

## THE GLOBAL CLIMATE CRISIS: 2026 MID-YEAR UPDATE

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JULY 2026

### Update report.

Our last update, “*End of Year Report: 2025*,” was published in January 2026 and is available on our website. In it we announced the publication of our 3<sup>rd</sup> book on global warming and climate change, *Irreversible: What Can We Do?* (See cover illustration here.) *Irreversible* emphasizes that we can cause the Earth to heat up, but not to cool down. Global warming is irreversible.

This book summarizes what we have learned over the past eight years in the process of writing *Reaching Net Zero* (2020) and *The Global Climate Crisis* (2024). It is an affordable paperback written for the interested, non-technical reader and is accompanied by a Kindle ebook and an audio book.

The book’s dedication is “*To the future generations who will inherit this Earth. The current generation owes them a better world without global warming.*” We hope all of our readers will become part of our efforts to stop global warming!

### Temperature update:

According to Berkeley Earth and other sources, the Earth’s average temperature is about 1.5°C (2.7°F) above the preindustrial 1850-1900 average. To date, the land temperature increases averaged 2.24°C (4.0°F) and the ocean temperature increase averaged 0.95°C (1.7°F). (Figures 2 and 3). The International Panel on Climate Change’s (IPCC) objective as stated in the 2015 Paris Agreement is to limit global temperature increases to below 1.5°C (2.7°F) by 2050. This will not be met.

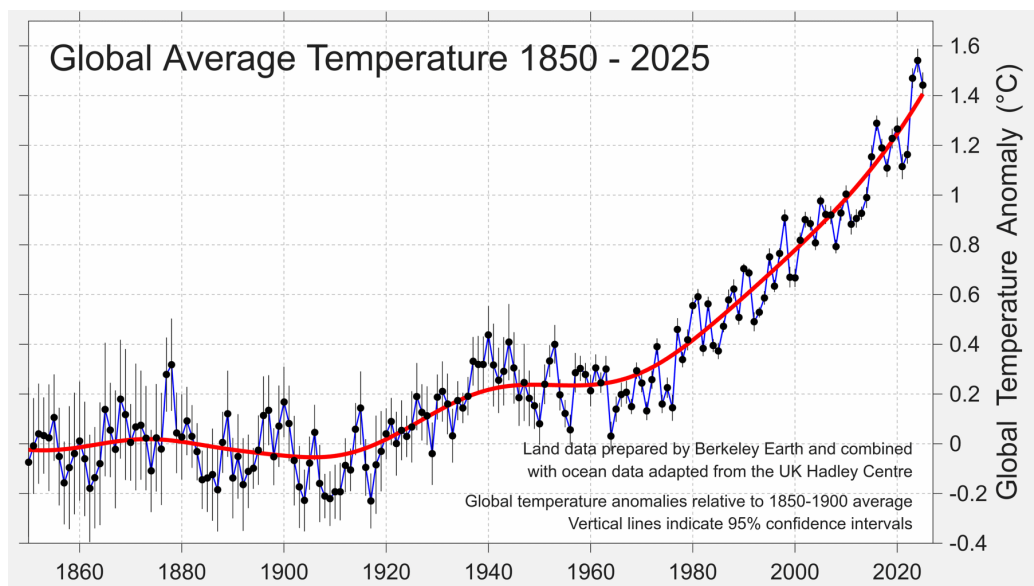
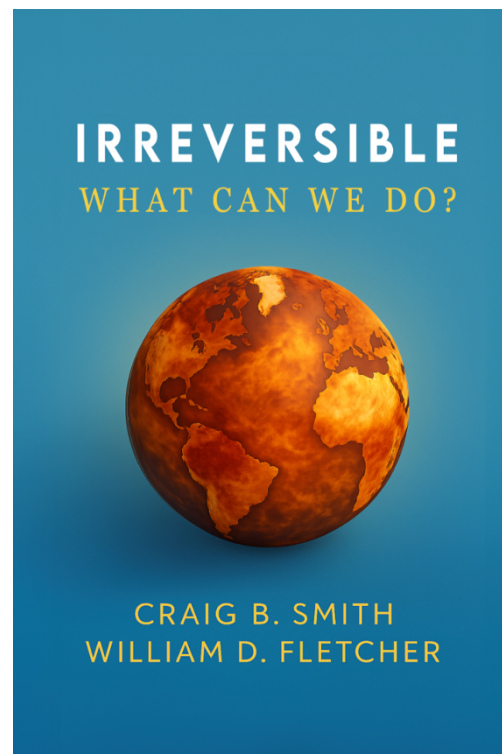


Figure 1: Global Average Temperature <sup>1</sup>

Data indicates that 2025 is the 3<sup>rd</sup> warmest year to have been directly observed using thermometer measurements. The last 11 years stand out as the 11 warmest years to have been so measured.

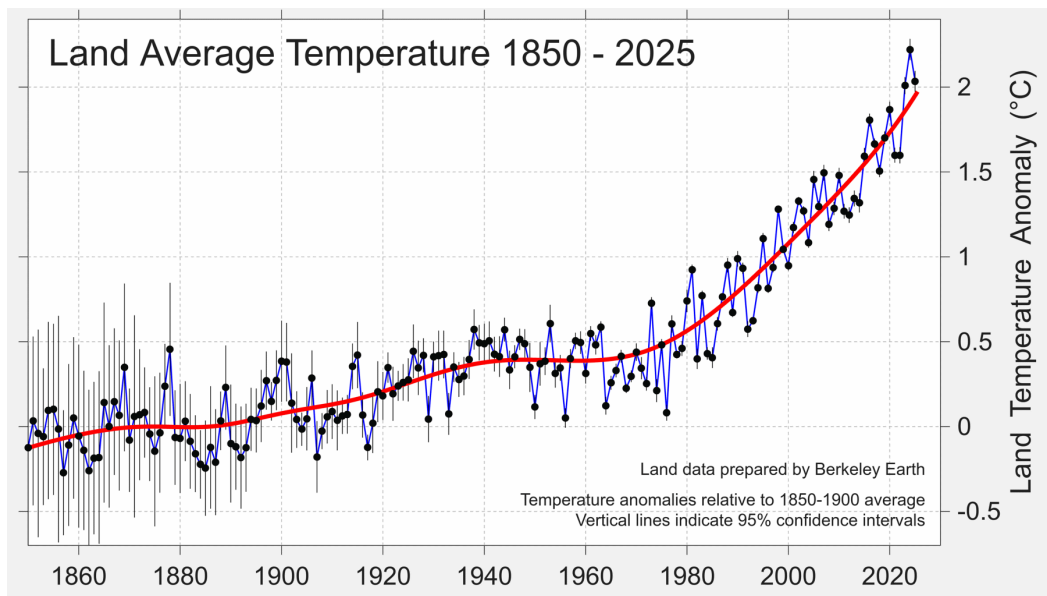


Figure 2: Land Temperature Average

On land, 2025 was the 2<sup>nd</sup> warmest year directly observed, reaching 2.03 °C / 3.66 °F above the 1850 to 1900 average. This is the third year with a land-average of more than 2.0 °C.

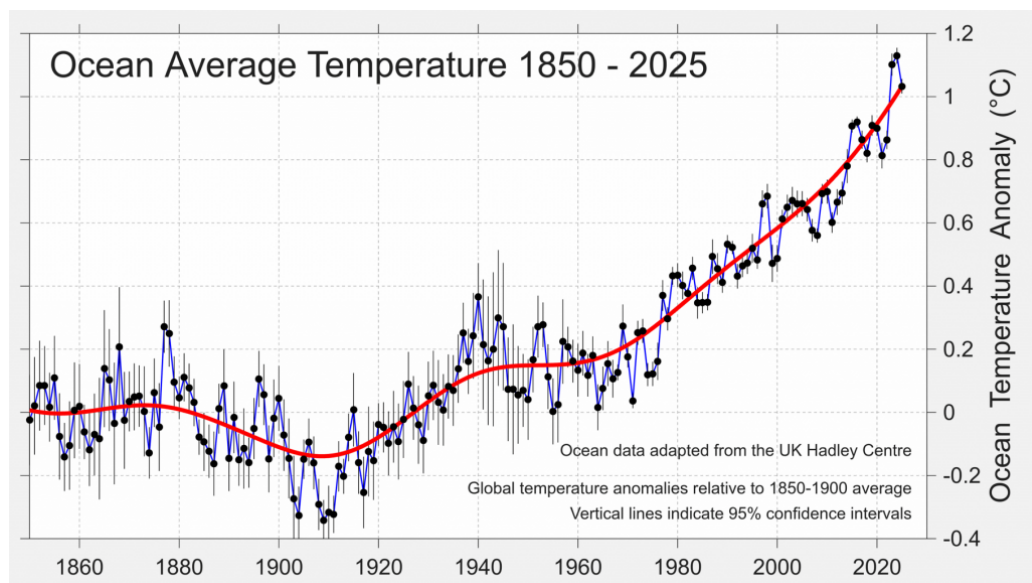


Figure 3: Ocean Temperature Average

On the ocean's surface, 2025 was the 3<sup>rd</sup> warmest year directly observed, reaching 1.03 °C / 1.86 °F. This is the third year with an ocean-average above 1.0 °C, though noticeably cooler than 2023 or 2024.

## Europe is currently the world's fastest warming Continent- its Deadly Spring Heat Wave Is Obliterating Temperature Records<sup>2</sup>

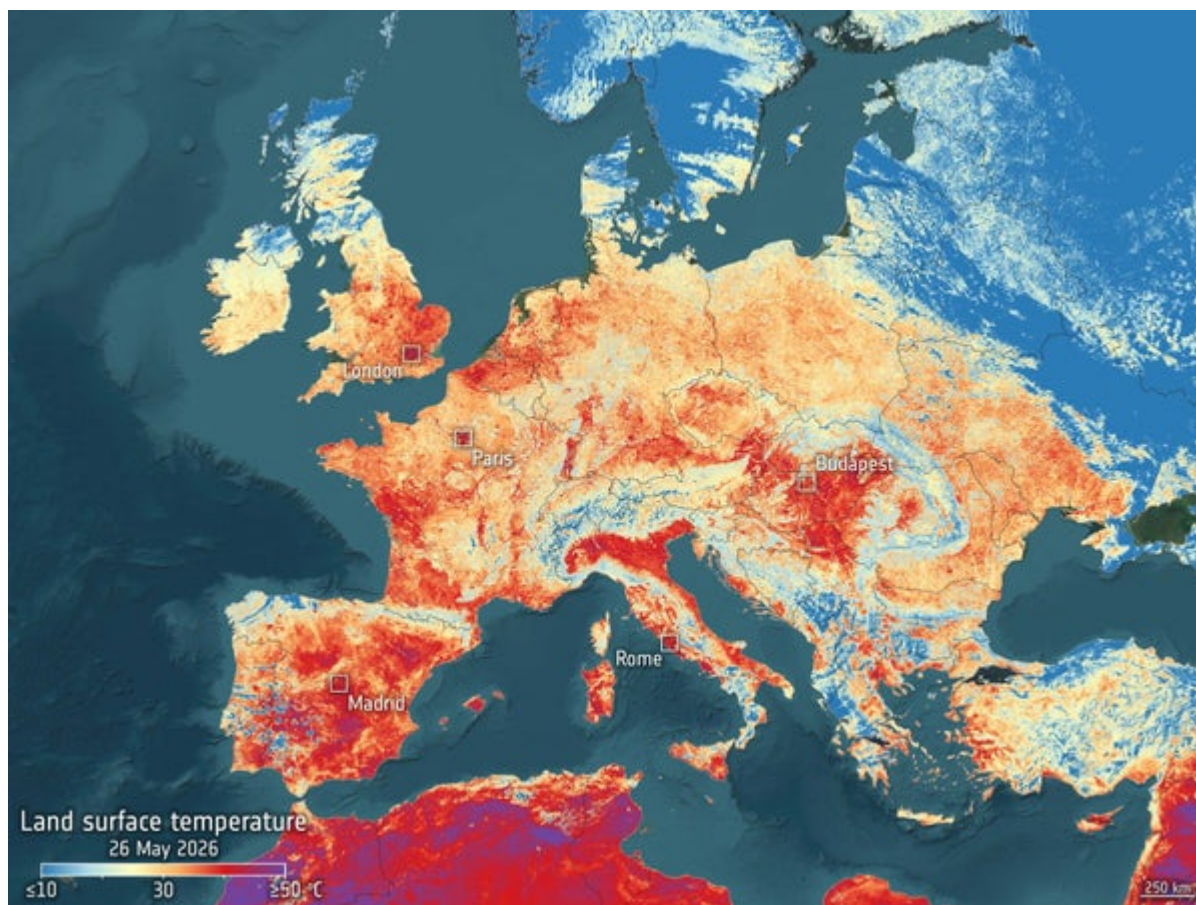


Figure 4: A map of Temperatures across Europe captured by the Copernicus Sentinel-3 satellite on May 26, 2026.

Unseasonably hot weather in Europe has already claimed at least 18 lives. And history shows more are likely on the way. Stark new data show how much the spring heat wave that has been affecting much of Western Europe has shattered temperature records. The heat has been linked to 12 deaths in the U.K. alone. Three occurred on Wednesday and Thursday, when three teenage boys died in separate water incidents while they sought reprieve from temperatures that beat the previous records by several degrees in portions of the nation.

The gravity of the situation can be seen in an image captured by the European Space Agency's Copernicus Sentinel-3 satellite, which is used to monitor surface temperatures. The areas in red are indicative of temperatures well in excess of 30 degrees Celsius (86 degrees Fahrenheit) and include major European cities such as Madrid and Paris.

The heat wave has broken a "remarkable number" of records for temperature, the U.K.'s Met Office said in a statement. Some 23 weather stations across England, Wales, Scotland and Northern Ireland have reported temperatures exceeding the previous U.K.-wide record of 32.8°C (91°F), which was set in 1922 and 1944. On Tuesday a research station in London's Kew Gardens recorded temperatures of 35.1°C (95.2°F), obliterating its previous record of 29.3°C (84.7°F) for the month.

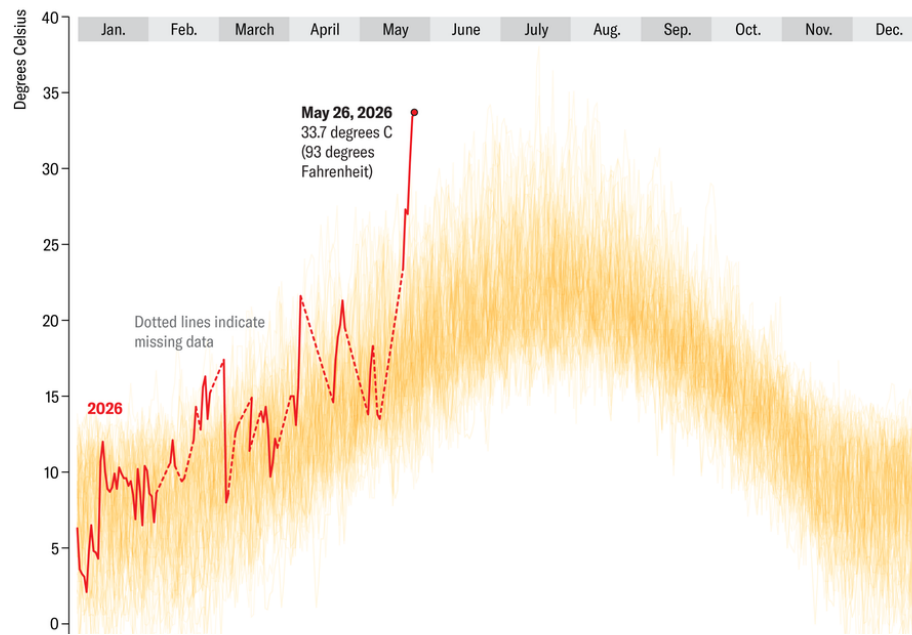


Figure 5: Amanda Montañez; Source: Met Office, U.K.

At least seven other deaths in France, five from drowning, have also been tied to the sweltering conditions. May 26 was the hottest May weather in the country’s history, according to Météo-France, the French national weather service, with an average temperature of 24.9°C (76.8°F). Two days later, daytime highs peaked at almost 40°C (104°F) in several regions.

“Such high temperatures have never been recorded in May since records began,” Météo-France said in a French-language statement.

The heat was bad enough to affect tennis’s French Open: top-ranked player Jannik Sinner was eliminated on Thursday after he took a medical time-out for cramping that was likely caused by dehydration.

The weather is being driven by a heat dome—a block of high pressure that traps hot air—hovering over Western Europe. But even with the heat dome factored in, temperatures have hit levels that are unusual at the peak of summer in several countries.

The heat seen since May 22 across much of France, Switzerland, Italy, Austria, Liechtenstein, Spain, Portugal and the U.K. was likely made three to five times more likely because of the effects of climate change, according to Climate Central’s Climate Shift Index.

Recent experience suggest more deaths are likely: unlike in the U.S., where an estimated 90 percent of households are equipped with air-conditioning, Europeans lag behind at only 20 percent, according to the International Energy Agency. That can make high temperatures particularly dangerous on the continent—in 2025 a series of heat waves led to some 24,400 deaths, 16,500 of which were attributed to climate change, while more than 62,700 people died of heat-related causes the year before.

### Temperature forecast:

According to *Climate Action Tracker*, the Earth’s average temperature increase by 2100, 75 years from now, is estimated to be between 2.5°C and 2.9°C (4.5°F and 5.2°F) depending upon the actions we take.<sup>3</sup>

### Greenhouse gas emissions.

Each year in May-June, the carbon dioxide (CO<sub>2</sub>) levels in the atmosphere reach their highest level, according to the National Oceanic and Atmospheric Administration (NOAA) monitoring station on Mauna Loa, Hawaii. On June 4, 2026 concentration reached 432 ppm.

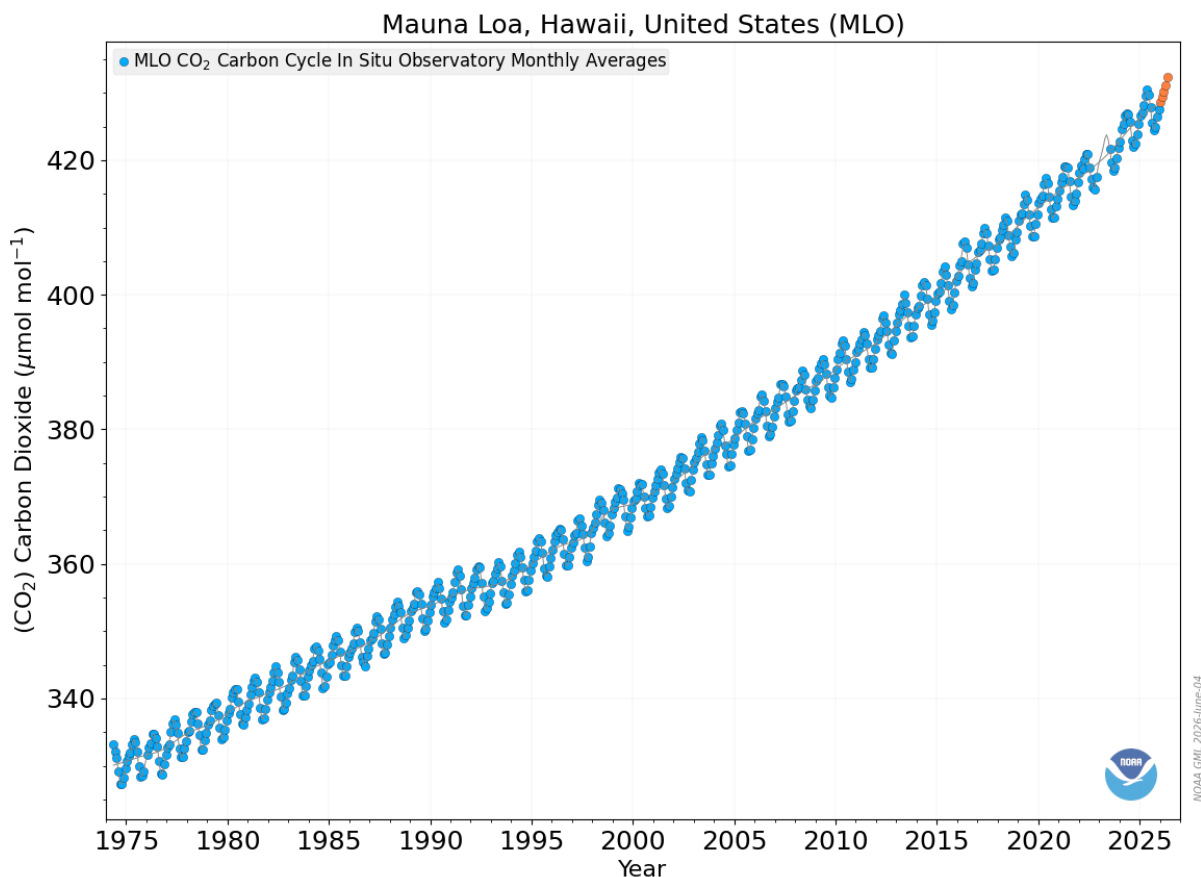


Figure 6: Carbon Dioxide Levels Measured at Mauna Loa to June 2026<sup>4</sup>

### Total Greenhouse Gas Emissions

Total greenhouse gas emissions in 2025 are expected to set a new record high, about 57–60 GtCO<sub>2</sub>e (shorthand for billion metric tons of CO<sub>2</sub>equivalent). This estimate of total global emissions is from the latest UN Emissions Gap Report. The breakdown of sources is about 73% of emissions are from the energy sector (production of electricity and heat, transportation, buildings, and industrial uses), 18% is from Agriculture, forestry and land use changes (AFOLU) (raising livestock, fertilizer use, deforestation, soils emissions, and rice production), about 5 to 6% is from non-energy producing industrial processes (cement and steel production, chemicals production), and about 3% is from waste (landfills and wastewater). Coal use has been declining globally except for China and India. Emissions of methane have been increasing with the greater use of natural gas. While China's emissions are slowing, U.S. emissions are expected to increase as the Trump Administration pushes for greater fossil fuel use

### Global warming is irreversible!

We should understand that global warming is irreversible. We can speed up global warming by discharging more greenhouse gases into the atmosphere, but we can't slow down or reverse global warming. Carbon dioxide discharged into the atmosphere stays there for hundreds of years until it slowly dissipates by natural forces. If we stop greenhouse gas emissions at some future date, the Earth's temperature will not go down. It will stabilize at some higher temperature consistent with greenhouse gases in the atmosphere at that time.

## Growth of renewable energy.

Is renewable energy cheaper than fossil fuels? The most significant comparison is for renewable energy sources such as wind and solar distributed on an electric distribution grids where battery storage is also included. In this situation, renewable resources have the lowest levelized costs of energy.<sup>5</sup>

Globally, over 90% of electricity capacity additions in 2025 were for renewables. China added 430 GW of combined solar and wind generating capacity. This gives China a total capacity of 1,800 GW of renewable energy, for over 60% of China's total power generation. In comparison, in 2026, the U.S. plans to add 86 GW of new capacity, of which 55 GW would be solar and wind.

Nuclear energy is receiving renewed interest as a source of carbon free energy, to help meet the growing demand of massive new data centers for artificial intelligence as well as "Small Nuclear Reactors" (SMRs) proposed to be cheaper and faster to build. However, we must remember that building new nuclear plants is a costly and lengthy process, with licensing historically taking five years or more. As former nuclear engineers, we think that designing, licensing and constructing a new concept nuclear power plant and delivering power in five years is wildly optimistic. Also, the three fundamental problems of nuclear power are still unresolved. Nuclear plants are the most expensive way to generate electricity, especially compared to solar and wind. Second, there is still no approved system for storing radioactive waste. And finally, siting of nuclear power plants is still a concern of the general public. These problems can be avoided with today's large renewable power plants—cheaper and faster to construct and do not need to be near cooling water.

## How big can solar plants be?<sup>6</sup>

A handful of sensationally large developments are underway around the world, demonstrating just how big solar can get. These three projects show us the giga-scale future for solar and wind. Here are three of the most prominent giga-projects currently underway, to provide a sense of just how big solar power plants are becoming and what it takes to make them happen. Giga-scale construction requires a whole new level of land access, workforce mobilization, and transmission planning. Collectively, these projects presage a future when the sunniest, most remote places in the world serve as electrical breadbaskets, supplying energy to population hubs far away.

1. India's Khavda Renewable Energy Park is pushing the boundaries of clean energy construction, installing a combined 30 gigawatts of solar and wind capacity alongside what may be the largest battery in the world. (Figure 7).

2. Talatan Solar Park, Qinghai Province, China: 17+ GW: China's largest cluster of solar farms has accumulated at Talatan Solar Park, in Qinghai Province. As of last fall, it could produce nearly 17 gigawatts, and it was still growing. The solar cluster covers an area equivalent to seven Manhattans. China displaced a million people to create an enormous power plant with the Three Gorges Dam, but now it installs solar capacity equivalent to that project **every three weeks**, according to reports.

3. Valley Clean Infrastructure Plan, California, USA: 21 GW: The Central Valley of California churns out one-quarter of the agricultural crop in the U.S., but its water is disappearing. The Westlands Water District has tackled this head-on with a coordinated strategy that, if implemented, would allocate fallow lands for a sprawling 21-gigawatt solar complex, served by a privately developed transmission corridor. If fully built, the Westlands effort would add as much utility-scale solar as the whole state of California has built thus far. It could give California one of the largest solar plants in the world, especially impressive given the state's famously high cost of doing business, and the elevated solar-panel prices from U.S. trade protectionism.

**NOTE: For our non-technical readers, ONE gigawatt (1,000 megawatts) is the output of ONE LARGE NUCLEAR POWER PLANT. These solar plants are equal to 20 to 30 LARGE NUCLEAR PLANTS.**

What makes the Valley project special is how it seeks to overcome the collective action problems stymieing renewables development across much of the U.S. While India can direct huge projects with sheer force of will, and the Chinese government can clear the way for its long-range

energy plans, the U.S. doesn't typically have a centralized entity planning energy, transmission lines, permitting, water supplies, and optimal land use. But the Westlands district has taken on that role as an evolution of its historical duties coordinating water infrastructure on behalf of its members.

The project could inject much-needed clean energy for California's quest to phase out fossil fuels by 2045. Plus, with its incentives for farmers and requirement of a community benefits plan, it could also model how clean energy can help communities adapt to a changing environment without leaving people behind.



Figure 7: India's Khavda Renewable Energy Park. (Punit Paranjpe/AFP via Getty Images)

### New U.S. electric generating capacity expected to reach record high in 2026<sup>7</sup>

U.S. power plant developers and operators plan to add 86 gigawatts (GW) of new utility-scale electric generating capacity to the U.S. power grid in 2026. (See the latest *Preliminary Monthly Electric Generator Inventory* report, a record if realized.) Solar power makes up 51% of the planned 2026 capacity additions, followed by battery storage at 28% and wind at 14%. In 2025, 53 GW of new capacity was added to the grid (30.8 GW was utility solar), the largest capacity installation in a single year since 2002. (Figure 8)

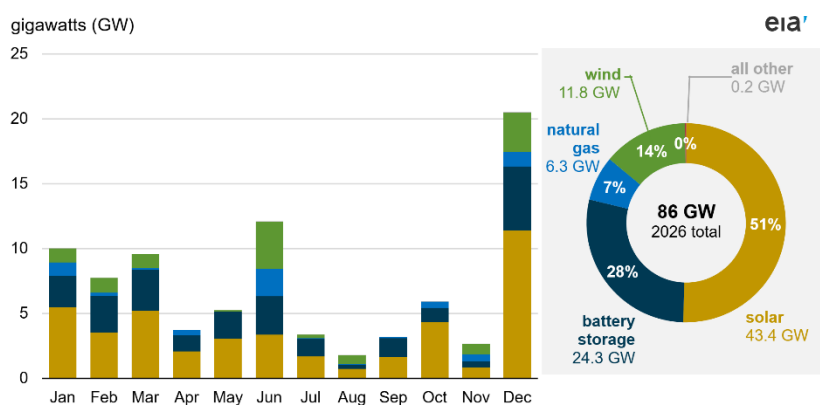


Figure 8: U.S. Planned Utility-Scale Capacity Additions (2026)

### An ever-hotter planet looms.<sup>8</sup>

A recent report from the World Meteorological Organization (the climate and weather arm of the United Nations) is predicting that over the next five years the world is going to see increasing warmth with resulting droughts, heat waves, longer fire seasons, and more intense fires. The report goes on to

say that the consequences of warming will vary widely across the world. Fast forward to March 2026, when the continental U.S. registered its most abnormally hot month in 132 years of records, according to NOAA data.<sup>9</sup> And the next year or so looks to turn the dial up on global warmth even more, as some forecasts predict a brewing El Niño will reach super strength.

Not only was it the hottest March on record for the U.S. but the amount it was above normal beat any other month in history for the lower 48 states. March's average temperature of 50.85°F (10.47°C) was 9.35°F (5.19°C) above the 20th-century normal for March. That easily passed the old record of 8.9 °F set in March 2012 as the most abnormally hot month on record – regardless of the month of the year – according to the National Oceanic and Atmospheric Administration (NOAA).

April 2025 to March 2026 was the warmest 12-month period on record in the continental United States, according to NOAA. More than 19,800 daily temperature records were broken for heat across the country. More than 2,000 places set monthly records for heat – harder to break than daily records.

### Projected Sea Level Rise By 2100

Sea level today is about 8–9 inches (21–24 cm) higher than it was around 1900. That's roughly 1.7 mm per year on average over the 20th century, with the rate accelerating in recent decades. Satellite data (since 1993) show even faster rise (~3.9 mm/yr), indicating acceleration tied to warming oceans and melting ice.

For a rough estimate, if sea level continues to rise at about 1.7mm/year on average for the next 75 years to 2100, the increase would be about 1.7 mm x 75 years = 127.5 mm total or about a 5.0 inch increase, for total increase from 1900 of about 13 or 14 inches. If the rate of increase is more like 3.9 mm/year, this increase would be about 292.5 mm or about 11.5 inches for a total increase since 1900 of 19.5 to 20.5 inches. This is roughly consistent with likely/middle-of-the-road scenario listed below.

Projections vary depending on future emissions and ice-sheet responses, but most scientific estimates fall roughly within the following ranges:

- Likely / Middle-of-the-road scenarios assume moderate to significant reductions in greenhouse gas emissions of about 30–60 cm (about 1–2 feet) globally by 2100.
- If emissions remain high and ice sheet loss accelerates, 60 cm to over 1 m (2–3+ feet) by 2100.

For sea level rise since 1900, the contributions are caused by:

Thermal expansion (warming water expands)	~30–50%
Melting glaciers (mountain glaciers worldwide)	~25–35%
Greenland Ice Sheet melt	~15–20%
Antarctic Ice Sheet melt	~5–15%

Today, melting ice slightly outweighs expansion. In recent decades (since ~1990) ice melt has accelerated rapidly. Land ice now contributes as much or more than thermal expansion. Greenland and Antarctica are growing contributors.

### 'Point of no return': New Orleans relocation must start now due to sea level rise<sup>10</sup>

The process of relocating people from New Orleans should start immediately, as the city has reached a "point of no return" that will see it surrounded by the ocean within decades due to the climate crisis, a stark new study has concluded. Ongoing sea-level rise and the rampant erosion of wetlands in southern Louisiana will swallow up the New Orleans area within a few generations, with

new research estimating the city “may well be surrounded by the Gulf of Mexico before the end of this century”. Low-lying southern Louisiana faces multiple threats, with rising sea levels driven by global warming, compounded by strengthening hurricanes, and the gradual subsidence of a coastline that has been carved apart by the oil and gas industry.

Southern Louisiana is facing 3-7 meters of sea-level rise and the loss of three-quarters of its remaining coastal wetlands, which will cause the shoreline “to migrate as much as 100km (62 miles) inland”, thereby stranding New Orleans and Baton Rouge, according to the study, which compared today’s rising global temperatures with a period of similar heat 125,000 years ago that caused a rise in sea level. This scenario makes the region the “most physically vulnerable coastal zone in the world”, researchers state, and requires immediate action to prepare a smooth transition to safer ground for its population of about 360,000 people.

Louisiana has already experienced population loss in recent years, and this trend will accelerate in a disordered way, unless action is taken to confront the perils faced by its largest city and surrounding communities.

“While climate mitigation should remain the first step to prevent the worst outcomes, coastal Louisiana has evidently already crossed the point of no return” writers say. Billions of dollars have been spent to fortify New Orleans with a vast network of levees, floodgates and pumps erected after 2005’s catastrophic Hurricane Katrina. But the growing threats to the city mean the levees, which already require hefty upgrades to remain sufficient, will not be able to save the city in the long run, the new paper warns.

An exodus has already begun, so if nothing is done, people will just trickle out over time and it will be an uncoordinated mess. The market will speak as people won’t be able to get insurance. Louisiana has to stop the bleeding and acknowledge this is happening. But at the moment there is no plan. New Orleans is not going to disappear in 10 years or anything like that, but policymakers really should’ve thought about a relocation plan a century ago.

“Governments may not have the ability to just command people to leave, but people will volunteer to move and we are seeing that already. Can the political system deal with this challenge? It will take leadership and unpopular decisions. Also, many people don’t want to move. They love where they were born.

### **Importance of Changes in the Arctic**

The Arctic is essential to stabilizing the Earth’s temperature and climate. The Earth is heated unevenly, receiving much more energy from the sun’s radiation in lower latitudes near the equator than at the poles. The Atlantic Meridional Overturning Circulation (AMOC) is a large ocean current that transports heat from the tropics to the Arctic and transports cold Arctic seawater south to cool the oceans in the tropics. Research suggests that the Atlantic Meridional Overturning Circulation could weaken by half this century with wide ranging consequences for weather, food and sea levels across the world. The Gulf Stream is a small part of the AMOC.

The Arctic is warming about 3–4× faster than the global average. This is called Arctic amplification. The Arctic is in a positive feedback loop where warming causes conditions that create even more warming, a self-amplifying system driven largely by the Albedo Effect. White Ice and snow reflect sunlight back into space. When they melt, they expose dark ocean or land, lessening the Albedo Effect, causing more absorption of heat from the sun. This creates a powerful feedback loop that accelerates warming.

In addition, the Arctic Ocean now stays ice-free longer in summer, storing heat that is released in autumn and winter, keeping the region warmer year-round. The temperature of the surface water of the Arctic Ocean is fairly constant at approximately  $-1.8\text{ }^{\circ}\text{C}$  ( $28.8\text{ }^{\circ}\text{F}$ ), near the freezing point of seawater. This exposed seawater is much warmer than the atmosphere in the Arctic during the winter. Arctic heating:

- Raises sea levels (via Greenland ice melt)
- Disrupts weather patterns (jet stream changes) in the northern hemisphere;
- Accelerates global warming overall

The jet stream becomes slower, wavier, and more unstable. The jet stream is driven by the temperature difference between the Arctic (cold) and mid-latitudes (warm) This difference keeps winds fast and relatively straight.

As the Arctic warms faster, the temperature differential is reduced and the jet stream slows down and becomes wavier (meandering). Weather systems get “stuck” in place longer leading to heatwaves that last weeks, prolonged rainfall and flooding, and cold weather dipping far south.

Ocean currents: risk of a slowdown. The Atlantic Meridional Overturning Circulation (AMOC) which includes the Gulf Stream. Melting ice (especially Greenland) adds freshwater to the North Atlantic, disrupts sinking of cold salty water, and can slow down the circulation. Europe could become **cooler** despite global warming. Shifts in tropical rainfall (monsoons, Amazon) can occur.

Across the Northern Hemisphere weather patterns are changing. Heatwaves → stronger and longer. Storms → wetter (more moisture in warmer air). Cold snaps → still possible, even in a warming world. Winters: more **erratic** (polar air spilling south). Summers: more blocking patterns → droughts + fires. High-pressure systems can **stall**. California can have droughts. Another factor is that warmer air and ocean currents from lower latitudes are moving north. As global warming intensifies, more heat is pushed into the Arctic.

### **A Strong El Niño May Be Coming. Global Warming Is Changing Its Effects.<sup>11</sup>**

As the planet warms, past episodes of the natural weather phenomenon may no longer be a reliable guide of how the next one plays out. El Niño occurs when water in these areas gets warmer: Africa, Europe, Asia, Australia, Antarctica, North America, South America, and the Pacific Ocean. During El Niño, it typically gets wetter in certain areas and drier in others, compared to La Niña weather.

Forecasters say a powerful El Niño weather pattern could form later this year, with a chance of becoming one of the strongest in three decades. The winds above the Pacific are shifting, the ocean is releasing stored-up heat, and a cascade of effects on rain, droughts and wildfires could be on its way.

The National Oceanic and Atmospheric Administration says there’s a roughly 60 percent chance of an El Niño developing between May and July. That’s a major reason scientists now say next year could surpass 2024 as the planet’s warmest year since modern records began in the mid-19th century.

El Niño and La Niña are the opposite phases of a natural climate cycle that has been active in the Pacific for thousands of years. They appear at irregular intervals, and no two events are ever the same. But Earth’s steady warming from the burning of fossil fuels is also influencing the way these episodes shape the weather around the globe.

Here’s how El Niño affects the world:

Life in **South America** has been entwined for centuries with El Niño and its distinctive pileup of warm ocean waters off Peru and Ecuador. Meteorologists classify El Niños as strong or weak depending on how much warmer those waters are than average. The strongest events cause a variety of effects across the continent: severe floods in southern Brazil in 1982-83, drought in Colombia that ravaged coffee crops in 1997-98, and below-normal rain and wildfires in the Amazon in 2015-16.

Technically, the most recent El Niño, in 2023-24, wasn’t as strong as its predecessors. Yet its effects in some areas were more catastrophic. Scarce rainfall brought some rivers in the Amazon basin to their lowest levels in 120 years. Fires scorched the Pantanal, the world’s largest tropical

wetland. Record-breaking rains in Brazil's southernmost state, Rio Grande do Sul, displaced half a million people.

A major amplifying factor, scientists have found, is human-induced warming. The effects followed the expected pattern for El Niño, but they were much worse because of climate change, because now this impact is happening in an atmosphere that is warmer. The extra warmth increased evaporation, which supercharged drought in the Amazon. It also intensified the rains in Brazil's south, because warmer air can hold more moisture.

In **North America**, El Niño typically delivers wetter conditions across the southern tier of the United States and warmer, drier weather up north. The very strong El Niño that began in 1997, for instance, saw weeks of drenching winter storms in California and heat records smashed in the Midwest and Northeast. Atlantic hurricane activity in the months before was below normal, another El Niño result.

**Other areas:** El Niño brings similar wetter and drier weather to parts of Asia, Africa, and Oceania.

Scientists expect both strong El Niños and strong La Niñas to become more frequent as humans continue heating the planet. That means sharp seesaws between the two could happen more often.

### **Billion-dollar weather and climate disasters so far in 2026<sup>12</sup>**

As of mid-2026, the United States has experienced several confirmed billion-dollar weather and climate disasters, with total accumulated costs continuing to rise as assessments remain ongoing for early spring events.

Tracked events so far in 2026 include these three:

- **Central and Southeastern Tornado Outbreak & Severe Storms (March 10–12):** This multi-day severe weather event generated more than 95 tornadoes across Illinois, Mississippi, Alabama, and Georgia. It caused an estimated **\$2.3 billion** in damages and claimed 5 lives.
- **Ongoing Assessments:** Several events that occurred earlier in the year are still being reviewed to determine if damages exceed the \$1 billion threshold. These include the **Hawaii Flooding** in mid-March and the **Northeast Winter Storm** from February 9–11.

Unfortunately, the NOAA National Centers for Environmental Information, which would be normally tracking billion-dollar climate and weather disasters, is no longer being updated by direction of the Trump Administration. The tracking of these events is being managed by **Climate Central**, which stepped in to maintain the database after federal datasets were discontinued. According to Adam Smith at Climate Central, “disaster costs are rising because people are building in disaster-prone places, many areas have inadequate building codes, and extreme weather is getting worse. Also, human-caused climate change is supercharging the intensity and the frequency of some of these extremes that lead to billion-dollar disasters.”

Yale Climate Connections also reports on climate disasters. It notes that the frequency of billion-dollar disasters has increased dramatically. The U.S. now experiences a billion-dollar disaster about every two weeks, on average. (There were 24 in 2025).<sup>13</sup>

### **A closely guarded plan to cool Earth is revealed<sup>14</sup>**

Stardust Solutions, a geoengineering company, is proposing to scatter tiny specks of silica in the atmosphere to block sun rays. Stardust, a company that aims to make billions of dollars by cooling the Earth, has lifted the veil of secrecy that until now has hidden its plans for preventing sunlight from overheating the planet. Its method is based on spraying aerosol particles that are 125 times smaller than the tiniest grains of sand into the atmosphere. Stardust's proprietary particles are made of amorphous silica and are 0.5 microns in size—only visible with a microscope. The company

has a proprietary system it would use to disperse the spherical silica particles at an altitude of 11 miles above the ground and monitor them as they fall back to the Earth.

The company is a new entry into solar geoengineering — the hypothetical pursuit of altering clouds or changing other characteristics of the atmosphere in ways that would interrupt sun rays before they hit the Earth. Other ideas envision building massive sun shades in space or creating bubbly mixtures of reflective sea foam to limit the amount of heat absorbed by the oceans. To date, while dozens of geoengineering concepts have been proposed, there has been no actual real-world demonstration on other than a laboratory scale. Proponents frequently refer to historic volcano eruptions that scattered ash and sulfur compounds into the atmosphere and darkened the sky for months as proof of concept.

Geoengineering is unlike other responses to climate change because, while it can theoretically reduce warming, it does not address the root cause: the burning of fossil fuels. That means the world would be effectively hooked on solar geoengineering until nations reduce their use of oil, gas and coal to safe levels and then remove excess climate pollution from the air and seas.

Stardust is developing two types of amorphous silica-based particles. One is “fully bio-safe, manufacturable at scale today, and at a very advanced stage of validation,” according to a summary of the research. Another similarly sized version of the silica particle includes a calcium carbonate core that it said would more effectively block solar radiation. Both designs are intentionally engineered to recycle into existing natural cycles after they settle to the ground, according to Stardust.

Amorphous silica has a different atomic structure than crystalline silica, the reactive, hazardous dust released by cutting or crushing certain types of rocks. Stardust is not using crystalline silica in its process. Amorphous silica isn’t known to pose a risk to humans at low doses, according to the World Health Organization’s cancer research agency.

Most scientists remain wary of Stardust and other solar geoengineering companies. They fear that not enough is known about how these various materials would propagate in the atmosphere, how they might have unanticipated side effects, or once in the atmosphere, might interfere with weather.

<sup>1</sup> Source for Figures 1-3 is Berkeley Earth, <https://berkeley-earth-wp-offload.storage.googleapis.com/wp-content/uploads/2026/01/13155613/2025-Time-Series.png>

<sup>2</sup> <https://www.scientificamerican.com/article/europes-deadly-spring-heatwave-is-obliterating-temperature-records/> By Adam Kovac, edited by Claire Cameron.

<sup>3</sup> <https://climateactiontracker.org/global/emissions-pathways/>

<sup>4</sup> NOAA Mauna Loa observatory, <https://gml.noaa.gov/dv/iadv/graph.php?code=MLO&program=ccgg&type=ts>

<sup>5</sup> See Craig Smith and William Fletcher, “Irreversible: What Can We Do?” *PublishAuthority*, 2026: Table 10.1, “levelized Cost of Various Energy Sources.”

<sup>6</sup> Julian Spector, 5/19/26: <https://www.canarymedia.com/articles/solar/how-big-can-solar-go>

<sup>7</sup> <https://www.eia.gov/todayinenergy/detail.php?id=67205>

<sup>8</sup> Purtill, Corinne, “An ever-hotter planet looms,” *Los Angeles Times*, pg. A-1, May 29, 2025

<sup>9</sup> [www.theguardian.com/us-news/2026/apr/09/hottest-march-on-record](http://www.theguardian.com/us-news/2026/apr/09/hottest-march-on-record)

<sup>10</sup> Oliver Milman, 4 May 2026: <https://www.theguardian.com/us-news/2026/may/04/new-orleans-sea-levels-relocation-climate-crisis?>

<sup>11</sup> Raymond Zhong, May 4, 2026: <https://www.nytimes.com/2026/05/04/climate/el-nino-global-warming.html?smid=nytcore-ios-share>

<sup>12</sup> <https://www.climatecentral.org/climate-services/billion-dollar-disasters>

<sup>13</sup> YCC team, 2/17/26: <https://yaleclimateconnections.org/2026/02/the-frequency-of-billion-dollar-disasters-has-increased-dramatically/>

<sup>14</sup> Corbin Hiar 05/15/2026: <https://www.politico.com/news/2026/05/15/a-closely-guarded-plan-to-cool-earth-is-revealed-00920438?cid=apn>