# The Sustainability Trends Report 2026

generation

16 September 2026

# Contents

# “To see what is in front of one’s nose needs a constant struggle.”

George Orwell

Dear Reader,

Welcome to the 10th annual edition of The Sustainability Trends Report. The report has changed significantly in that decade, and so has the world around us. This report series was launched in the flush of enthusiasm that followed the Paris Agreement on Climate Change, adopted in late 2015. The period since has been marked by profound challenges, yet the spirit of Paris is alive. Citizens, governments and corporations continue to strive to meet the Paris goals, and they are getting a major boost — from the technology and economics of renewable energy, from clean cars and from better batteries.

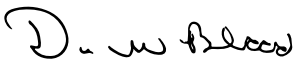
In fact, the cost trends are so favourable that a long-sought goal now appears within reach. The idea that developing countries might jump past fossil fuels and go straight to clean energy is no longer a fantasy: this great ‘leapfrog’ is starting to happen. As electric cars become more affordable, some countries are starting to ban the sale of petrol-burning models, determined to seize a greener future, and to liberate their citizens from the volatility of the oil market. Solar power is becoming so cheap in some parts of the world that it may become the basis of large manufacturing industries, giving sun-drenched tropical countries an advantage they never had before in the global competition for jobs.

In this report, we will not minimise the difficulties of the moment. Politics has taken a dark turn across much of the democratic world, threatening more than just climate goals. Yet political leaders ultimately take their marching orders from citizens, and solving the climate crisis offers us the potential to replace the politics of fear and repression with one of hope and vision.

We can see a better world just over the horizon, and we urge all readers of this report to raise their voices and help call it into existence.

Al Gore, Chairman

David Blood, Senior Partner



# At a glance

## 01 Year in Focus

For the second time in half a decade, a fossil-fuel supply crisis has shocked the global economy. It is now obvious that energy security and the climate crisis are not separate problems. They are a single problem with a single solution, a rapid embrace of clean energy.

## 02 Power

Clean energy grew fast enough in 2025 to satisfy all new demand on the global power system. Solar power in particular is the breakout star of the transition, growing at 30 percent a year.
The idea that developing countries might skip fossil fuels and 'leapfrog' to clean energy is increasingly plausible.

## 03 Transportation

Electric cars have seized a quarter of the world market and their share is growing. Fuel-burning cars peaked almost a decade ago and are now a declining technology. Having dragged their feet on the energy transition, Western carmakers are now losing market share to Chinese brands and fighting a rear-guard action to slow the transition.

## 04 Buildings & Industry

We are finally starting to see movement in the effort to clean up global industry. Huge heat pumps are proving that they can take on big jobs that used to require burning gas.
Public policy in these sectors is still much too weak, and new laws will be required to spur cleaner buildings and factories.

## 05 People, Land & Food

Food prices are high, and we are at risk of a new global food crisis over the next year. The Iran war bottled up critical supplies of fertiliser during the spring planting season. The developing El Niño weather pattern, predicted to be one of the strongest on record, could hit some crops hard and worsen the situation.

## 06 Financing the Transition

Investment flowing into clean energy is double the investment flowing into fossil fuels. But at $2.2 trillion it is still not enough, and needs to hit $4.5 trillion by the early 2030s if global climate goals are to be met. Heat waves, fires and other climate impacts are contributing to a worsening global insurance crisis.

## 07 Looking Ahead

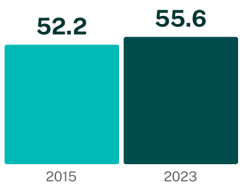
We are living through an age of disruption, with populist political parties offering false solutions to voters desperate for change. The greatest disruption of all may be the advent of artificial intelligence, which holds the potential to render many jobs obsolete. But it could also help us in the energy transition, finding efficiencies and solutions that have long eluded us.

# Key Trends

# A decade of struggle

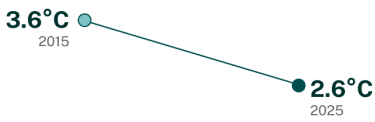
With this 10th edition of the report, we introduce a set of indicators designed to answer a simple question: is society moving in the right direction? Every major sector of the economy is represented here, sometimes by a single metric. We cite steel emissions, for example, as a proxy for industry at large. Each panel shows a decade-long view, or as close to a decade as we can get with available data, and each one shows whether things are moving in the right direction or wrong direction. We commit to updating this billboard each year as a way for readers to keep track of the overall trends.

**Global GHG emissions, in GtCO2e**



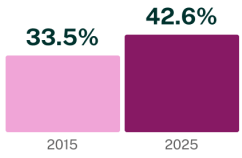

Climate Action Tracker

**Projected 2100 warming under current policies**



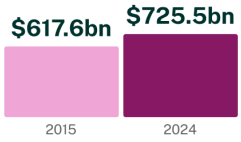

Climate Action Tracker

**Clean share of global electricity generation**



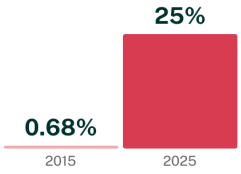

Ember

**Explicit fossil fuel subsidies**



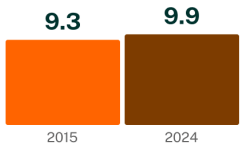

IMF

**Electric cars as share of global new-car sales**



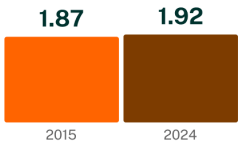

IEA

**Global buildings operational $CO_2$ emissions, in $GtCO_2$**



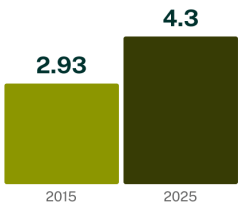

Global ABC

**$CO_2$ intensity of global steel production, in $tCO_2/t$**



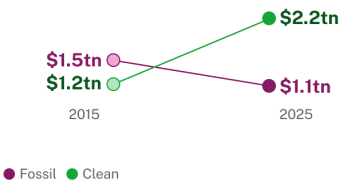

World Steel Association

**Tropical primary forest loss, in million hectares/year**




WRI

**Fossil vs clean energy investment**




IEA

# 01
# Year in Focus


## Hazard ahead

We have been warned.

More precisely, we have been warned again. The oil shock that reverberated around the world as a result of the American war on Iran came just four years after the global gas and oil shock from Russia's invasion of Ukraine. Prices soared, and in the countries most dependent on Middle Eastern fuel imports, in Asia, people were forced to grapple with physical shortages and panic buying.

In the 20th century, three great oil shocks, spread across two decades, gave us ample warning of the hazards of dependency on fossil fuels.[1] Now two 21st-century shocks in the span of half a decade drive home a point we have all been too slow to understand: fossil-fuel dependency is not just bad for the environment. It is bad for national and regional security, bad for the cost of living and bad for the food supply. As shortages loomed and prices soared in recent months, Indians found themselves bereft of cooking gas, Vietnamese motorcyclists could not get petrol, and Bangladeshi classrooms went dark. Ceasefires have been declared in this war and then fallen apart weeks later; the war still threatens to morph into a broad regional conflict involving multiple countries. Despite an American-led operation that appears to be moving millions of barrels of oil out of the region under cover of darkness,[2] reserve margins in the oil markets are eroding. Worse may be to come over the next few months as food shortages take hold.[3]

**1.** For a brief history of oil shocks since 1973 and discussion of their macroeconomic import, see Lutz, Kilian et al., 'US economy less vulnerable to geopolitical oil price shocks than in the past.' Federal Reserve Bank of Dallas, 23 June 2026.

**2.** For a summary of the situation, see Kantchev, Georgia et al., 'US says oil is pouring through Hormuz. Trackers can't find it.' The Wall Street Journal, 24 August 2026. But note that the Reuters agency first broke the story that the Americans were escorting large volumes of oil past Iranian guns. See Dalatey, Feras et al., 'Exclusive: the US is using an Iranian smuggling tactic to sneak oil out of the Gulf.' Reuters, 16 June 2026.

**3.** UN Food and Agriculture Organisation, 'Supply concerns drive FAO Food Price Index higher in August.' 4 September 2026.

## Queuing up


A motorcyclist who made it to the front of a long queue watches the numbers tick up as she buys fuel in Ho Chi Minh City, Vietnam, amid high prices linked to conflict in the Middle East.

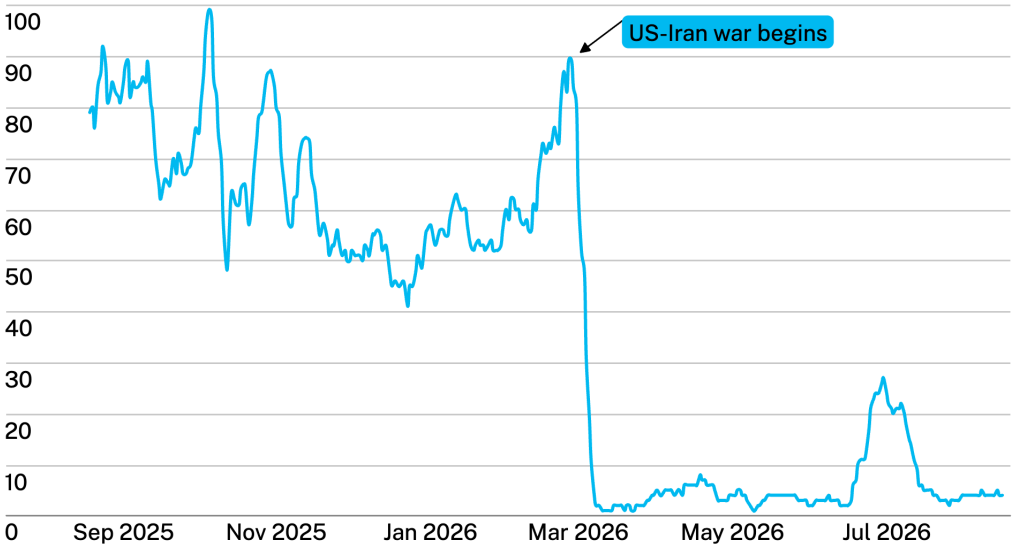
Source: Thanh Hue, via Getty

Anybody familiar with the geography of the Persian Gulf has long understood that Iran and its authoritarian mullahs loomed menacingly over one of the world's most important waterways, the Strait of Hormuz. Little more than 50 kilometres wide at its narrowest point, it is the only route for ships to enter and exit the Persian Gulf, the world's single most important oil-producing region. Nonetheless, the ill-considered American and Israeli attack led the Iranians to discover a power they did not know they possessed: the ability to frighten companies that insure marine shipping. They mined shipping lanes. They threatened to fire on ships passing through the strait, and episodically made good on the threat. That caused insurers to cancel or reprice cover on hundreds of vessels, effectively closing the strait to traffic and bottling up a quarter of global seaborne oil trade, a third of global seaborne fertiliser trade and nearly a fifth of global trade in liquefied natural gas.[4]

**4.** International Energy Agency, 'Strait of Hormuz factsheet.' February 2026. See also UN Conference on Trade and Development, 'Strait of Hormuz disruptions: implications for global trade and development.' 10 March 2026.

**Figure 1: The big drop**

**Ship traffic through the Strait of Hormuz**

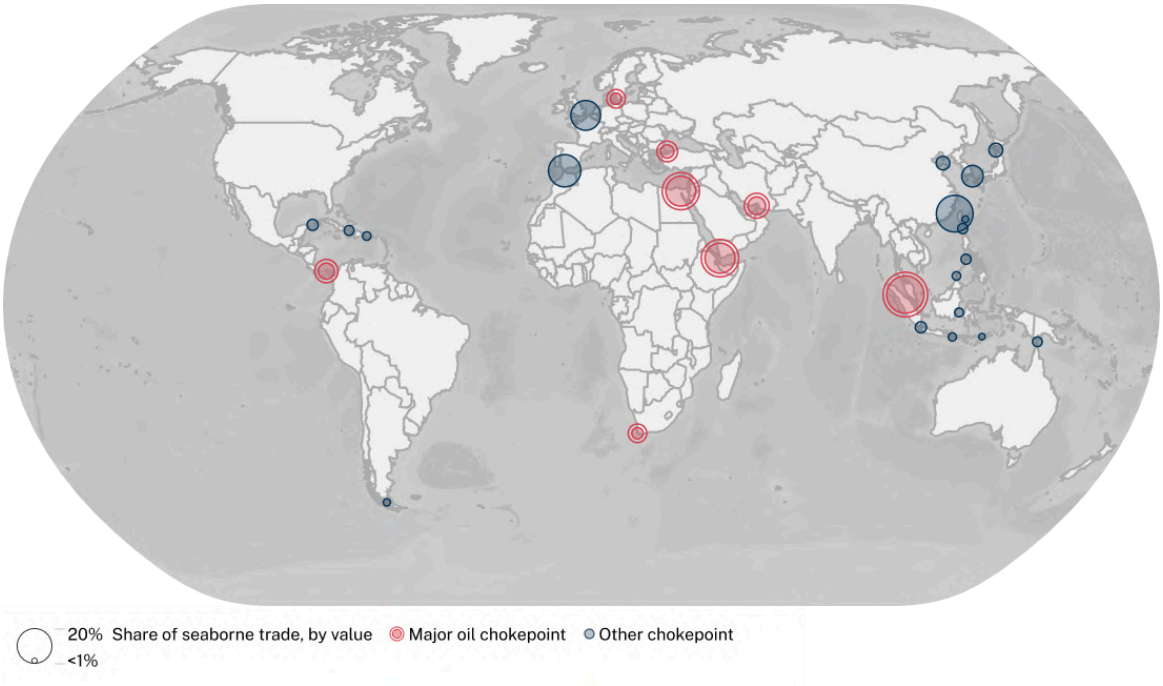



Ship traffic transiting the Strait of Hormuz fell sharply in March 2026 and has remained below previous levels, highlighting the continued disruption to one of the world's most important maritime chokepoints. This chart shows a seven-day moving average of ships passing through the strait, though it includes only those that keep their transponders on.

Source: IMF PortWatch

Shortages of other critical materials that had been exported from the Gulf quickly propagated through entire industries, including deficits of sulphur, used as an intermediate chemical in mining, in fertiliser production and for many other purposes. Helium exports were blocked; this gas is used to produce computer chips and to cool tens of thousands of magnetic resonance imaging machines around the world. The helium shortage thus disrupted the diagnosis of strokes, cancers and other medical problems. The partial reopening of the strait over the summer did not entirely alleviate the shortages, in part because production facilities were so badly damaged in the war that they will take years to repair.

**Figure 2: The world's chokepoints**




This world map shows many of the major chokepoints for global trade.

Source: Verschuur et al.

The vulnerabilities and the potential for shortages run in both directions. While the Earth's geological history has blessed the Middle East with oil, that region is not blessed with water or an abundance of fertile land. As they ship out the fertiliser that allows other countries to grow food, the countries of the Middle East and North Africa must import more than half the calories their people consume. In some countries, that figure approaches 90 percent.[5] In summary, the region stretching from Morocco to Iran is home to 590 million people who cannot grow enough food to feed themselves, and the region is headed toward a population that will approach 800 million by 2050.[6]

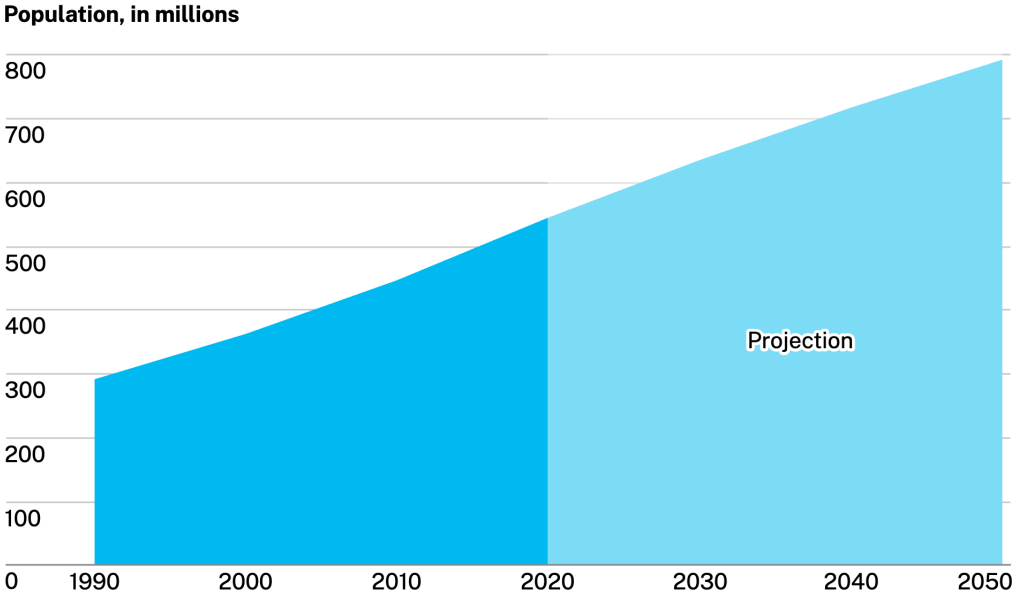
Luckily, the world grain market was oversupplied for several years before the war broke out. Most Middle Eastern countries were smart enough to build national food reserves when they could. Egypt, the world's largest wheat buyer, and the wealthy Gulf states all added to their reserves during 2025.[7] For countries in this fortunate position, the consequences of the war were transmitted through markets as higher prices, not physical shortages.

**5.** UN Food and Agriculture Organisation, 'Global agrifood implications of the 2026 conflict in the Middle East.' 15 March 2026.

**6.** UN Department of Economic and Social Affairs, Population Division, 'World Population Prospects 2024.' July 2024.

**7.** Simpson Spence Young Ltd, 'Middle East gulf grain imports.' 7 May 2026.

**Figure 3: Population boom**




This chart shows the past population growth, and future projected growth, of countries in the Middle East and North Africa region.

Source: UN DESA

But the regional average conceals a sharp divide. For war-torn countries and areas including Palestine, Yemen, Sudan, Syria, and now Lebanon, the issue is not the grain market itself; it is the collapse of income and the devaluation of currency caused by conflict, robbing people of ready access to the market. Famine was confirmed in parts of both Gaza and Sudan in 2025,[8] and it is there, not in the commodity balances, that the real emergency lies. In the rest of the region, no famine appears to be at hand in the near term, but these countries cannot rest easy. If the fertiliser shortage leads to poor global harvests this autumn and the building El Niño weather pattern hits crops as well, the region's grain reserves may come under pressure, and hunger could spread beyond the war-torn countries where it is already acute. Another factor compounding the situation is reductions in foreign-aid budgets by the US and several other rich countries, resulting in large-scale cuts to feeding centres and medical clinics in the world's poorest places.[9]

**8.** For the Gaza declaration, see UN Food and Agriculture Organisation, UNICEF, World Food Programme and World Health Organisation joint statement, 'Famine confirmed for first time in Gaza.' 22 August 2025. In Sudan, the long-running food crisis worsened in 2025 and 2026, with declarations of famine in new areas of the country; see ReliefWeb, 'Sudan becomes the world's hungriest country as famine spreads to two new areas of Darfur.' 5 February 2026.

**9.** Goodman, Peter S., 'Catastrophe is emerging in the world's most vulnerable places.' The New York Times, 18 May 2026.

**Going hungry**

Mohamed Abdi Abdullahi, aged 18 months, was found to be suffering from malnutrition when examined this spring at a hospital in Mogadishu, Somalia. Higher costs for fertiliser and diesel caused by the Iran war, coupled with recent aid cuts by rich countries, are rapidly worsening a long-running hunger crisis in Somalia. Mohamed received treatment and survived.

Source: Finbarr O'Reilly/VII Foundation

Having discovered their ace in the hole, the Iranians are not going to forget it, whatever settlement they ultimately manage to strike with the United States and Israel. Possibly for decades to come, the Strait of Hormuz will have to be viewed as one of the world's most dangerous trouble spots. As this report was going to press, official traffic through the strait was still well below its pre-war level. In late August, though, news broke that the US Navy was shepherding many ships through a channel on the south side of the strait, hugging the Oman coast.[10] This traffic cannot be tracked well by independent analysts, because the ships turn off their location beacons and transit at night, but some estimates put the flow of oil leaving the Persian Gulf this way as high as 10 million barrels a day, or half the pre-war volume. Presumably, vital imports — including food supplies — are moving into the region by the same route. It is not a full restoration of commodity flows, but this development should ease pressure in the markets. How long the American Navy can sustain it is an open question. Controversy erupted in late summer over excessively long deployments of some American ships, a threat to the well-being of their crews.

**10.** Ismay, John and Peter Eavis, 'How the US Navy is helping get oil through the Strait of Hormuz.' The New York Times, 19 August 2026.

Hormuz is not the only critical chokepoint on the world map. The largest oil tankers cannot use the Suez Canal, another chokepoint at the north end of the Red Sea. To pick up oil from Saudi Arabia's western coast, they must pass through the Bab el-Mandeb, a strait at the southern end whose main channel is but 26 kilometres wide at its narrowest point. This waterway has long been threatened by an Islamist insurgency in Yemen, and in September, a group called the Houthis seized the port of Mokha on the Red Sea, threatening one of Saudi Arabia's major conduits for supplying world markets. The Suez Canal itself is almost certainly vulnerable to drone warfare: unknown parties have already struck Egyptian ports nearby.

Historically, much of the Persian Gulf oil destined for delivery to the Mediterranean region and to Western Europe had to travel in smaller vessels that passed through all three chokepoints: they exited the Strait of Hormuz, looped around the Arabian Peninsula, entered the Red Sea through the Bab el-Mandeb, and then exited the region via the Suez Canal. (Some of this oil is now being re-routed through an Egyptian pipeline that can load ships at a Mediterranean port, but the volume is limited.) Even before the Hormuz closure, the world got a glimpse in 2021 of what a deliberate targeting of one of these chokepoints might achieve. A cargo ship called the Ever Given accidentally got stuck in the Suez Canal for six days, blocking more than $9 billion worth of seaborne trade per day. An escalation of the war could conceivably shut down all three chokepoints at once. ⇕

**Stuck in place**


Hundreds of ships got stuck in the Persian Gulf when the Strait of Hormuz was effectively closed by Iranian threats and American counter-threats. Here, Iranian beachgoers watch ships anchored just offshore.

Source: Amirhossein Khorgooei / ISNA / AFP via Getty

More than 6,000 kilometres to the east of Suez is another critical chokepoint: a quarter of the world's seaborne trade and more than a quarter of its oil passes through the Strait of Malacca, the main shipping channel between the Indian and Pacific oceans.[11] The strait narrows at one point to less than three kilometres, though for most of its length it is at least tens of kilometres wide. It would become a theatre of war in any conflict between China and the West. We know this for certain because it happened in World War II, when Britain mined the Strait of Malacca to hinder Japanese shipping. Additionally, the Panama Canal, the Strait of Gibraltar and the Bosphorus Strait are all narrow shipping lanes representing potential bottlenecks for global trade. A severe drought in 2023 lowered water levels in part of the Panama Canal, creating a massive shipping backlog. The same thing may be about to happen again, with some shipping restrictions having taken effect in early September.[12]

If you believe the rhetoric of the moment, governments are chastened by the vulnerabilities highlighted by the Iran war. Many of the rational governments — a category that does not include the one now running the United States — are suddenly pledging to accelerate the energy transition as a way to reduce their susceptibility to fossil-fuel shocks. "The Republic of Korea as a whole must move very quickly toward renewable energy," the president of South Korea, Lee Jae Myung, declared in late March in a characteristic comment. "Our future will be at serious risk if we continue to rely on fossil fuels."[13] We hope countries now expressing such sentiments are sincere, but history gives us pause. Three-quarters of the world's countries are fossil-fuel importers;[14] had they been working diligently in past years to carry out their own pledges and promises regarding the energy transition, they would already be much less dependent on these fuels, and thus less vulnerable to this kind of energy shock. Even before the Iran war broke out, the countries that had made faster progress saw large benefits. The International Energy Agency calculated that they avoided $260 billion in fossil-fuel import costs in 2025 alone.[15]

For now, at least, governments are putting up money and clearing red tape. Many corporations and ordinary citizens are also drawing the obvious conclusion from recent events, and taking action. When the first of the great oil shocks hit the Western world in 1973, there was no apparent alternative to dependency on oil. Governments of the time took the only path immediately open to them, which was to use taxes and regulations to push drivers into more efficient cars. However, the crisis also set off a long search, and today, alternatives are very much at hand. People who drive electric cars in California or ride electric scooters in Ho Chi Minh City are not fretting about the price of petrol at the pump. The first quarter of this year saw a huge grassroots response to the fossil-fuel price shock. In Europe, sales of electric heat pumps jumped 17 percent and electric cars 30 percent; African imports of solar modules from China jumped 120 percent; Indians rushed to replace gas-burning hobs with electric induction models, with sales of the devices rising 10-fold for a brief period.[16]

**11.** For estimates of the volume of oil passing through the Strait of Malacca and other chokepoints, see US Energy Information Administration, 'World oil transit chokepoints.' 3 March 2026. For an estimate of the broader importance of the Strait of Malacca to world trade, see Dent, Thomas, 'The Strait of Malacca's global supply chain implications.' Inside Supply Management, Institute of Supply Management, 21 November 2023.

**12.** Hoskins, Peter, 'Panama Canal to reduce shipping as El Niño strikes vital route.' BBC News, 21 August 2026.

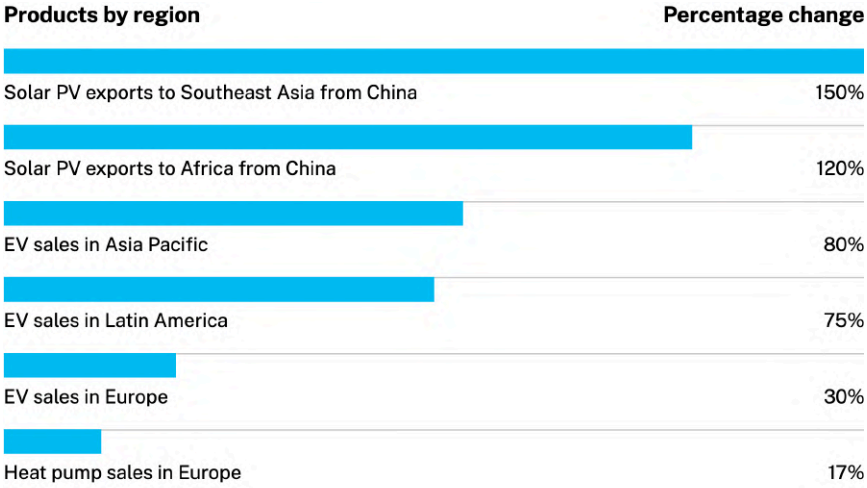
**13.** Ji, Da-gyum. 'South Korean President Lee calls for fast renewable pivot, says energy crisis keeps him up at night.' The Korea Herald, 31 March 2026.

**14.** Bond, Kingsmill et al., 'Energy security in an insecure world.' Ember, 22 April 2025. See also International Renewable Energy Agency, 'Geopolitics of the energy transition: energy security.' April 2024.

**15.** International Energy Agency, 'World Energy Investment 2026.' 28 May 2026.

**16.** Acharya, Disha and Jessica Rajan, 'No gas! Induction cooktop sales on fire on qcomm platforms.' Economic Times, 11 March 2026.

**Figure 4: Seeking alternatives**




The price spikes and shortages from the Iran war have led consumers and businesses to seek out alternatives, with huge sales shifts in some product categories and some geographies. This chart shows percentage sales increases in the first quarter in selected categories, compared to the same quarter a year earlier.

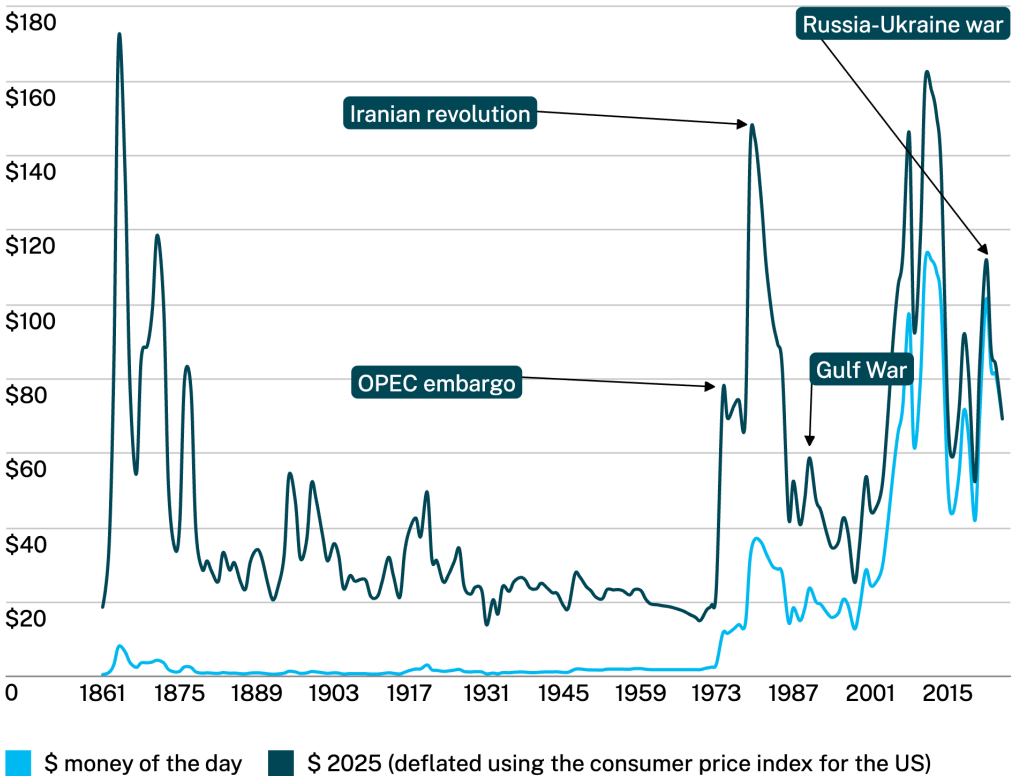
Source: IEA

These reactions occurred even though the price shock from the closure of the Strait of Hormuz was not as bad as initially feared. When the war broke out, some analysts predicted costs to rise to $200 a barrel of oil. In reality, oil trading in the futures markets for near-term delivery has not exceeded $130 a barrel during the conflict, although it is true that some physical cargoes changed hands at higher prices. As of this writing, oil futures are 40 to 45 percent above the pre-war price, although some refined products like diesel have seen much larger price spikes. To some extent, the restraint in the oil market was a matter of luck: just ahead of the conflict, that market, like the grain market, had been oversupplied, and commercial channels were stuffed with fuel. Another big factor, though, was that governments had actually learned something from the previous oil shocks. Many countries of the world now hold strategic petroleum reserves, and coordinated releases of millions of barrels helped to replace the missing Persian Gulf oil and suppress the price hike.[17]

**17.** The International Energy Agency was founded in response to the first great oil shock, the 1973 Arab oil embargo, and has long encouraged its 32 member countries to build strategic reserves. That approach proved its worth this year when the IEA coordinated the largest-ever release from those reserves, 400 million barrels. See IEA, 'IEA Member countries to carry out largest ever oil stock release amid market disruptions from Middle East conflict.' 11 March 2026.

**Figure 5: A volatile commodity**

**Crude-oil price, US dollars per barrel**




This chart shows crude-oil prices, in both nominal and inflation-adjusted dollars, from the beginning of the fossil era in 1861 until the present day, not including the price spikes from the Iran war.

Source: Energy Institute

The most remarkable behaviour came from China, which does not publish figures on its strategic oil reserves, but appears to hold the largest in the world, according to estimates from Western analysts. Several published estimates suggest the stockpile could well exceed 1 billion barrels. When the war started, China managed to cut its imports by almost half, more than 5 million barrels a day, greatly easing the shortfall in the world market. Nobody is entirely certain how China did it, and that country has been in no hurry to explain. One possibility was a covert increase of imports from Russia, but the available pipelines are not large enough to support a huge increase, nor was ship traffic detected that could have explained it. Several measures helped, including a ban on the export of refined petroleum products. China's switch to electric cars was already limiting the growth in oil demand for several years before the Iran war started.[18] However, the major factor seems to be that China drew down its underground reserves.[19]

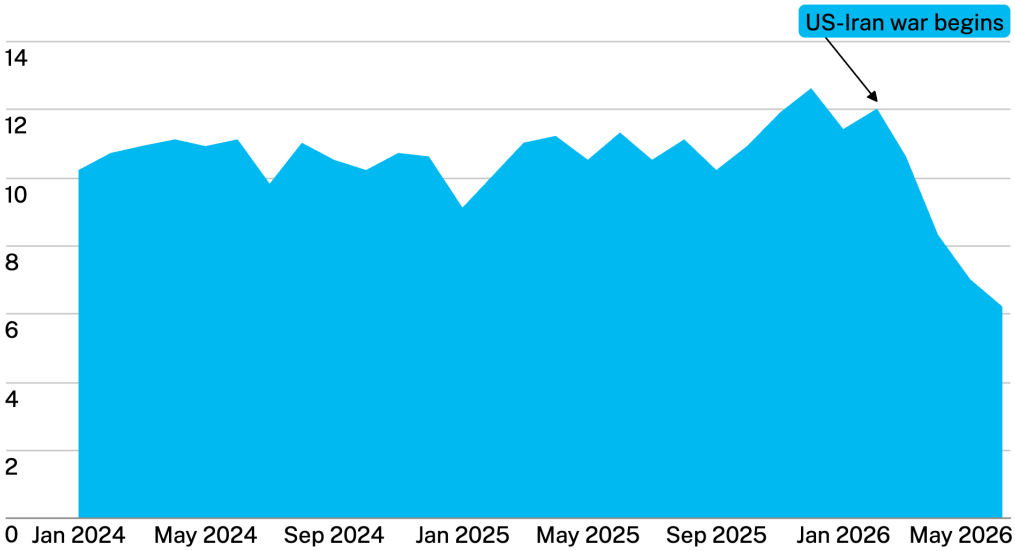
**18.** Healy, Ciarán et al., 'Oil demand for fuels in China has reached a plateau.' International Energy Agency, 11 March 2025.

**19.** Support for the estimates cited in this paragraph can be found in an excellent overview piece on the Chinese oil situation. See Feng, Rebecca and Brian Spegele, 'How Xi Jinping turned oil from a weakness into a geopolitical weapon.' The Wall Street Journal, 28 August 2026.

The lack of a clear explanation represents a danger to the West: if China has this much flexibility in its oil market, that means it may have the power to manipulate global oil prices by raising or lowering import demand. In other words, if China had a reason to send prices soaring, it might well be able to do so. Thus, understanding exactly what happened with oil demand in China is now an urgent imperative for Western policymakers.

**Figure 6: China's oil demand**

**Million barrels per day**




Monthly imports of oil into China, estimated by tracking ships. Preliminary figures show a modest recovery in July, to a figure above 7 million barrels a day.

Source: Kpler, via The New York Times

In so many ways, China is the fulcrum, simultaneously, of the fossil economy that needs to be replaced and of the renewable economy that is struggling to be born. That country remains the world's largest user of fossil fuels, the largest emitter of greenhouse gases, the largest builder of new coal-fired power plants, the largest operator of coal-fired steel mills, and it runs by far the largest chemical industry based on coal. Yet China is also the world's dominant producer of solar panels, wind turbines, electric cars and large-scale batteries. As we will detail later in this report, China within its borders is moving faster than any country on renewable energy, and at the same time, is determined to be the merchant nation selling low-carbon technology to the rest of the world. It has built a dominant position in refining lithium, needed for batteries; the production and refining of rare-earth elements, needed in most renewable technologies; in electrolysers, needed for creating clean-burning green hydrogen; and many more.

This means the nations of the West confront a delicate problem. The latest shock makes it abundantly clear that they must redeem their pledges about switching to clean energy, for immediate reasons of national security and long-term reasons of climate protection. But if they buy all the needed kit from China, will they be trading one odious set of dependencies for another?

**Powering up**

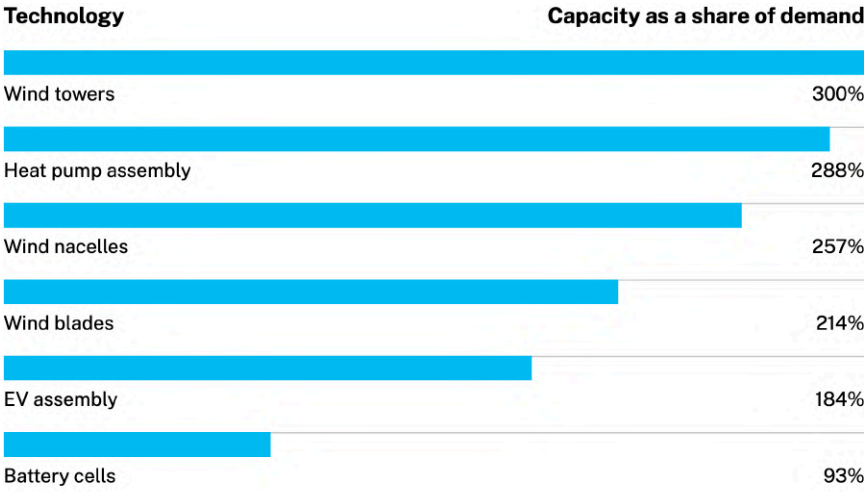
A huge solar farm outside Hechi, China, glows in the morning light.

Source: Long Tao, VCG via Getty

The big difference, of course, is fundamental to the technologies in question. In economic terms, it is the difference between stocks and flows. Oil has to be bought again and again, and that flow can be interrupted by, say, threats to shoot at oil tankers. Solar panels only have to be bought once, and they can produce electricity for 30 years. Sunlight does not need an armed escort through the Strait of Hormuz. Likewise, an electric car only has to be bought once, and may give 20 years of service. Moreover, China is going to have competition in at least some segments of the transition: India, for one, is developing the capability to produce its own solar panels, and aspires to sell them in volume to the world. The US, too, is gradually increasing its ability to produce all the components of solar panels. The offshore wind industry would not have come to scale without strong investments from Britain, and Europe retains a technological edge in putting giant turbines into the water. A recent report from Ember, a think tank, found that Europe could meet its internal demand for wind turbines, electric vehicles and heat pumps entirely with domestic manufacturing if the right government policies were put into place.

The West is simply going to have to pick the sectors where it can compete, then swallow its pride and buy the rest of the kit from the East. This implies that smoothing over trade tensions and retaining good commercial relations between China and the West is a critical enabling condition of the energy transition.

**Figure 7: Home-grown kit**




This chart shows European manufacturing capacity for assorted components required in the energy transition, compared to domestic demand.

Source: Ember

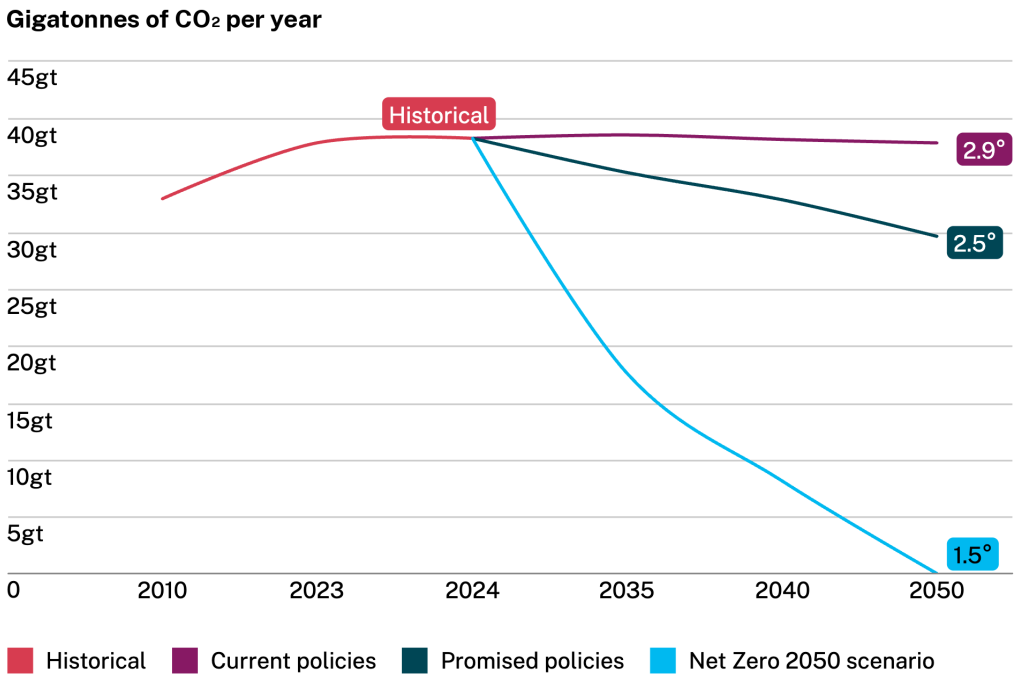
Will the Iran war and its aftermath finally lead us to see the risks of the fossil economy clearly? A war ought not to have been required. Last year once again brought record emissions of greenhouse gases, record levels of carbon dioxide in the atmosphere and record heat waves across many parts of the world. Scientific work is still under way to determine the cause of the catastrophic flood that killed thousands in Nepal, but early indications suggest that melting ice may have played a major role.[20] Preliminary calculations suggest that tens of thousands of people died over the summer in heat waves in Europe, India, the US and elsewhere.[21] Great European rivers — the Rhine, the Danube, the Po, the Loire — fell to such critically low levels that shipping had to be halted or restricted. Forest fires are wrecking air quality across large parts of the world. Global temperatures are tracking near the high end of projections, and temperature records may be shattered over the next year as a developing El Niño weather pattern amplifies global temperatures on top of the human-caused increase.

**20.** Basu, Mohana, 'Satellite images before Nepal disaster showed warning signs.' Nature, 2 September 2026.

**21.** In Europe alone the preliminary estimates already exceed 35,000 deaths, but that number is expected to rise as demographers work to quantify 'excess' mortality during the heat waves. See Henley, Jon, 'At least 35,000 excess deaths recorded in Europe's back-to-back heat waves.' The Guardian, 25 August 2026.

We have yet to turn the corner and start driving global emissions down, despite the Paris Agreement, and despite the pledge countries made almost three years ago to “transition away” from fossil fuels. The fossil pledge, made at a big global climate conference in Dubai, has produced little real action. Exasperation with the slow pace of the United Nations-led talks prompted a group of countries to convene in Colombia this year to discuss the need to end dependency on fossil fuels. They produced no grand plan, yet this group of 57 countries is — at last — discussing the right problem. Unfortunately, they are discussing it without the participation of the largest users of fossil fuels, with China, India and the US all skipping the talks.

**Figure 8: Challenging**




The chart shows three IEA emissions scenarios to 2050. The temperature labels show projected warming in 2100. In the Net Zero Emissions by 2050 Scenario, warming temporarily exceeds 1.5°C before returning below it by 2100.

Source: IEA

The Paris Agreement on Climate Change is now just over a decade old. The United Nations Environment Programme warned in early September that the countries of the world would fail to meet its most ambitious target, limiting overall global warming to 1.5 degrees Celsius. In a report, it warned that the only way to return to that temperature later in the century might be to rely on expensive and uncertain technologies to draw emissions out of the air.[22] Countries still have time to meet the main goal, keeping warming below 2 degrees, but the UN warned that will not happen either without a sharp change of direction. Are countries finally ready to push harder, chastened by the vulnerabilities that now stand exposed?

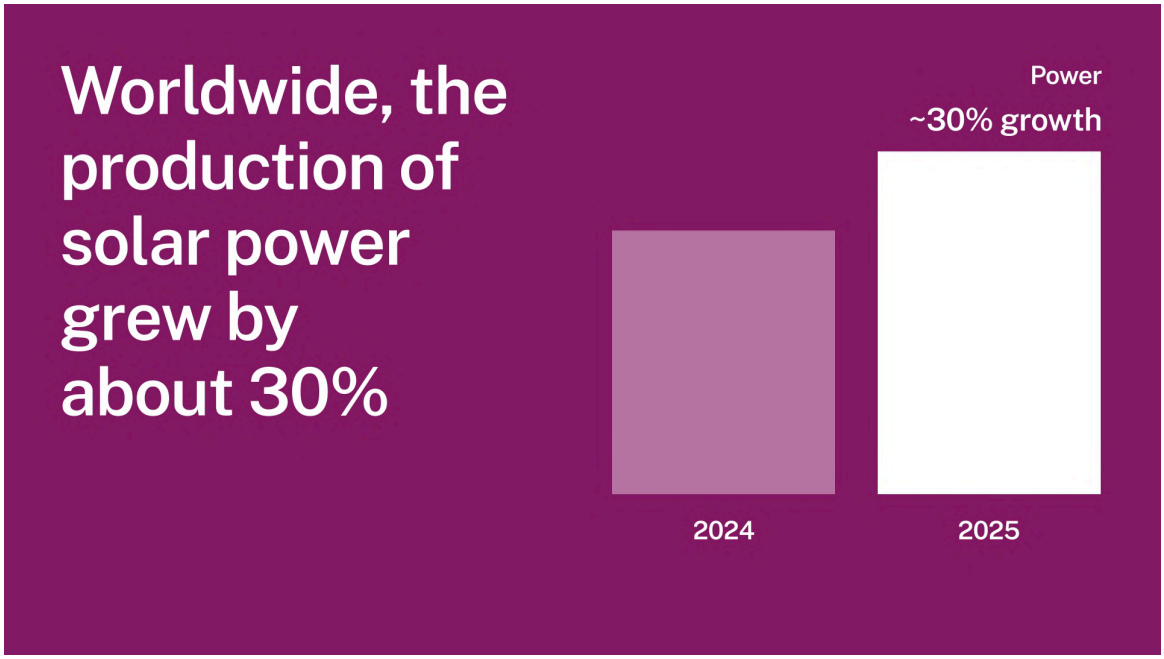
**22.** United Nations Environment Programme, 'Limiting overshoot: Navigating exceedance of 1.5°C and pathways towards return.' 2 September 2026.

If you want reasons to doubt that, look no further than the lobbying activities of the fossil-fuel companies and their handmaidens, the Western car industry. As renewable energy and electrification start to threaten their markets, they are not embracing the future. Instead they are fighting to weaken targets, undermine national commitments and repeal longstanding goals. In Europe they are on the verge of undercutting a law that requires phasing out sales of fuel-burning vehicles by 2035. They have already broken the cross-party political consensus in Britain in favour of a rapid move to clean energy. Their greatest success has come in the US, where these forces of revanchism did a great deal to put Donald Trump into the White House, motivated by his pledge to stop the energy transition.

We will make the case in this report that Mr Trump is failing in that ambition. Paradoxically, in launching his Iran war, he has managed to clarify the dangers of fossil dependency in a way nothing else could have done.

We hope most of the world's governments will analyse recent events and come to the right conclusion: the way to get away from fossil-fuel shocks is to create an economy where they no longer matter. The energy transition is under way, and we have new reasons to speed it up. The only question left is how fast we can go.

# 02
# Power




## The grid is the real bottleneck

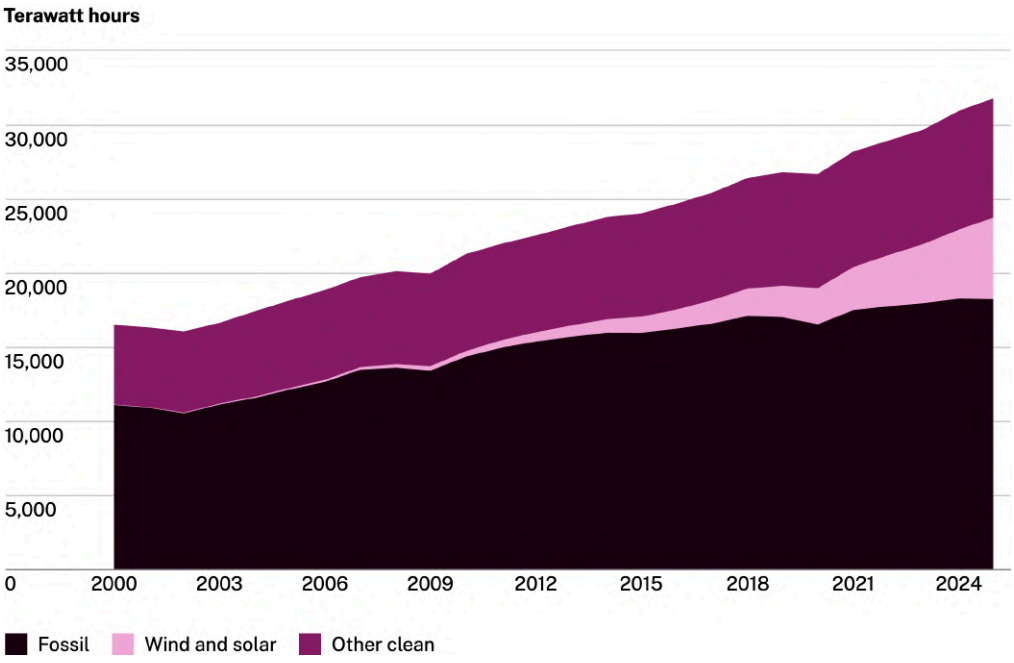
Clean sources of electricity grew fast enough in 2025 to satisfy *all* demand growth[1] on the global power grid, and then some — meaning they drove down the use of fossil fuels to generate electricity, albeit slightly. Power emissions fell in both China and India.[2] Nuclear power made a contribution, with several plants coming online. But the biggest contributor to clean electricity growth by far came from solar panels, whose electricity output jumped by 30 percent last year,[3] capping more than a decade of explosive growth. This year, both solar panels and wind turbines are expected to pass nuclear reactors as electricity sources, a historic milestone for the energy transition.

**1.** Ember, 'Global Electricity Review 2026.' 21 April 2026.

**2.** Ibid.

**3.** Ibid.

**Figure 9: Getting cleaner**




This chart shows the sources of global electricity production. 'Other clean' includes nuclear plants and hydroelectric generation.

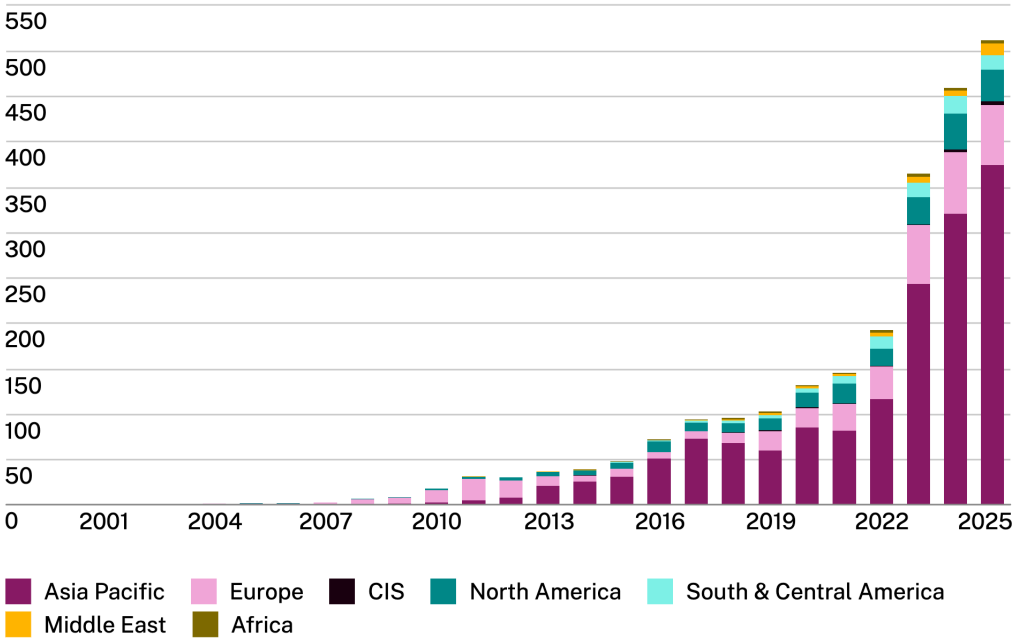
Source: Ember

The growth of solar power is so rapid in places like California, Australia and Spain that some grids are flooded with cheap electricity in the middle of the day. More and more, the solution is to build huge, grid-scale batteries that can be charged with solar power at midday, then discharged in the early evening to supply electricity to homes. The cost of batteries has plunged, and their global deployment rose 46 percent in 2025.[4] We are fast approaching the point on leading grids where batteries charged from the sun will be able to supply more than half the power during the evening peak.

**4.** Ibid.

**Figure 10: Gangbusters**

**Annual net additions to solar capacity, in gigawatts**




This chart shows annual net additions of solar-power-generating capacity, by region.

Source: Energy Institute

This level of electricity storage was unimaginable a decade ago, but batteries are now becoming a leading technology of the energy transition. This trend, already robust, may be about to accelerate as new technology moves into the marketplace. Grid-scale batteries to date have been based on compounds of lithium, a critical element subject to wild price fluctuations. However, the world's largest battery company, in China, is coming to market with batteries based on sodium, one of the most plentiful elements on Earth. (The oceans contain quadrillions of metric tonnes of sodium dissolved as salt, sodium chloride.) Lithium-containing batteries can occasionally catch fire, and a handful of disasters have led to some public opposition to the installation of large batteries. Sodium batteries may be safer, and in the long run they are likely to be cheaper in uses like grid-scale storage.

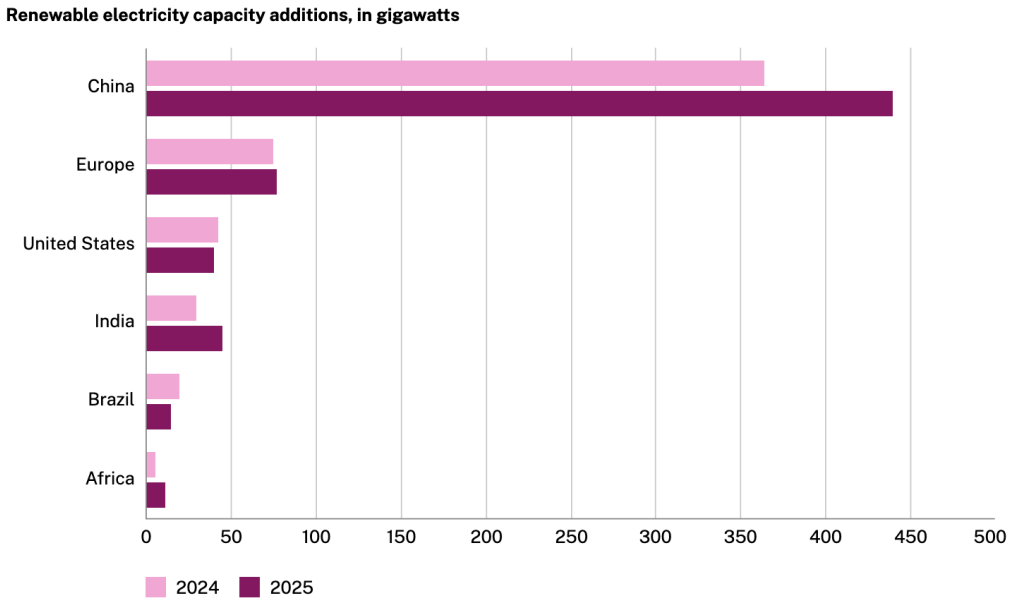
## Too hot

Lithium-ion batteries can catch fire and burn, as did this facility at Moss Landing in California. Strong safety standards are needed to protect the public.

Source: Nic Coury, Bloomberg via Getty

For decades, it appeared as though the greatest bottleneck of the transition would be the supply of clean power: simply building enough wind farms, solar plants and nuclear power stations to make a difference. In 2026, that has become yesterday's problem across much of the world. It is now becoming clear that the real bottleneck is going to be power grids. They are no longer fit for purpose, and they are not being upgraded fast enough to keep up with the rapid changes going on at both ends of the power lines.

**Figure 11: Speeding up**




Additions of wind and solar farms reached record levels in 2025, driven by continued rapid expansion in China and sustained growth across most other markets.

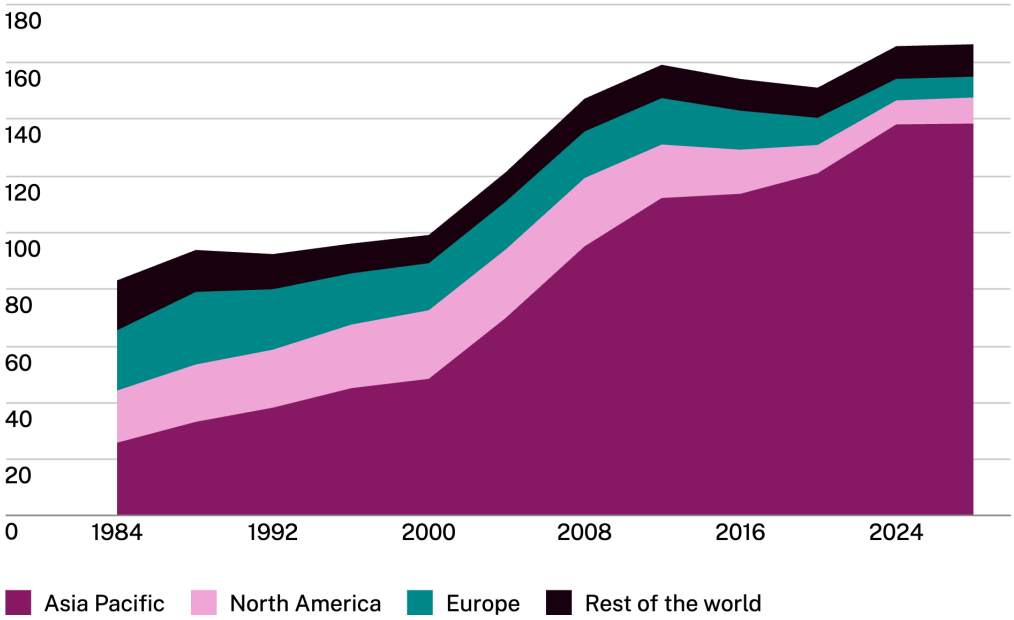
Source: IRENA

In economic terms, power grids are simultaneously experiencing both a supply shock and a demand shock. The supply shock is coming from the rapid increase of wind farms, solar farms and other sources of renewable energy. A measure of the magnitude of the supply shock is that in many countries, companies seeking to build new renewable capacity face years-long waits merely to obtain permission to connect to the power grid.

The rapid renewables expansion is unquestionably good news, but it is creating a situation that demands careful management. As conventional generators like coal-burning power plants shut down, new equipment may need to be procured to help keep the grid stable. Equipment settings must be reviewed and revised periodically.

**Figure 12: Still burning coal**

**In exajoules**



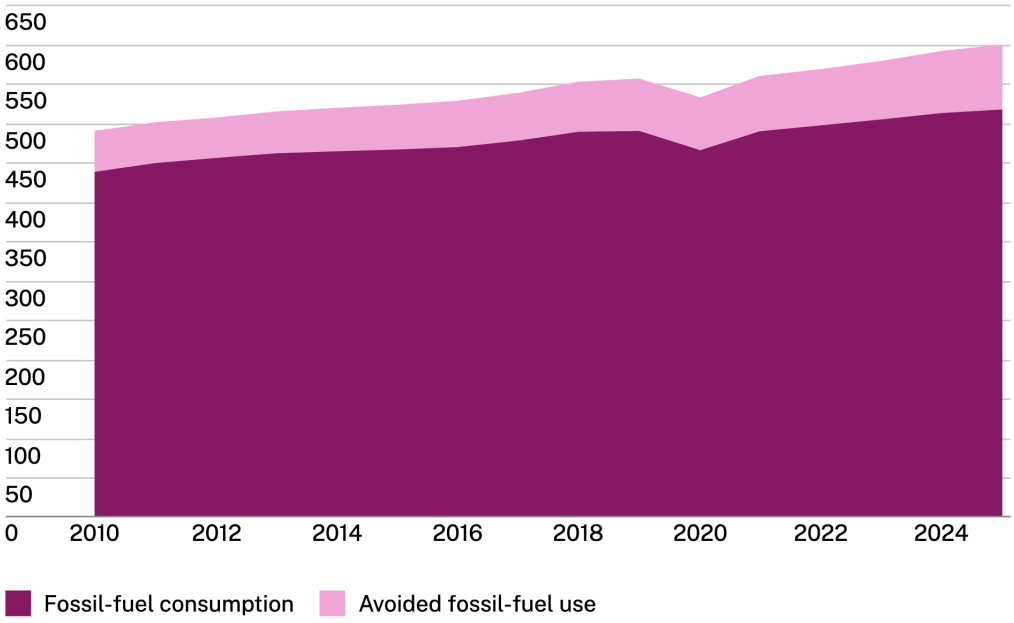

The burning of coal to generate power is no longer growing rapidly, but coal is not yet declining much, either. A steep decline is needed to meet climate goals.

Source: Energy Institute

The demand shock is also good news, mostly. The fundamental strategy for cleaning up greenhouse emissions in the economy is to electrify as many uses of energy as possible, and then run them on clean power. This is starting to work in many countries, with electric cars displacing demand for oil, and heat pumps in buildings displacing demand for gas. In addition, the rapid construction of data centres to power artificial intelligence models is also placing demands on the grid in some countries, most notably the US. AI programs promise to help cut emissions in the long run, but in the short run, they are a new load that has to be served.

**Figure 13: Quenching the fire**

**In exajoules**




This chart shows the amount of coal, oil and gas combustion that was avoided by using renewables and nuclear power to supply electricity instead.

Source: Energy Institute

Global power demand was up 3 percent last year, and in the US, where half the new data centres are being built, it was up by 2.8 percent.[5] This is slower growth than forecast only a couple of years ago, but it is still rapid by historical standards. The rising power demand for data centres poses risks. The companies building them are trying to buy clean power where possible, but they have also proposed a huge new fleet of gas-fired power plants. If allowed, these may lock in high emissions for decades. The biggest data companies are snapping up water supplies; they are so desperate to build they are even stuffing data centres into tents. Their demands on the grid could drive up power prices for consumers if not managed carefully. The situation has already provoked an enormous political backlash in the US, with voters of all political stripes rallying to oppose new data centres. The debate seems to be a proxy for how people feel about AI, with environmental concerns — including the water use of data centres — also playing a major role. AI promises to be a significant political issue in the American elections this autumn.

As the power grid evolves, experts agree that it has to become smarter, more dynamic and more resilient, all at once. The grid needs to get better at moving power in both directions, not just from power plants into homes, offices and factories.

**5.** US Energy Information Administration, 'US electricity generation in 2025 hit a record, again.' 5 March 2026.

The power grids of the future will need to manage fluctuating supply from renewable sources by sending signals to loads — including data centres — that can turn themselves up or down. Imagine a car smart enough to charge itself only when demand on the grid is at its lowest; that sort of thing may be the wave of the future.

These changes are already under way on nearly every electrical grid, but they are not happening fast enough. Not only are the grids physically outdated, but they are encumbered by rules written for another era, run by power companies stuck in the past, and governed by bureaucracies incapable of moving quickly. Tackling this set of problems with smart grid reforms needs to be an urgent priority for every government in the world.

The cost of moving too slowly on grid upgrades has become clear in a handful of major power blackouts. The most recent big one occurred in Spain and Portugal on 28 April 2025. At the time, the Spanish grid was getting almost 55 percent of its power from solar panels.[6]

On that basis and no other, the enemies of the energy transition rushed to blame the blackout on renewable power.

**6.** Red Eléctrica de España, electricity-generation data for 28 April 2025. See also Flores, Daniel and José Á. Carpio, 'How power was restored after the blackout: from the collapse of solar energy to the restart using hydro and gas.' RTVE, 29 April 2025, in Spanish.

**Train in Spain, going nowhere**


The blackout in Spain and Portugal brought life to a halt for a day. Here, passengers wait next to an electrically powered train stuck on the tracks near Albacete, a town in Spain.

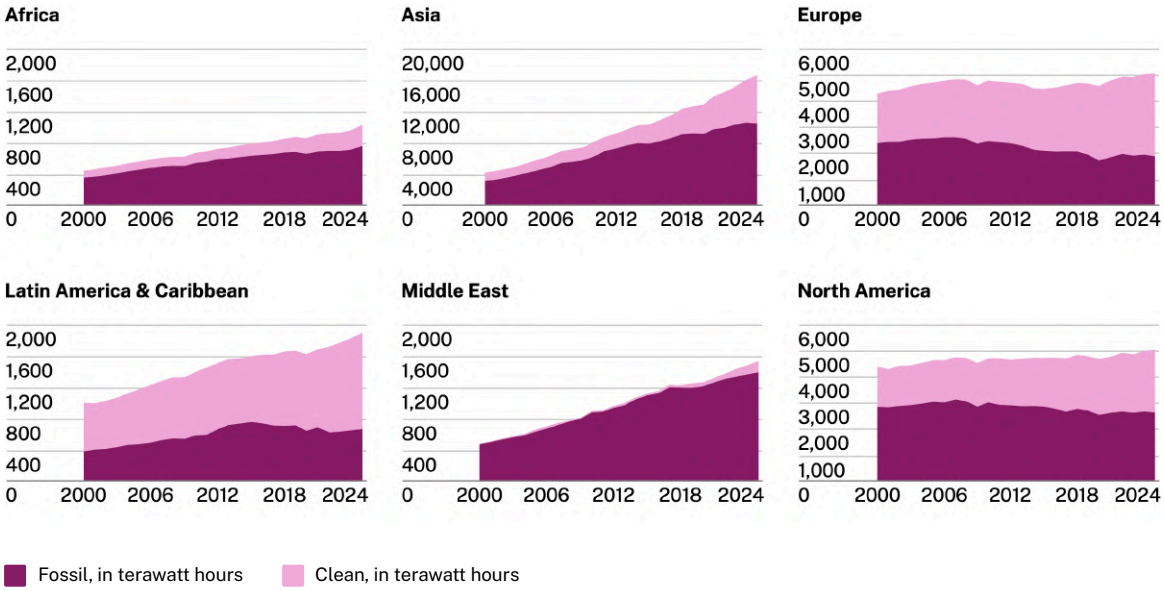
Source: Víctor Fernández, Europa Press, via AP

In early 2026, we finally got the truth. The official report on the blackout identified a slew of interrelated failures, with improper settings for both conventional and renewable generators prominent on the list.[7] The high level of renewable power at the time of the blackout did increase the Spanish grid's vulnerability to collapse, for a simple reason: a power grid dominated by spinning conventional generators often has enough inertia to allow it to ride through electrical disturbances, whereas a grid running mainly on solar panels might not, unless certain precautions have been taken. The real cause of the blackout was the failure of the Spanish grid operator, Red Eléctrica de España SA, to take those precautions. Special machines should have been added, and settings altered, in ways that would have stabilised the grid at the critical moment. A belated frenzy is now under way in Spain to do that work.

The Spanish blackout is a warning for other countries. The Iberian Peninsula is one of the regions that has proven that power grids can operate with very high levels of renewable energy. But as in Spain, the grids in many countries are antiquated and are not keeping up with the demands that are being placed on them.

7. European Network of Transmission System Operators for Electricity, 'Grid incident in Spain and Portugal on 28 April 2025: ICS investigation expert panel final report,' 20 March 2026.

**Figure 14: Clean vs dirty power**




Clean power is making dramatic progress in Europe, Latin America and North America, with other regions further behind. This chart shows electricity generation in terawatt hours; note the differing scales. 'Clean' includes low-emissions sources, including wind, solar, bioenergy, hydropower, nuclear power and other renewables.

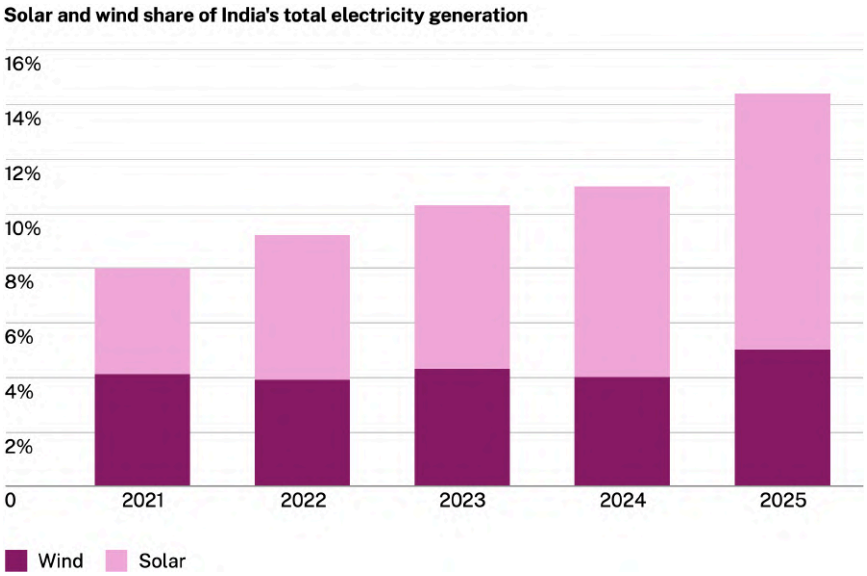
Source: Ember

Three years ago, at a big climate conference in Dubai, the nations of the world pledged to triple their installed base of renewable electricity by 2030. Judging by the plans and timetables they have since published, they are not on track to achieve this goal, with those schedules implying something closer to a doubling by 2030. Yet the installation of solar power is moving so fast that quite a few countries appear likely to exceed their own targets, and the goal of tripling renewable energy remains within reach.

In fact, the greatest aspiration of the clean-energy movement seems increasingly plausible. That is to create a situation in which developing countries are able to build their own economies on clean electricity, bypassing the fossil-fuel-intensive phase of development and thus restraining the growth of global emissions. The great testing ground of this 'leapfrog' idea is likely to be India, whose growth for many years was powered by coal. While politicians there have, in the past, belligerently rejected the idea that India should limit its emissions growth, the facts on the ground are beginning to make that rhetoric look pointless. Solar in India is consistently growing at more than 40 percent a year, and grew 54 percent in 2025. The country is building a single solar farm that will be the largest on Earth, able to supply enough electricity to the Indian grid that it could theoretically power the entire country of Austria. This year, solar will likely supply 10 percent of India's electricity, and wind about another 5 percent, with both clean sources expected to grow rapidly.[8] (A subsidiary of Generation, Just Climate, has invested in a major Indian renewable developer.)

**8.** International Energy Agency, 'Electricity 2026: analysis and forecast to 2030.' 6 February 2026.

**Figure 15: Growing fast**



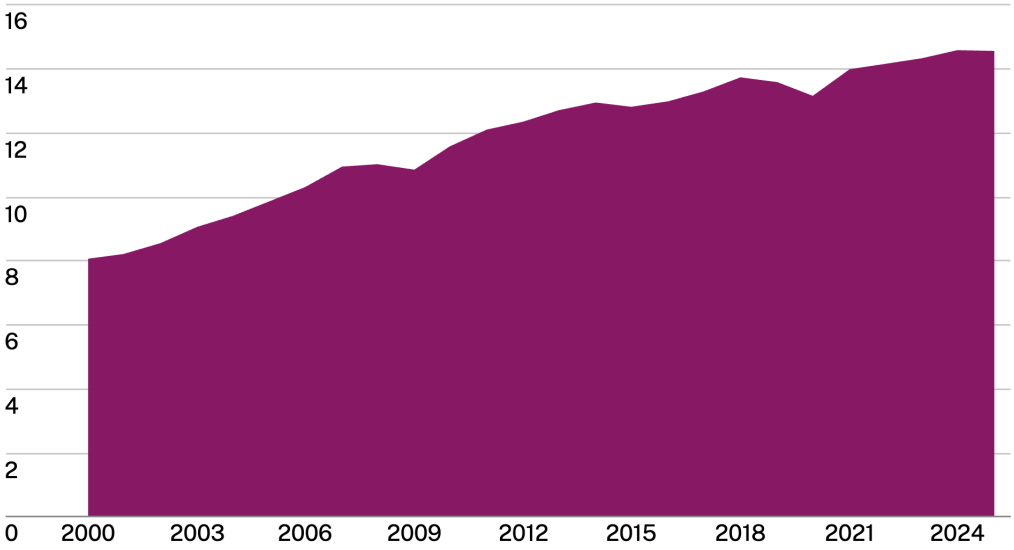

Clean power is claiming a growing slice of India's electricity. Solar has more than doubled its share since 2021, to 9.4 percent, while wind is near 5 percent, evidence that a fast-industrialising economy can lean on renewables rather than coal alone.

Source: Ember

The dazzling clean-power growth of 2025 came before the Iran war started on 28 February 2026. That war has, of course, jolted global energy supplies and refocused many minds on alternatives to fossil fuels. Monthly statistics can be misleading and we will not get a clear picture until the end of this year, but preliminary numbers suggest rapidly rising interest in renewable energy across the developing world.

**Figure 16: Not falling fast enough**

**Global power emissions, in gigatonnes of $CO_2$**




This chart shows worldwide emissions for the power sector, which have stopped growing but are not yet falling at the pace required to meet climate goals.

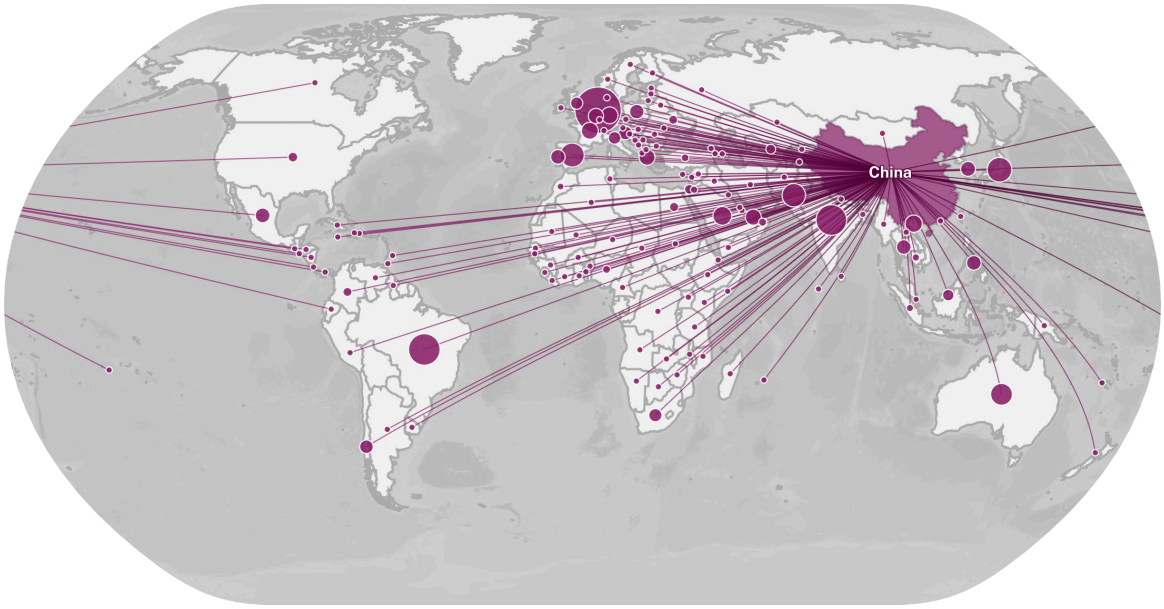
Source: Ember

China is the world's dominant producer of solar technology, and its exports to Africa surged in March, rising by 207 percent in Kenya, 391 percent in Ethiopia and 519 percent in Nigeria compared with February.[9] These countries are starting from a low installed base, but it will not take many years of such rapid growth for solar to become an important part of their power mix. It has already happened in Pakistan: the disruptions in gas supply due to the Ukraine war in 2022 led to blackouts on that country's power grid and set off a grassroots push to install solar panels. Solar now accounts for more than a quarter of Pakistan's electricity, and possibly higher — the change has happened so quickly that analysts have not been able to track it well. [10]

**9.** Ember, 'Chinese solar exports double in a month to hit record high amid energy crisis.' 22 April 2026.

**10.** Naveed, Huma and Nabiya Imran, 'Renewables first: Pakistan electricity review 2026.' See the figures on page 10; dividing the estimated 51 terawatt-hours of distributed-solar generation by total electricity generation of 186 terawatt-hours yields 27.4 percent.

**Figure 17: Supplier to the world**




These maps show China's solar panel exports to the rest of the world from 2017–2026.

Source: Ember

Given the scale of the global solar boom, one might imagine that Chinese producers of solar panels would be wallowing in profits. But China, in its eagerness to dominate industries of the future like solar power and electric cars, has overinvested in production capacity. Moreover, a business in which the price of the product is falling rapidly is a tough business in which to operate — new factories are obsolete almost as soon as they open. Most Chinese solar producers are losing money, and a huge shakeout in that industry seems inevitable, with many companies likely to be forced out of business. It is possible this will lead to temporary price rises in solar panels, as has happened in the past, but the long-term decline seems set to continue.

Chinese dominance in the production of the new technologies has, of course, led to rising global trade tensions. Countries like the US and India are attempting to establish their own production lines for solar modules, though they are still highly dependent on imports of Chinese components. How these tensions will play out in future years remains unclear.

**Creating the future**

Workers inspect solar panels on the production line at a factory in Suqian, China, in 2025.

Source: Xu Changliang/VCG via Getty

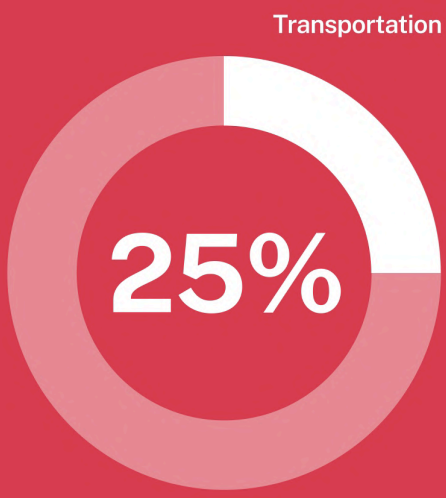
In the US, the administration of Donald Trump took office pledging to slow or halt the clean-energy transition. Mr Trump managed to push through a broad repeal of most of the clean-energy policies that the previous administration, under Joe Biden, had put in place. In situations where the federal government directly controls what gets built, the Trump administration is having success. For instance, the government is cancelling leases for offshore wind farms in areas of the sea floor that it governs, and paying developers billions of dollars to walk away from their projects. These efforts appear certain to set back offshore wind development in the US by at least a decade.

However, the Trump administration's broader attempts to stop the clean-energy transition are yielding fewer results. On land, developers are still putting up wind and solar farms. The administration is attempting to throw up bureaucratic hurdles to completing projects, but it keeps losing in court. In 2025, with Mr Trump in office nearly the entire year, more than 60 percent of the growth in power demand in the US was met by solar alone, with all clean sources supplying well over 70 percent of the growth.[11]

**11.** Ember, 'Solar met 61% of US electricity demand growth in 2025.' 16 January 2026.

# 03 Transportation

# EVs have grown to represent a quarter of the global automobile market

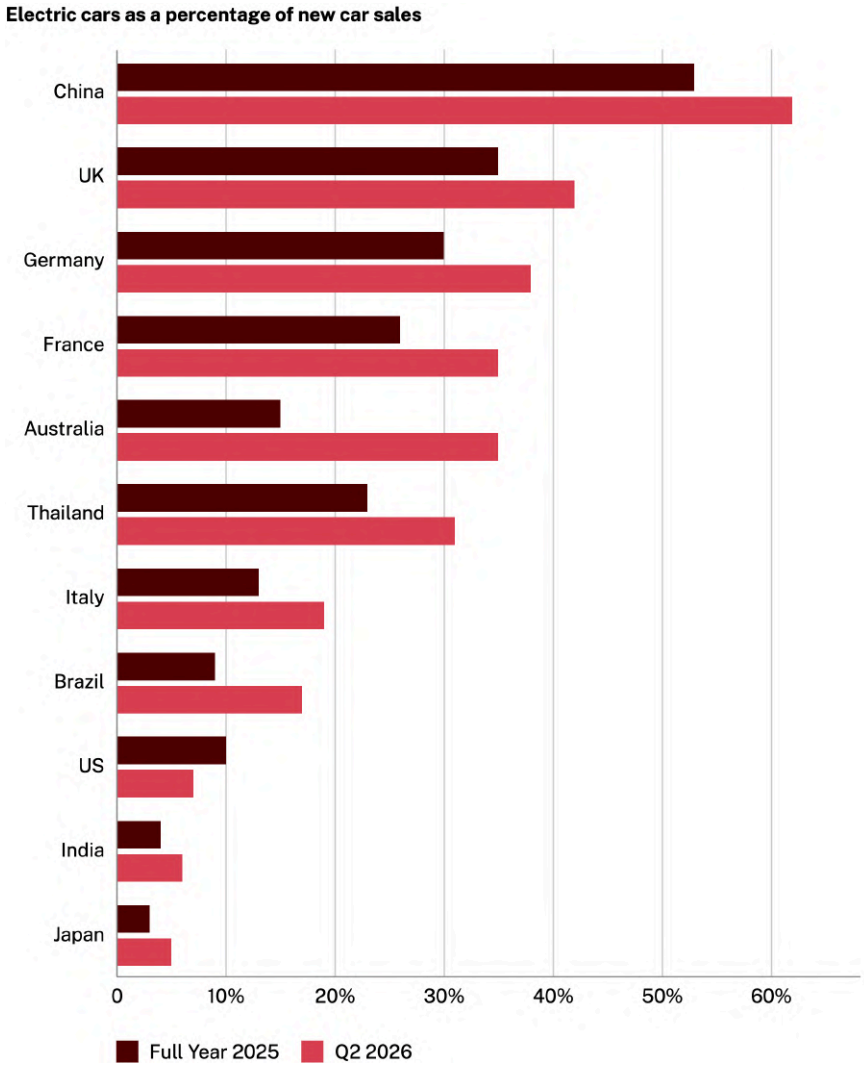



## Zoom

The global switch to electric cars continues apace, and indeed, seems to have accelerated this year in response to the high petrol prices caused by the Iran war. One in four cars sold worldwide in 2025 had a power plug, and that figure is projected to reach almost 30 percent this year.[1] It is clear, in retrospect, that sales of petrol-only cars peaked in 2017 and will likely never recover to the volume of that year.

**1.** International Energy Agency, 'Electric car markets in a time of uncertainty.' 30 July 2026.

**Figure 18: Electric cars get a jolt**




Higher fuel prices and renewed concerns over energy security following the Middle East war are accelerating EV adoption across major markets, with the US a notable exception.

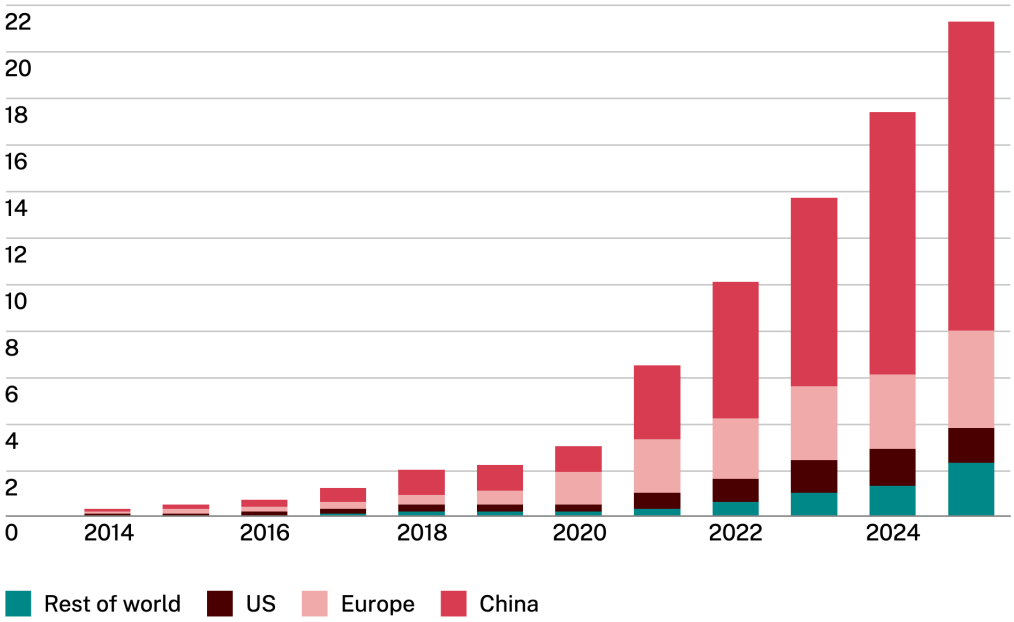
Source: IEA, via the Wall Street Journal

In a few countries, electric cars now account for more than half of new-car sales. That includes China, the world's largest maker and buyer of electric cars and the largest producer and user of EV batteries. Electric models rose from 53 percent of new-car sales across the full year of 2025 to 62 percent in the second quarter of 2026. Over the same periods, the shares rose from 35 to 42 percent in Britain, from 30 to 38 percent in Germany and from 15 to 35 percent in Australia. The US was a notable exception, falling from 10 percent in 2025 to 7 percent in the second quarter of 2026.[2]

**2.** International Energy Agency, 'Global EV Outlook 2026.' 20 May 2026; International Energy Agency, 'Electric car markets in a time of uncertainty: An update to the Global EV Outlook 2026.' 30 July 2026

**Figure 19: Taking off**

**EV sales, in millions**



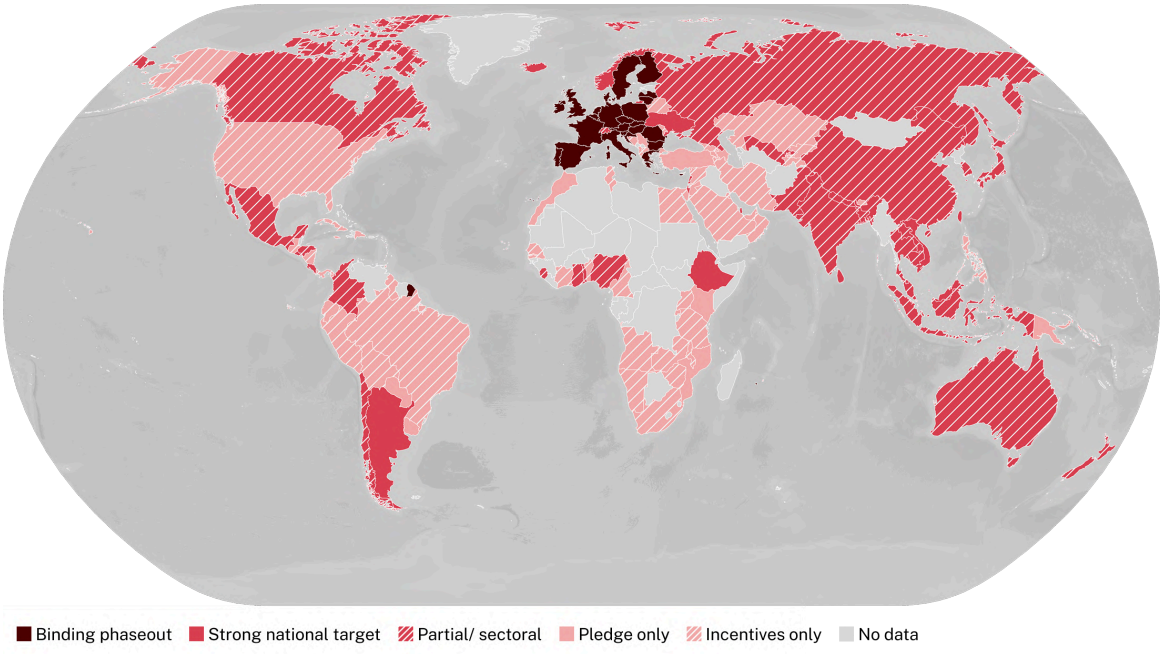

Electric and plug-in hybrid cars are capturing a large share of the market around the world. The big laggard is the US, the world's most car-dependent large country.

Source: IEA

More and more countries appear determined to phase out petrol cars entirely. The number of countries announcing such policies keeps growing. It is true, however, that as the bans draw closer — 2035 is a common target year — the political backlash against them is intensifying. Western carmakers, who dragged their feet on this transition for 20 years and are now deeply threatened by China's dominance, are lobbying furiously to weaken the bans. They appear to be on the verge of a limited success in the European Union, where a measure going through the bloc's tortuous approval process would somewhat undermine the 2035 targets, without repealing them entirely.[3] In some countries, the carmakers have already won massive tariffs on Chinese EVs in an attempt to protect themselves, including 100 percent tariffs in the US. Canada adopted a 100 percent tariff as well, but then replaced it with a quota that limits Chinese imports to 49,000 vehicles a year.

**3.** For an overview of the current EU targets, the proposed revisions and the fierce lobbying in favour of weakening the law, see Influence Map, 'Policy tracker: light-duty vehicles $CO_2$ targets.' Undated.

**Figure 20: Getting rid of petrol cars**




Many countries aim to phase out petrol and diesel cars, on varying timelines. Their political willingness to stick to the goals will be tested as phaseout dates draw nearer.

Source: IEA

Some developing countries with no capacity to make their own cars have decided to embrace electric models from China wholeheartedly — another example of the leapfrog trend at work. It has not escaped their attention that China is making high-quality cars at remarkably low prices, as low as $4,800 for one 'micro' urban runabout. Nepal is pushing hard and its small car market is now 68 percent electric.[4] Ethiopia, weary of subsidising fuel for motorists who refuse to pay global prices, has entirely banned the import of petrol-only cars.[5] In Latin America, Uruguay has achieved 28 percent electric sales.[6]

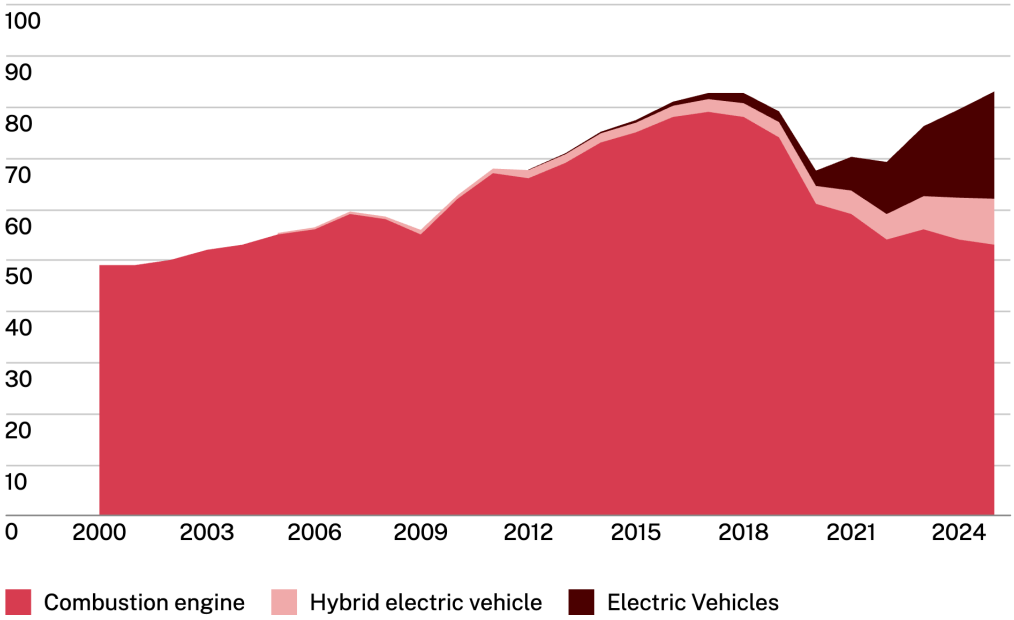
**4.** International Energy Agency, 'Electric car sales share for countries exceeding 10%, 2020 and 2025.' 5 May 2026.

**5.** Poon, Linda, 'How Ethiopia's ban on gasoline car imports fueled an EV boom.' Bloomberg News, 18 February 2026.

**6.** International Energy Agency, 'Electric car sales share for countries exceeding 10%, 2020 and 2025.' 5 May 2026.

**Figure 21: An epochal shift**

**Car sales, in millions**



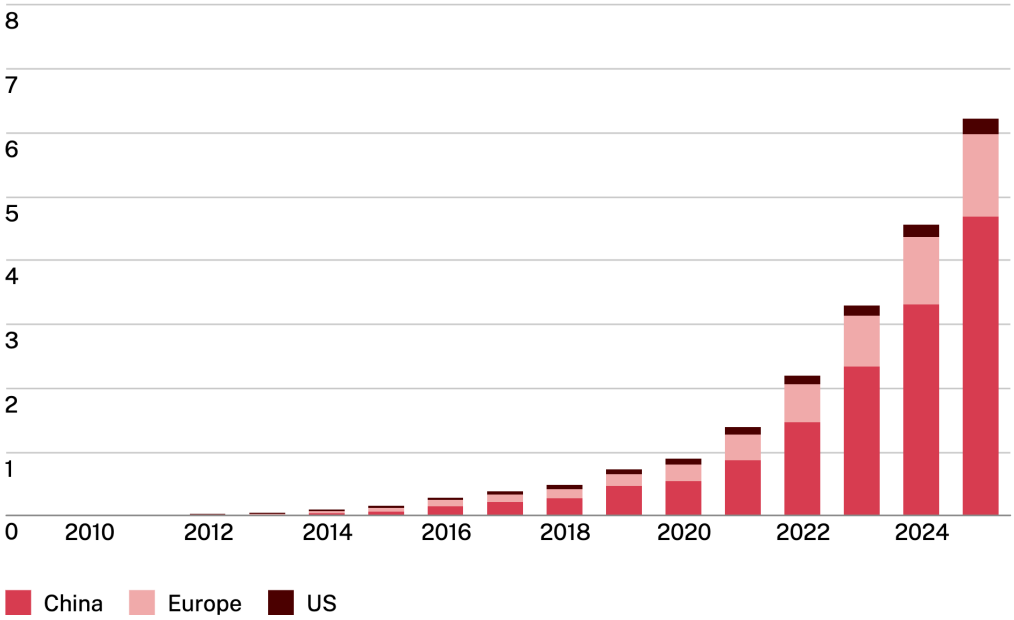

Fuel-burning engines are one of the defining technologies of the modern age, but they are on the way out as electric cars claim an ever-larger share of the market.

Source: IEA

The US appears determined to bring up the rear. National sales of cars with plugs comprised about 10 percent of the market in both 2024 and 2025, but they fell off a cliff late in the year after the repeal of a federal tax credit for car buyers. Anecdotal reports suggest that high petrol prices from the war in Iran have somewhat revived interest in electric cars, but we await the full-year numbers to see how much difference that will really make. Attempts by California, Colorado and other states that are leading the energy transition are under threat as the federal government mounts a legal assault on their ability to set their own car standards. With the hostility emanating from the federal government, the US could be the last major car market to switch entirely to electric drive trains; we also have no doubt that it will happen, eventually. These are simply superior cars. Technological innovation is driving prices down to the point that electric cars are going to be cheaper than petrol cars, and they will eventually charge almost as fast as a petrol car can refill. They require less maintenance than petrol cars, and are far cheaper to operate for people who can charge at home. Ultimately, we believe Washington will not be able to stop this technology.

**Figure 22: Getting there**

**Number of EV chargers, in millions**



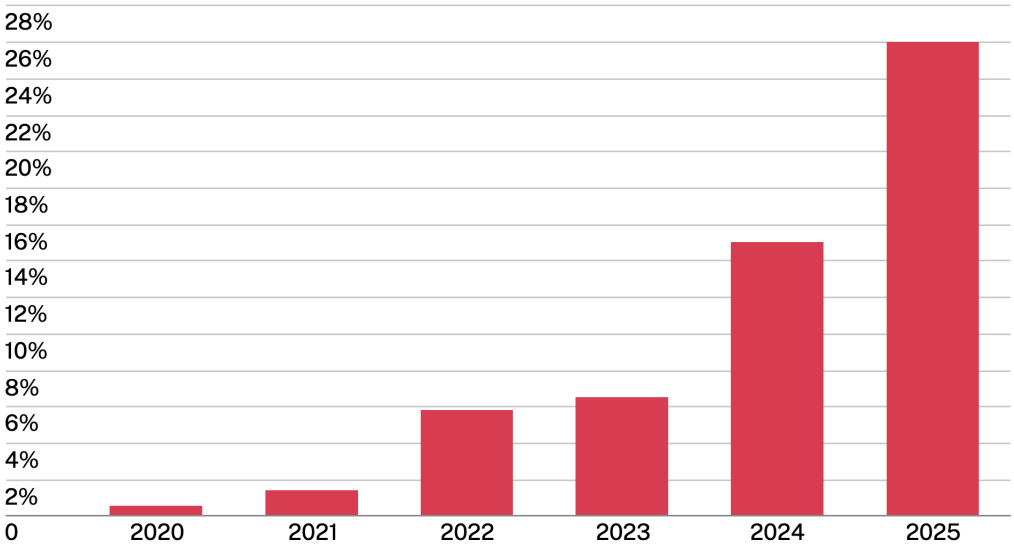

This chart shows the number of public EV charging points in China, Europe and the US.

Source: IEA

Electric cars fall into the category known as light-duty transport, and it is basically a good-news story for a simple reason: batteries are now good enough to carry that much weight. Heavy transport, which includes lorries, buses, trains and planes, is a more complicated problem. Batteries can work well on repetitive, fixed routes. The vans that deliver post and packages within cities are well on their way to complete electrification. Buses, including school buses and public transport, can also run on batteries and are gradually going electric. (Many cities have for decades run electric buses that draw power from overhead wires, which are known as trolleybuses, but the infrastructure to do that is expensive and batteries are going to render it unnecessary.) Electrification of the heaviest lorries, known as Class 8 lorries, is proceeding at a brisk clip in China. The Chinese government has used its might to conjure into existence a battery-swapping system that can keep heavy lorries on the road. Now, we are seeing evidence that electrification of the largest lorries is going to spread beyond China.

**Figure 23: Lorries are shifting, too**

**Market share in China**




Electric lorries are claiming a rapidly growing share of the Chinese market, in part because the government has created a system that allows rapid battery-swapping and thus eliminates long recharge times.

Source: IEA

Tesla, the American electric car company, is finally producing a large electric lorry in significant volume, after years of dabbling. As production scales in Nevada, the company is taking orders for hundreds of Tesla Semis at a time. Similarly, in Europe, sales of electric lorries are escalating as manufacturers seek to comply with European Union regulations requiring emissions cuts. Unfortunately, the lorry manufacturers have already succeeded in watering those regulations down somewhat, which will slow the development of the market. Nonetheless, some of those lorry makers are reporting that 3 to 4 percent of their order books are for electric vehicles.[7] More heavy-duty charging infrastructure is needed to keep up, but we foresee the gradual electrification of even the largest lorries on the road.

**7.** Registrations of electric lorries in the EU market as a whole are growing at double-digit rates from a small base. The European Automobile Manufacturers Association reported that 4.8 percent of new lorry registrations in the first half of 2026 were for electric vehicles. See 'New commercial vehicle registrations, European Union,' press release from European Automobile Manufacturers Association, 29 July 2026.

**Buses get a jolt**

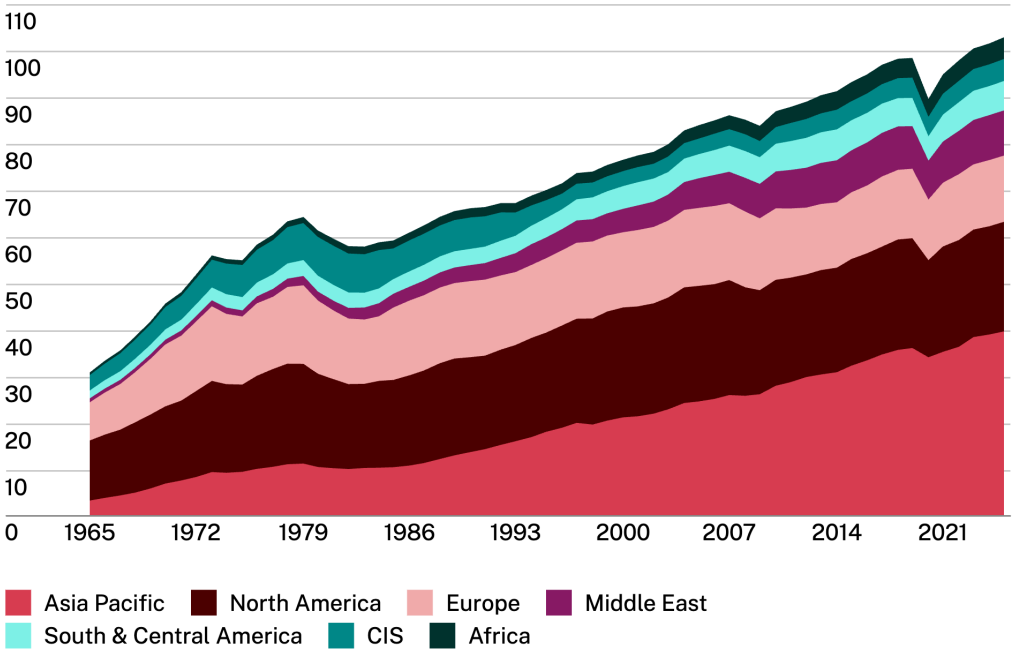

Rome's electric bus fleet charges at a depot, part of the city's effort to clean up public transport. A Generation subsidiary, Just Climate, is an investor in ABB E-Mobility, the company that provided this charging infrastructure.

Source: ABB E-Mobility

Ships represent an unsolved problem. Again, electrification will work on certain routes, like ferries covering relatively short distances, but the shipping of goods on the high seas is likely to continue to depend on liquid fuels, and it is not clear yet what the best options might be. All low-carbon fuels that could replace diesel or marine bunker fuel continue to cost more than companies are willing to pay. A set of rules that would have required the clean-up of shipping was agreed to at the International Maritime Organisation several years ago, but the Trump administration is trying to block the deal. We hope countries will move forward without the US, if necessary, adopting rules that give shipping companies the incentive to work harder at finding clean fuels.

**Figure 24: Thirst for crude**

**Million barrels per day**




Demand for oil has risen relentlessly over the long term, interrupted by economic shocks like the COVID-19 pandemic. 'CIS' is the Commonwealth of Independent States, a group of successor states to the Soviet Union anchored by Russia.

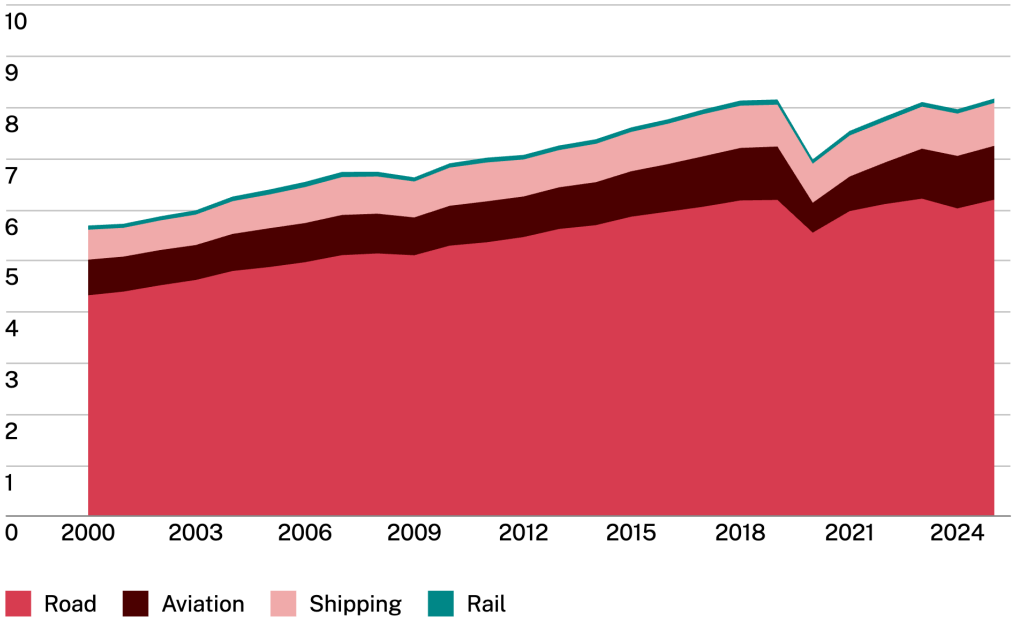
Source: Energy Institute

Aeroplanes represent an even bigger problem. They are a relatively small part of the global emissions picture now, but are growing fast as carriers expand to meet the seemingly insatiable public demand for global travel. European rules are gradually forcing into existence an industry to make low-carbon fuels for the airlines; if you have been offered the chance to buy 'sustainable aviation fuel' for a flight you booked, that is basically a request to pay extra to help fund the development of such fuels. Commercial-sized fuel plants, using feedstocks such as waste wood, are just going into operation to meet the European mandates. However, the fuels can cost more than 10 times the price of standard jet fuel,[8] so the big question is how fast the price can come down as the industry scales up.

**8.** Garcia, Marisa, 'Sustainable aviation fuel: eSAF found to be 13 times the cost of regular aircraft fuel.' Aerospace Global News, 20 November 2025.

**Figure 25: Getting around**

**Annual transport emissions, in gigatonnes of $CO_2$**

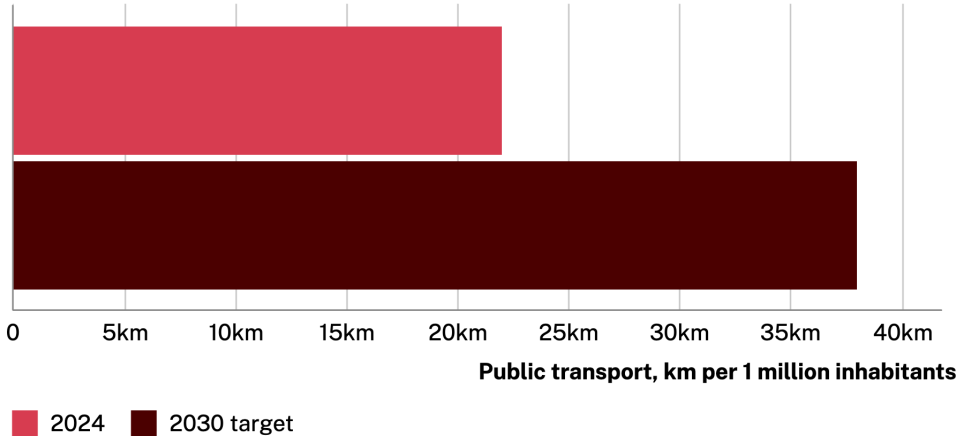



This chart shows annual emissions from transportation by transport mode.

Source: BloombergNEF

As we have argued for years, successful transportation policy must do more than call better cars or lorries into existence. In dense urban areas, especially, the big task is to get people out of cars, not to put more of them on the road. Every time an electric car is substituted for a petrol car, that is a win, but the bigger win would be no car. Greater investment in public transportation is a critical need, although in truth, many public transport systems are still recovering from the ridership hit they took during the COVID-19 pandemic and the subsequent work-at-home trend.

**Figure 26: More rails & tracks needed**




Public transport systems like metros, trams, commuter rails and rapid bus lanes are increasing, but not fast enough to reach a 2030 target set by an organisation called the Systems Change Lab.

Source: Systems Change Lab

With determined political leadership, profound transformations can be achieved in a decade or two. Paris, for instance, has gone a long way towards undoing one of history's great mistakes, the surrender of public space to the tyranny of the car. The city has now seized many kilometres of roads to create cycle routes, shut down main roads along the River Seine and converted them to pedestrian and bike paths, and eliminated tens of thousands of parking spaces. The results have been stunning: car traffic in Paris fell by half from 2002 to 2022.[9]

We continue to advocate one policy that is the closest thing to magic for cities choked by cars: congestion charging. This is essentially a toll for driving a car into the most crowded part of a city during the busiest times.
It has been proven to work in Singapore, in Stockholm, in London — and now, in New York City.

**9.** City of Paris Department of Roads and Transport, 'Car traffic within Paris (weekdays).' 2022, in French.

**Fresher air for Manhattan**


After decades of political struggle, New York City finally imposed a congestion charge that has delivered striking benefits, including 73,000 fewer vehicles entering Manhattan each day.

Source: Michael Nagle/Bloomberg via Getty

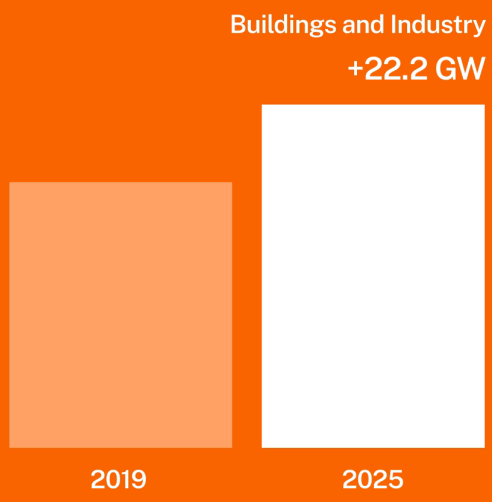
The governor of New York State, Kathy Hochul, delayed the plan in a political panic after it was already agreed to by multiple parties. But she finally allowed it to go into effect, after cutting the proposed congestion charge in half. The results have nonetheless been remarkable, with less traffic entering Manhattan, speedier travel times for cars, more people riding mass transit, and billions of dollars being collected to invest further into the public transport system.[10] We are not surprised by these developments; they mirror the effects seen all over the world when congestion charging is put into effect.

We thus believe that any city coping with severe traffic congestion should be tracking the results in these leading cities, and drawing up their own plans for a tolling system that will let them regain control of the public streets.

**10.** Badger, Emily et al., 'Here is everything that has changed since congestion pricing started in New York.' The New York Times, 11 May 2025.

# 04
# Buildings & Industry

# Heat pumps are starting to displace gas in buildings




## Going big

In February, a paper mill in Finland switched on a huge new piece of machinery called a heat pump, to produce steam for the plant with no greenhouse emissions. It is the largest steam-producing heat pump in the world, but probably not for long. In Cambridge, an American town near Boston, another heat pump is under construction to create steam for heating a large cluster of buildings. It will suck heat out of the Charles River, producing steam even during Boston's icy winters. And in Germany, construction is under way on a massive heat pump at the BASF chemicals complex in Ludwigshafen, allowing that company to clean up its production line for a compound called formic acid.

These are all signs of progress in what has been one of the toughest nuts to crack in the energy transition. Buildings, factories and industrial activities produce more than a quarter of the world's emissions, but the cleanup of these sectors has barely begun. Heat pumps, ranging in size from small ones that can warm or cool an apartment to large ones that can replace boilers in factories, will be one of the fundamental technologies to get it done. The technology is finally scaling, as every week or two brings announcements of ever-larger heat pumps tackling ever-larger problems.

## Scaling up


A component for one of the world's most powerful heat pumps arrives at the BASF chemical factory in Ludwigshafen, Germany.

Source: BASF

What is a heat pump?

It is, in essence, a reversible air conditioner. Instead of creating heat, the way a gas boiler does, a heat pump sucks heat from one place and moves it to another. To cool an interior space or to chill water, the device ejects heat to the outside. To warm a space or to heat water, it runs in the opposite direction, pulling heat from the outside environment and moving it indoors. You can think of a heat pump as the overgrown cousin of a refrigerator, which cools its interior compartment by pumping heat out the back. The surprising thing is that these devices can pull heat from the environment even when it is freezing outside, like the one that is going to pull heat from the iced-over Charles River.[1]

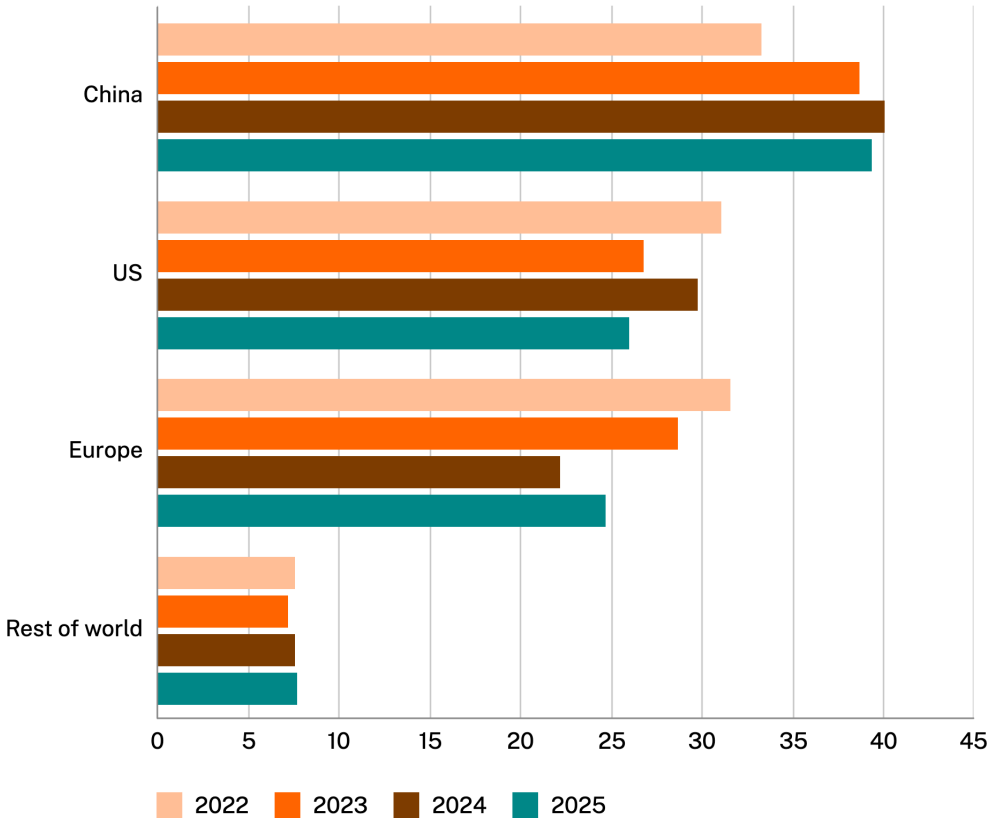
**1.** Delfort, 'Delfort Is converting the first paper production site to run entirely on fossil-free energy.' 18 February 2026. See also St. John, Jeff, 'Boston's Century-Old Steam Heat System Is Getting a Low-Carbon Makeover.' Canary Media, 5 November 2025. And see BASF, 'The core of one of the most powerful industrial heat pumps has arrived at BASF's Ludwigshafen site.' 8 April 2026.

Because they can run on clean electricity, heat pumps offer a path to eliminate burning fossil fuels to create steam or hot air. They have been available for decades in sizes suitable for heating and cooling buildings, but are now reaching a scale to be able to tackle large needs in industrial plants. This is one of the great frontiers of innovation in the energy transition, and we expect in the coming years to see heat pumps have a material effect on cutting emissions.

The problem with heat pumps is that they can cost more to run than boilers burning fossil gas. This is not always the case; it depends on the relative cost of gas and electricity in a particular market, as well as whether the government in that area has imposed a price on emissions. Lowering power prices, as the energy transition aims to do by flooding the grid with renewable electricity, will make heat pumps more economically competitive, as will improving the efficiency of the devices themselves. This is where a great deal of technical work is being done.

**Figure 27: Pumping heat**

**Annual sales, in gigawatts of capacity**




Heat pump sales are sensitive to the fluctuating price of electricity as well as to the vicissitudes of public policy. Government support, in the form of installation subsidies, is erratic.

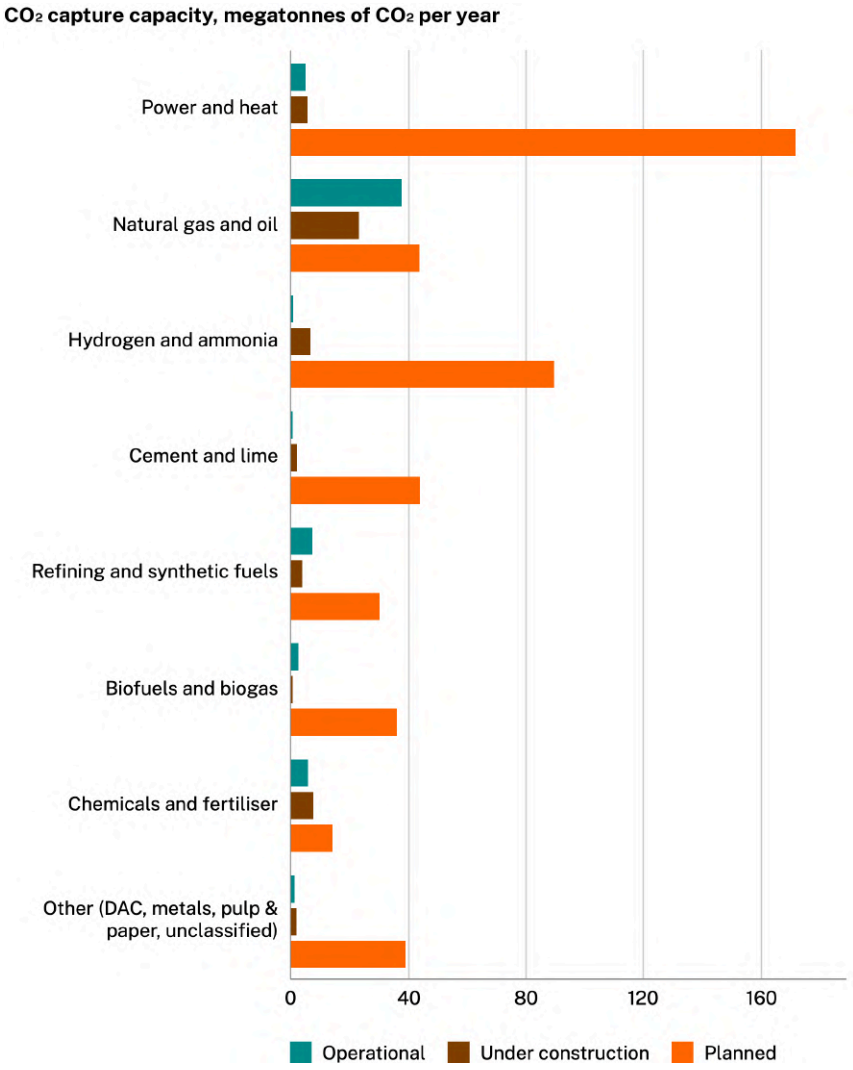
Source: IEA

While heat pumps will be a critical future technology, they are by no means the only one we need to clean up the world's buildings and industry. Production lines for steel, cement and chemicals are all big sources of emissions, and tentative approaches are under development to cut emissions in all of them. Regarding steel, see the sidebar in this chapter about the huge Stegra 'green steel' plant under construction in Sweden. (Just Climate, which is a subsidiary of Generation, is an investor in alternative production methods for both steel and cement.)

The cost and workability of these alternative methods have yet to be proven at scale. A different approach is to capture the emissions coming from the smokestack of a plant, separate the carbon dioxide, and pump it into long-term underground storage to keep it out of the atmosphere. This technology, known as carbon capture and storage, has been under development for decades, but progress has been achingly slow. The history is vexatious: the fossil-fuel industry has long talked up this approach while investing very little in it, essentially trying to distract people from the emissions the industry keeps pouring into the air. However, investment in the technology is increasing, with much of it coming from public coffers, not the oil industry. According to the Global CCS Institute, 77 commercial projects were operating worldwide in 2025, nearly three times the number five years earlier.[2] To make a material difference, thousands of them will be needed, and they are simply not scaling at the required rate.

**2.** Global CCS Institute, 'Carbon capture stays the course despite global headwinds, with 54 percent rise in operational projects.' 9 October 2025.

**Figure 28: Capturing emissions**




This chart shows carbon capture and storage projects around the world, by project status. Many projects never proceed beyond the planning stage, so the contribution this technology is making towards solving the climate crisis remains minuscule.

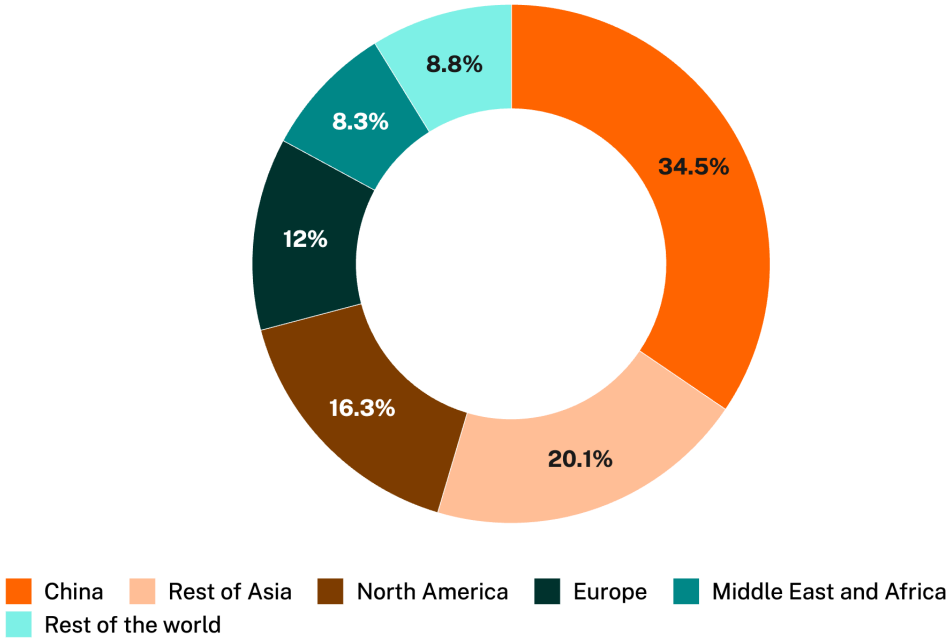
Source: IEA

The missing ingredient in the transformation of industry is public policy. Whereas many governments are finally pushing to clean up the electric grid and to clean up cars, they are still not pushing very hard at all on industrial clean-up. A slew of policy tools are available, and they are all being underused. Governments buy a large fraction of the world's cement for road and bridge projects, so they could specify cleaner options in their own procurement.[3] So far, though, only a handful of jurisdictions, notably California, are demanding that the products they buy be produced with lower emissions. Governments could also impose gradually tightening standards on all sales of steel, cement and other commodities.

**3.** Industrial Deep Decarbonisation Initiative, 'Driving green public procurement of cement, concrete and steel.' United Nations Industrial Development Organisation, 2025.

The chemical industry is another major source of industrial emissions, and the dirtiest sub-sectors are the plants producing ammonia for agricultural use, and the factories producing plastics. Some headway is being made to clean up ammonia production, responsible by itself for almost 2 percent of all global emissions.[4] In the US, certain subsidies that survived Donald Trump's budget axe are spurring the construction of cleaner ammonia factories. We continue to hold out hope for a global treaty to control the ever-rising production of plastics, but negotiations for such a treaty have stalled. The fossil-fuel industry, which supplies the chemical feedstocks for plastic production, has enlisted the Trump administration to try to prevent any formal caps on the amount of plastic that can be produced. However, ambitious nations want binding caps. New negotiations appear likely in 2027, but a formal deal may have to wait until Mr Trump is out of office.[5]

**Figure 29: Making plastic**




The chart shows the share of plastic production by regions. China is now the world's largest plastics producer by far, with some of its production exported to other countries as packaging.

Source: PlasticsEurope

**4.** Shin, Woojae et al., 'Toward a sustainable energy future using ammonia as an energy carrier: global supply chain cost and greenhouse gas emissions.' Energy & Environmental Science 19:1, 13 January 2026. For evidence of the claim that ammonia production is slowly getting cleaner, see also the Fertilisers section in International Energy Agency, 'The breakthrough agenda report 2025.' 30 October 2025.

**5.** Le Poidevin, Olivia and Volcovici, Valerie, 'Oil producer pressure, Trump rollbacks threaten global treaty on plastics pollution.' Reuters, 4 August 2025. See also United Nations Environment Programme, 'Activities Leading Up to INC-5.4.' Updated 7 September 2026.

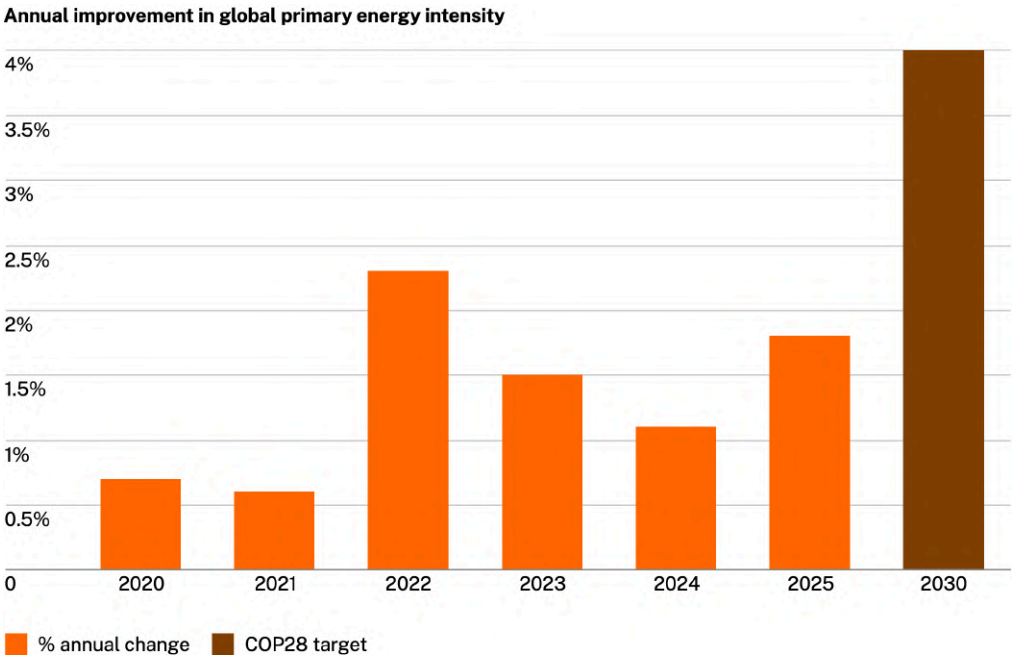
One of the most gaping holes in public policy relates to new buildings. The International Energy Agency estimates that around half the buildings that will exist in the world in 2050 have yet to be built,[6] and if current public policy is allowed to stand, many of the ones that go up in the coming decades will be energy hogs. Few governments in the world have adopted building codes that we would consider sufficiently stringent, although slow progress is being made to tighten them up. Even worse, more than half the world's construction still takes place in countries with no building codes in place or no energy requirements within their codes. The situation is gradually improving, with approximately a 30 percent increase since 2015 in the number of countries adopting energy codes, but this is not nearly fast enough to meet climate goals.[7] It is a remarkable level of dereliction on one of the most important issues of the transition. As they struggle to pay the import bill this year for more expensive fossil fuels, we hope the neglectful governments will wake up and pull one of the best levers they have to cut future energy use.

New buildings are not the only problem, of course; we also need to fix the old ones. Three things need to happen: the shells of draughty buildings must be made tighter, gas boilers need to be swapped for heat pumps, and as buildings wean themselves from gas, the distribution system for fossil gas needs to be shut down. None of this is happening at remotely the pace required to achieve the world's climate goals.

**6.** International Energy Agency, 'Perspectives for the clean energy transition: the critical role of buildings.' 2025.

**7.** UN Environment Programme, 'Beyond foundations: mainstreaming sustainable solutions to cut emissions from the buildings sector.' Global Alliance for Buildings and Construction, 7 March 2024.

**Figure 30: Smarter energy use**




The overall energy efficiency of the world economy is improving steadily, but at less than the pace needed to meet a commitment that countries made in 2023. They resolved to double the rate of improvement, shown as the brown bar on the right.

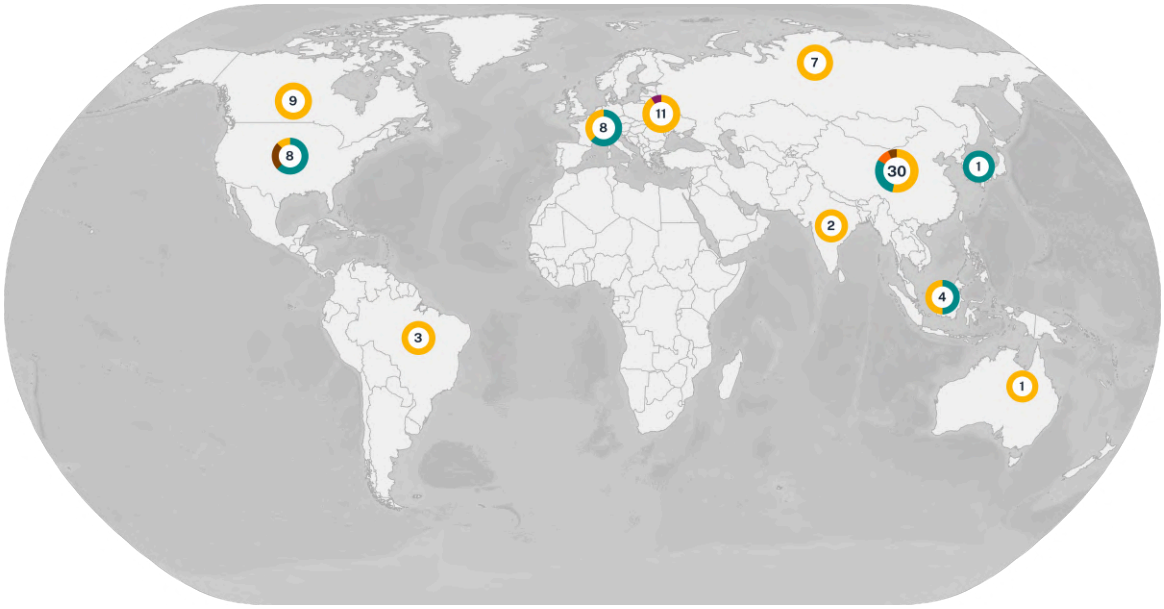
Source: IEA

The industrial sector must carry much of the burden of meeting the goals that countries have set for themselves relating to energy efficiency. The International Energy Agency calculates that to meet the world's climate goals, the energy efficiency of the entire global economy needs to improve at a pace of about 4 percent a year. However, the pace of improvement averaged only 1.3 percent between 2019 and 2024, the agency reported. It forecasts a slightly better result this year, but the situation demands far more focus and attention from governments than it is getting. Many of those governments pledged in 2023 to double the pace of improvement, but have done little to redeem their own pledges. They will not be able to do so unless they get industry moving at least as fast as the transportation and power sectors are now moving.

**Figure 31a: Announced**

**Figure 31b: Final investment approval**


**Figure 31c: Operating**




These maps show industrial decarbonisation projects around the world — in steel, cement, chemicals and other heavy industry — by status: announced, having secured final investment, and now operating.

Source: Mission Possible Partnership

While improvements in sectors like steel, cement and chemicals have been slow to take hold, we are seeing one encouraging note: a rising pace of investments. Mission Possible Partnership, an organisation tracking progress, recently reported that 19 commercial-scale industrial decarbonisation projects had secured final investment over a six-month period, more than twice the rate recorded a year earlier.[8] The pressure on industry to clean up its act is intensifying. Starting this year, certain imports into the European Union will be judged on their 'embedded emissions' and taxed accordingly, a system designed to create an incentive for exporting countries to adopt meaningful climate policies.

**8.** Mission Possible Partnership, 'Clean industry financing doubles as countries move to strengthen supply chains.' 8 June 2026.

# Green steel, coming soon

## A project under development in northern Sweden will test whether low-emissions steel can be produced at a commercial scale.


An artist's rendering of the Stegra steel plant under construction in Sweden.

Source: Stegra

Deep in the boreal forest of northern Sweden, a new factory rises, not far from a mighty river. It is unlike any factory in Europe, and indeed has no real peer anywhere in the world.

The company building it is called Stegra, and the plant is the boldest attempt ever made to clean up production of one of the world's dirtiest commodities, steel. Within the past year, this grand project confronted serious challenges. But now it has a new lease on life, and soon, it is expected to produce its first steel.

Thousands of workers are labouring to complete the plant. Only an aerial flyover — see the drone images with this report — can capture the sheer scale of the place. The largest commercial airplane in the sky is the Airbus A380; the largest building at the Stegra plant, were it an empty shell, could hold 14 Airbuses parked nose to tail. It is only one of the many buildings, pipelines, conduits, towers, transformers, power cables, railway lines, roads, conveyor belts and loading bays required to bring the mill to life.

Steel is the most important metal of industrial civilisation, and it is also a huge problem. The immense heat, and the chemical reactions, required to turn iron ore into refined iron and then into steel usually come from burning coal in a blast furnace.
That makes steelmaking a major contributor to the climate crisis, producing about 7 percent of global greenhouse emissions.

Stegra's plan is to make conventional steel by an unconventional method. It will use hydrogen as the fuel source, which means the main emission from the plant will not be carbon dioxide, as in a traditional blast furnace, but plain water vapour. This alternative approach should cut emissions by about 95 percent, the company estimates.

Stegra construction site

Source: Stegra

But where will the hydrogen come from? The company plans to make its own, by drawing water from the Lule River and using electricity to split the water into hydrogen and oxygen. One of the buildings under construction now will be the largest such hydrogen-producing facility in the world when it opens. For the process to be clean, the power itself has to be clean, and that explains why the plant is going up in the wilds of northern Sweden.

This region, near the town of Boden, happens to be blessed with far more renewable energy than it can use, generated by wind turbines and by hydroelectric plants on Sweden's rivers. "In order to make steel, all we need is for the rivers to flow and the wind to blow," said Henrik Henriksson, chief executive of the company.

In smaller plants, one Swedish and two Chinese steel producers have shown that this hydrogen method can work. But the Stegra plant will be several times the size of those demonstration plants, ultimately producing an estimated 5 million tonnes of steel per year at peak capacity.

The required investment runs far into the billions of euros, and that has been the tricky part.

With construction delays and other cost overruns last year, the company ran low on funds. Banks that had lent to it grew concerned. A Generation subsidiary, Just Climate, is one of the investors in Stegra, and as the company fell into problems, Just Climate leapt into action.

A Just Climate executive, Shaun Kingsbury, took over temporarily as chairman of Stegra's board and spent months in Stockholm working with the company on a revised plan.

In an interview, Mr. Kingsbury pointed out that the effort to decarbonise heavy industry around the world had gone slowly, and the Stegra plant was perhaps the single most ambitious attempt to prove that it can be done. "We could not let that effort fail," he said. "We *had* to solve it."

Nonetheless, the negotiations were difficult. The bankruptcy of another Swedish clean-energy company, the Northvolt battery producer, cast a long shadow over the discussions with finance providers. Ultimately, though, the board and the company secured a refinancing package that brought an additional €1.4 billion to the Stegra project.

Among the new investors who came in were a Swedish family called the Wallenbergs. That name may ring a bell; Raoul Wallenberg, the World War II hero, was a member of the family. Today the Wallenbergs are the leading industrialists and bankers of Sweden, controlling significant stakes in companies like AstraZeneca, Electrolux, Ericsson and the SEB bank. Their involvement in a project like Stegra brings credibility and reassures other investors.

With new funding secured, construction is ramping up in northern Sweden, though the plant will likely not reach its maximum capacity until 2030. In will flow iron ore from Sweden and at least two other countries. Out will flow some of the world's cleanest steel.

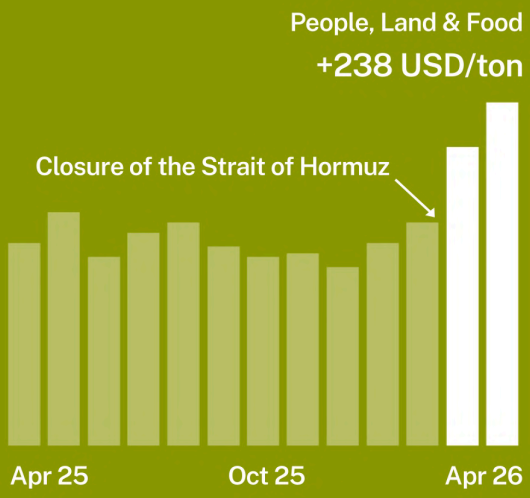
The construction overruns and the new refinancing package mean that costs for the plant have gone up. But Mr. Kingsbury noted that the economics have actually improved: power costs in that part of Sweden have fallen, and prospective buyers are proving willing to pay a significant 'green premium' for steel produced with low emissions.

The buyers signing deals include automotive companies who face rising European fees on dirty steel, and who also want to boast of green steel in their electric cars. Even other steel companies, having dragged their feet on their own cleanup plans, are now looking to buy from Stegra so they can resell clean steel to customers who are starting to demand it.

**a.** World Steel Association, 'Climate change and the production of iron and steel.' 2025.

# 05
# People, Land & Food

# The fertiliser shortage led to escalating prices for farmers

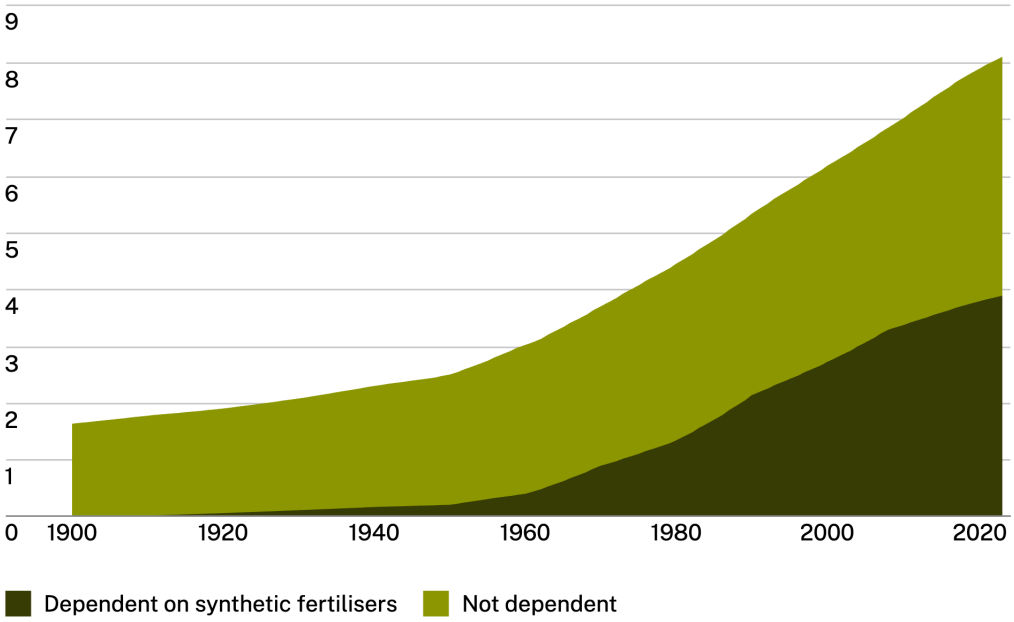



## Food supply at risk

We may be on the verge of another global food emergency. The blockade of the Strait of Hormuz bottled up some 30 percent of the nitrogen fertiliser normally supplied to the world's farmers, and food production depends critically on that mineral. Prices for a common type of nitrogen, called urea, jumped more than 50 percent in major markets in the middle of the crisis, and that increase coincided with the spring planting season in the Northern Hemisphere. Farmers consequently bought and used less of it, which is likely to reduce total production as the 2026 harvest is completed in the coming months.[1]

**1.** UN Food and Agriculture Organisation, 'Implications for world food security and agriculture arising from disruptions of supply chains in the Gulf region, including the closure of key maritime routes: opening statement.' 28 April 2026.

**Figure 32: A chemical dependency**




Almost half the world food supply depends on nitrogen fertilisers created in factories. This chart shows the share of the world population who are alive because of this chemical intervention.

Source: Our World in Data

Whether we can expect broad food shortages across the world is still unclear, however. Food prices are elevated compared to the relatively low prices that prevailed for decades. However, the recent price spike is not as severe, so far, as the one that accompanied the start of the Ukraine war, which temporarily shut off exports from Ukraine, one of the world's major breadbaskets.

**Figure 33: World food prices**


The UN Food and Agriculture Organisation tracks the wholesale prices of a representative selection of food commodities. The line shows monthly prices adjusted for inflation, indexed to 100 in 2014–2016.

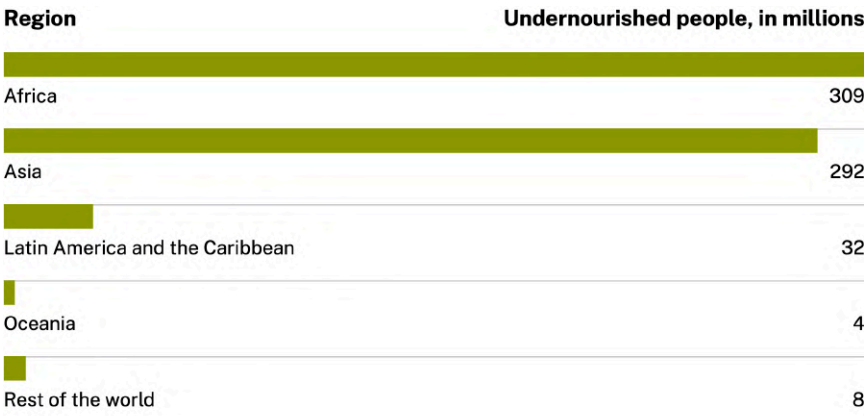
Source: FAO

The reality of higher prices is being felt all over the world, and indeed, the sense that things are out of control at the supermarket is one of the factors feeding the populist political revolt. Nevertheless, higher prices tend to lead to extensive malnutrition only in the poorest countries, where families spend most of their household income buying food. The number of people suffering acute hunger is currently estimated at 318 million,[2] with the World Food Programme warning that it could jump as high as 363 million,[3] but if this materialises it will happen over the better part of a year. The most severe problems at the time of this writing are not a result of the Hormuz crisis but are in regions directly affected by drought or war. One of the world's worst hunger spots at the moment appears to be the Gaza Strip, where the normal flow of food has been interrupted by displacement and by Israeli military action.

**2.** UN World Food Programme, 'WFP 2026 global outlook: hunger and hope – innovative solutions to address food insecurity.' 18 November 2025.

**3.** UN World Food Programme, 'WFP projects food insecurity could reach record levels as a result of Middle East escalation.' 17 March 2026.

**Figure 34: A concentrated problem**




An estimated 645 million people experienced persistent hunger in 2025, more than 90 percent of them in Africa and Asia. (This is a broader measure of hunger than the 318 million people mentioned in the text as suffering acute malnutrition.)

Source: SOFI

The closure of the Strait of Hormuz has, however, highlighted a mutual co-dependency that had received little attention until recently. After decades of rapid population growth, the broad desert and semi-desert region stretching from North Africa to the Middle East is home to about 600 million people. At the time of the first oil crisis, in 1973, Saudi Arabia had a population of seven million; that has since jumped to 35 million.[4] By 2050, according to United Nations estimates, the population of the region is headed toward 792 million.[5]

By and large, the people living in this region do not have enough water and fertile land to produce their own food. They are dependent on imports, with home-grown food covering less than half of what some countries eat, and in the most exposed, barely more than 10 percent.[6] What they do have, however, is oil; in a roundabout way, the oil exports from the Middle East pay for the food imports. The dependency runs both ways, however. The region has abundant fossil gas. The nitrogen fertiliser that underpins world food production is created by combining fossil gas with nitrogen from the air. Before the war broke out, the Middle East had become the source of almost a third of the world's nitrogen fertilisers.[7] So the people of the Middle East depend on the rest of the world to grow their food, and the farmers who do the growing depend heavily on the Middle East to supply the inputs they require. The situation is a hallmark of modern times, creating gleaming, teeming cities in parts of the world that were inhabited not that long ago by desert nomads.

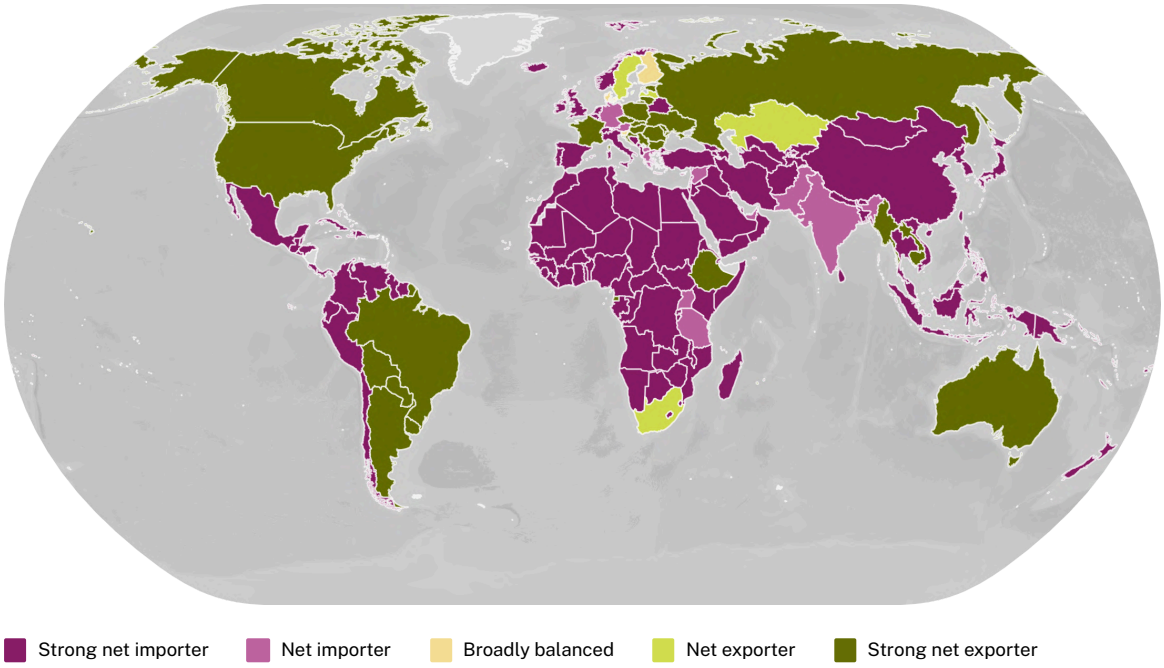
**4.** Saudi Arabia General Authority for Statistics, 'Population census data 1974' and General Authority for Statistics, 'Population estimates publication 2024.' 6 February 2025.

**5.** UN Department of Economic and Social Affairs, Population Division, 'World population prospects 2024.' July 2024.

**6.** UN Food and Agriculture Organisation, 'Implications for world food security and agriculture arising from disruptions of supply chains in the Gulf region, including the closure of key maritime routes: opening statement.' 28 April 2026.

**7.** UN Food and Agriculture Organisation, 'Global agrifood implications of the 2026 conflict in the Middle East.' 15 March 2026.

**Figure 35: How we eat**




Cereals still supply most human calories. The map shows which countries are net exporters or importers of wheat, soya beans, maize and rice.

Source: FAO

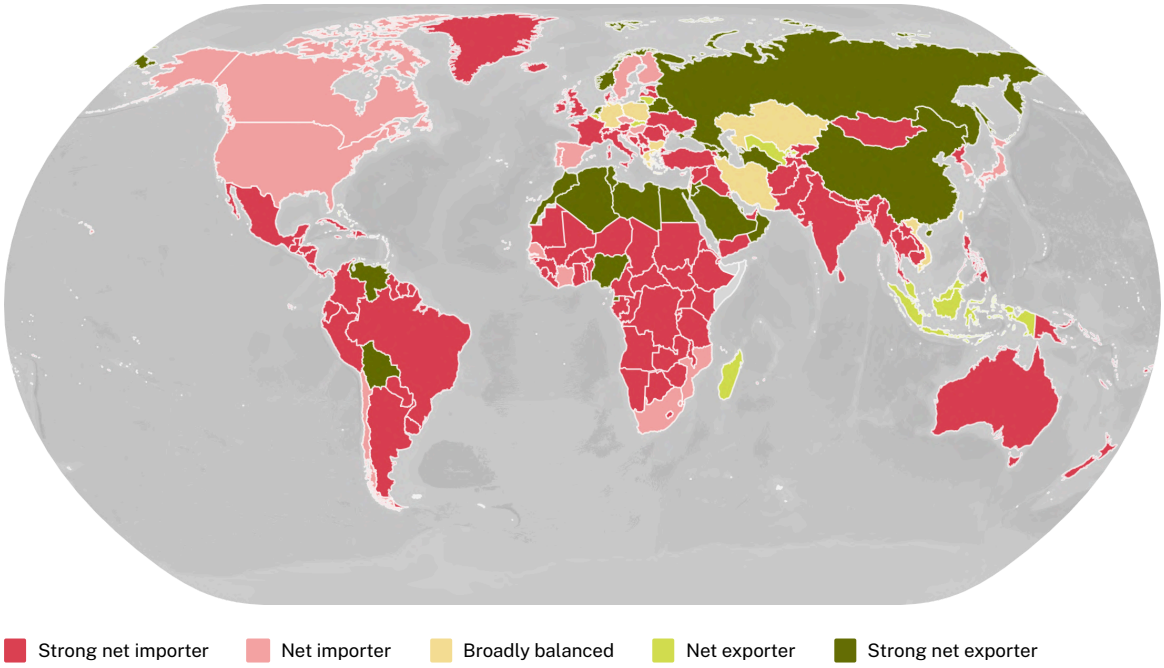
The Strait of Hormuz blockade broke the trade in both directions. Gas, oil and fertilisers could not get out; grain shipments could not get in. Sulphur used in many of the world's most important mines could not get out.[8] Helium used to produce the world's computer chips could not get out.[9] Fortunately, the result was not an immediate crisis in most goods trade: the vulnerability of the Strait of Hormuz had long been understood, and many at-risk countries and industries had built strategic stockpiles. We have already mentioned China's oil stockpile, apparently massive in scope. Similarly, many governments around the Persian Gulf had the perspicacity years ago to set up strategic national grain reserves.[10]

**8.** UN Food and Agriculture Organisation, 'FAO chief economist warns of severe global food security risks from disruption to Strait of Hormuz trade corridor.' 26 March 2026.

**9.** Chan, Kelvin, 'Iran war halts Qatar helium output, threatening global tech supply chains.' Associated Press, 21 March 2026.

**10.** UN Food and Agriculture Organisation, 'Implications for world food security and agriculture arising from disruptions of supply chains in the Gulf region, including the closure of key maritime routes: opening statement.' 28 April 2026. See also Gulf Cooperation Council, 'Agriculture and food security ecosystem in GCC states is a strategic priority and fundamental pillar of joint gulf action.' 3 September 2026.

**Figure 36: How we grow**




World food production strongly depends on nitrogen fertiliser, produced by using fossil gas to convert the nitrogen in the air into a form plants can use. Agriculture in most countries depends on fertiliser imports, with almost a third of global production centred in the Persian Gulf.

Source: FAO

Many people probably imagine that governments everywhere, like those of the Arab states, hold food reserves sufficient to feed their people in case of crisis. It is, however, less true than it used to be. At a global scale, we more or less eat what we grow from year to year. Most governments depend on the just-in-time deliveries of the global trade system to keep their people fed. A true global-scale interruption of food production — from, say, a massive volcanic eruption that blackened the sky for months, or from failures in multiple breadbaskets caused by climate change — would almost certainly produce chaos, panic and mass starvation. However, some countries do hold food reserves, most notably China, where famines that killed millions have taught the government to be exceedingly cautious about keeping the population fed. China not only holds reserves of grain, but even an immense reserve of frozen pork.[11]

**11.** US Department of Agriculture, Foreign Agricultural Service, 'China: grain and feed annual.' March 2026. See also National Development and Reform Commission of China, 'The state will soon begin purchasing and storing central frozen-pork reserves.' 21 August 2025.

With ships sneaking through the Strait of Hormuz under cover of darkness, we suspect some food deliveries are actually being made. Outside the known trouble spots, like Gaza, there is no indication that countries of the region are worried about running out. At a global scale, the potential shortfall in production from the Hormuz crisis will take many more months to show itself fully, and will intersect with other hits to food production, including the strengthening El Niño weather pattern. This means it will be a while before we know the full magnitude of the food crisis, and its effects on the world's poorest people.

**Figure 37: Costly fertiliser**


Fertiliser prices surged during the spring planting season as the Strait of Hormuz crisis disrupted global supplies, before retreating from their peak.

Source: World Bank

The situation offers opportunities. Some countries have a history of overusing nitrogen fertilisers, resulting in pollution that washes down rivers and causes 'dead zones' where they meet the ocean. If today's high prices prompt farmers to use fertilisers more judiciously, that could potentially be a salutary development. In addition, this is a prime moment for companies offering alternatives to standard agricultural chemicals, especially those using biology to do that which has usually been done with chemistry. For instance, Generation has invested in a company called Pivot Bio that sells an alternative to nitrogen fertiliser, using a bacterial coating that allows plants to take up airborne nitrogen through their roots.[12] More broadly, we hope this moment will help to boost more sustainable and regenerative agricultural practices across the board. The greatest contribution of the organic movement to agriculture has been to emphasise the importance of healthy soil, which is rich in nutrients and therefore requires less or no chemical fertiliser.

**12.** Martinez-Feria, Rafael et al., 'Genetic remodeling of soil diazotrophs enables partial replacement of synthetic nitrogen fertiliser with biological nitrogen fixation in maize.' 12 November 2024.

Historically, food shortages have led to intensified human pressure on the world's forests, as people cleared land for greater agricultural production. With the current focus in global politics on slowing deforestation, we hope that land-clearing does not spike this time. Brazil, under its current government, has made progress in slowing human-caused forest loss in the Amazon, and it is leading a global push to set up a system that pays tropical countries to leave their forests standing.[13]

**13.** World Resources Institute, 'Tropical rainforest loss drops 36% in 2025, but fires threaten global progress.' 29 April 2026. Also see World Resources Institute, 'Brazil launches Tropical Forests Forever Facility.' 6 November 2025.

**A changing summer**

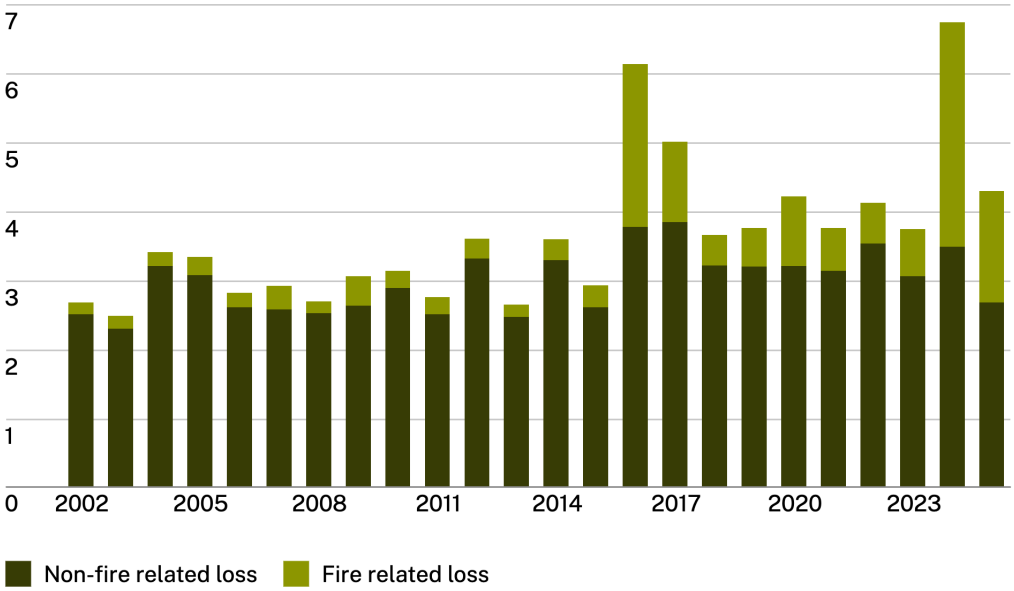
Beachgoers watch smoke rise from a wildfire in Lacanau, in southwestern France, in July 2026. The fire was one of many blazes to strike an overheated European continent. Climate change is intensifying the hot, dry conditions that allow wildfires to spread.

Source: Maximilien Lamy / AFP via Getty Images

However, the rise in global heat waves and drought is undermining the effort to save forests. Even as direct human-caused losses decline, losses from fire — a consequence of the global rise in greenhouse gases — are rising. This is true not just in the tropics but in the vast boreal forest, a ring of trees encircling the high latitudes of the Northern Hemisphere.

**Figure 38: Losing forests**

**Tropical primary forest loss, in million hectares**




As the climate heats up, fires are becoming a more significant cause of tropical forest loss.

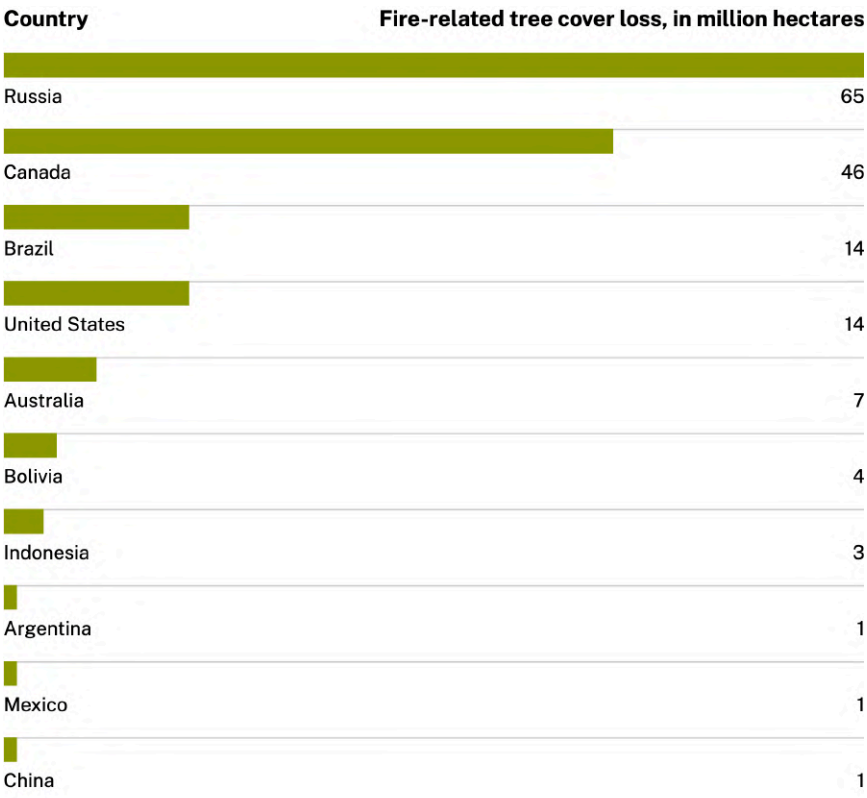
Source: WRI

The rise in fires is a hit not just to forests, but to public health, with wildfire smoke from Canada polluting the air in huge cities like Chicago and New York.[14] The Amazon is now at extreme risk from desiccation and forest fires in an overheated climate, and the situation there could peak this winter as El Niño reaches its maximum strength.[15]

**14.** National Oceanic and Atmospheric Administration, 'Smoke from Canadian wildfires blankets US.' 8 June 2023.

**15.** World Meteorological Organisation, 'Global seasonal climate update for September – October – November 2026.' 3 September 2026.

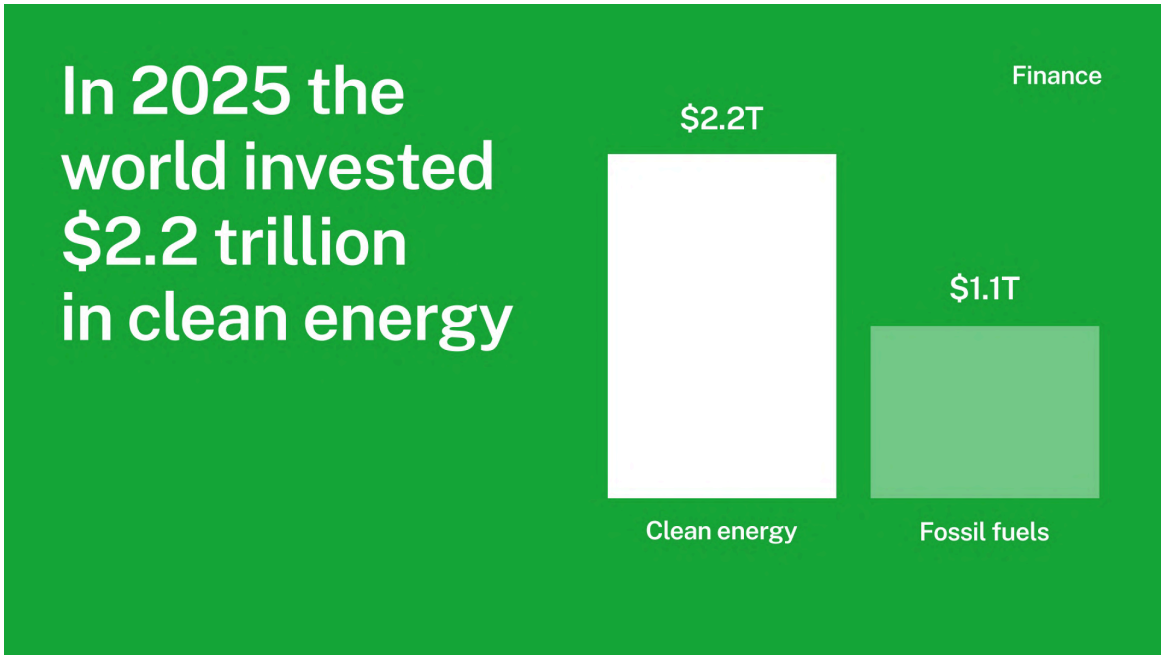
**Figure 39: Feeling the burn**




Fire-related tree cover loss, 2001–2025, was highest in the boreal forests of Russia and Canada, part of the immense ring of trees encircling the high latitudes of the Northern Hemisphere.

Source: WRI

# 06
# Financing the Transition



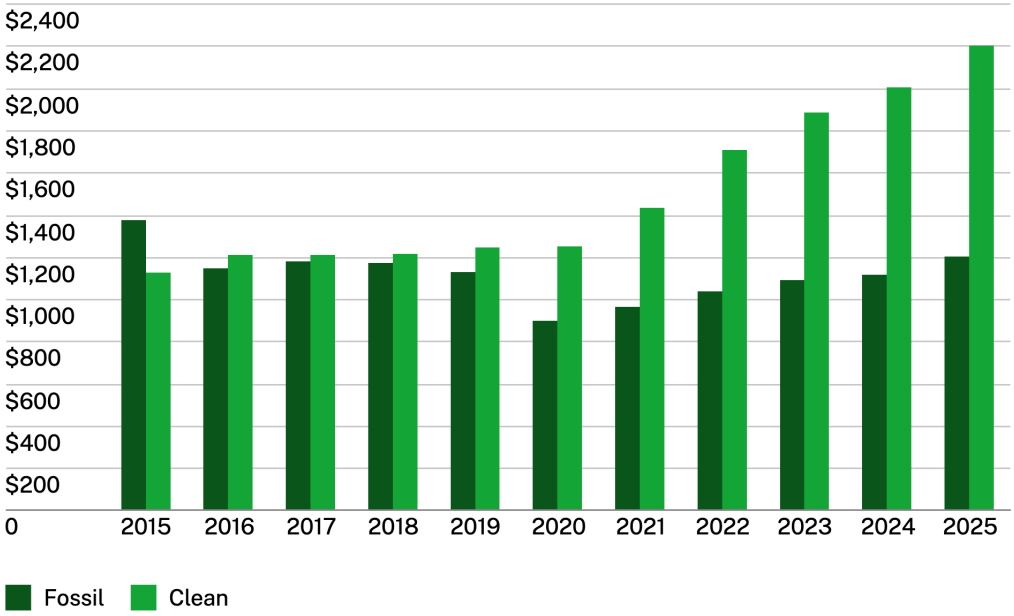

## Still not enough

Global clean energy investment reached a record $2.2 trillion in 2025[1] — up 10 percent from 2024 and continuing a multi-year run in which overall investment in renewables, electrification and low-carbon transport substantially outpaced investment in the supply of fossil fuels. For several years now, this clean-to-dirty ratio has been running at about two-to-one.

**1.** International Energy Agency, 'World Energy Investment 2026.' 28 May 2026.

**Figure 40: Pulling ahead**

**Investment, in billion US dollars**




Once again, clean energy investment is roughly double the investment in fossil fuels.

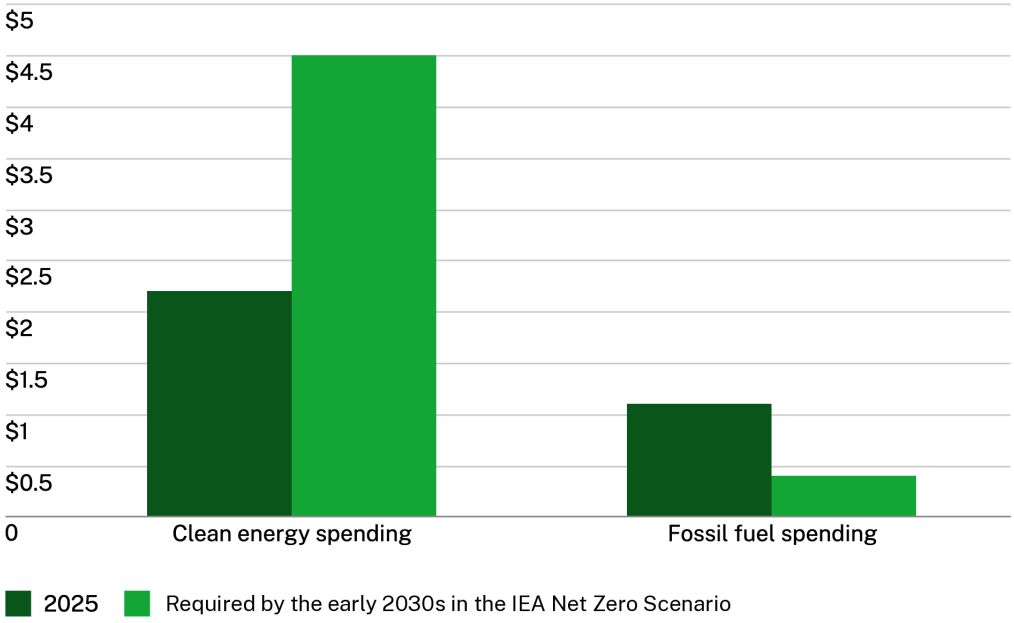
Source: IEA

National security is one driver of this phenomenon: countries are realising that every unit of electricity generated by wind and solar farms at home is a unit that no longer depends on imported fossil fuels, which are subject to war-driven volatility and the whims of exporting nations. As we outlined earlier in this report, the incentives for countries to wean themselves off fossil fuels have only strengthened as a result of the conflict between the US and Iran.

Yet despite this acceleration, the International Energy Agency estimates that meeting the global climate goal of limiting warming to 1.5°C requires clean energy investment to reach $4.5 trillion per year by the early 2030s, and some analysts put the net-zero requirement even higher at $5 trillion annually. This means we are only about halfway to this goal.

**Figure 41: Far to go**

**Trillion US dollars**




Reaching net zero emissions by mid-century means clean energy investment roughly doubling by the early 2030s, to about $4.5 trillion per year, while spending on oil and gas supply falls to about $400 billion per year.

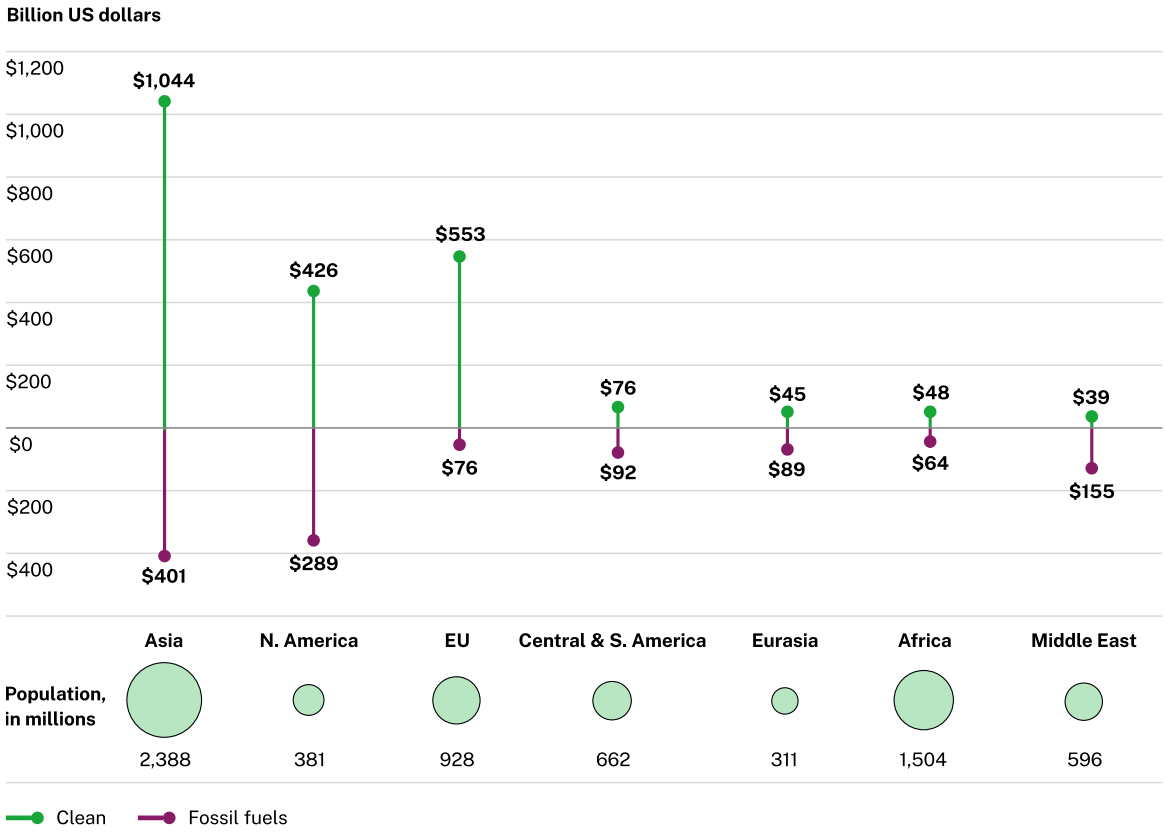
Source: IEA

More troubling than the headline gap is the geographic distribution. Emerging and developing economies outside China receive only around one-fifth of global clean-energy investment. Africa receives just 2 percent, despite being home to 20 percent of the world's population.[2] For private financial flows, the picture looks worse: emerging markets captured only 8.5 percent of global portfolio allocations and 3.3 percent of climate fund capital in 2025,[3] demonstrating that private capital is underrepresented in these regions.

**2.** Ibid.

**3.** World Bank, 'Global economic prospects.' January 2025. With additional analysis by Just Climate.

**Figure 42: Rebalancing needed**




In developing regions other than China, investment in fossil fuels still exceeds that in clean energy.

Source: IEA/World Bank

Moreover, the largest pools of capital are not moving at the pace and scale required to close the gap. A study of 35 of Europe's largest pension funds and insurers found that their investments were concentrated in large emerging markets, with little to no investment in developing economies.[4] Since 2015, little additional institutional capital has flowed to these markets, and net allocations have even fallen in some areas. UK pension funds allocated just 0.5 percent of their assets under management to emerging and developing economies in 2022.[5] Where pensions and insurers do invest in these markets, flows skew to listed, investment-grade assets in established sectors: low-and middle-income countries have seen a small decline in private markets allocations, even as high-income countries saw a 20 percent increase in primary market infrastructure investment in 2023.[6]

**4.** Attridge, Samantha et al., 'Trillions or billions? Reassessing the potential for European institutional investment in emerging markets and developing economies.' ODI Global, 22 May 2024.

**5.** Ibid.

**6.** Global Infrastructure Hub, 'Infrastructure Monitor 2024.' 6 May 2025.

The other side of the story is one of the least-discussed but most consequential dynamics in sustainable finance: the continued growth of fossil fuel-related financing in emerging and developing economies. While investors in developed markets like Europe have acknowledged that continued fossil-investment could produce 'stranded assets' as the energy transition progresses, many lower-income countries are still expanding their fossil-fuel infrastructure — financed by sovereign debt, development finance and bilateral lending — in response to legitimate energy access needs and structural limitations that the finance community has yet to overcome. Many emerging and developing regions receive a larger share of global fossil-fuel investment than of clean-energy investment. In aggregate, emerging and developing economies outside China were expected to account for 44 percent of global fossil-fuel investment but only 18 percent of clean-energy investment in 2025.[7]

The scale of this exposure is significant. Despite commitments made at a 2021 global climate conference to end public support for unabated coal, oil and gas abroad, cumulative fossil fuel financing from development finance institutions and export credit agencies has continued. China's policy banks and state owned enterprises have been important sources of fossil-fuel finance in Sub-Saharan Africa and parts of Southeast Asia, though there are clear signs of a pivot toward renewable energy in these institutions' overseas financing.[8] Progress in the public sector is slow, but it is at least occurring. This cannot be said for the majority of the largest private-sector banks financing fossil fuels. In 2025 alone, the world's 65 largest banks provided $906 billion in fossil-fuel financing, an 8 percent year-over-year increase. This is equivalent to approximately $2.5 billion per day, or more than $100 million per hour. US banks accounted for 32 percent of fossil-fuel financing worldwide.[9]

The stranded-asset risk embedded in this financing is substantial and underappreciated. Fossil fuel projects being financed today — some with 30- to 40-year operational horizons — are being built against a backdrop where clean energy costs are improving rapidly and where carbon pricing or regulation may erode their commercial viability well before the debt is repaid.

It is, of course, an urgent ethical imperative to deliver modern energy access to the hundreds of millions of people, concentrated in Sub-Saharan Africa, who still do not have lights at night or pumps for clean water. If all the fossil investment were going towards this purpose, it would be hard to criticise, even though solar panels and batteries are looking like the better path for delivering power to much of Africa. But in fact, much of the fossil investment in poor countries is actually going to secure new supplies of oil and gas to be sold to Western consumers on the world market, with little expectation that ordinary Africans will benefit from the hydrocarbon riches.[10]

**7.** International Energy Agency, 'World Energy Investment 2026.' 28 May 2026. In particular, see 'Energy investment across regions and sectors, 2015 and 2025,' a component of the World Energy Investment report.

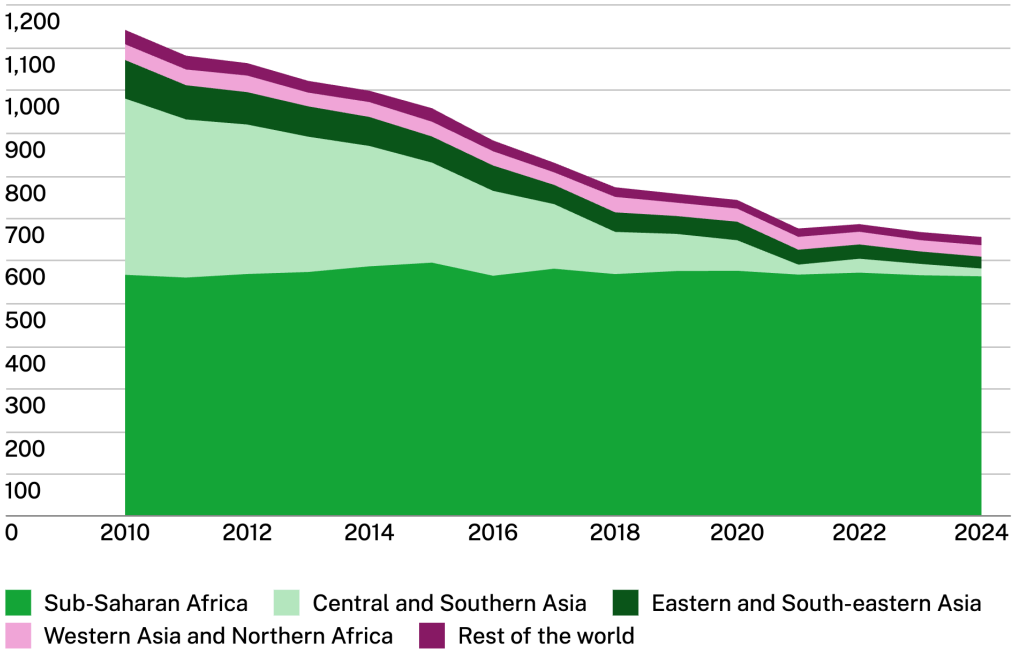
**8.** International Energy Agency, 'Trends in China's outbound energy finance,' in 'China's official energy finance in emerging and developing economies.' 22 December 2025.

**9.** Rainforest Action Network et al., 'Banking on climate chaos 2026: fossil fuel finance report.' Banking on Climate Chaos Coalition, 8 June 2026.

**10.** Schücking, Heffa et al., 'Who is financing fossil-fuel expansion in Africa?' Published by Urgewald e.V. and 46 allied organisations, November 2022.

**Figure 43: Waiting for power**

**Population without access to electricity, by region, in millions**




The number of people lacking electricity access has fallen sharply since 2010, but one part of the world has been left behind: nearly 600 million people in Africa are still waiting. Investment is urgently needed to get them onto the grid or onto small solar systems that can provide lights and phone charging.

Source: World Bank

The case for accelerating sustainable finance flows to emerging markets is both moral and economic. Despite its success in rolling out renewable energy, India was the country with the third-largest carbon footprint in 2025.[11] In Brazil, roughly two-thirds of emissions derive from agriculture and land use; the remaining third from industry, a share that is growing as the economy expands.[12] Both countries present compelling investment opportunities alongside these challenges: critical mineral reserves, rapidly declining clean-energy costs, large and growing domestic markets, and, in Brazil's case, a renewable power system that is already among the world's largest and most integrated.

**11.** ClimateTRACE, 'Climate TRACE data show global greenhouse gas emissions hit a new record high in 2025.' 26 February 2026.

**12.** Brazilian Ministry of Science, Technology and Innovation, 'Brazil's fifth national GHG inventory,' 2024.

The challenge is that institutional capital is not moving at the pace or scale required. Three barriers repeatedly emerge. First, genuine or perceived risk: technology immaturity in some markets, sovereign credit concerns, contract enforceability and currency volatility can represent real constraints on the risk-adjusted returns that investment committees require. Second, familiarity and transaction costs: deploying capital into unfamiliar markets imposes real costs even where project-level returns may be comparable to rich-country markets. Third, regulatory friction: EU rules make emerging market investments structurally more expensive for European insurers, regardless of underlying project quality.

A strategy called 'blended finance' has emerged to tackle some of these problems. Financing deals may include some public or charitable money that would take the first loss in case of financial problems, reducing risk for commercial investors, and thus lowering the overall financing cost of a project. Likewise, grants or subsidies can be used more directly to improve the returns of a project. They can buy insurance or hedge against losses due to changes in currency rates. The problem is that not enough public or charitable money is available for these purposes. Rich countries have been cutting back their foreign aid even as they publicly acknowledge that poorer countries need more help to cope with a climate crisis not of their making.

Getting investment flows right is by no means the only challenge the world faces in confronting the costs of the climate crisis. Property losses from natural catastrophes are escalating as heat waves, wildfires, storms and coastal flooding all accelerate.

Global insured losses from natural catastrophes have followed a 5 to 7 percent annual growth trend since 1994, roughly double the 2.7 percent rate of overall economic growth over the same period. However, insurance companies do not attribute much of that growth in losses to climate change. Other forces are at work, notably the increase in asset values in exposed areas, driven by urbanisation and rising populations in regions susceptible to natural perils. Insurers argue that the impact of the changing climate has been relatively small so far. However, given the worsening trends in natural disasters, we expect the growth in losses to accelerate.[13]

**13.** Swiss Re Institute, 'Natural catastrophes in 2023: gearing up for today's and tomorrow's weather risks.' Sigma 1/2024, 26 March 2024.

**Value at risk**

A home is engulfed by the Eaton fire in Altadena, California, in January 2025. The Los Angeles wildfires caused tens of billions of dollars in damage, adding to mounting pressure on insurers and leaving many losses uncovered.

Source: Josh Edelson, via Getty

A structural feature of the industry shapes how this risk is absorbed. Because most property coverage is written on annual contracts, primary insurers can reprice, or withdraw coverage, each year, so climate change registers as a rolling underwriting decision rather than a long-term solvency threat. Those primary insurers tend to buy a product called reinsurance, from huge companies like Swiss Re or Munich Re, for potential losses that might exceed their capacity to pay. So the work of pricing a changing climate falls disproportionately to the reinsurers and the catastrophe-modelling firms that serve them. Reinsurers were among the earliest financial actors to link a warming climate to potential for rising losses. In some cases they have limited the scope of coverage or stopped writing reinsurance for perils, or for regions, they deem to have become too risky.

That, in turn, is feeding through to the retail marketplace and forcing policy cancellations and withdrawals. Insurers have been exiting high-risk areas and declining to renew policies across parts of the US, including California, Colorado and the Gulf Coast. In California, the retreat was driven partly by regulation: state rules long prevented insurers from raising rates to reflect mounting wildfire risk, so rather than write cover at prices they judged inadequate, several large carriers simply left. The displaced homeowners and businesses fall back on state-run insurers of last resort, whose coverage is usually narrower and more expensive. Many billions of dollars of potential losses are creeping off the books of private insurers and onto backstop insurance programs whose losses, when they occur, are likely to be socialised across the wider industry and the public.

However, insurers are by no means just innocent victims of climate change. Insurance companies are among the largest institutional investors, and a substantial share of US insurers' portfolios is invested in fossil-fuel-related assets,[14] even as their underwriting books start to absorb the physical losses a warming climate produces. The sector is thus exposed on both sides of the balance sheet: to physical risk on the liabilities it underwrites, and to transition and stranded-asset risk on the investments it holds.

In some parts of the Global South where insurance penetration is low to begin with, the consequence of rising climate risk is not just premium increases, but potentially a permanent lack of coverage. This risks further expanding the protection gap: the difference between total economic losses and insured losses. In 2024 and 2025, more than half of catastrophe losses were not covered by insurance at all.[15] The gap matters for development finance because uninsured losses either devastate households directly or fall on governments, which must divert scarce funds to disaster response at the expense of longer-term investment, including in the clean-energy infrastructure that would help to mitigate future risk.

Turning from insurance to sustainable finance more broadly: genuinely sustainable finance requires a fundamental set of rules and guidelines. Companies need to measure their emissions consistently, make sustainability disclosures in comparable ways and set credible targets for reducing emissions. Without such details, financial institutions lack the information they need to make decisions. These rules and guidelines are playing an ever more central role in business and financial decision-making. But they are also facing pressures that could weaken and undermine them if we do not take collective action to strengthen and reinforce them. They need support from governments, businesses and financial institutions.

**14.** Fenlock, Lindsay et al., 'Cut and run: how insurers dodge the climate costs they help create and why fossil fuel should pay.' Center for International Environmental Law, 3 March 2025.

**15.** Banerjee, Chandan et al., 'Natural catastrophes: insured losses on trend to USD 145 billion in 2025.' Swiss Re Institute, 29 April 2025; Swiss Re Institute, 'Natural catastrophes in 2025: the persistent rise of wildfire and storm risk.' 19 March 2026.

The Greenhouse Gas Protocol is by far the most widely used system for measuring corporate emissions, but it now faces a competing approach. In October 2025, Carbon Measures, a coalition backed by ExxonMobil, launched a framework based on product-level carbon accounting.[16] Crucially, it counts emissions only up to the point at which a product leaves the producer. For oil and gas companies, that would mean excluding the emissions generated when their products are ultimately burned — which is to say, the bulk of the emissions these companies produce. The debate may appear technical, but the stakes are significant: changing what companies are required to count can fundamentally change how responsibility for emissions is understood.

Meanwhile, disclosure on material sustainability issues also needs support in the face of current political challenges. The International Sustainability Standards Board was established to create a common global baseline for sustainability reporting, and more than 40[17] jurisdictions have adopted or committed to its standards. But there is not yet sufficient global convergence around that baseline. The current US administration is hostile to any mandatory climate disclosure, and is in the process of rescinding the Biden administration's climate disclosure rules for US-listed companies.

The European Union has developed its own sustainability reporting regime and it is very much a live debate as to how to ensure the EU rules are as aligned with and complementary to the ISSB as possible. Whether we can get to a globally coherent and comparable global baseline on corporate disclosures of material sustainability factors will be critical to progress moving forward.

Meanwhile, corporate climate targets also face pressure. The Science Based Targets Initiative has helped thousands of companies translate climate science into emissions-reduction targets. The task now is to keep attracting new companies and to retain existing participants in the face of US political pressure and some of the real world challenges of the transition. SBTi launched a refreshed flagship corporate net-zero standard in 2026 that has been well received by business. The initiative then scored a major success when Walmart recommitted and set a new target. Asia is a major driver of continued growth and in 2025 saw the highest proportional growth anywhere in the world in companies setting SBTi-validated targets.

This matters because there is good evidence that science-based targets work: studies have associated them with meaningful reductions in corporate emissions with no corresponding decline in profitability.[18]

**16.** Mehta, Angeli, 'Exxon-backed initiative on carbon accounting sparks fears of bid to slow climate action.' Reuters, 13 May 2026.

**17.** IFRS Foundation, 'IFRS Foundation launches training programme to help companies use ISSB Standards.' 2026.

**18.** Schüder, Martin, and Henning Zülch, 'Corporate carbon performance and the science-based targets initiative: disentangling the effects across Scope 1, 2, and 3 emissions.' Journal of Industrial Ecology, 2026. See also Li, Jingduan et al, 'The role of science-based targets on carbon mitigation: addressing the tension between net zero anxiety and economic growth,' British Accounting Review, 2025.

These institutions may sound remote from the day-to-day business of investing capital, but they provide much of the common language that allows investors to compare companies, assess climate risk and judge whether businesses are genuinely transitioning. Indeed, there are also positive developments. Despite current political pressures, the great majority of companies are continuing to pursue their climate targets, commitments and reporting because they see them as key tools to manage their businesses effectively. After setbacks last year, the Net Zero Asset Managers initiative relaunched earlier this year with over 250 signatories. Companies and investors alike continue to factor climate risks and opportunities into their decisions as key business inputs.

There are indeed reasons to expect a bumpy ride in sustainable finance over the coming years. But political momentum and economic momentum are not the same thing. The underlying economics of the transition remain powerful. Investment in clean and renewable energy continues to outpace fossil-fuel investment and is accelerating, not decelerating, amidst political volatility globally. While there are headwinds, we remain optimistic that the building blocks of carbon emission measurement, sustainability disclosure and science-based targets are in place. If we work together to strengthen this critical scaffolding, we believe we can continue to see meaningful progress in financing the transition required for a sustainable economy.

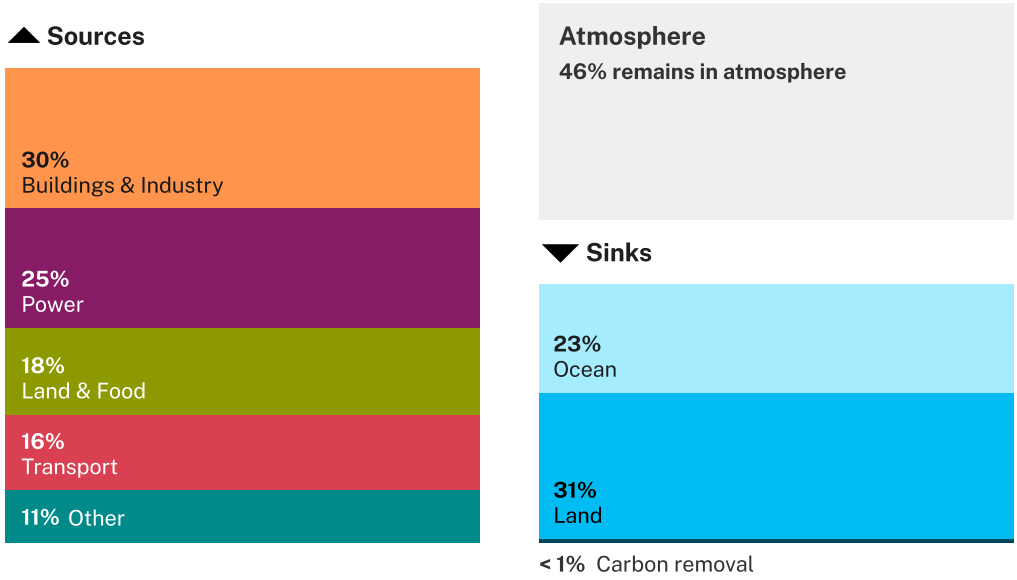
# 07
# Looking Ahead

# Age of disruption

Scientists tell us that the heat accumulating across the Earth as a result of human emissions is roughly equivalent to the energy that would be released by 800,000 Hiroshima-sized atomic bombs exploding across the face of the planet every day. That number has doubled since it was first calculated in 2012, due to the continuing increase of greenhouse gases in the atmosphere.[1]

1. The comparison between the Earth's energy imbalance and the heat released from atomic bombs was first made by James Hansen, the famed NASA climate scientist. We confirmed the latest estimate with Dr Hansen, who is retired from government service but remains active in climate research. Personal communication between James Hansen and Brad Hall. 29 May 2026.

**Figure 44: Overheating the world**



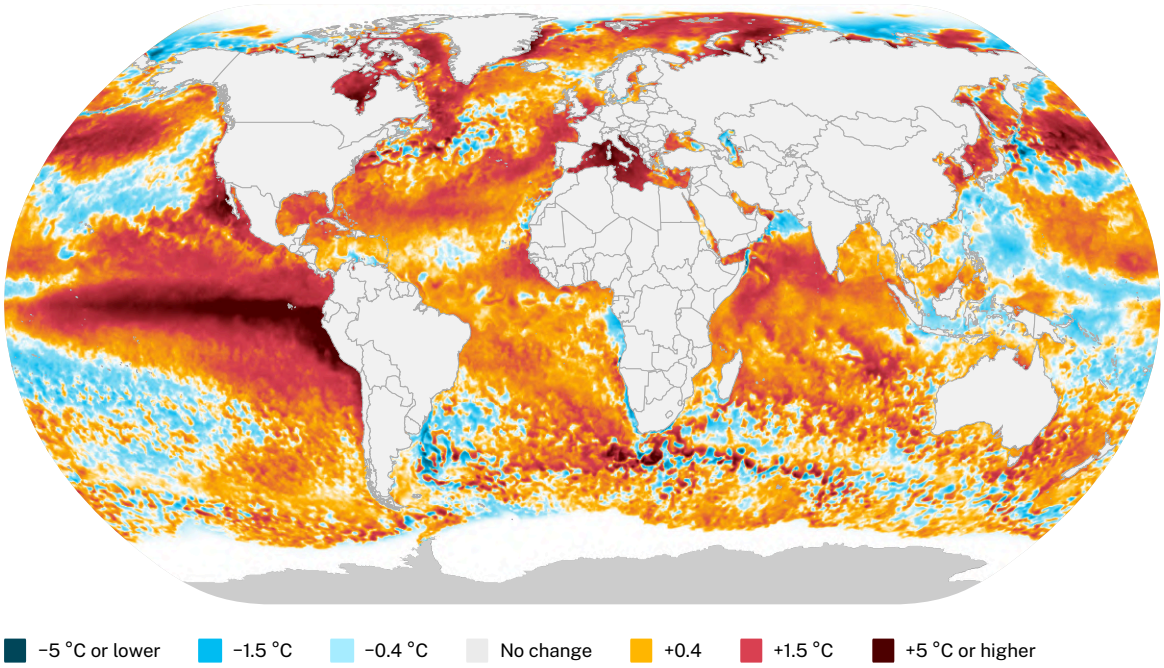

This chart shows the sources of greenhouse-gas emissions, as well as the proportion of those gases taken up by the land and ocean, leaving 46 percent in the atmosphere.

Source: Project Drawdown & IPCC

The predicted consequences include the intense heat waves, the remarkably heavy rains and the ongoing sea-level rise that have been evident in recent years, among many others. The predictions emerging from computerised models of the climate include an intensification of the El Niño and La Niña cycles that can alter weather patterns worldwide. We may be about to live through such a cycle, with an El Niño having already begun — and predicted to intensify through the coming winter into an exceedingly powerful and disruptive force.[2]

2. National Oceanic and Atmospheric Administration, Climate Prediction Center, 'El Niño-Southern Oscillation: recent evolution, current status and predictions.' 31 August 2026.

**Figure 45: Angry ocean**



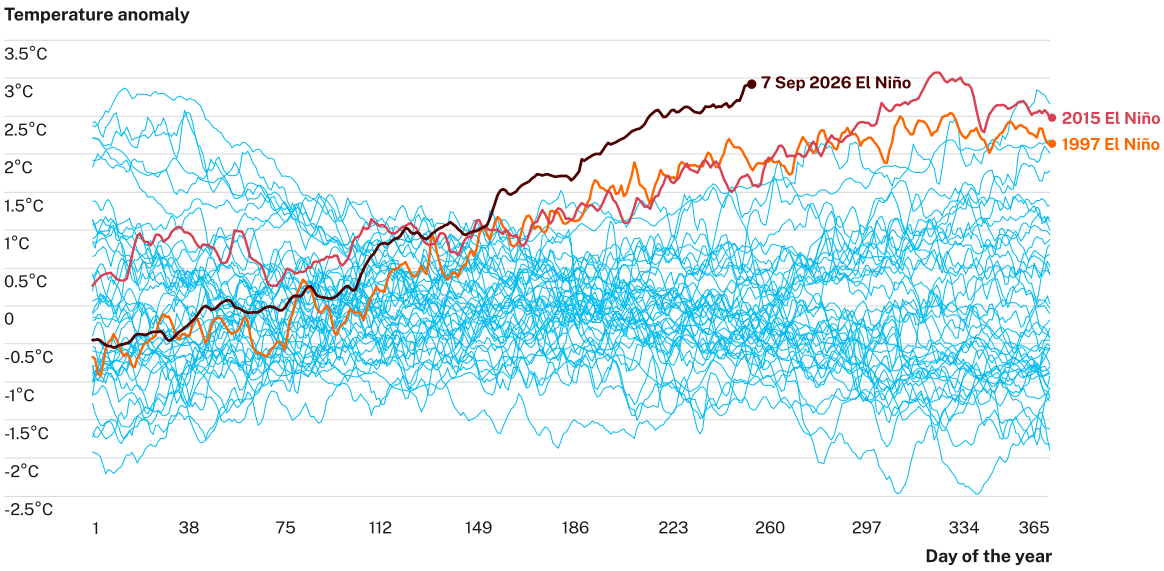

This map shows recent temperatures at the sea surface, relative to baseline. The intense area of surface heat in the tropical Pacific Ocean is the hallmark of an El Niño weather pattern that could hit its peak late this year.

Source: Copernicus Climate Change Service

During an El Niño, the ocean pours an immense amount of heat into the atmosphere, altering the global circulation. It is a natural cycle that starts with shifts in wind patterns in the tropical Pacific, but nowadays it always rides on top of human-caused global warming, which appears to intensify the damage. This El Niño can be expected to dump heavy rains in California, the southern United States, Peru and East Africa; to increase cyclones in the Pacific Ocean but suppress hurricanes in the Atlantic; to increase the spread of tropical diseases like malaria and dengue fever as heavier rains encourage mosquitoes; and possibly to cause a mass bleaching of coral reefs around the world, for what would be the fifth time in recorded history.[3] Both 2026 and 2027 could set all-time global temperature records, though this is less certain. By hitting crops with drought or floods, El Niño has the potential to further destabilise a food supply already under strain.

**3.** For a general description of the effects of El Niño, see Doering, Jenni, 'El Niño is here and will have big consequences for global weather.' Inside Climate News, 20 June 2026. For discussion of the risks to coral reefs in particular, see Czachor, Emily Mae, 'El Niño could bring more widespread coral bleaching, NOAA warns.' CBS News, 3 June 2026.

**Figure 46: El Niño in context**




The lines on this chart show the temperature anomaly for a particular region of the tropical Pacific Ocean, compared to baseline, for every year since 1982. The particularly intense 1997 and 2015 El Niños are highlighted for comparison with the El Niño that is developing in 2026.

Source: NOAA OISST v2, analysed by Zeke Hausfather

This will be, of course, just one more grand disruption in a world that feels less stable and less predictable by the year.

Economic inequality has fed a growing public anger that, while it may be justified in principle, has been harnessed to the benefit of populist political parties offering false solutions. The populists have destabilised some Western democracies to the point that they are becoming ungovernable. Britain just inaugurated its seventh prime minister in a decade. The US continues its drift toward authoritarianism. Only in a few countries has the populist wave been decisively pushed back in recent elections.

Now comes a new disruption, potentially the most profound of the 21st century: the advent of artificial intelligence programs that may be able to do much of the work people are accustomed to doing. How disruptive the advent of AI will be for society at large is still anybody's guess. Economic history would seem to suggest that if AI removes barriers and eliminates some types of scarcity, the long-term result will be to leave society better off; but that hardly means no job losses or other painful consequences in the near term. Indeed, the potential of AI to roil entire industries seems obvious, though it is also true that many of the imagined uses of the technology have yet to be proven at scale.

In the long run, as we said in this report last year, AI could be a boon for the sustainability transition. It may help us improve efficiency, eliminate waste and solve many longstanding problems. However, it has big downsides for sustainability: the AI models are already being used to extract more fossil fuels,[4] and in the near term, AI is placing sudden and profound demands on a power grid that is not ready for them.

The scale of the investments that companies are making to build their AI services is staggering. McKinsey & Company, the consultancy, has estimated that spending on data centres to meet AI workloads is already well into the hundreds of billions of dollars per year, and may exceed $5 trillion cumulatively by 2030.[5] That sum is hard to believe: it would be five times the current annual budget of the Pentagon. Historically, the major Silicon Valley technology companies could finance themselves from their cash flow, but now they are borrowing immense sums to build data centres.
At least half the construction is located in the US, although that country is also seeing a massive political backlash against data centres that cuts across political ideologies.

Data centres are not the only driver of rising electricity demand, and in most countries, not the most important. Electric cars and heat pumps are both contributing, a good sign for the energy transition. But in many countries the biggest factor is a rise in air conditioning use — partly a consequence of rising affluence, but also a response to rising temperatures.[6] The intense heat waves we are now seeing can cause premature deaths by the tens of thousands, and access to air conditioning is becoming a matter of life and death in some parts of the world. That rise will, of course, lead to higher emissions on grids still powered by fossil fuels, one of the many troublesome feedback loops that is worsening the climate crisis.

Power prices are rising in many countries, for complex reasons that go beyond the rise of AI, but the apparent correlation between AI and power bills has fed public distrust in the technology. However, it is not axiomatic that rising power demand needs to lead to higher prices. In fact, for the power grid, the data-centre expansion may well be a massive opportunity disguised as a problem.

**4.** Global Witness, 'Enabled emissions: how AI helps to supercharge oil and gas production.' 27 January 2026.

**5.** Noffsinger, Jesse et al., 'The cost of compute: a $7 trillion race to scale data centres.' McKinsey & Company, April 2025.

**6.** International Energy Agency, 'Air conditioning use emerges as one of the key drivers of global electricity-demand growth.' 14 May 2018.

The tech companies are so desperate for connections to the electricity grid that they are flashing their wallets, willing to finance upgrades that could benefit all electricity ratepayers. The truth is that generators, transformers and power lines are often underutilised; if data centres can be operated in a way that uses these facilities when they would be idle, that could actually improve the overall economics of the grid and lead to downward pressure on rates. To make it work, the data centres will have to agree to cut their power demand at times when the grid is stressed. Some tech companies, including Google, are already signing deals along these lines. Governments and grid operators are starting to establish rules to capture these potentially broad benefits.

Still, there is no doubt that AI programs are going to demand electricity that would not otherwise have to be generated. The big question for us is: how clean will it be?

The tech companies are buying clean power whenever they can, but they are also willing to buy dirty power, and are now at risk of missing their own climate goals as a result. One of Elon Musk's companies, xAI, faces a lawsuit claiming that it illegally operated large, portable gas generators to power a data centre in Memphis, Tennessee, polluting nearby Black neighbourhoods in the process.[7] The breakneck pace of the buildout has even led Meta, the corporate owner of Facebook, to install huge computer clusters in tents located in Ohio and Tennessee.

**7.** Kerr, Dara, 'Elon Musk's xAI data centre generating extra electricity illegally, regulator rules.' The Guardian, 16 January 2026. We note that since a wave of unfavourable publicity about the gas turbines, xAI has been working to clean up the situation, including seeking required operating permits, but the lawsuit against the facility continues.

**The AI boom on the ground**

Meta, the parent company of Facebook and WhatsApp, has put AI data centres into huge tents in Ohio, a sign of the feverish construction boom as technology companies race each other to capture the market. They are making enormous demands for land, electricity and water.

Source: USA Today Network, via Reuters Connect

It would, of course, be a public service for the tech companies to throw their political muscle into getting more clean power built. They may get a chance soon. In Washington, the Trump administration is turning every bureaucratic knob to try to block new solar and wind farms. That it has largely failed thus far does not necessarily mean it will continue to fail. But, with at least one house of Congress likely to be captured by the Democratic Party in November, the Trump administration will face a new political reality starting in January. Restoring tax breaks and other policies to favour clean energy will be high on the Democrats' agenda, and Mr Trump may have to accept such a plan to get a budget through Congress. The odds will improve if the tech companies throw their weight behind a clean-power bill.

So far, the populist wave roiling politics in the democracies has managed to defy physics, in the sense that the populists get away with disinforming people about the climate crisis. In the end, though, we think physics will win. The signs of climate breakdown are evident all around us. Polls suggest that the public understands it and wants action, even if concerns like the cost of housing and food are higher near-term priorities for voters.

We await a visionary new politics that sees cheap, clean energy as the key to solving many of these problems at once.

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Copernicus Climate Change Service, 2023, "ERA5 hourly data on single levels from 1940 to present," Copernicus Climate Change Service Climate Data Store, DOI: 10.24381/cds.adbb2d47, accessed 8th September 2026

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**Fig. 46** El Niño in context

NOAA OISST v2, analysed by Zeke Hausfather

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