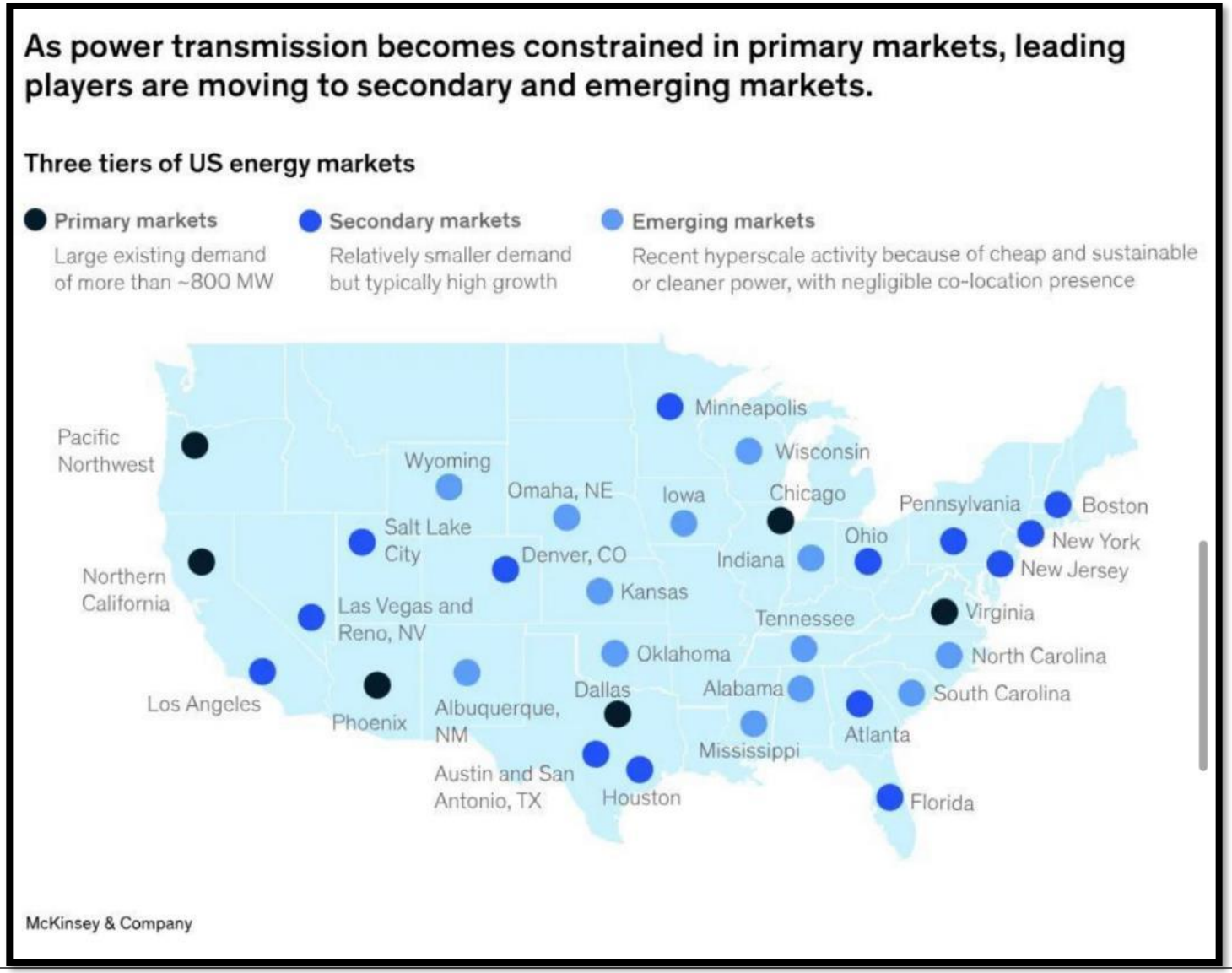
Power availability and capacity **will remain top issues** for developers and operators in 2023.



U.S. data center operators will have **the significant challenge of decreasing** Scope 1, 2, and 3 emissions for carbon reduction mandates while overcoming supply chain delays and power shortages.

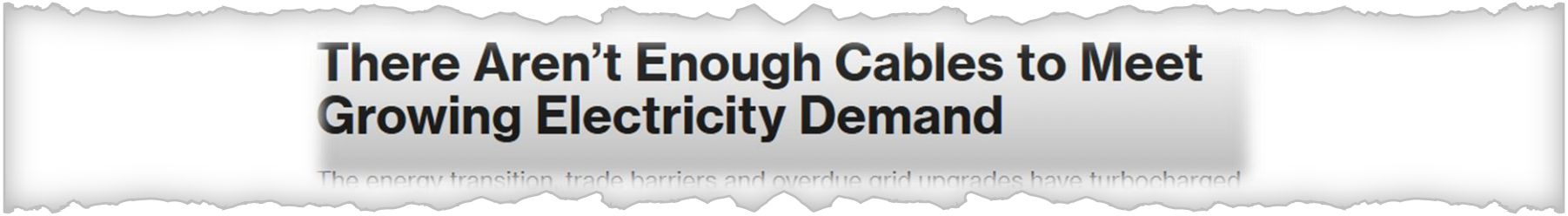
https://www.cbre.com/insights/reports/north-america-data-center-trends-h1-2023

Hyperscalers Will Deeply Strain Power Access In **ALL** U.S. Markets



A 10% to 15% Increase In Delivered Electricity By 2030 Is ~400–600 TWh Higher Than 2023 Levels

Why The Existing Grid Can't Simply Absorb That Growth



Transmission Bottlenecks	▪ DOE's *National Transmission Needs Study* finds "**today's grid cannot adequately support** 21st-century challenges," with *significant within-region additions needed as soon as 2030* in the Plains, Midwest, and Texas
Resource Retirements	▪ NERC's 2024 *Long-Term Reliability Assessment* flags **79 GW of confirmed coal & nuclear retirements** and >115 GW potential retirements this decade, while peak demand keeps rising. Over half the continent is already at *elevated or high risk* of shortfalls
Interconnection Backlog	▪ Active queue requests topped **2,600 GW** at end-2023 – *double* the entire U.S. operating fleet – because projects wait 4–8 years for a hookup

Pickering Energy Partners

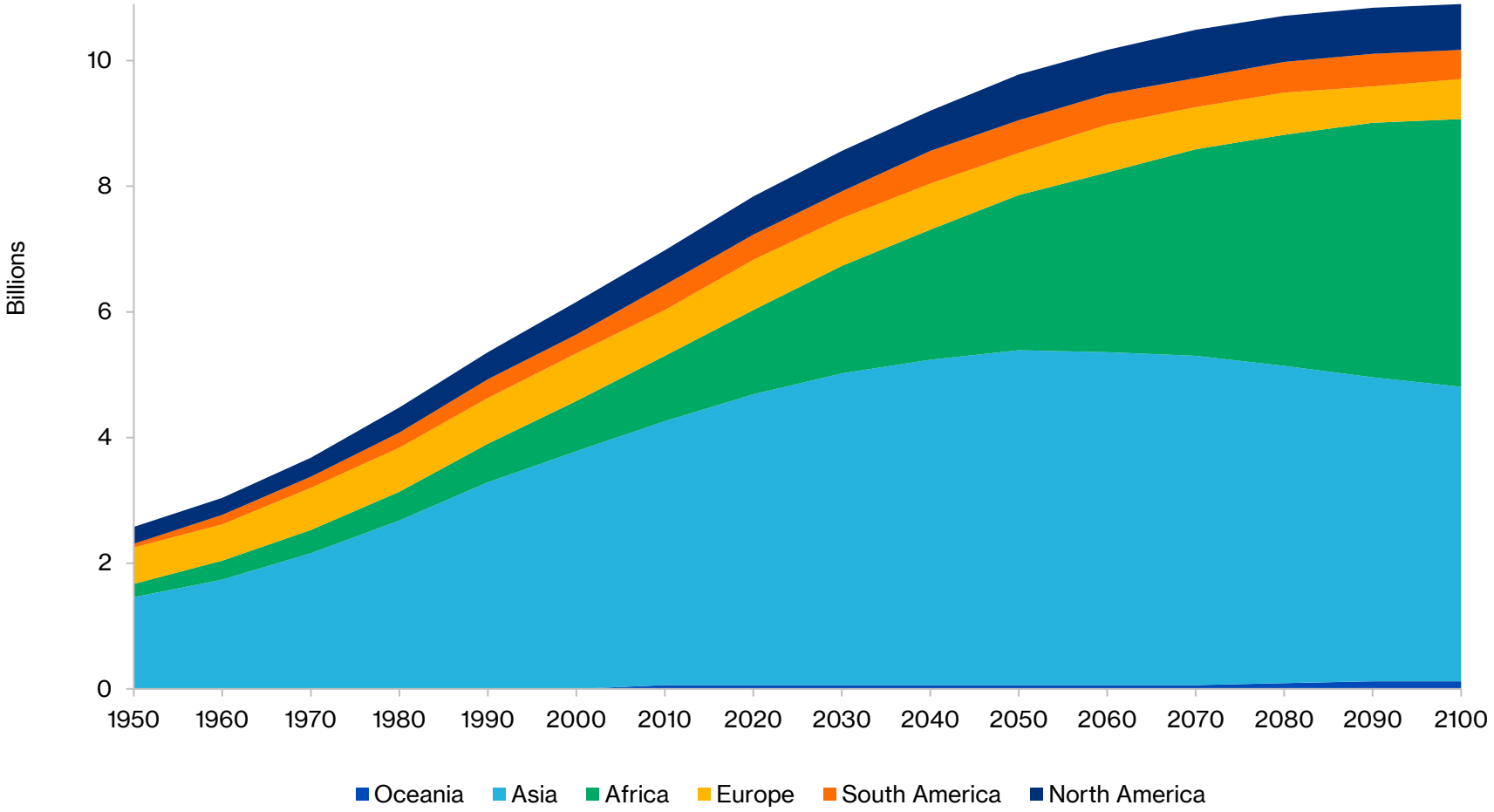
https://www.energy.gov/gdo/national-transmission-needs-study
https://www.nerc.com/pa/RAPA/ra/Reliability%20Assessments%20DL/NERC_Long%20Term%20Reliability%20Assessment_2024.pdf
https://emp.lbl.gov/news/grid-connection-barriers-new-build-power-plants-united-states

Electricity Efficiency Impacts Economic Expansion, Which Will Impact The Balance Of Global Power For The Next Century

Population Growth Fronted By Countries Experiencing Energy Poverty

World population by region

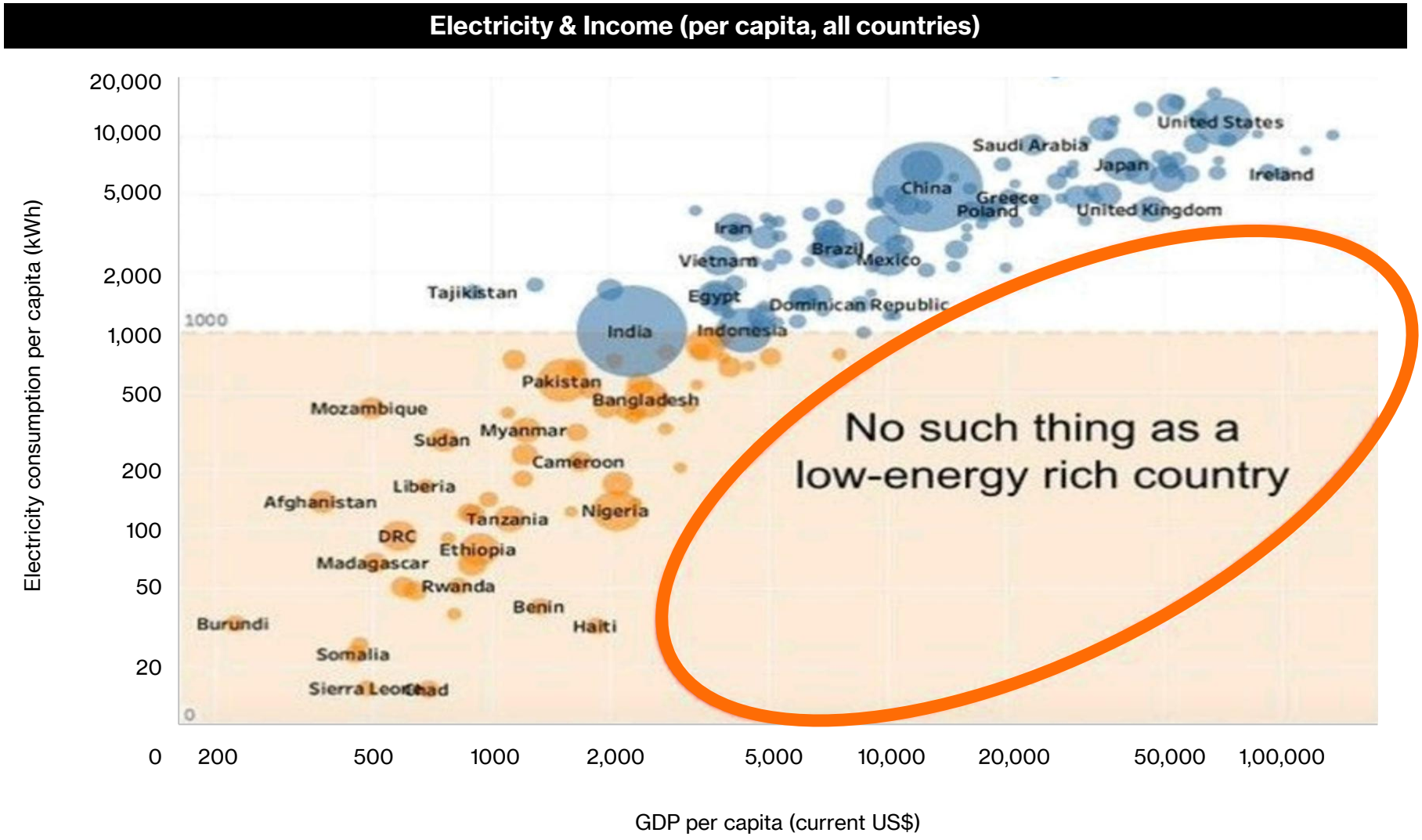
Projected population to 2100 is based on the UN's medium population scenario.



Pickering Energy Partners

Source: Gapminder (v6,) HYDE (v3.2), UN (2019)
https://ourworldindata.org/future-population-growth

GDP per Capita Is Directly Correlated To Electricity Consumption



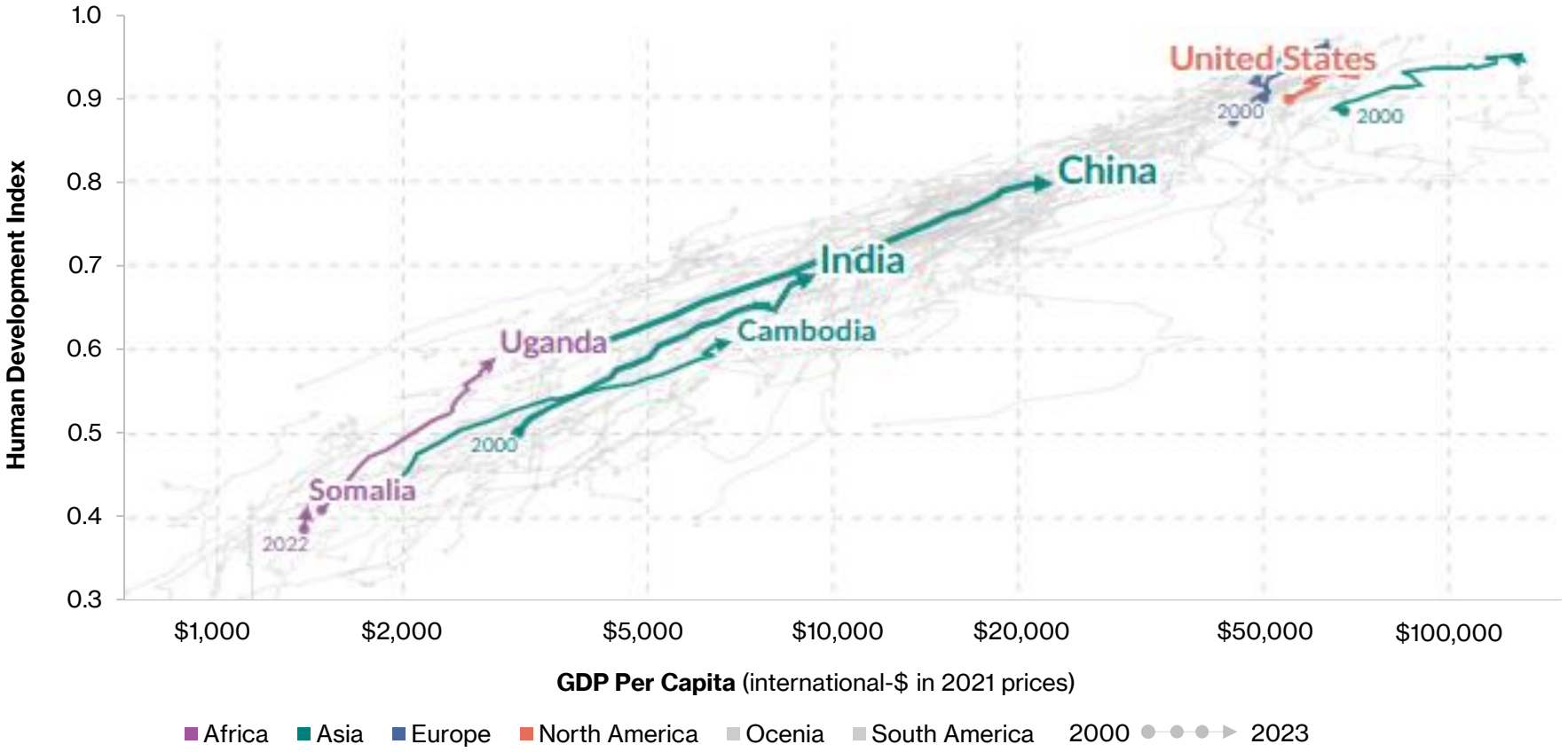
Pickering Energy Partners

Source: IEA, World Bank
https://ourworldindata.org/grapher/energy-use-per-capita-vs-gdp-per-capita

There Is Still A Long Way To Go In Catching Up With The United States

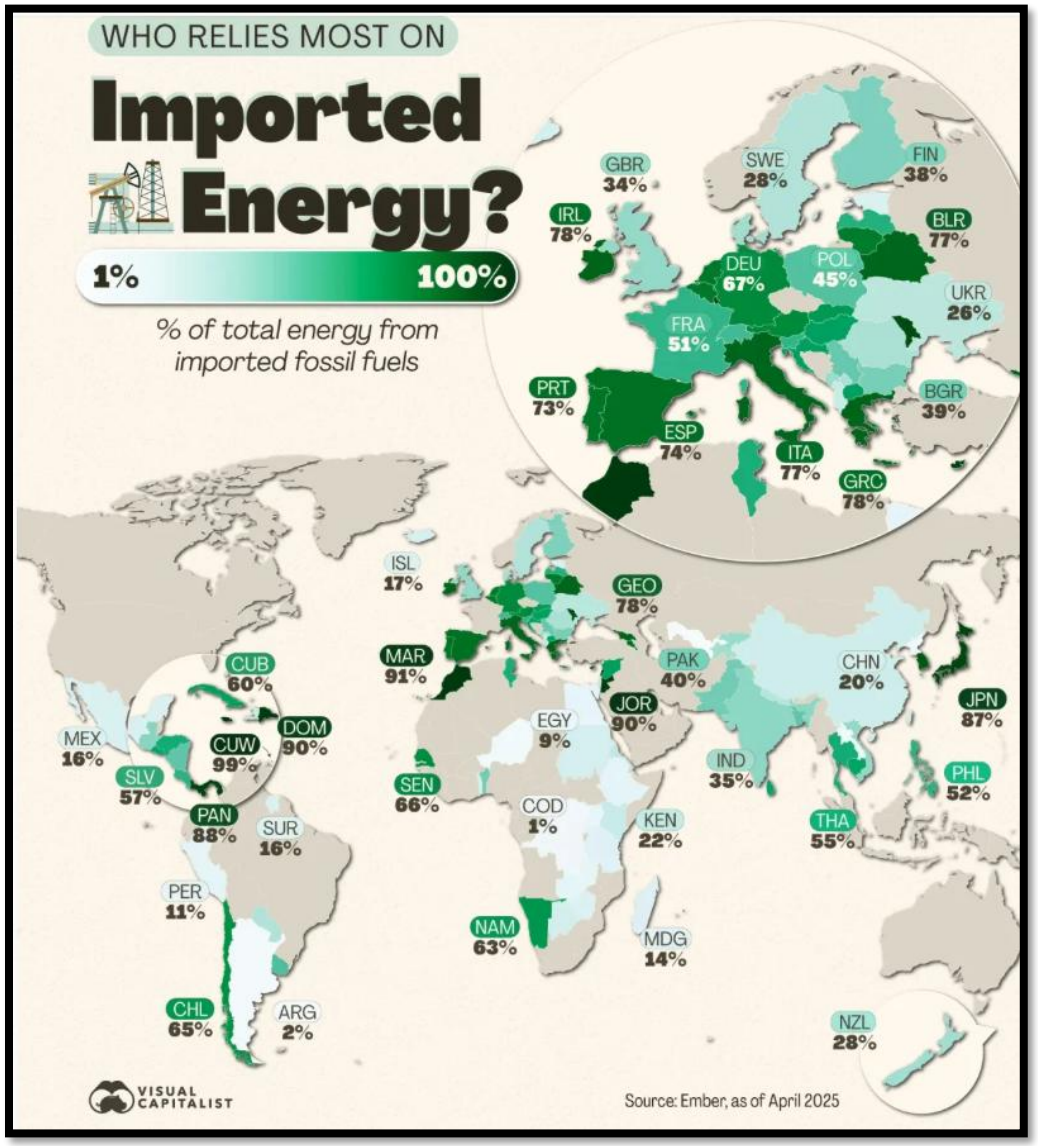
Human Development Index vs. GDP per capita, 2000 to 2023

The Human Development Index (HDI) is a summary measure of key dimensions of human development: a long and healthy life, a good education, and a decent standard of living. GDP per capita is adjusted for inflation and differences in living costs between countries.



Data source: UNDP, Human Development Report (2025); Data compiled from multiple sources by World Bank (2025) – Learn more about this data
Note: GDP per capita is expressed in international-$ at 2021 prices.
OurWorldinData.org/human-development-index | CC BY
Max Roser, Bertha Rohenkohl, Pablo Arriagada, Joe Hasell, Hannah Ritchie, and Esteban Ortiz-Ospina (2023) - "Economic Growth" Published online at OurWorldinData.org. Retrieved from: 'https://ourworldindata.org/economic-growth' [Online Resource]

The World's Economy Also Continues To Depend On Fossil Fuels

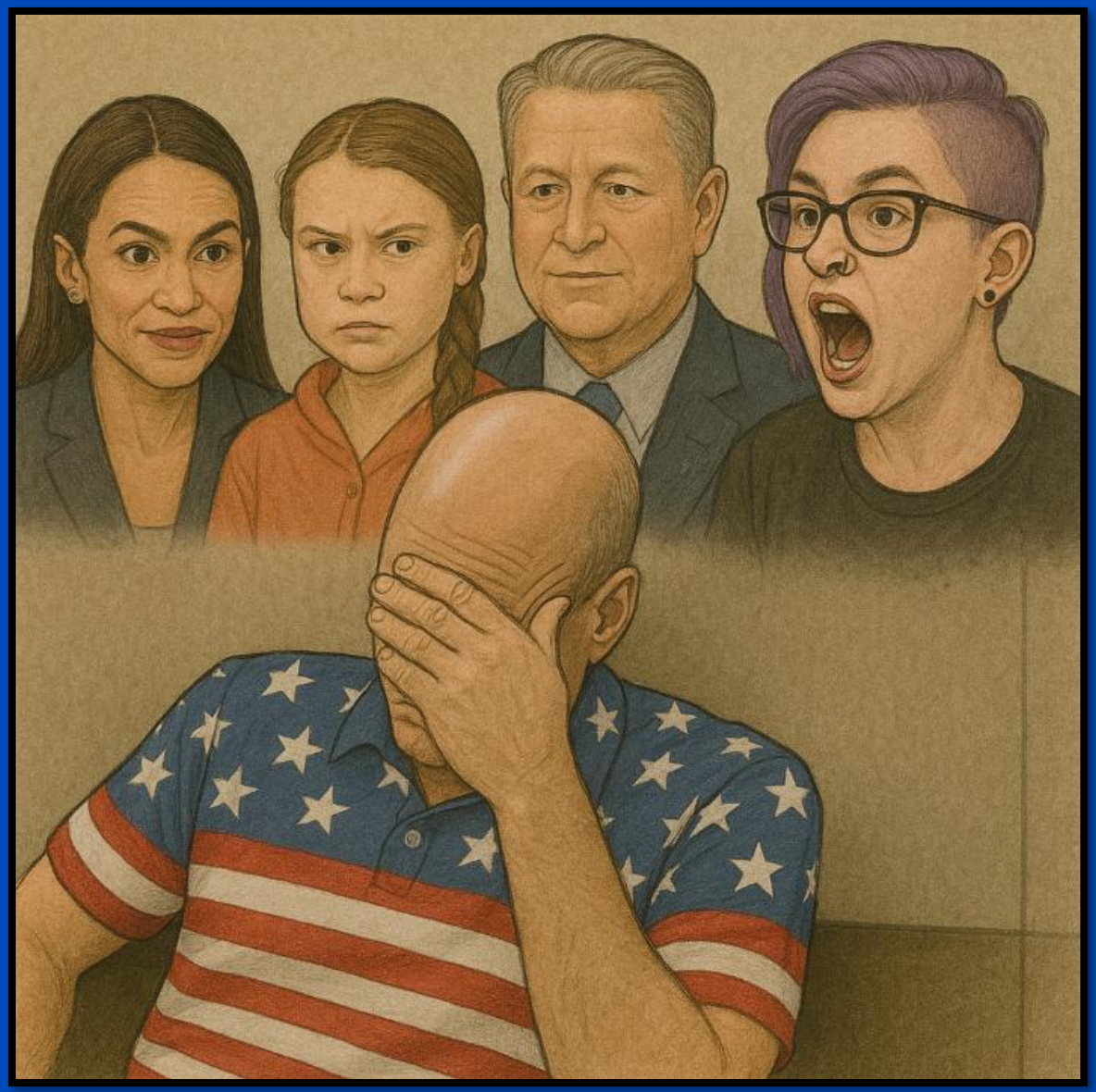


- *Three-quarters of the world's population* live in countries that are **net importers** of fossil fuels
- Imports meet over **2/3's of energy needs** in countries accounting for 20% of global GDP
- The U.S. accounts for ~17% of the *global* natural gas exports in 2023, which totaled ~1,228 bcm
- In 2023, the U.S. exported a record 20.9 Bcf/d of natural gas, marking **a 10% increase** from 2022
- Of that total, 11.9 Bcf/d were LNG exports, solidifying the U.S.'s position **as the top LNG exporter** globally

Pickering Energy Partners

3 in 4 People Worldwide Rely on Imported Fossil Fuels – Voronoi
The United States remained the world's largest liquefied natural gas exporter in 2024

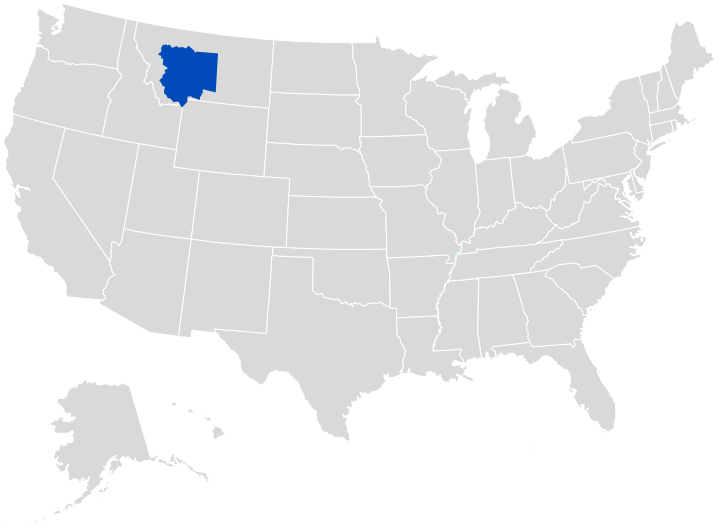
Why Do Western Economies Display Such A Disproportionate Fixation On Emissions?

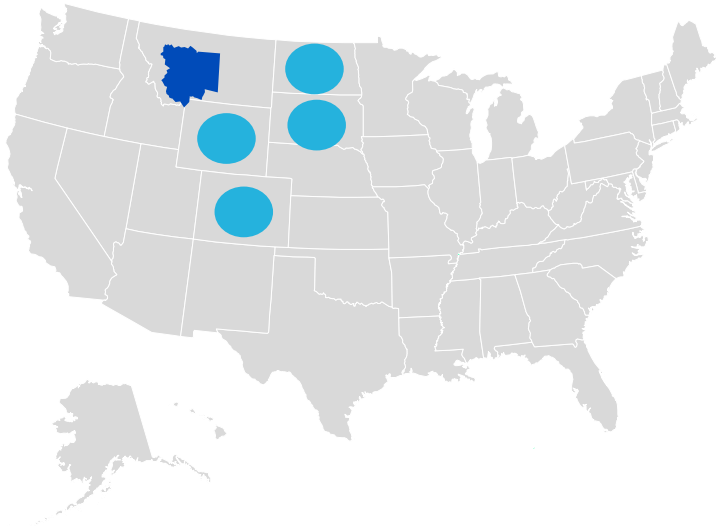


We Would Need ~40 Yellowstones To Meet **Wind** Electricity Generation

- **Solar farms** typically require around ***3 acres per GWh*** *per year*.
- **Wind farms** need more space, averaging ***26 acres per GWh*** *per year*.
- **Nuclear power plants** have the smallest footprint, *requiring about 0.06 acres per GWh per year*.
- **Natural gas plants** also have a compact footprint, though exact figures vary based on plant type and fuel extraction methods.

	Acres/GWh	Required GWh	Acres Required	# Yellowstone Parks
Solar	3.0	3,360,000	10,080,000	4.6
Wind	26.0	3,360,000	87,360,000	39.7
Nuclear	0.06	3,360,000	201,600	0.1

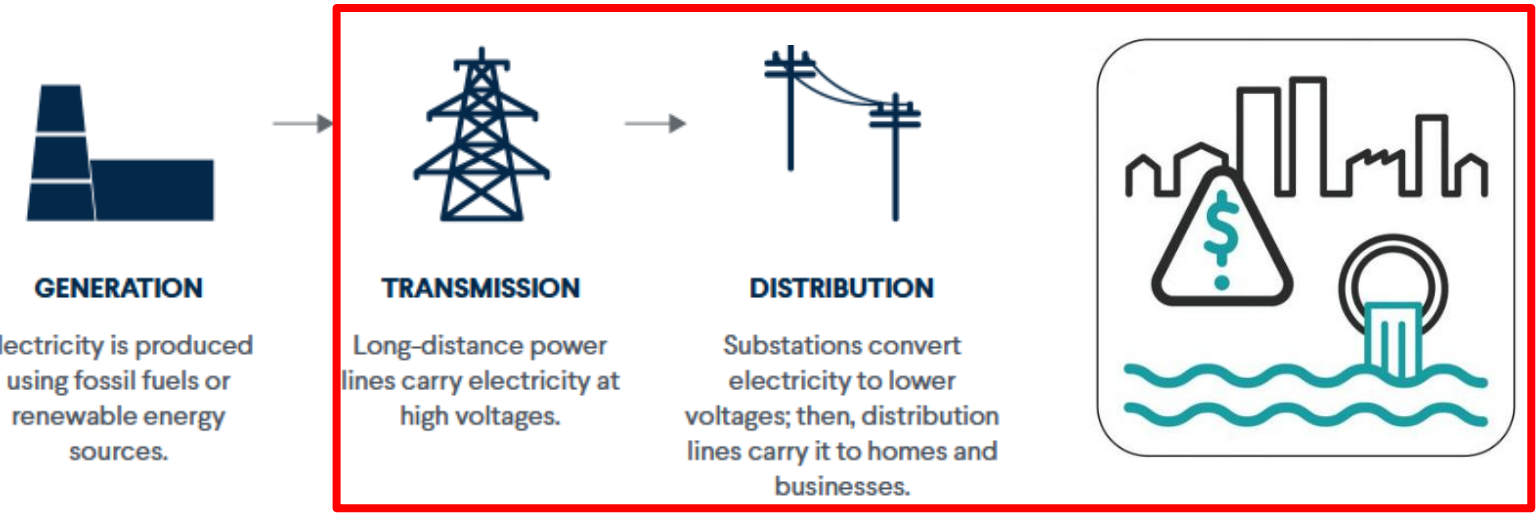




Pickering Energy Partners

https://www.freeingenergy.com/land-usage-comparison-solar-wind-hydro-coal-nuclear/

The State Of U.S. Infrastructure Highlights A Crippling Vulnerability



- U.S. infrastructure is overstretched and **drastically lags China**
- The American Society of Civil Engineers (ASCE) estimates that there is an **"infrastructure investment gap"** of nearly $2.6 trillion that will cost the United States **$10 trillion in lost GDP** by 2039 if left unaddressed
- The EPA estimates that drinking water and wastewater systems **will require at least $744 billion** in additional investment over the next decade
- Ports and waterways, which are critical links in the country's freight transport network, **face mounting delays**
- The operators of the U.S. electrical grid are **struggling to make the necessary investments**, and increasing power outages are costing the economy billions of dollars

https://www.cfr.org/backgrounder/how-does-us-power-grid-work
https://www.cfr.org/backgrounder/how-us-water-infrastructure-works

Cyber-Attacks On The U.S. Grid Will Only Intensify

US electric grid growing more vulnerable to cyberattacks, regulator says

By **Laila Kearney**

April 4, 2024 4:48 PM CDT · Updated a year ago

Aa

Chinese 'kill switches' found in equipment at US solar firms trigger national security fears. What are they?

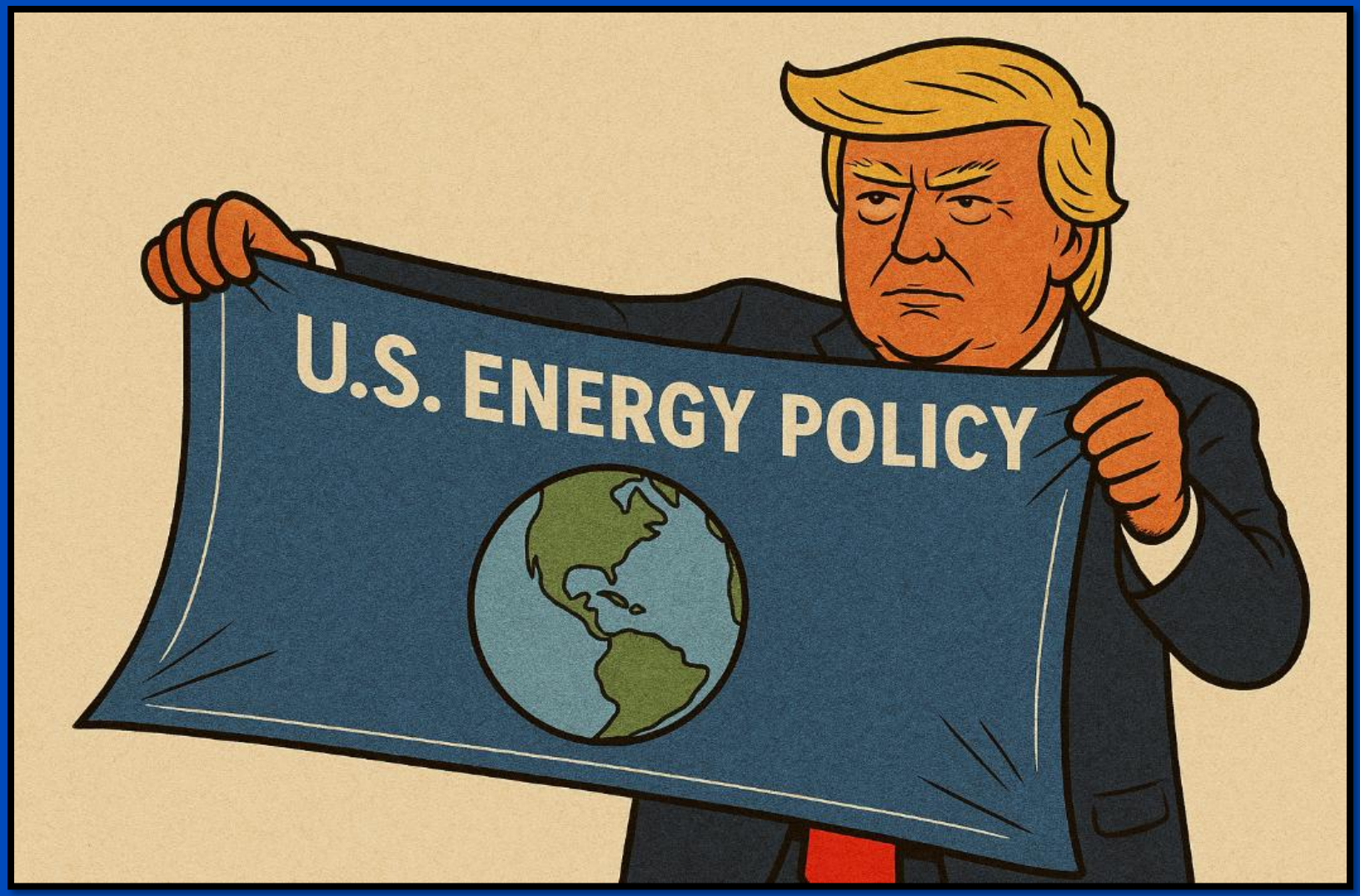
Colonial Hackers Stole Data Thursday Ahead of Shutdown

- Attackers stole nearly 100GB of data in two hours on Thursday
- Theft followed by locking of computers and ransom demand

https://www.logicmanager.com/resources/news/colonial-pipeline-hack/

https://www.otorio.com/blog/colonial-pipeline-ransomware-part-of-a-growing-trend-of-industrial-cyber-attacks/

The GLOBAL Economy Requires A U.S. Energy Expansion, Not A Transition



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Geopolitical Dynamics Will Be Recalibrated Over The Next Decade

China Should Remain The Primary Concern Of The United States

Israel's Retaliation Against Iran Didn't Shake Up The Market

- Spot reaction ***post*** Israel retaliation against Iran:
  - Brent crude = $74 to $76
  - Henry hub = $3.50 to $3.60
- Most industry analysts assign a temporary $5 "war premium" collar to Brent
- "Peace Through Strength" stabilizes the energy markets
- Very unlikely that other adversaries back Iran's losing cause
- Unless there is a material disruption to the Strait of Hormuz or Gulf LNG lanes, we shouldn't see massive price swings

The Oil And Gas Industry Must Retake The Investment Narrative

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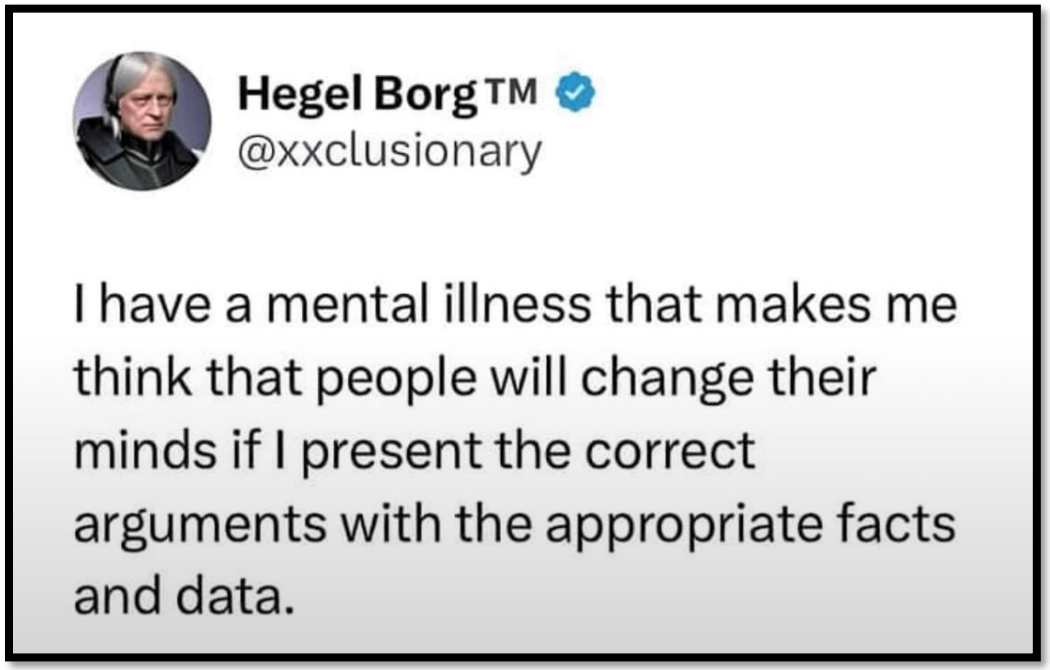
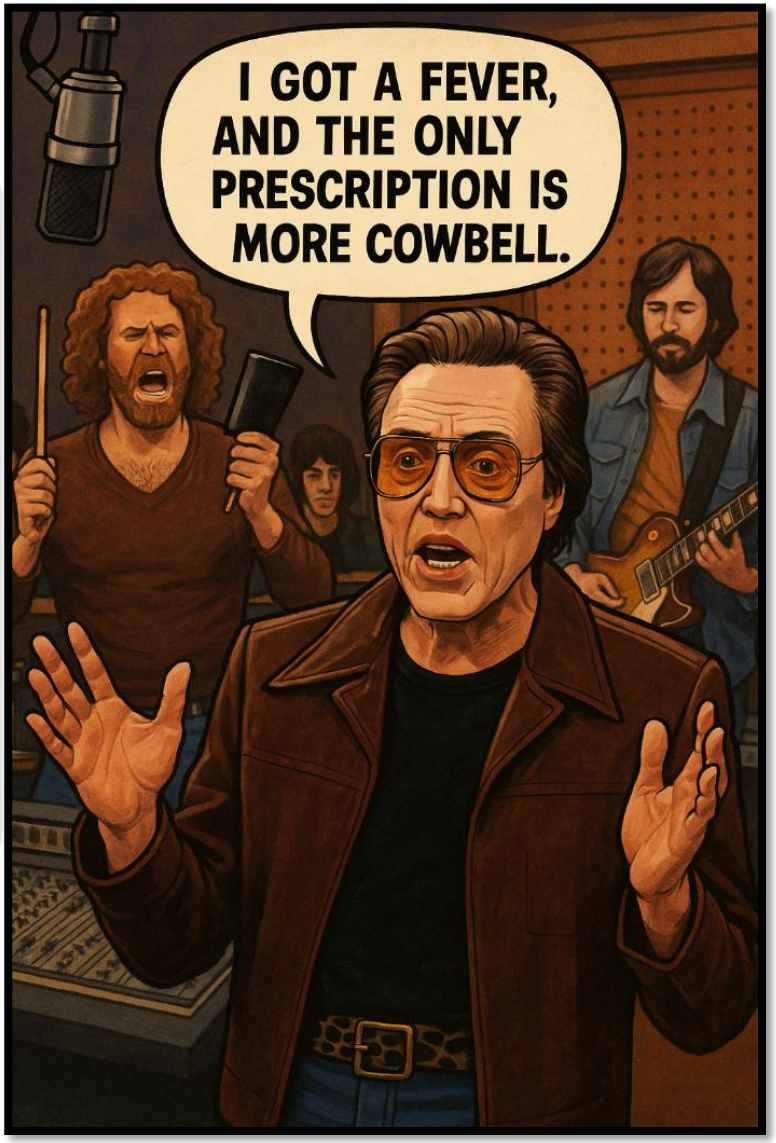
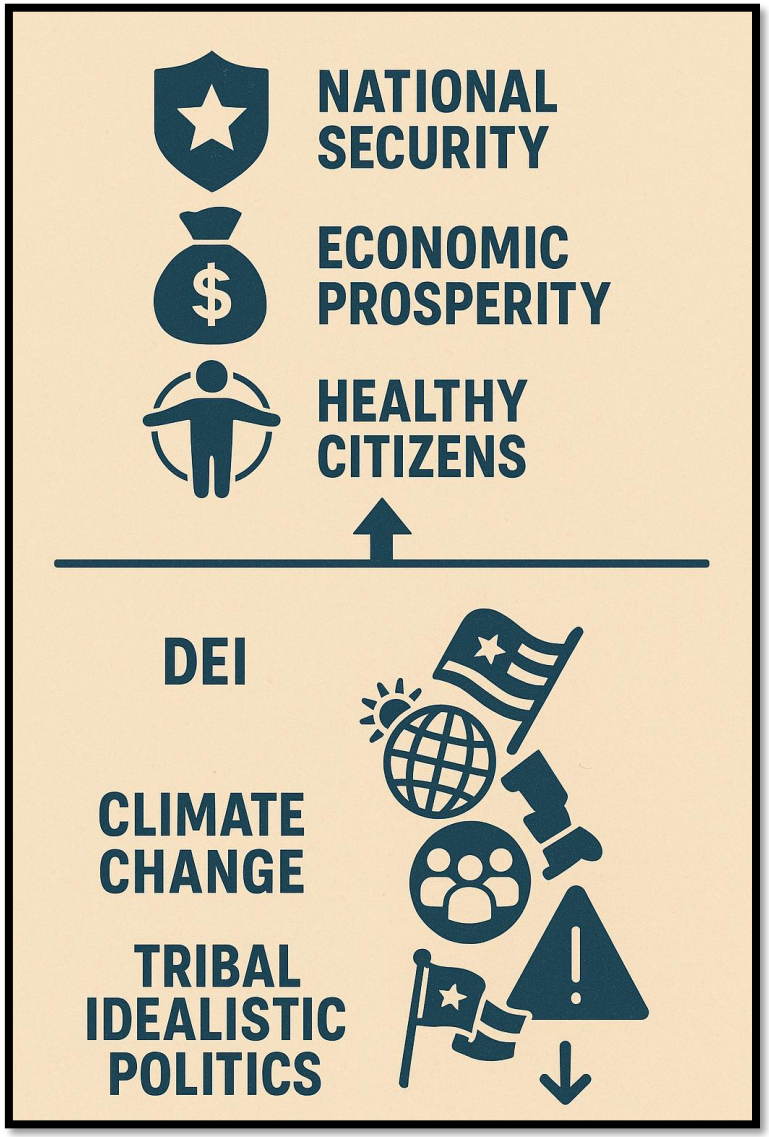
The Battle For The Pragmatic Middle Requires Objective Data

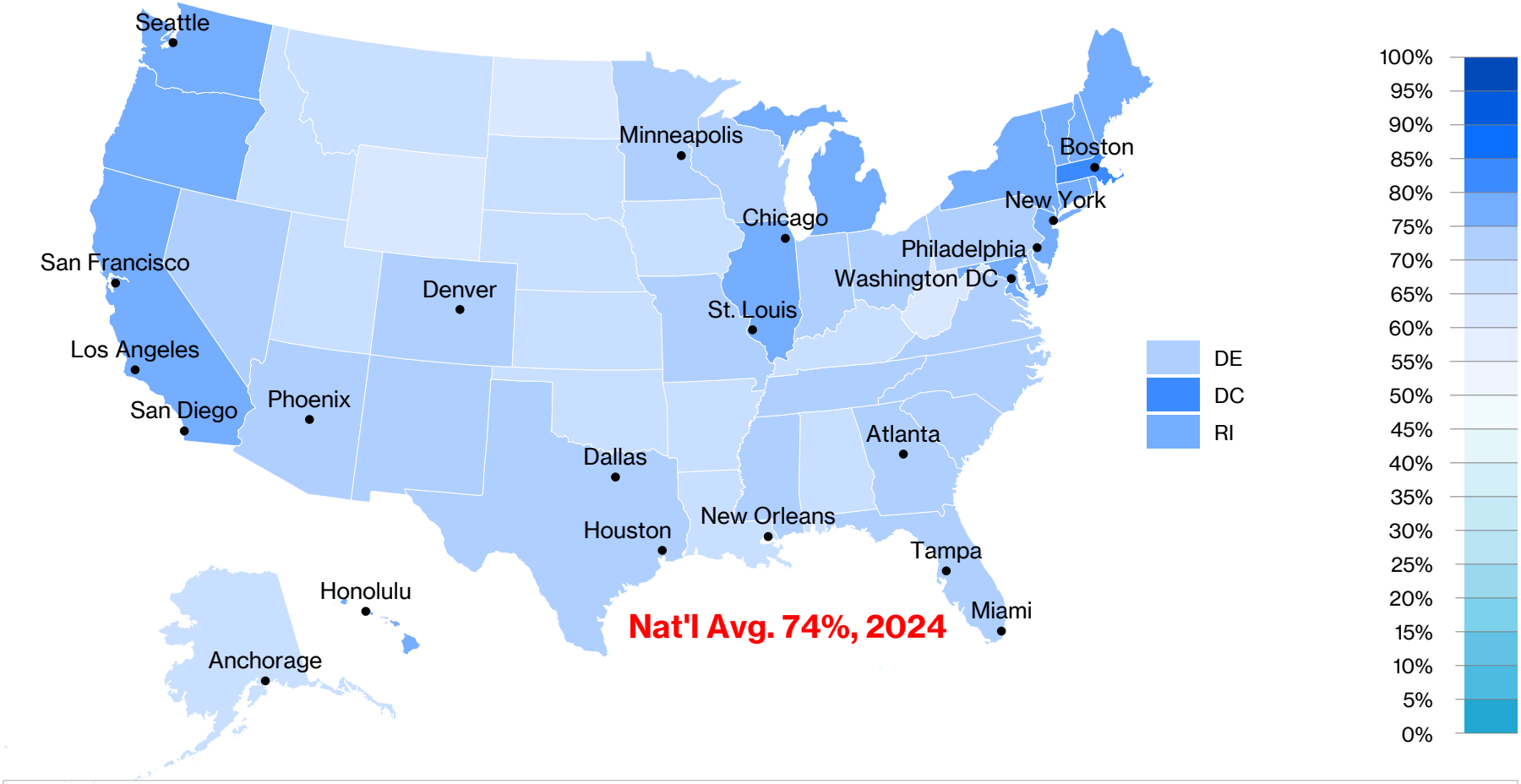




The Left Is Ideologically Anchored To A Few Concentrated Ideas They Want Imposed On Everyone, Regardless Of Facts



"Estimated % of **Adults** Who ***Somewhat or Strongly Support*** Regulating Carbon Dioxide As A Pollutant"



UCSB UNIVERSITY OF CALIFORNIA SANTA BARBARA

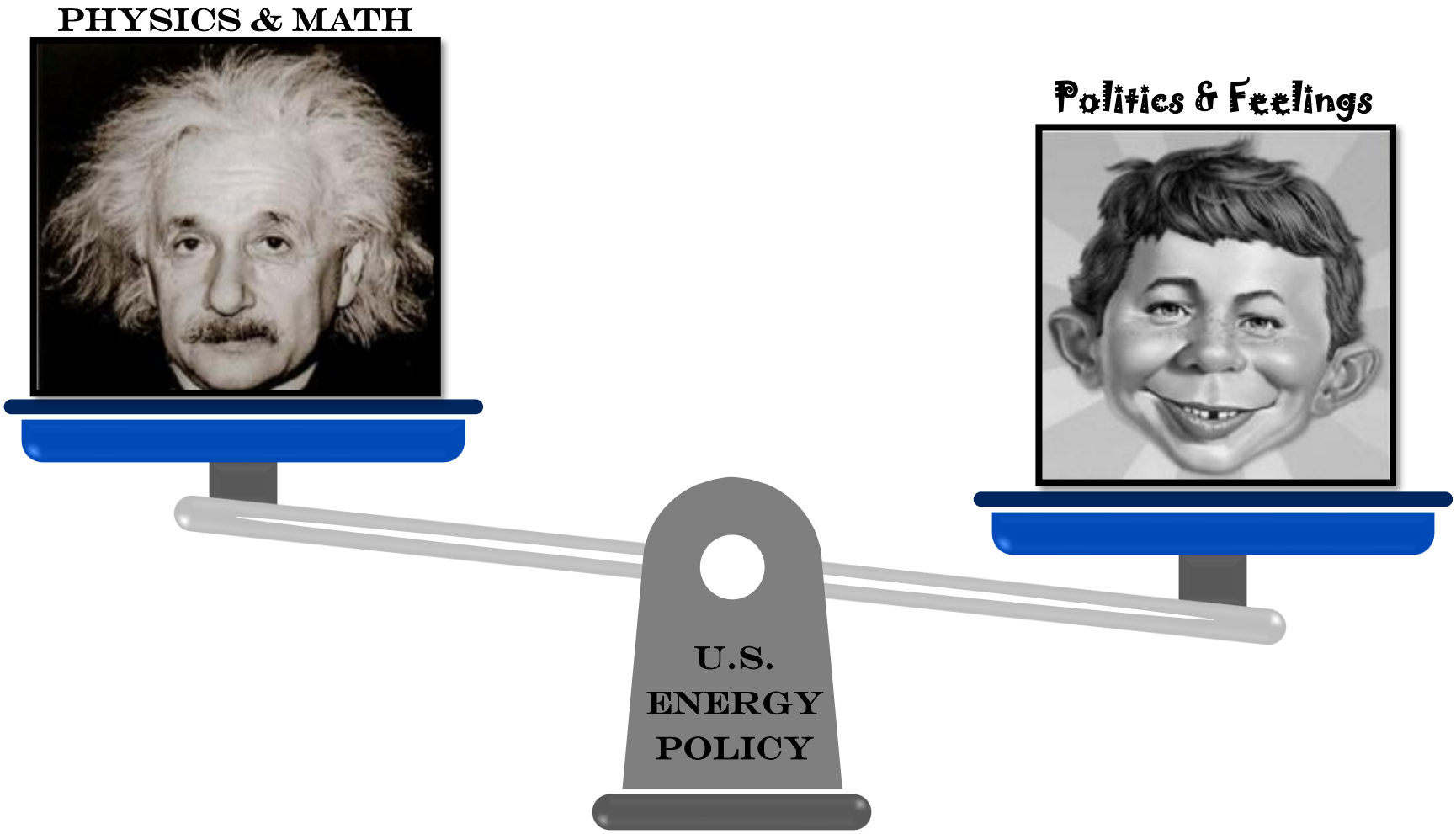
YALE PROGRAM ON Climate Change Communication

UtahState University

Pickering Energy Partners

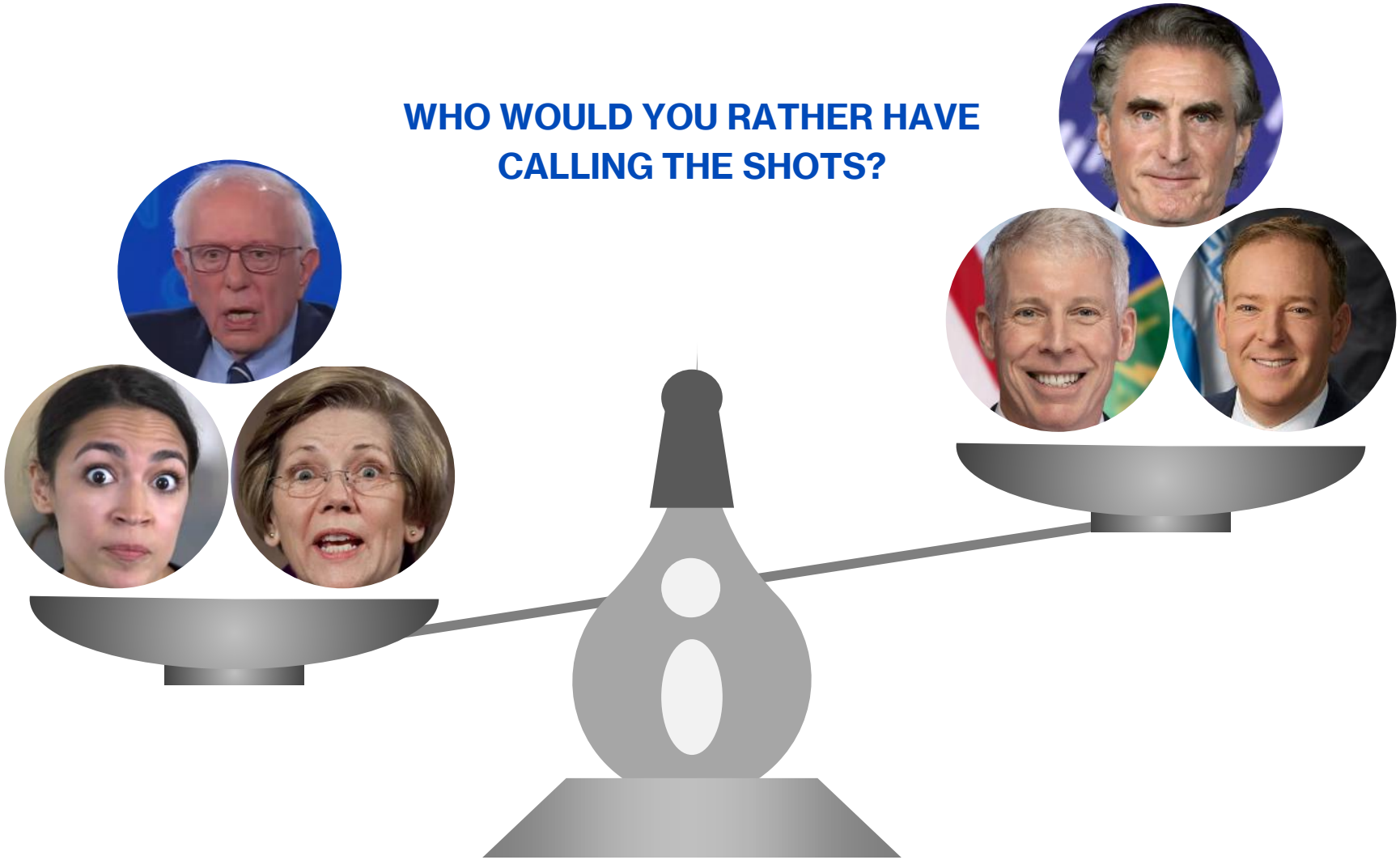
https://climatecommunication.yale.edu/visualizations-data/ycom-us/

Energy Policy Must Remain Solely Focused On Physics & Economics



The Industry Must Utilize Deregulation To **ENHANCE** Best Practices

WHO WOULD YOU RATHER HAVE CALLING THE SHOTS?



Mapping The Pragmatic Path Forward

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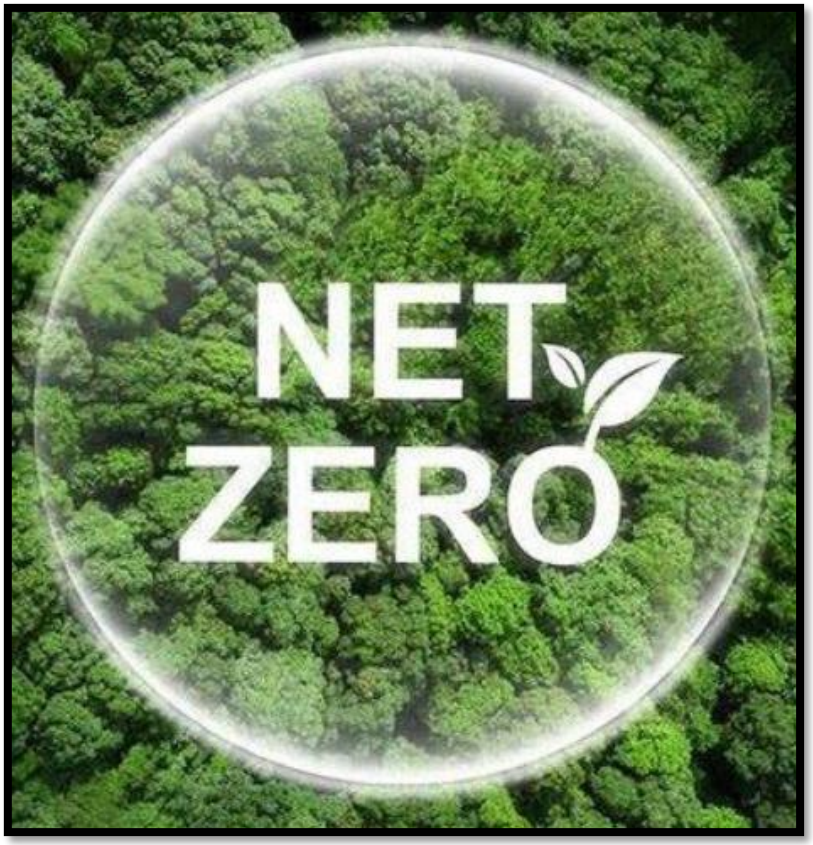
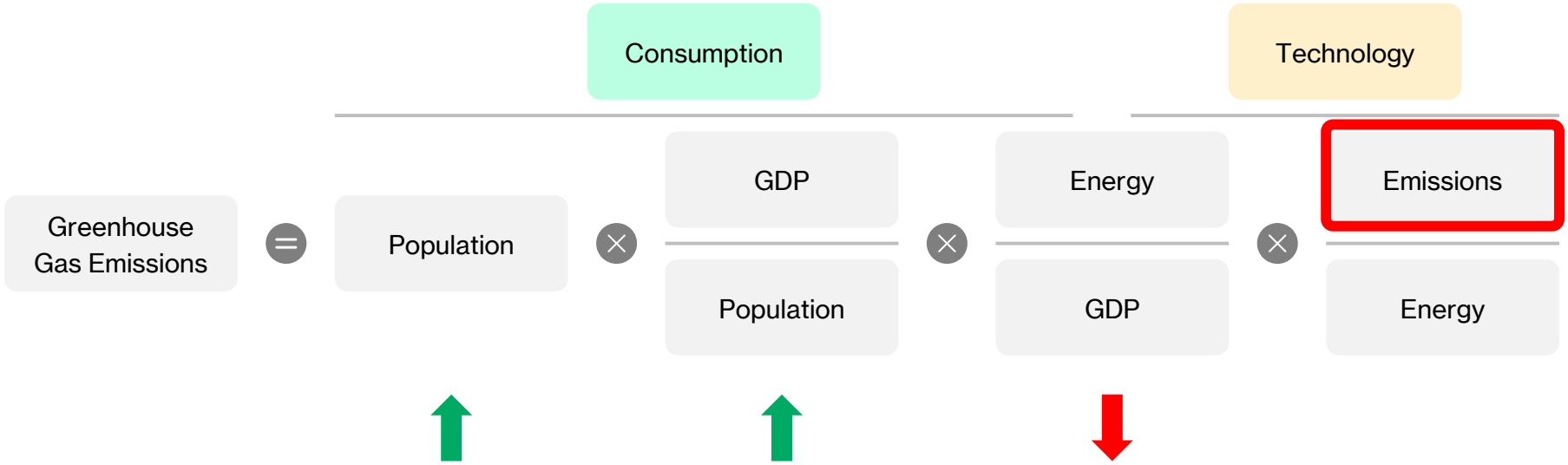


"ONE OF THE GREAT MISTAKES IS TO JUDGE POLICIES AND PROGRAMS BY THEIR INTENTIONS RATHER THAN THEIR RESULTS"

– MILTON FRIEDMAN

The Industry Must Continue To Tell A Better (Quantitative) Story

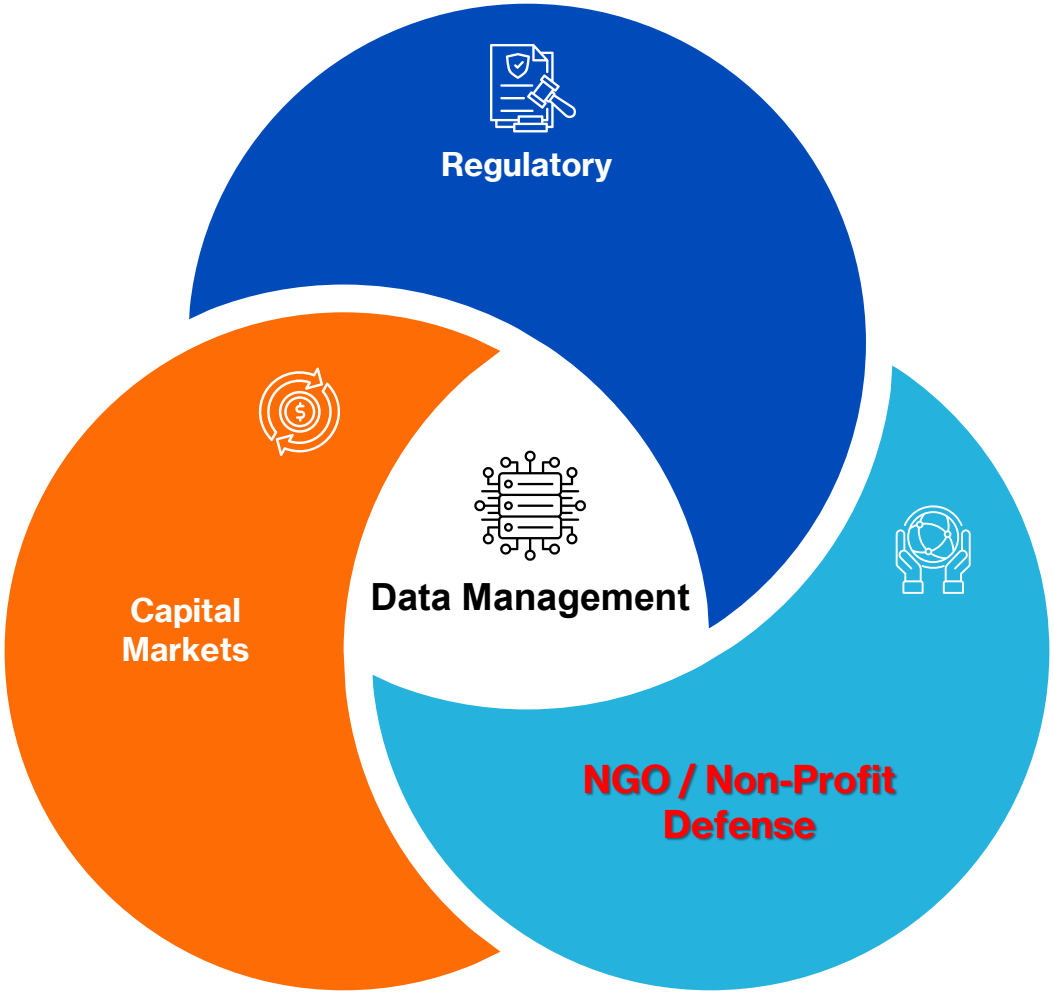
Using Basic Math Can Help Ensure Consistency In Managing Emissions



- The global population is projected to ***increase*** by 1.6 billion between 2025 and 2050
- Global GDP per capita is ***projected to double*** between 2025 and 2050
- Energy intensity is projected to ***decline by ~40%*** by 2050
- Carbon intensity is reliant on ***five inputs***:
  - Natural gas
  - Nuclear
  - Coal
  - Wind, Solar & Hydro, i.e., “Renewables”
  - Biomass

IEA Net Zero by 2050, ***IPCC SSP2 "Middle of the Road"***, *and* ***EIA International Energy Outlook***
https://climatemodels.uchicago.edu/kaya/kaya.doc.html

Showcasing The Prowess Of US Energy Requires Improved Data Quality & Proactive Reporting That Aligns With Economic Reality



U.S. Energy Is The Cleanest, Safest, And Most Efficient On The Planet!

Questions & Discussion