

# Climate Change 2025: Challenge and Opportunity

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Photos: EnergyAsia.org, Earth.org, NY Times, energy-storage.news

# Today's talk...

- The **BAD** news (some climate science)
- The **GOOD** news (solutions are known, available and getting cheaper fast)
- BUT... we're not moving fast enough
- What can we each do to help?

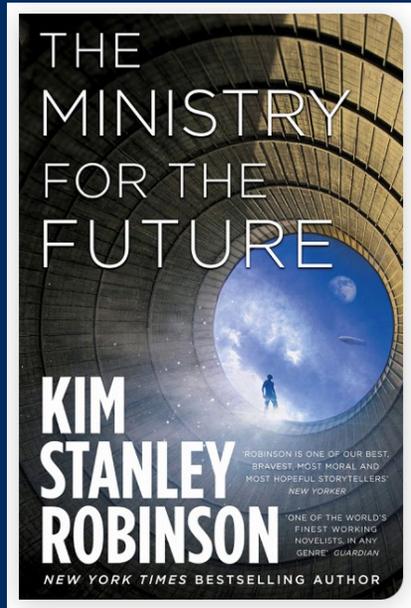
# The Bad News...

“the planet is now in a  
meltdown phase –  
literally and figuratively”

Jonathan Overpeck - *Washington Post*, March 20, 2024

The 2025 Northern Hemisphere heatwave season has begun...

Anyone read this book?



World / Asia

# Extended heatwave in India, Pakistan to test survivability limits, with temperatures reaching Death Valley levels

By [Sophia Saifi](#), [Rhea Mogul](#) and [Aishwarya S. Iyer](#), CNN  
4 minute read · Updated 3:51 AM EDT, Tue April 15, 2025

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**April 15, 2025**

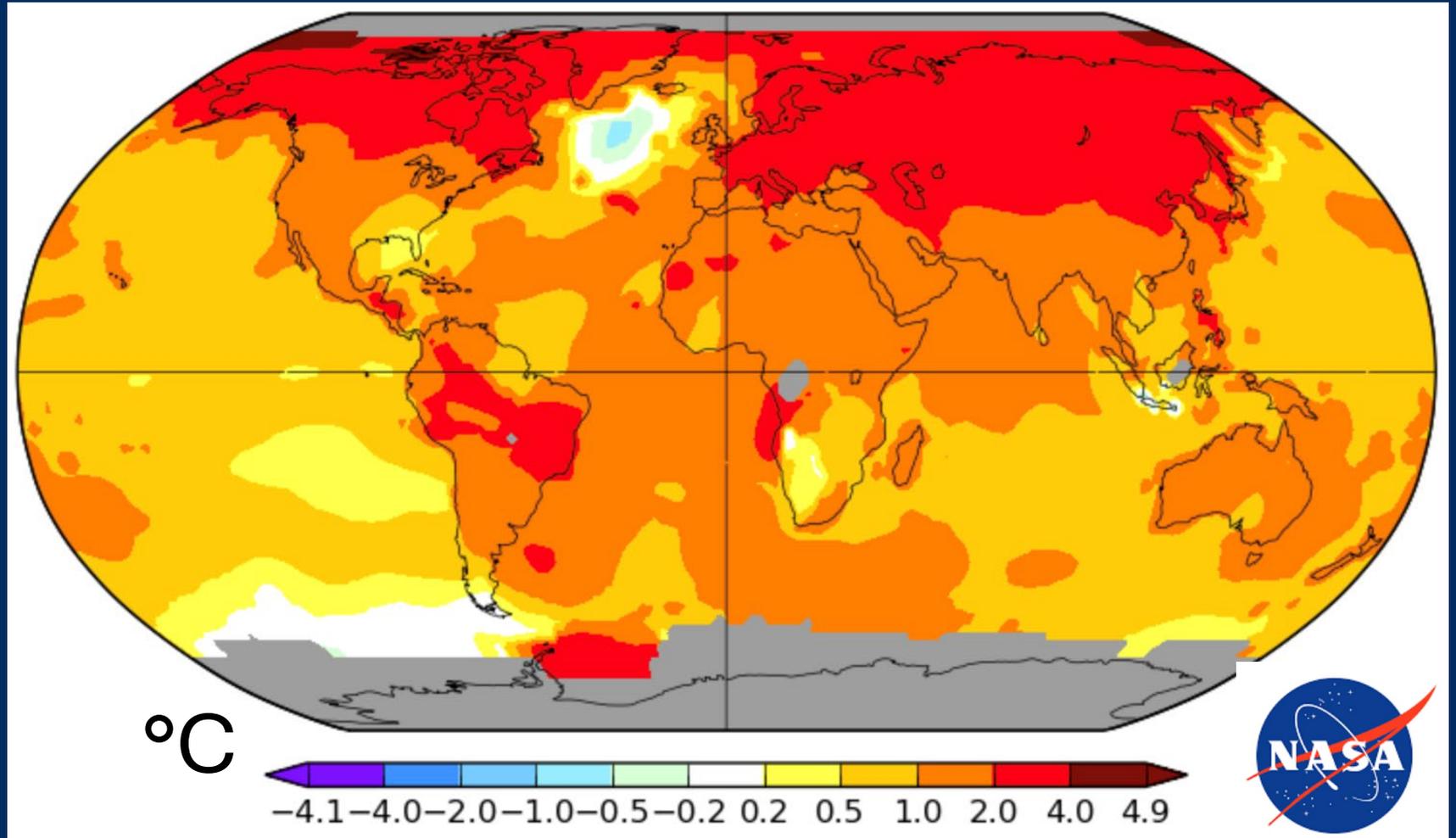


# *The globe is warming almost everywhere\**

## Mean Annual Temperature Trend 1880-2024

**2023** Global  
Temperature  
**Smashed** Previous  
Records

**2024** was warmer  
& the first year  
where the globe  
was more than  
1.5°C above pre-  
industrial – **an  
ominous first**



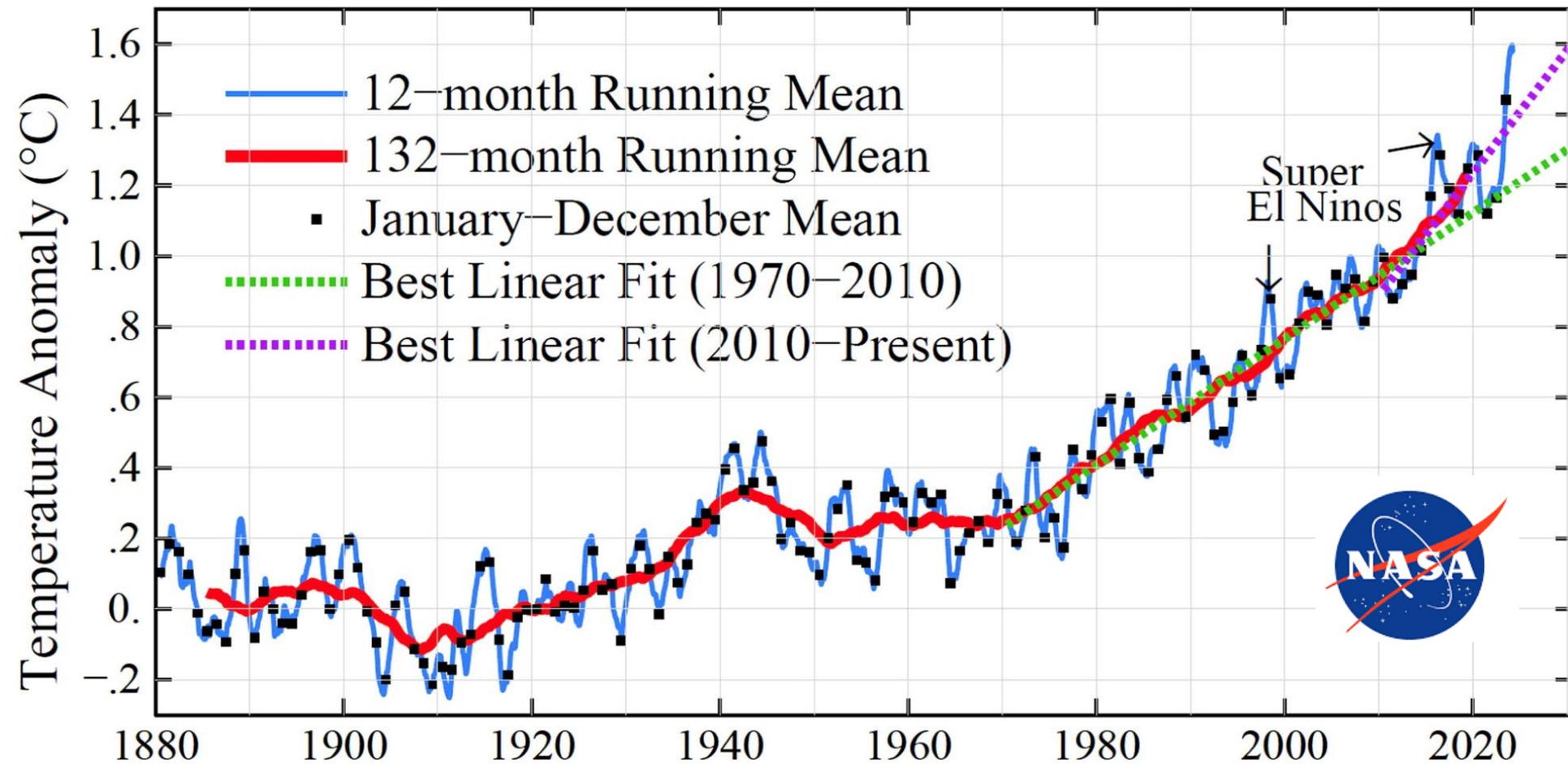
\* **NOTE:** North Atlantic cooling as predicted - due to Greenland Ice Sheet melting and precipitation change

# Global Warming Has Accelerated: Are the United Nations and the Public Well-Informed?

James E. Hansen, Pushker Kharecha, Makiko Sato, George Tselioudis, Joseph Kelly, Susanne E. Bauer, ...show all

Pages 6-44 | Published online: 03 Feb 2025

*Environment* (2025) – Science and Policy for Sustainable Development

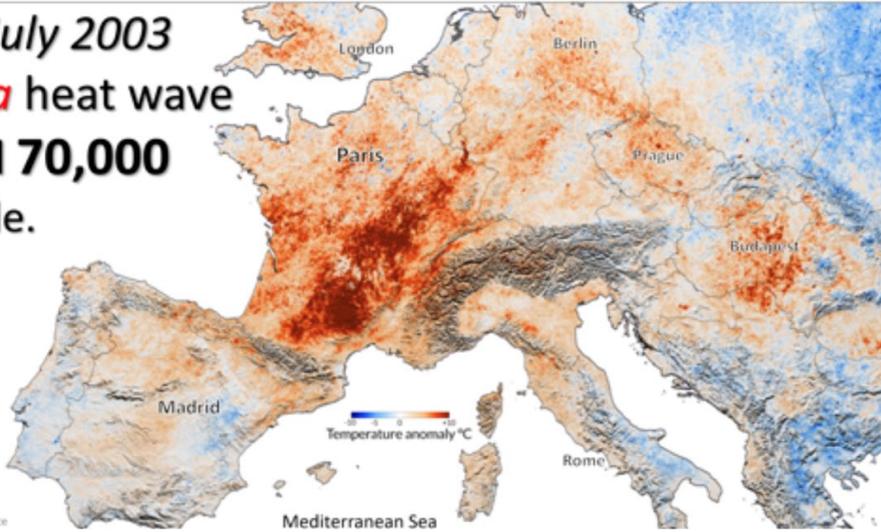


We were on track to  $< 3^{\circ}\text{C}$  global warming, but now we are likely on track for greater warming

July 2003

## European Heatwave (2003)

The July 2003 **mega** heat wave killed **70,000** people.



Source: UK Met Office

European Heatwave (2003)

# Climate Change's Number One Killer: Heat Waves

April 2024

## Dangerous Heat Wave Strikes Metro Manila and 23 Other Areas

THE MANILA JOURNAL

BY JANIMONOW | APRIL 16, 2024

May-June 2024

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WORLD NEWS

### Extreme heat in India has killed more than 100 people in the past three and a half months

August 2023

## As extreme heat hits South Korea and Japan, death toll rises sharply

By Min Joo Kim and Julia Mio Inuma  
August 2, 2023 at 5:12 a.m. EDT

The Washington Post

euronews Euronews (English)

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### 2024 – 335 deaths

Deadly floods, storms and heatwaves: Europe suffered the 'serious impacts' of climate change in 2024

# Global climate change impacts are continuing to accelerate

## A record 63 billion-dollar weather disasters hit Earth in 2023

Seven nations had their most expensive weather disaster on record, and the continent of Africa suffered two of its deadliest.



by JEFF MASTERS  
JANUARY 18, 2024



Rescue workers evacuate flood-affected people in Zhuozhou, China, on August 2, 2023, in the wake of Typhoon Doksuri. The typhoon and its remnants caused \$18.5 billion in damage, making it Earth's most expensive weather disaster of the year. (Image credit: China News Service, CC BY 3.0, <https://commons.wikimedia.org/w/index.php?curid=135517949>)

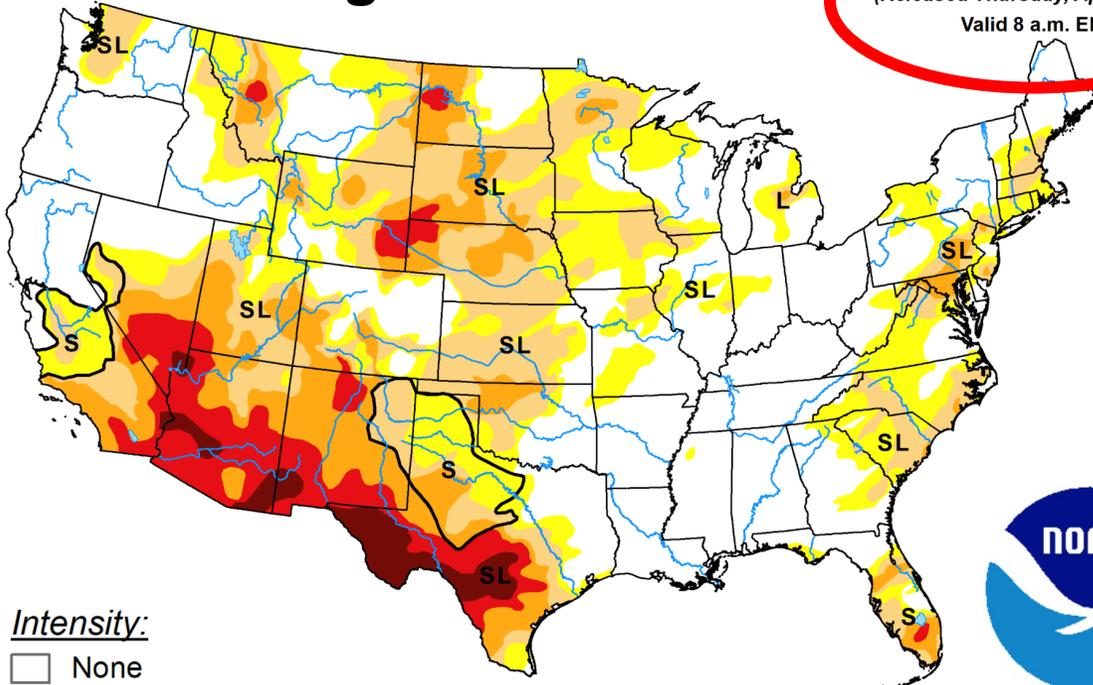
- Extreme heat
- Supercharged hurricanes, typhoons, tropical cyclones
- Extreme rainfall & flooding
- Hot drought & megadrought
- Unprecedented wildfire

**Warming supercharges them all**

# 25<sup>th</sup> year of SW Megadrought is really climate change aridification

## U.S. Drought Monitor

April 15, 2025  
(Released Thursday, Apr. 17, 2025)  
Valid 8 a.m. EDT



### Intensity:

- None
- D0 Abnormally Dry
- D1 Moderate Drought
- D2 Severe Drought
- D3 Extreme Drought
- D4 Exceptional Drought

### Drought Impact Types:

- ~ Delineates dominant impacts
- S = Short-Term, typically less than 6 months (e.g. agriculture, grasslands)
- L = Long-Term, typically greater than 6 months (e.g. hydrology, ecology)



## Aridification Spreading in North America a New Study Finds

MAY 26, 2020 ARIDIFICATION, CALIFORNIA, DROUGHT,



Overpeck and Udall (2020) PNAS

# Remember - this is a tale of two hydrologic extremes

An intensified hydrological cycle can also yield increases in:

- **Average Precipitation**
- **Extreme Rainfall**
- **Flooding**

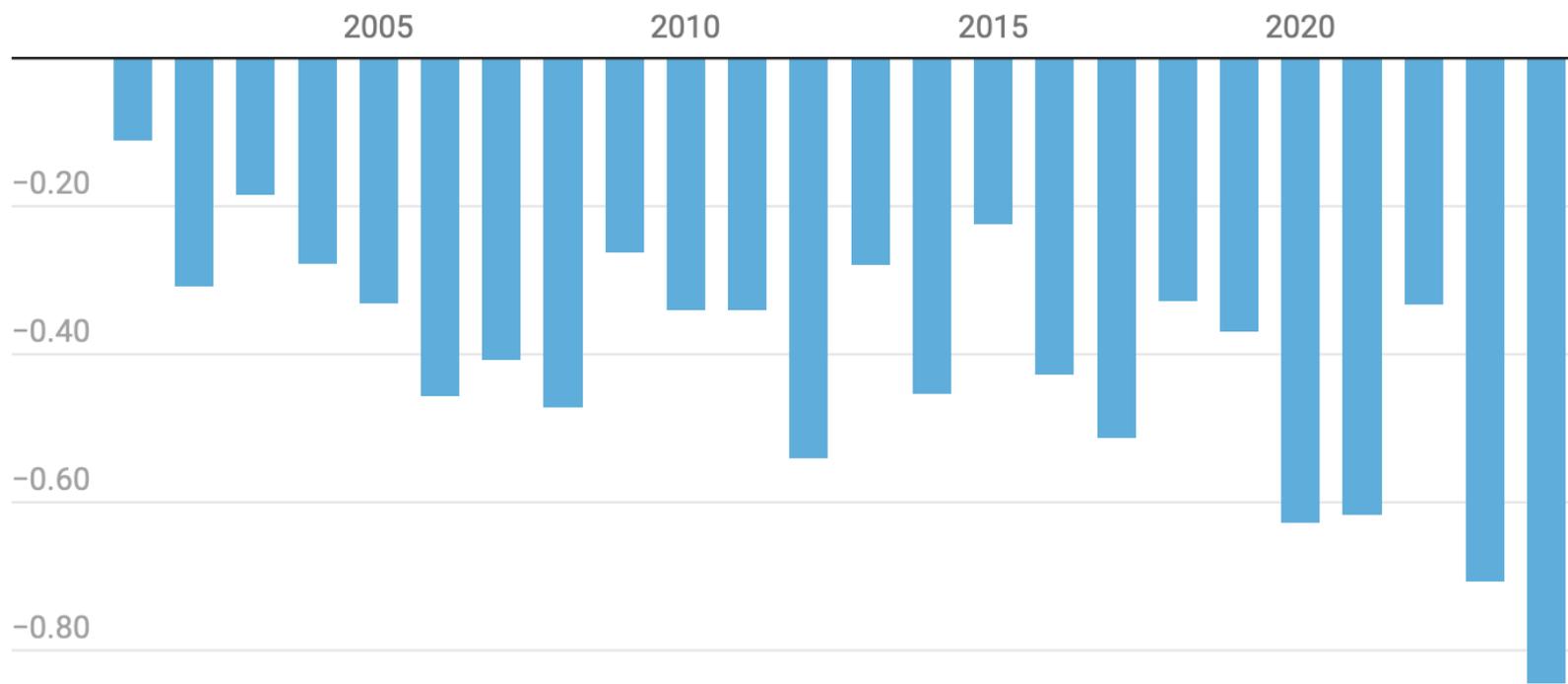


*Algae blooms also grow worse with warming*

# Mountain glacier melting is accelerating

## Glacier loss is accelerating around the world

Global glacier loss has increased over the past 25 years. The bars show the annual mass loss of glaciers outside the Antarctic and Greenland ice sheets, in meters of water equivalent per year.



Speeding up  
sea level rise

Chart: The Conversation, CC-BY-ND • Source: [GLAMBIE, 2025, Nature](#) • [Get the data](#) • [Embed](#) • [Download image](#) • Created with [Datawrapper](#)



*Polar Ice Sheet melting is combining with record ocean expansion due to warming to also cause an acceleration in global sea level rise*

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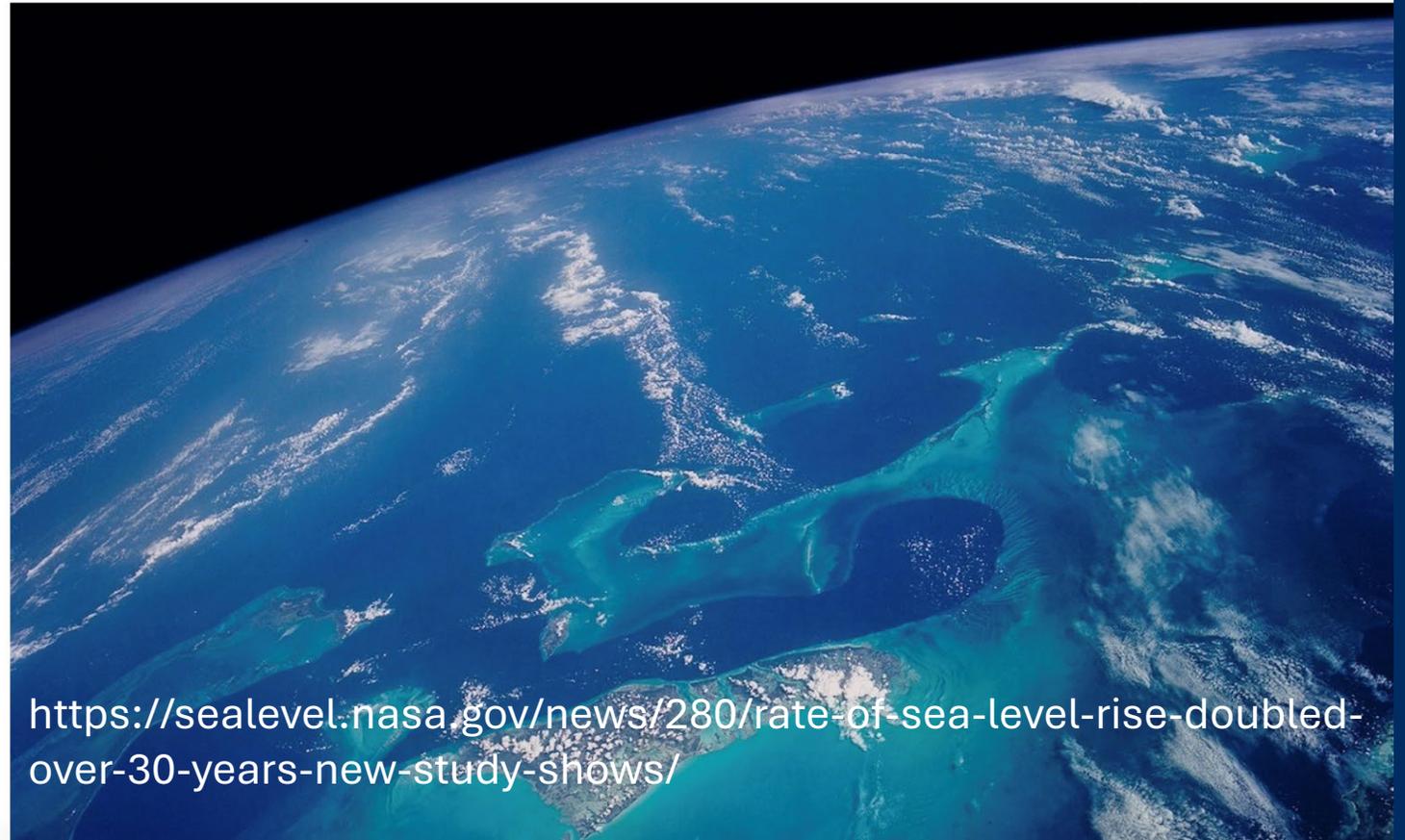
**Energy Live News**

March 17, 2025

NEWS | February 25, 2025

## Rate of Sea Level Rise Doubled over 30 Years, New Study Shows

By Ethan Huang, NASA's Sea Level Change Team



<https://sealevel.nasa.gov/news/280/rate-of-sea-level-rise-doubled-over-30-years-new-study-shows/>

Article

# The Paris Climate Agreement and future sea-level rise from Antarctica

*Nature* (2021)

<https://doi.org/10.1038/s41586-021-03427-0>

Received: 15 October 2018

Accepted: 8 March 2021

Robert M. DeConto<sup>1✉</sup>, David Pollard<sup>2</sup>, Richard B. Alley<sup>2,3</sup>, Isabella Velicogna<sup>4</sup>, Edward Gasson<sup>5</sup>, Natalya Gomez<sup>6</sup>, Shaina Sadai<sup>1</sup>, Alan Condron<sup>7</sup>, Daniel M. Gilford<sup>8</sup>, Erica L. Ashe<sup>8</sup>, Robert E. Kopp<sup>8</sup>, Dawei Li<sup>1,9</sup> & Andrea Dutton<sup>10</sup>

*“These results demonstrate the possibility that rapid and unstoppable sea-level rise from Antarctica will be triggered if Paris Agreement targets are exceeded.”*

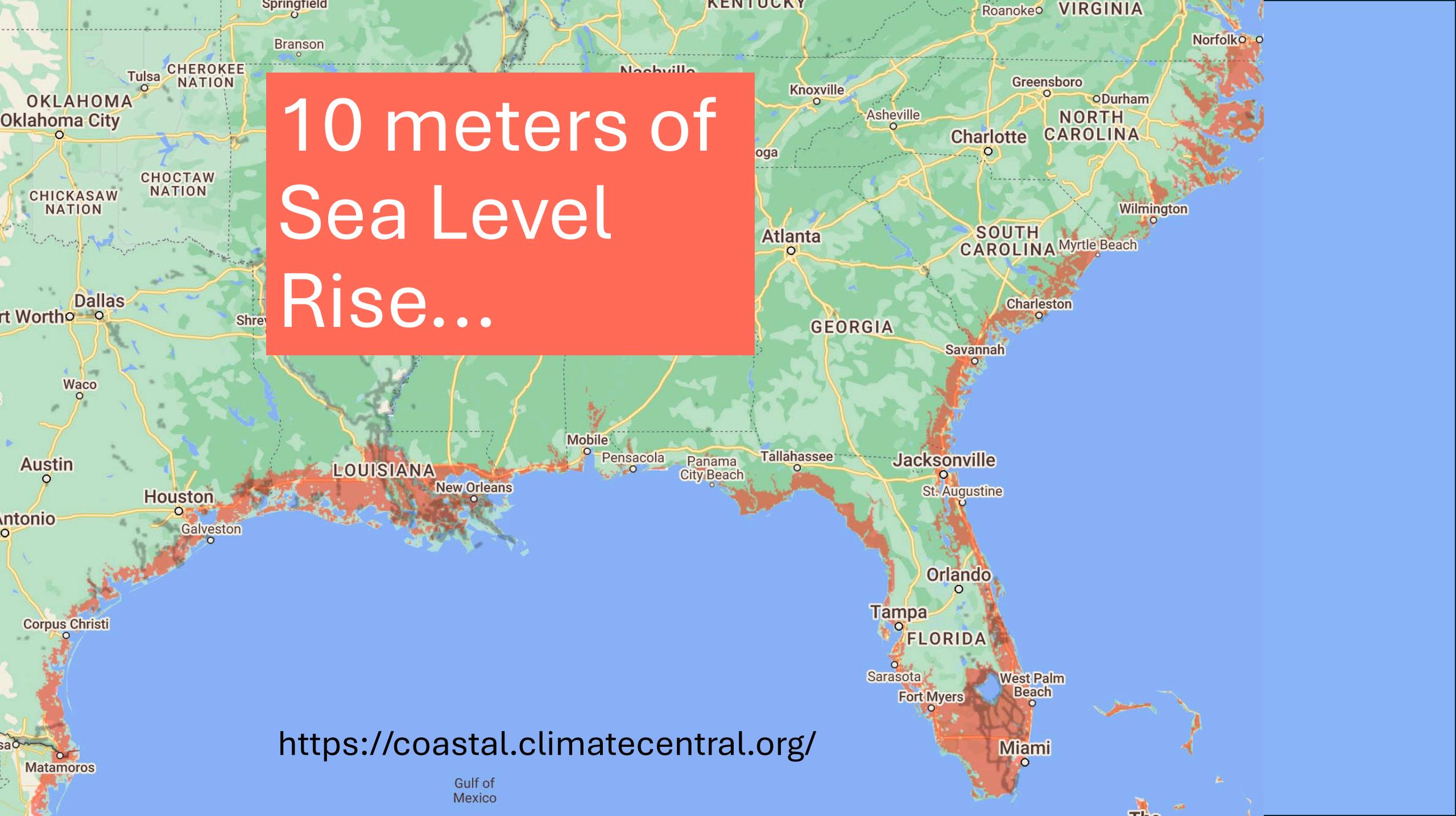
**IPCC (2021):**

If 2°C–3°C peak warming → 2-5m sea-level rise possible

If > 3°C peak warming → 6-12m sea-level rise possible

**Possibly on century time-scales**

# 10 meters of Sea Level Rise...



<https://coastal.climatecentral.org/>

# Why I have HOPE



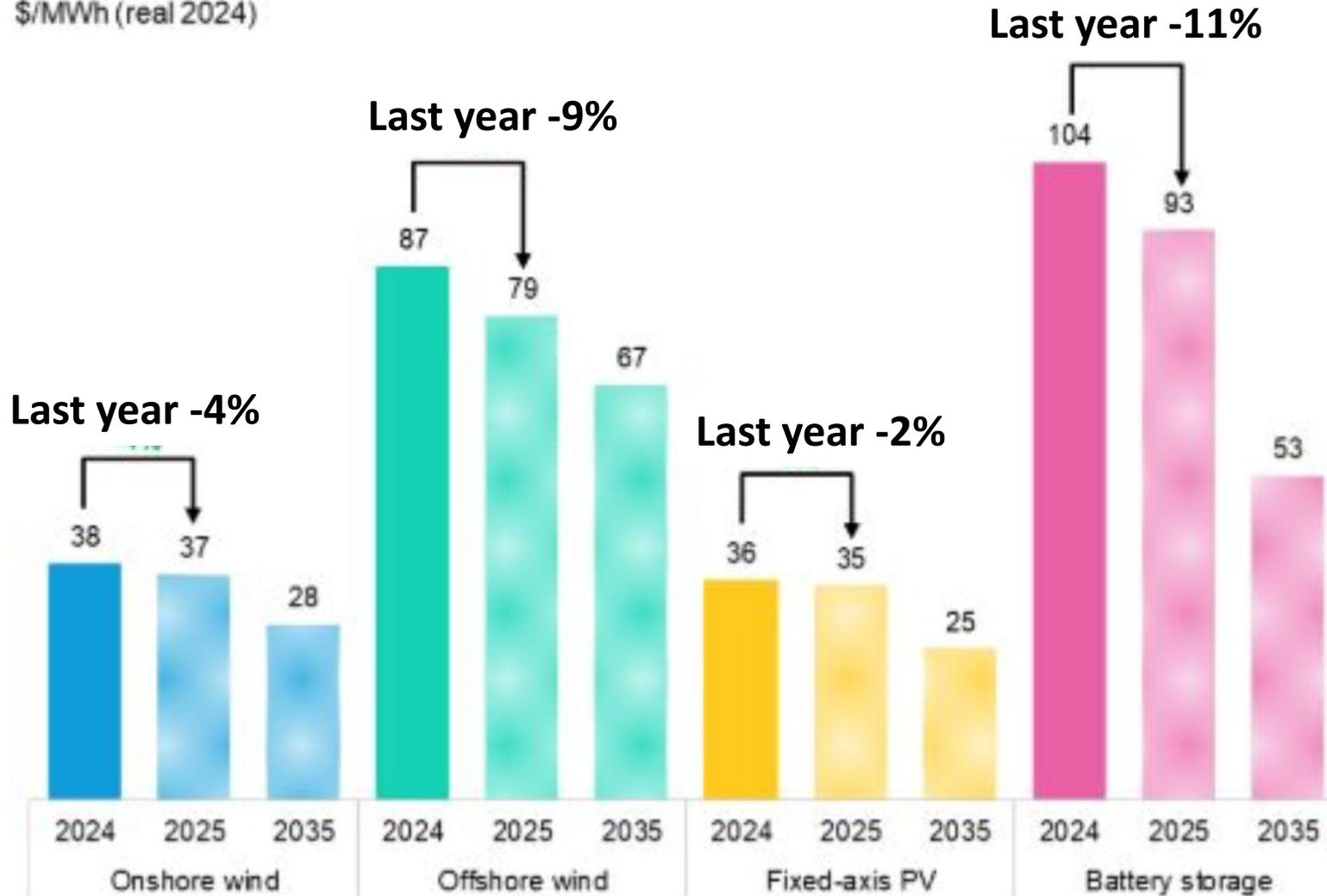
# The **Good News** – The **development** and **deployment** of solutions are also accelerating

- To reduce, mitigate, **halt** climate change
- To **build resilience** and **adapt** to the climate change that cannot be avoided or halted
- To **recover** from impacts

# Good News: The costs associated with the biggest clean solutions continue to fall, and this is fueling rapid deployment

Figure 1: Global benchmark levelized cost of electricity, 2024, 2025 and 2035

\$/MWh (real 2024)

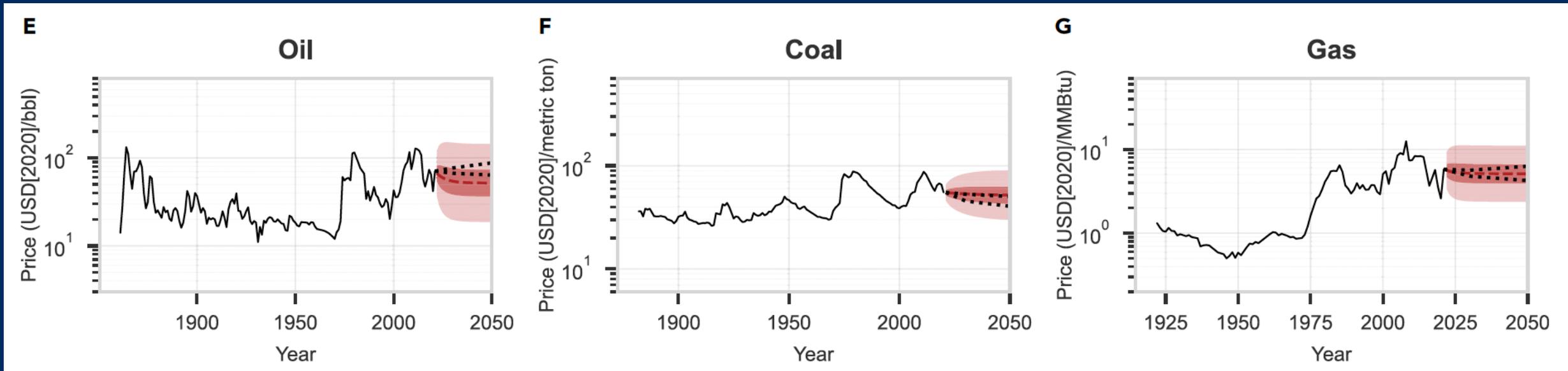


Renewable energy is becoming the is least expensive energy around the globe

Source: BloombergNEF.

More reason to feel hopeful: carbon-free solution costs are plummeting and will continue to plummet...

But fossil fuel solution costs will not...



**Joule**

2022

Article

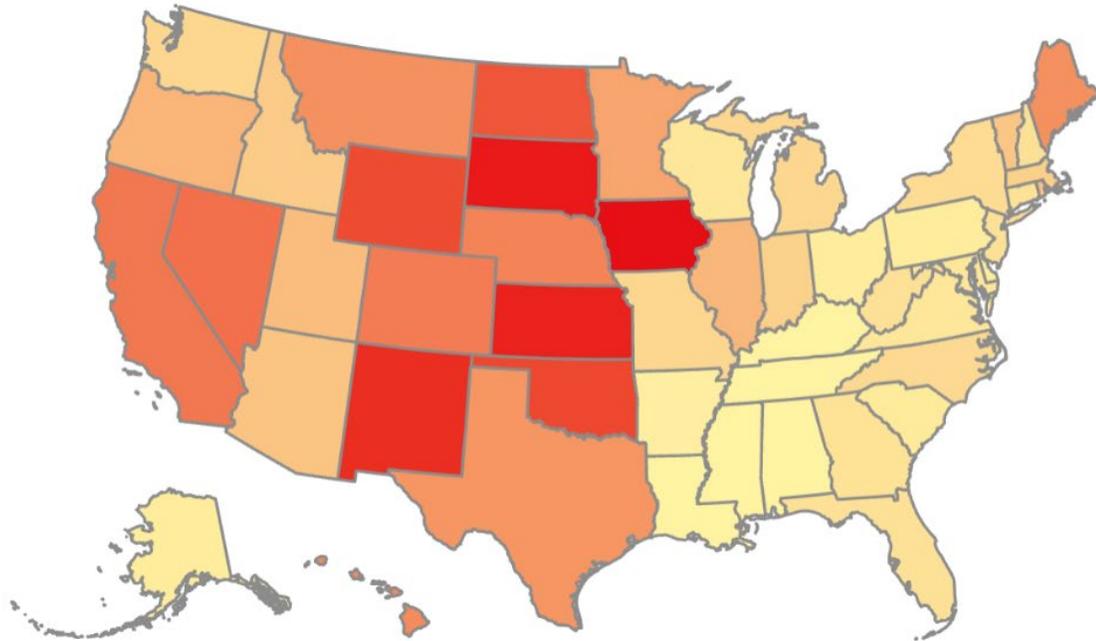
Empirically grounded technology forecasts and the energy transition

Rupert Way,<sup>1,2,6,\*</sup> Matthew C. Ives,<sup>1,2</sup> Penny Mealy,<sup>1,2,3</sup> and J. Dooyne Farmer<sup>1,4,5</sup>

# Why is this good news?

## How much of our energy comes from renewables?

Wind, solar and geothermal energy as a percent of retail electricity sales



2023

In 2024:

**~50 GW Solar Installed**

**20 GW in just 3 states:**

Texas – 12GW

California – 5GW

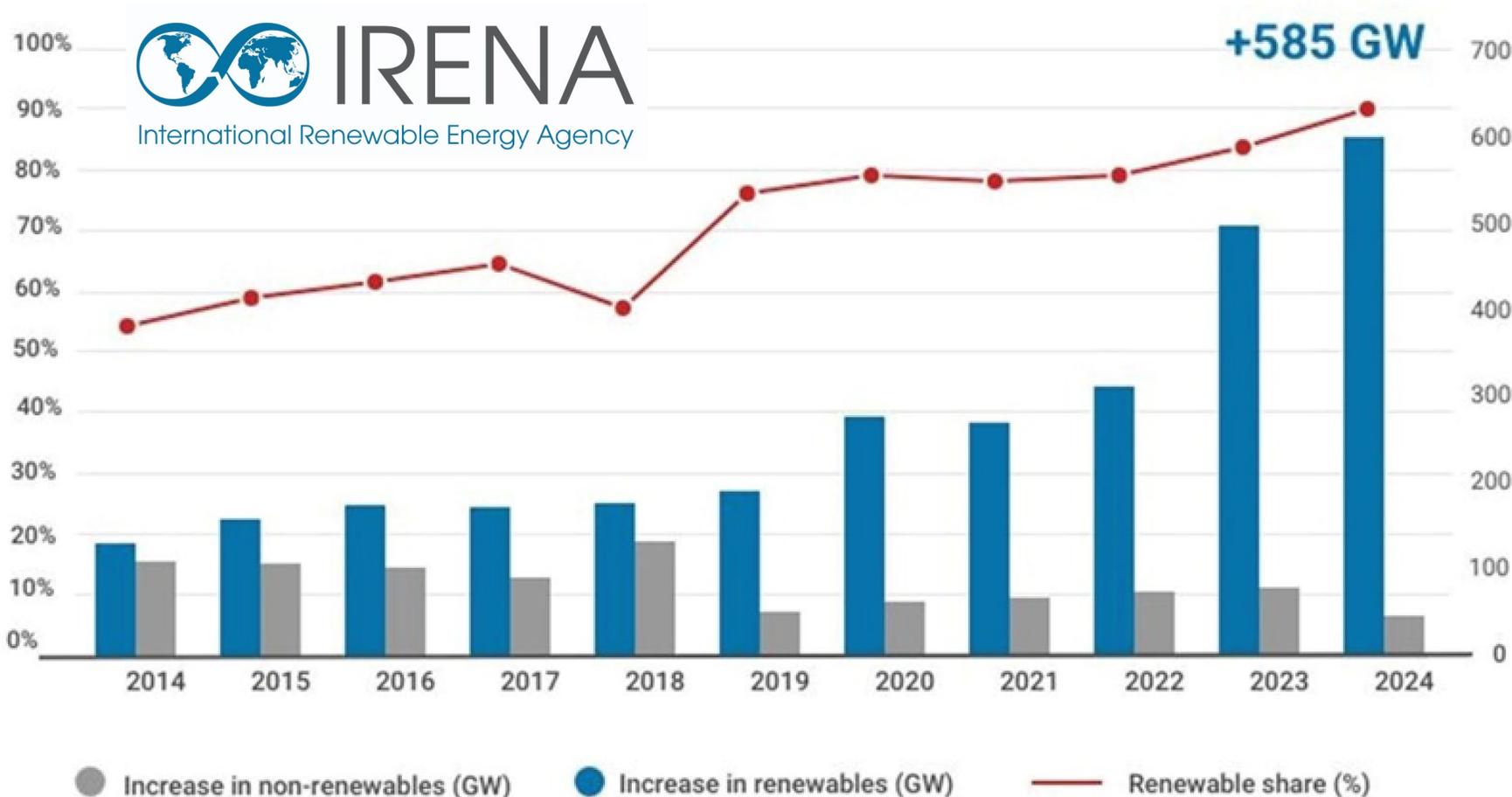
Florida – 4.7GW

Also, the many states in the **US Climate Alliance** – pledged to hit net-zero by 2050

# Good News: The costs associated with the biggest clean solutions continue to fall and deployment continues to rise

## Renewables account for more than 92% of total power expansion in 2024

Share of new electricity generating capacity (%)      Annual capacity installations (GW/yr)



Deployment is accelerating around the globe (much faster than fossil fuels)

# Globally, low-carbon electricity deployment is accelerating

## The planet is going carbon-neutral (1.6% growth/year)

April 8, 2025

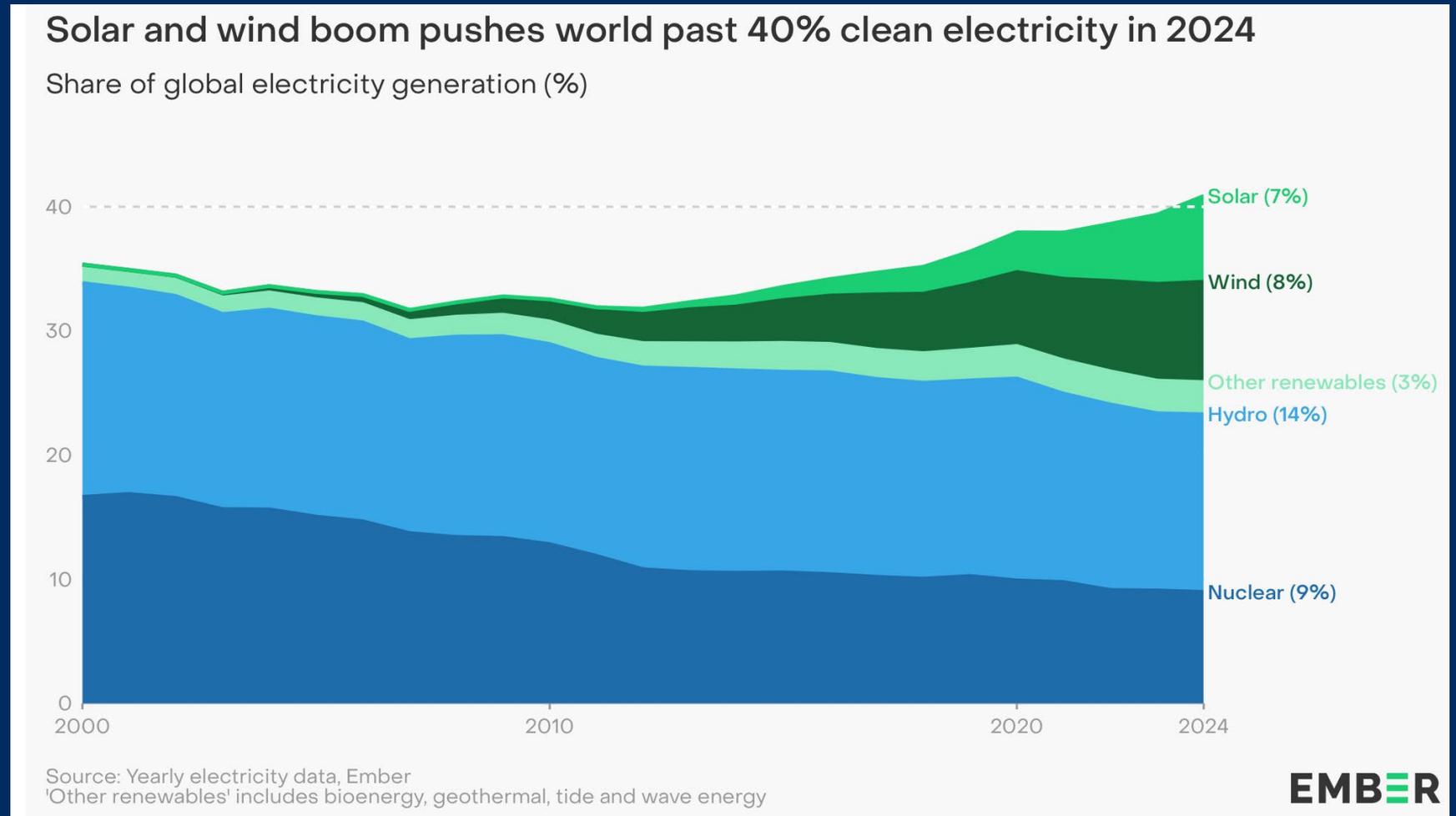
**EMBER**

### Global Electricity Review 2025

Record renewables growth led by solar helped push clean power past 40% of global electricity in 2024, but heatwave-related demand spikes led to a small increase in fossil generation.

8 April 2025

Lead authors : Euan Graham and Nicolas Fulghum  
Other authors : Katy Altieri



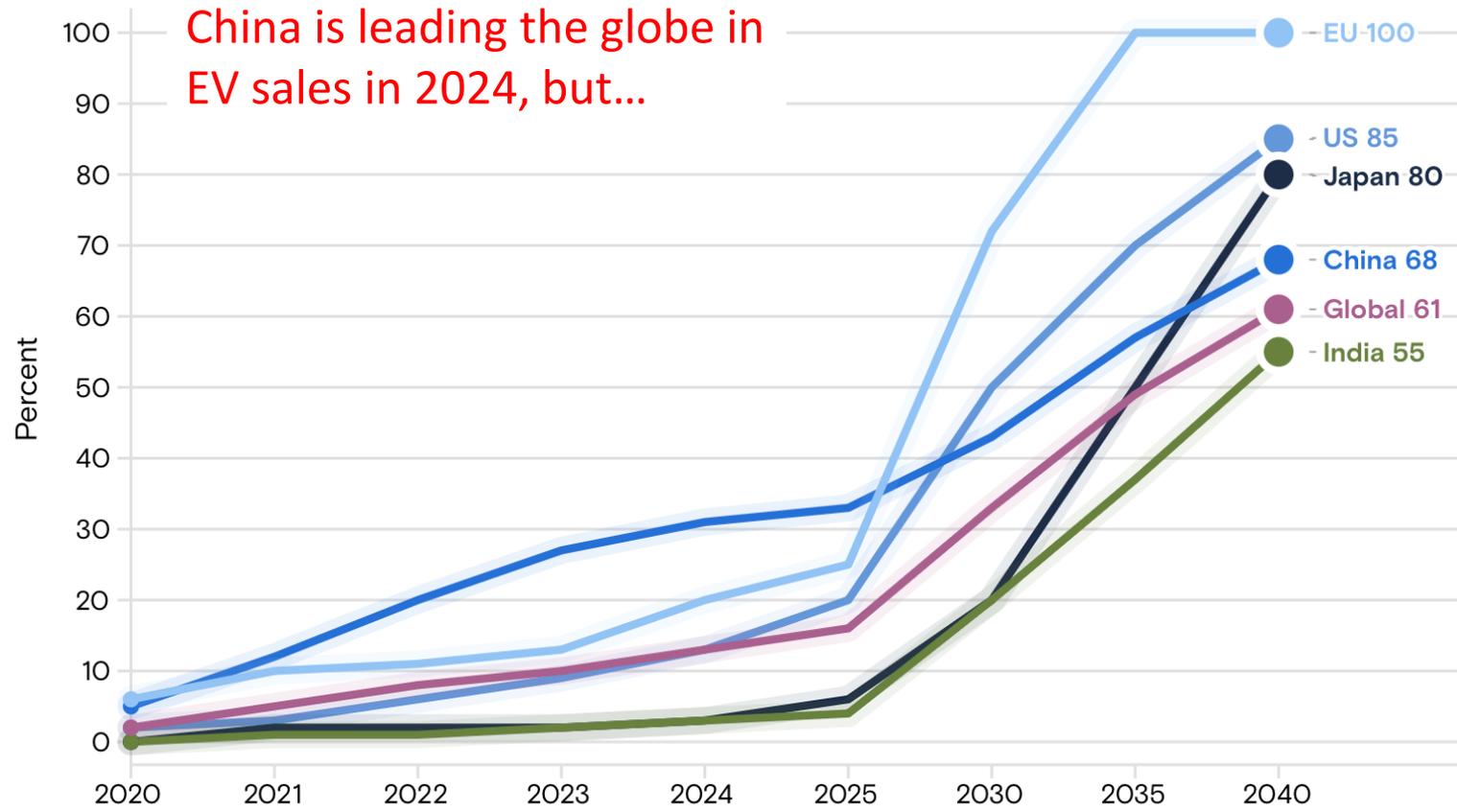
# Global solar power is now doubling every 3 years (now at 2000TW!)

# Cool updates: EV sales still surging, but...

<https://www.goldmansachs.com/intelligence/pages/electric-vehicles-are-forecast-to-be-half-of-global-car-sales-by-2035.html>

## The shift to electric vehicles is forecast to accelerate

Electric vehicle sales ratio (%)



Source: IHS Global Insight, Goldman Sachs Research • 2022-2040 are forecasts

**Goldman  
Sachs**

Global EV sales in last two years increased by an average of 25% per year

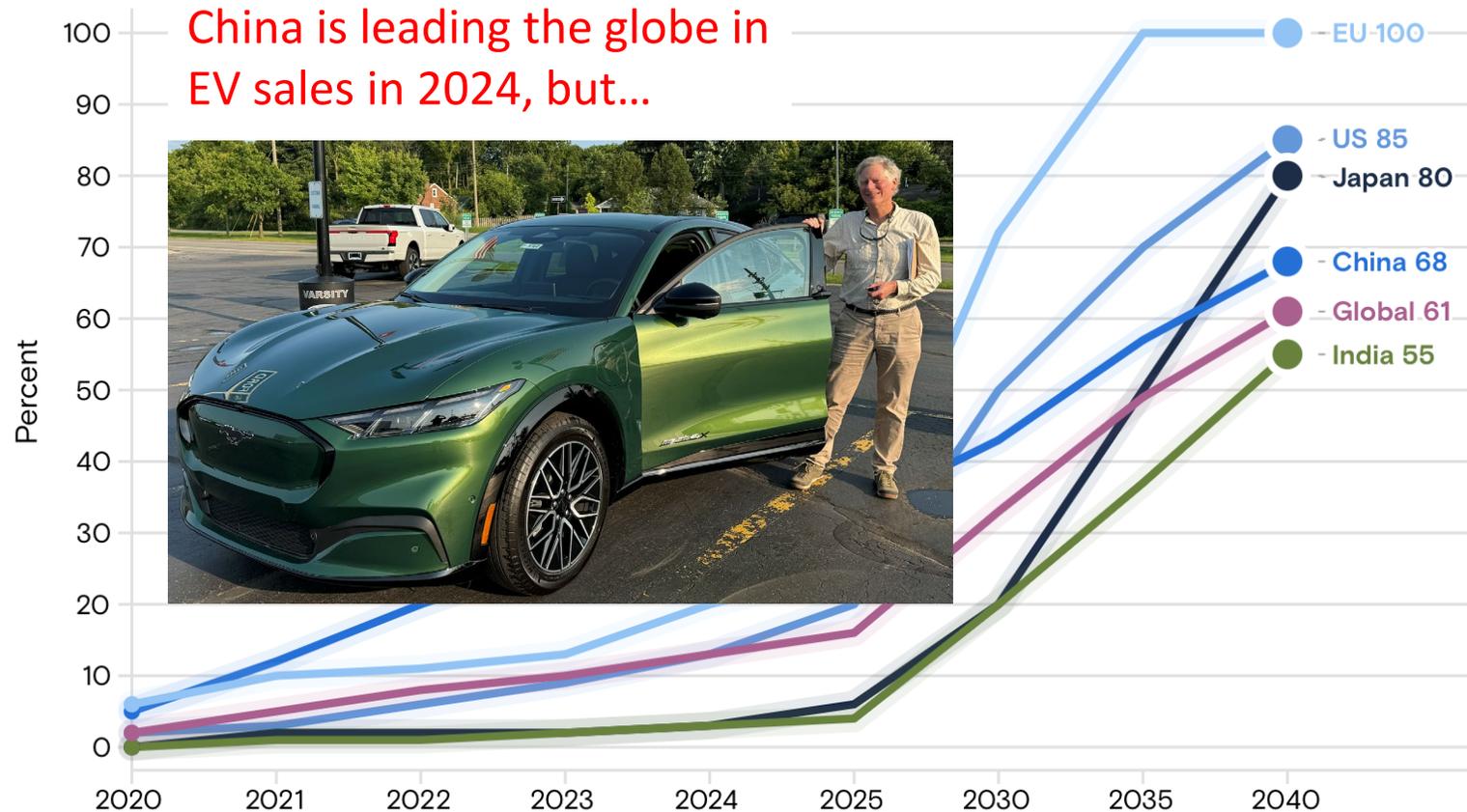
Projected to reach >50% by 2035

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**Goldman  
Sachs**

Global EV sales in last two years increased by an average of 25% per year

Projected to reach >50% by 2035

A silhouette of a three-bladed wind turbine is centered in the frame against a background of a cloudy sky. The sky transitions from a pale, hazy blue on the left to a darker, more uniform grey-blue on the right. The turbine's tower is a solid black vertical line extending from the bottom center. The three blades are also solid black, with one pointing horizontally to the left, one pointing upwards and to the right, and one pointing downwards and to the right. The text "So, what's the problem?" is overlaid in white on the left side of the image.

So, what's the problem?

# Yet more reason for hope:

Large majority of  
Americans know  
climate change is  
real, and are worried  
In 2024:

- National average 71%
- Michigan steady at 71%
- Ohio at 68%
- Texas at 70%
- Florida at 70%
- California at 77%

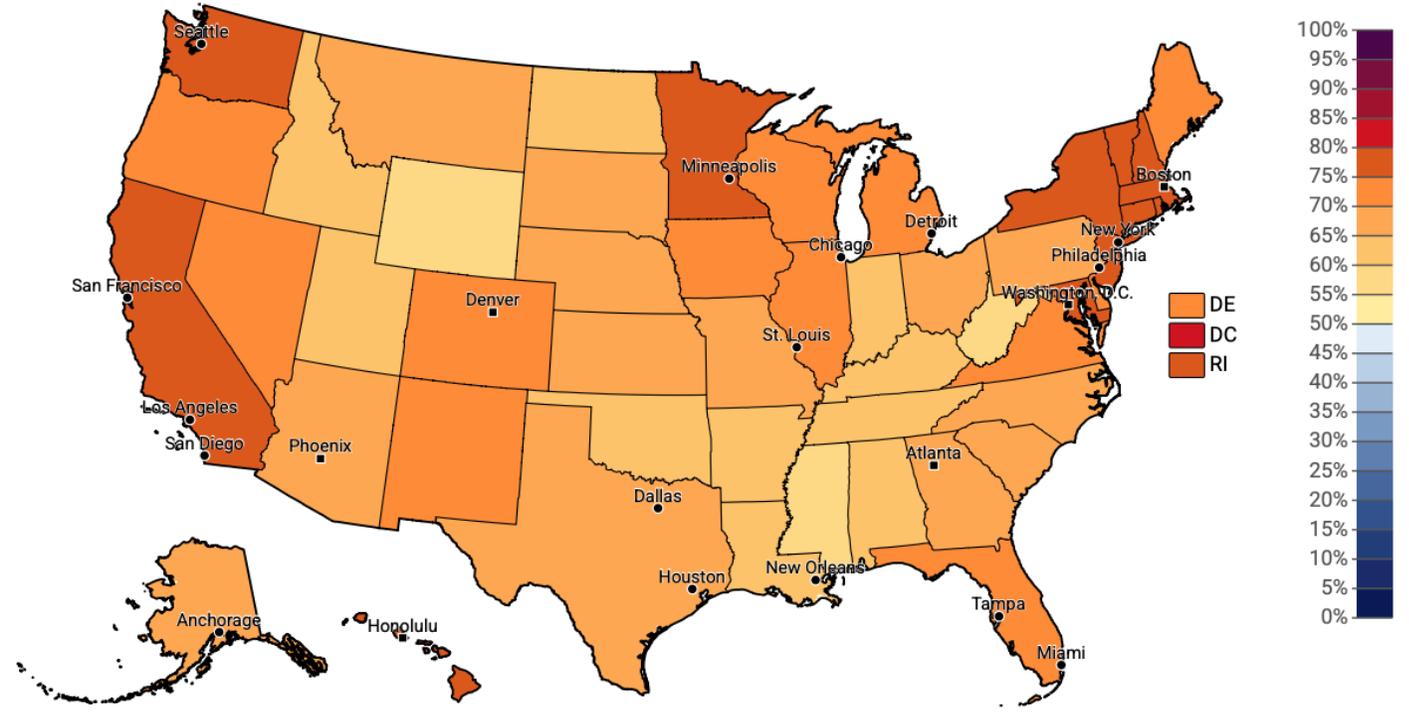
## Estimated % of adults who think global warming will harm future generations a moderate amount or a great deal (nat'l avg. 71%), 2024

Select Question: Global warming will harm future generations

Click map or: Select a State

Absolute Value

National States Cong. Districts Metro Areas Counties



# Conclusions...

- Climate change, **impacts** and **costs** are accelerating
- Solution **cost reductions** are accelerating 
- Solution **deployment** is accelerating
- **BUT** solutions are still being deployed too slowly
- “**Fairness**” **not being emphasized enough** – if everyone benefits, the energy transition will speed up, in the US and globally
- **We all have to make talking about climate change, and acting on climate change, a higher priority**

# Thanks!

Did you know the Great Lakes hold over 20% of the world's unfrozen surface water

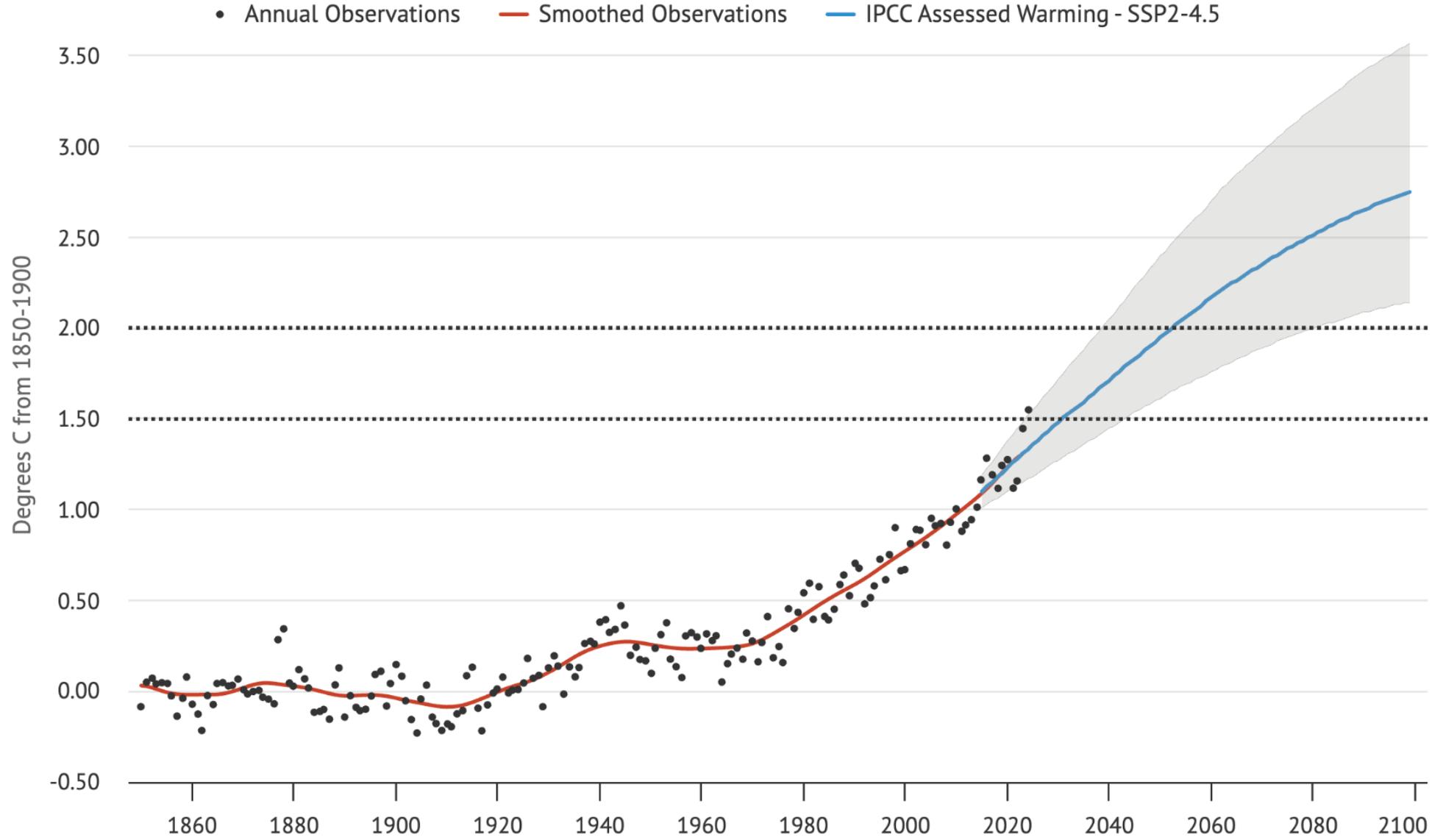


@GreatLakesPeck



@GreatLakesPeckTwo

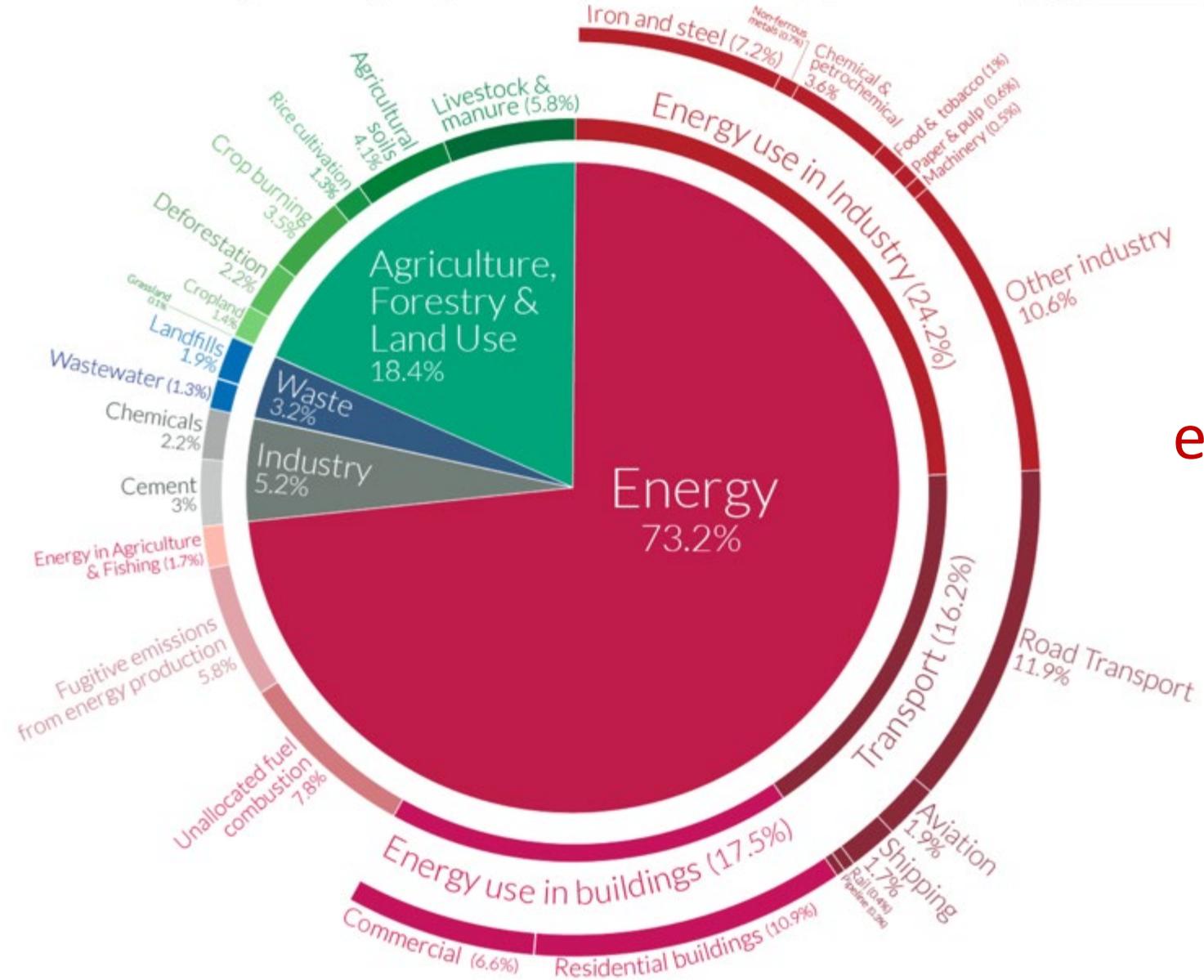
# IPCC Assessed Warming Projections and Observations - SSP2-4.5



Sources: Berkeley Earth, GISTEMP, NOAA GlobalTemp, HadCRUT5, and IPCC AR6 Assessed Warming Projections for SSP2-4.5

# Global greenhouse gas emissions by sector

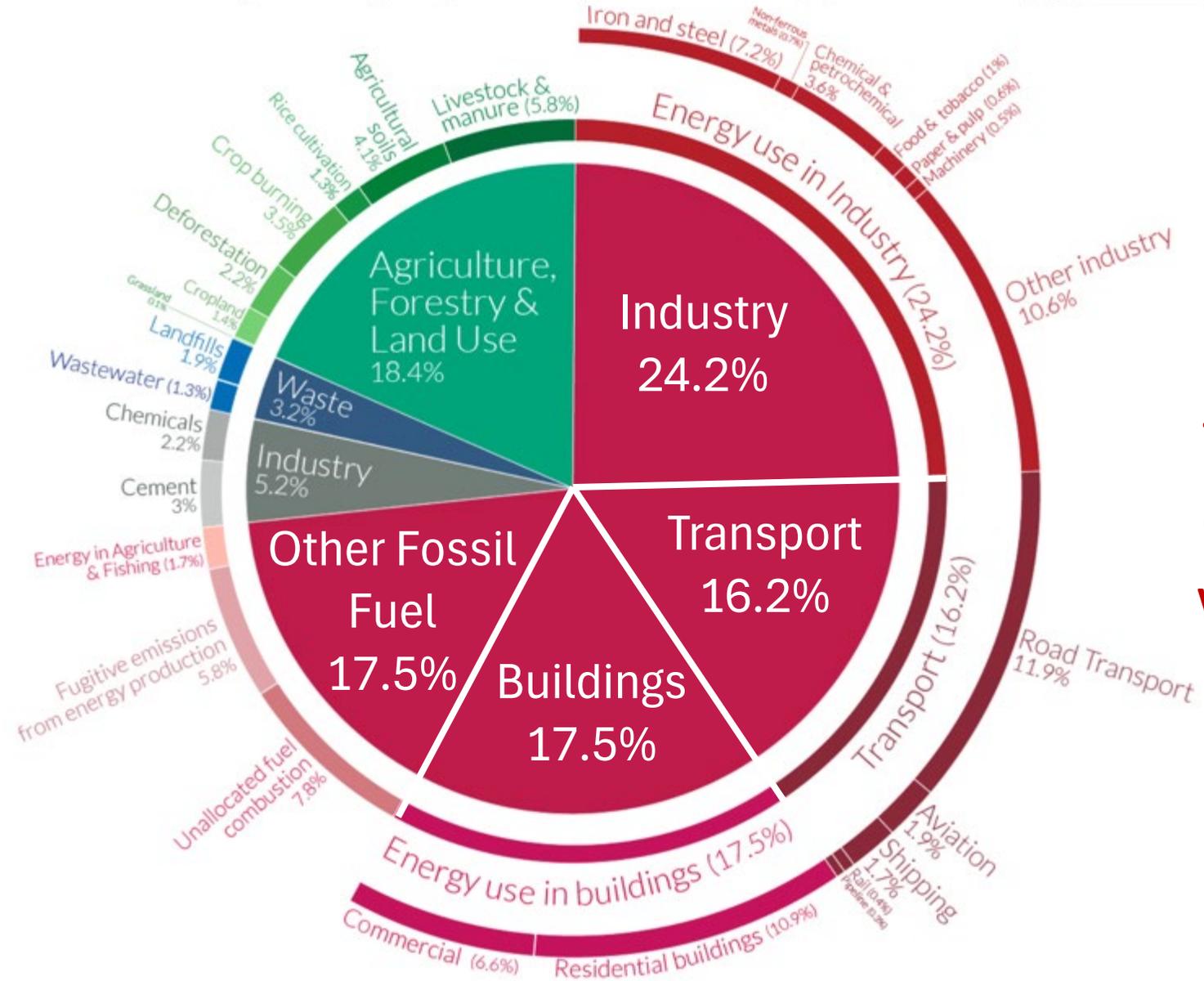
This is shown for the year 2016 – global greenhouse gas emissions were 49.4 billion tonnes CO<sub>2</sub>eq.



Decarbonizing our energy systems is the biggest job

# Global greenhouse gas emissions by sector

This is shown for the year 2016 – global greenhouse gas emissions were 49.4 billion tonnes CO<sub>2</sub>eq.



Developing and implementing low-carbon solutions = the 21<sup>st</sup> century new economy requiring a wide range of talents

And justice must be a factor in all solutions