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1. Earth's 'vital signs' show humanity's future in balance, say climate experts

Damian Carrington, Guardian Environment editor, 8 Oct 2024

Many of Earth's "vital signs" have hit record extremes, indicating that "the future of humanity hangs in the balance", a group of the world's most senior climate experts have said.

More and more scientists are now looking into the possibility of societal collapse, says the report, which assessed 35 vital signs in 2023 and found that 25 were worse than ever recorded, including carbon dioxide levels and human population. This indicates a "critical and unpredictable new phase of the climate crisis", it says.

The temperature of Earth's surface and oceans hit an all-time high, driven by record burning of fossil fuels, the report found. Human population is increasing at a rate of approximately 200,000 people a day and the number of cattle and sheep by 170,000 a day, all adding to record greenhouse gas emissions.

The scientists identified 28 feedback loops, including increasing emissions from melting permafrost, which could help trigger multiple tipping points, such as the collapse of the massive Greenland icecap.

Global heating is driving increasingly deadly extreme weather across the world, they said, including hurricanes in the US and 50C heatwaves in India, with billions of people now exposed to extreme heat.

The scientists said their goal was “to provide clear, evidence-based insights that inspire informed and bold responses from citizens to researchers and world leaders – we just want to act truthfully and tell it like it is.” Decisive, fast action was imperative to limit human suffering, they said, including reducing fossil fuel burning and methane emissions, cutting overconsumption and waste by the rich, and encouraging a switch towards plant-based foods.

“We’re already in the midst of abrupt climate upheaval, which jeopardises life on Earth like nothing humans have ever seen,” said Prof William Ripple, of Oregon State University (OSU), who co-led the group. “Ecological overshoot – taking more than the Earth can safely give – has pushed the planet into climatic conditions more threatening than anything witnessed even by our prehistoric relatives.

“Climate change has already displaced millions of people, with the potential to displace hundreds of millions or even billions. That would likely lead to greater geopolitical instability, possibly even partial societal collapse.”

The assessment, published in the journal *Bioscience*, says the concentrations of CO₂ and methane in the atmosphere are at record levels. Methane is a potent greenhouse gas, 80 times more powerful than CO₂ over 20 years, and is emitted by fossil fuel operations, waste dumps, cattle and rice fields.

“The growth rate of methane emissions has been accelerating, which is extremely troubling,” said Dr Christopher Wolf, formerly of OSU, who co-led the team.

While wind and solar energy grew by 15% in 2023, the researchers said, coal, oil and gas still dominated. They said there was “stiff resistance from those benefiting financially from the current fossil-fuel based system”.

The report includes the results of a Guardian survey of hundreds of senior climate experts in May, which found that only 6% believed that the internationally agreed limit of 1.5C of warming would be adhered to. “The fact is that avoiding every tenth of a degree of warming is critically important,” the researchers said. “Each tenth places an extra 100 million people into unprecedented hot average temperatures.”

The researchers said global heating was part of a wider crisis that included pollution, the destruction of nature and rising economic inequality. “Climate change is a glaring symptom of a deeper systemic issue: ecological overshoot, [which] is an inherently unstable state that cannot persist indefinitely. As the risk of Earth’s climate system switching to a catastrophic state rises, more and more scientists have begun to research the possibility of societal collapse. Even in the absence of global collapse, climate change could cause many millions of additional deaths by 2050. We need bold, transformative change.”

Among the policies the scientists recommend for rapid adoption are gradually reducing the human population through empowering education and rights for girls

and women; protecting, restoring or rewilding ecosystems; and integrating climate change education into global curriculums to boost awareness and action.

The assessment concludes: “Only through decisive action can we safeguard the natural world, avert profound human suffering and ensure that future generations inherit the livable world they deserve. The future of humanity hangs in the balance.”

The world’s nations will meet at the UN’s Cop29 climate summit in Azerbaijan in November. Ripple said: “It’s imperative that huge progress is made.”

2. Five main takeaways from the Global Commission on the Economics of Water Report, October 2024

Extracted from the Guardian website

The world has a water crisis

More than 2 billion people lack access to safe drinking water, and 3.6 billion people – 44% of the population – lack access to safe sanitation. Every day, 1,000 children die from lack of access to safe water. Demand for fresh water is expected to outstrip its supply by 40% by the end of this decade. This crisis is worsening – without action, by 2050 water problems will shave about 8% off global GDP, with poor countries facing a 15% loss. Over half of the world’s food production comes from areas experiencing unstable trends in water availability.

There is no coordinated global effort to address this crisis

Despite the interconnectedness of global water systems there are no global governance structures for water. The UN has held only one water conference in the past 50 years, and only last month appointed a special envoy for water.

Climate breakdown is intensifying water scarcity

The impacts of the climate crisis are felt first on the world’s hydrological systems, and in some regions those systems are facing severe disruption or even collapse. Drought in the Amazon, floods across Europe and Asia, and glacier melt in mountains, which causes both flooding and droughts downstream, are all examples of the impacts of extreme weather that are likely to get worse in the near future. People’s overuse of water is also worsening the climate crisis – for instance, by draining carbon-rich peatlands and wetlands that then release carbon dioxide into the atmosphere.

Water is artificially cheap for some and too expensive for others

Subsidies to agriculture around the world often have unintended consequences for water, providing perverse incentives for farmers to over-irrigate their crops or use water wastefully. Industries also have their water use subsidised, or their pollution ignored, in many countries. Meanwhile, poor people in developing countries frequently pay a high price for water, or can only access dirty sources. Realistic

pricing for water that removes harmful subsidies but protects the poor must be a priority for governments.

Water is a common good

All of human life depends on water, but it is not recognised for the indispensable resource it is. The authors of the report urge a rethink of how water is regarded – not as an endlessly renewable resource, but as a global common good, with a global water pact by governments to ensure they protect water sources and create a “circular economy” for water in which it is reused and pollution cleaned up. Developing nations must be given access to finance to help them end the destruction of natural ecosystems that are a key part of the hydrological cycle.

3.Extracts from IEA World Energy Outlook 2024 Executive Summary

Clean energy transitions have accelerated sharply in recent years, shaped by government policies and industrial strategies, but there is more near-term uncertainty than usual over how these policies and strategies will evolve.

Reflecting today’s uncertainties, our three main scenarios are complemented by sensitivity cases for renewables, electric mobility, liquefied natural gas (LNG) and how heatwaves, efficiency policies and the rise of artificial intelligence (AI) might affect electricity demand. The scenarios and sensitivity cases illustrate different pathways that the energy sector could follow, the levers that decision-makers can use to reach them, and their implications for energy markets, security and emissions, and for people’s lives and livelihoods. The Stated Policies Scenario (STEPS) provides a sense of the energy sector’s direction of travel today, based on the latest market data, technology costs and in-depth analysis of the prevailing policy settings in countries around the world.

The next phase in the journey to a safer and more sustainable energy system is set to take place in a new energy market context, marked by continued geopolitical hazards but also by relatively abundant supply of multiple fuels and technologies. Our detailed analysis of market balances and supply chains brings an overhang of oil and LNG supply into view during the second half of the 2020s, alongside a large surfeit of manufacturing capacity for some key clean energy technologies, notably for solar PV and batteries. These provide something of a buffer against further market disruptions, but also imply downward pressure on prices and a period of increased competition among suppliers. The rapid rise in clean energy deployment in recent years came during a period of price volatility for fossil fuels. Clean technology costs are coming down, but maintaining and accelerating momentum behind their deployment in a lower fuel-price world is a different proposition. How consumer choices and government policies play out will have huge consequences for the future of the energy sector, and for tackling climate change.

Clean energy is entering the energy system at an unprecedented rate, including more than 560 gigawatts (GW) of new renewables capacity added in 2023, but deployment is far from uniform across technologies and countries.

China stands out: it accounted for 60% of the new renewable capacity added worldwide in 2023 – and China’s solar PV generation alone is on course to exceed, by the early 2030s, the total electricity demand of the United States today. There are open questions, in China and elsewhere, about how quickly and efficiently new renewable capacity can be integrated into power systems, and whether grid expansions and permitting times keep pace. Policy uncertainty and a high cost of capital are holding back clean energy projects in many developing economies.

Demand for energy services is rising rapidly, led by emerging and developing economies, but the continued progress of transitions means that, by the end of the decade, the global economy can continue to grow without using additional amounts of oil, natural gas or coal. This has not been the case in recent years: despite record clean energy deployment, two-thirds of the increase in global energy demand in 2023 was met by fossil fuels, pushing energy-related CO₂ emissions to another record high. In the STEPS, the largest sources of rising demand for energy are, in descending order, India, Southeast Asia, the Middle East and Africa. But growth in clean energy and structural changes in the global economy, particularly in China, are starting to temper overall energy demand growth, not least because a more electrified, renewables-rich system is inherently more efficient than one dominated by fossil fuel combustion (in which a lot of the energy generated is lost as waste heat). Outcomes in individual years can vary in practice depending on broader economic or weather conditions, or in hydropower output, but the direction of travel under today’s policy settings is clear. Continued growth in global energy demand post-2030 can be met solely with clean energy

The slowdown in oil demand growth in the STEPS puts major resource owners in a bind as they face a significant overhang of supply. China has been the engine of oil market growth in recent decades, but that engine is now switching over to electricity: the country’s oil use for road transport is projected to decline in the STEPS, although offset by a large increase in oil use as a petrochemical feedstock. India becomes the main source of oil demand growth, adding almost 2 million barrels per day (mb/d) to 2035. Cost-competitive EVs – many of them from Chinese manufacturers – are making inroads in a range of markets, although there is uncertainty over how fast their share will grow. EVs currently have a share of around 20% in new car sales worldwide, and this rises towards 50% by 2030 in the STEPS (a level already being achieved in China this year), by which time EVs displace around 6 mb/d of oil demand.

A new energy system needs to be built to last: this means prioritising security, resilience and flexibility, and ensuring that the benefits of the new energy economy are shared. The STEPS does not see traditional energy security concerns diminishing, particularly for importers in Asia that face a long-term rise in their dependence on oil and gas imports to nearly 90% for oil and

around 60% for gas by 2050. At the same time, faster clean energy transitions put the spotlight on electricity security, as growing electricity demand and more variable generation increase the operational need for flexibility in power systems, both for short-term and seasonal needs. This also requires a rebalancing of power sector investment towards grids and battery storage, as proposed by the IEA in advance of the COP29 climate conference in Baku, Azerbaijan. At the moment, for every dollar spent on renewable power, 60 cents are spent on grids and storage. By the 2040s, this reaches parity in all scenarios. Many power systems are vulnerable to an increase in extreme weather events and cyberattacks, putting a premium on adequate investments in resilience and digital security.

4. Extracts from Energy Source & Distribution Magazine, Sep/Oct 2024

<p>NORWAY</p> <p>Norway's sovereign wealth fund will commit €900 million to the latest renewable energy fund of investment firm Copenhagen Infrastructure Partners (CIP). Norges Bank Investment Management (NBIM) committed the sum to CIP's fifth flagship fund CI V, which invests in offshore and onshore wind, solar farms, grid and distribution, as well as storage. The investments will be equally split between North America, Western Europe and developed countries in the Asia Pacific region.</p>	<p>JAPAN</p> <p>Japan's largest power generator, JERA, has signed an agreement with South Korean chemical conglomerate Lotte Fine Chemical (LFC) to collaborate on developing the value chain for green hydrogen-based fuels. JERA and LFC will jointly collaborate on standardisation of commercial frameworks; optimisation of each party's ammonia portfolio by enhancing operational flexibility through joint studies; and joint efforts to discuss with both governments to establish and expand low carbon fuel value chain.</p>
<p>PHILIPPINES</p> <p>ACEN, GenZero and Keppel Ltd will partner to convert a coal-fired power station into a renewable energy facility in the Philippines, using transition credits as financial leverage. These credits, generated by the reduction in greenhouse gas emissions during the plant's conversion, will provide crucial funding for the decommissioning of existing infrastructure and the installation of new renewable capacity. The project involves replacing 246MW of baseload generation with an integrated solar generation and energy storage.</p>	<p>USA</p> <p>Form Energy has received funding to deploy what is set to become the world's biggest battery. Funded by the US Department of Energy, the Power Up New England project comprises a 85MW/8.5GWh iron-air multi-day battery capable of up to 100 hours of storage. Form Energy says its iron-air battery systems can be deployed anywhere and don't require heavy metals in their construction, making them highly recyclable.</p>

5. Reducing climate emissions from farm livestock.

James Tapper, Observer, 28 Sep 2024

Research by the Soil Association Exchange shows that farms with a mixture of arable crops and livestock have about a third more carbon stored within their soil than those with only arable crops, thanks to the animals' manure.

This also has an effect on biodiversity: mixed arable and livestock farms support about 28 grassland plant species in every field, compared with 25 for arable-only and 22 for dairy-only.

Joseph Gridley, chief executive of SAE, which was set up by the Soil Association in 2021 to support and measure sustainable farming, said it was unlikely that carbon captured in soil would balance out the enormous amounts of methane created by cattle. Farm livestock around the world creates about 14% of human-induced climate emissions.

“It's pretty unequivocal in the data that having livestock on your farm does mean you have more emissions – five or six times more emissions,” he said. “But if you integrate livestock into the system, on every metric on soil health, there's an improvement, and on a lot of the biodiversity measures as well.”

Soils are degrading, but by how much exactly is unclear. In 2015, the UN Food and Agriculture Organisation claimed that the world had only 60 harvests left, but researchers at Oxford University and Our World In Data said in 2021 that there was a complex picture, and that while there were 16% of soils with an expected lifespan of fewer than 100 years, a third were expected to last at least 5,000.

The Department for the Environment, Food and Rural Affairs has been investigating so-called methane blockers as a way to reduce emissions. Adding substances such as essential oils, probiotics and even seaweed to cattle feed can reduce the amount of burps and wind they generate.

Last month the Green Alliance charity said that feeding Bovaer, a methane blocker, to a third of the UK's dairy cows would cut the country's emissions by about 1%. Yet this is not happening, the campaign group warned, because farmers were unwilling to pay extra for something they did not benefit from. It said methane blockers should be subsidised, as other green farming schemes were.

6. Energy-saving coffee concrete makes major project debut

Energy Source & Distribution website, October 1, 2024

Coffee-boosted concrete developed at RMIT University has been used for the first time in a major infrastructure project, being laid into a footpath along a busy Melbourne road in as part of Victoria's Big Build.

Organic waste going to landfill, including spent coffee grounds, contributes to 3% of greenhouse gas emissions. This waste cannot be added directly to concrete because it

would decompose over time and weaken the building material, which is why the used coffee is converted into biochar before being added to the concrete mix.

Australia generates 75 million kilograms of ground coffee waste every year—most of it goes to landfills, but it could replace up to 655 million kilograms of sand in concrete because it is a denser material.

For this project, Earth Systems converted 5 tonnes of spent coffee grounds—about 140,000 coffees worth of grounds—into 2 tonnes of useable biochar, which has been laid into the 30 metres cubed footpath along McGregor Road in Pakenham, which is being managed by Major Road Projects Victoria (MRPV) and project contractor Bild Group.

Lead inventor of the coffee concrete and RMIT Postdoctoral Research Fellow Dr Rajeev Roychand said, “This proactive support plays a significant role in creating a potential for diverting all forms of biodegradable organic waste, which is currently ending up in landfills and contributing to 3% of Australia’s greenhouse gas emissions.”

Earlier this year, RMIT teamed up with Macedon Ranges Shire Council to conduct a successful world-first trial of coffee concrete in a footpath in Gisborne, Victoria. The RMIT team developed a technique to make concrete 30% stronger by turning waste coffee grounds into biochar, using a low-energy process without oxygen at 350 degrees Celsius.

Due to current supply chain limitations, the team could not use their low-energy process to produce biochar so the coffee concrete used in the Gisborne trial had a similar strength to standard concrete. To translate the team’s innovation into a commercial reality, RMIT is engaging with a commercialisation partner and also with companies in the construction and agriculture sectors that would potentially benefit from using biochar products.

7. Deakin launches hydrogen R&D hub in Warrnambool

Energy Source & Distribution website, October 1, 2024

Deakin University’s hydrogen research and demonstration centre, the Hycel Technology Hub, has officially opened at the Warrnambool campus in Victoria.

The 2200m² bespoke facility is the first of its kind in Australia and is designed for hydrogen research, demonstration, testing and training. It is strategically located at Deakin’s Warrnambool campus, along a key interstate transport corridor that connects industries, communities and resources, and is within a Victorian Renewable Energy Zone.

Hycel’s vision is to facilitate the industry-led advance of safe, commercially viable adoption of hydrogen into Australia’s clean energy mix. The hub includes purpose-built spaces for industry co-location with a focus on fuel cell and hydrogen technologies.

The building includes plumbed-in low- and high-pressure hydrogen to specialised laboratories and equipment such as the G400 fuel cell stack testing station—the only one of its kind in Australia.

Fuel cells are the technology that transform hydrogen gas into electricity to power land vehicles, aviation and marine applications, as well as ground-based uses such as generators. The facility includes a new product engineering lab and three dedicated lab bays with associated offices.

The hub also boasts a dedicated community and multifunctional space for events, training, industry collaboration and networking. At Hycel, industry partners can leverage these unique spaces and equipment to maximise their competitiveness and create new global market opportunities.

8. Amid Australia's chaotic climate politics, the rooftop solar boom is an unlikely triumph

Extracts from an article by Adam Morton, Guardian Australia, 30 Sep 2024

Australia was a different place in 2011. Julia Gillard's Labor government, the Greens and a couple of country independents were rewriting the country's climate policies, including introducing a world-leading carbon pricing system and creating three agencies to back it up. Those organisations – the Clean [Energy](#) Finance Corporation, the Australian Renewable Energy Agency and the Climate Change Authority – have survived and help shape the investment and policy landscape. The carbon pricing system didn't.

A less-heralded consequential clean energy shift around this time was the decision to split the national renewable energy target in two. In January 2011 it was divided into separate schemes to support large-scale renewable energy, which required the creation of solar and wind power stations, and small-scale household installations.

Both have been successes, but it's the latter – driving Australia's household rooftop solar boom – that sets the country apart.

It's difficult to overstate how rapidly Australians have embraced solar power, and how much it has exceeded expectations. In 2011, the forecast was that rooftop solar would eventually contribute 4 terawatt hours of electricity. In the context of the Australian grid, this was next to nothing – barely 2% of total generation.

More than a decade on, that number has been eclipsed more than six times over in the five eastern states connected by the country's main power grid. Rooftop solar panels connected to the National Electricity Market generated 24.6TWh over the last year of data. Put another way, homes have contributed 11.6% of electricity – nearly as much as windfarms, comfortably more than large-scale solar farms or hydro plants, and twice as much as gas-fired power.

More than 3.7m households and small businesses have solar systems. It means more than one in three homes across the country generate their own power when the sun is

out. Data released by the Clean Energy Regulator last week suggests Australians will install 3.1 gigawatts of rooftop solar capacity this year, roughly continuing the recent pace. Industry group the Clean Energy Council points out that, in capacity terms, Australia now has more rooftop solar than coal-fired power.

The most important measure – an upfront national rebate that is processed by and paid to the installer that is progressively wound back as solar becomes more affordable – maintains wide support, including from both major political parties. The rebate has helped bring down the cost to a level where a system can be effectively paid off via reductions in power bills, over about five years (with some variation depending on where you live). Combined with significant jumps in the cost of large-scale fossil fuel electricity – driven by Russia invading Ukraine, and gas and coal shortages and outages – it has made solar a financial no-brainer for home- and mortgage-owners who can pay the initial cost. Some states offer loans to make that easier.

The rooftop solar expansion will continue, with an expectation there will be more than 70GW connected by 2050. A key question is what lessons the country takes from how it got here.

One must be that any continual expansion needs to be equitable. With home ownership increasingly out of reach for many, Australia needs to consider innovative ways to make the benefits of solar available to renters and people in social housing. There have been some initial steps in this direction, but more will be required.

Another should be a reckoning on the role that household batteries will play in our future electricity supply. Batteries have not received the wave of government incentives that boosted solar. With some exceptions, they mostly still do not make financial sense for households. But analysts have pointed out the lesson from the solar success is that going hard early can bring unanticipated benefits, even while you adjust as you go.

As with the flood of solar energy in the middle of the day, an increase in household batteries – both standalone batteries and those in electric vehicles, which can be used in a similar way – will require changes in how power grids operate and are paid for. Consumers are likely to be paid less for the electricity they feed into the grid and may be blocked from selling their excess power at peak times. On the upside, electricity use would become more flexible and more efficient.

Given we still run on a system designed to power homes and businesses from a few large generators, the change will be a regulatory challenge, and energy companies may resist significantly more control over energy use being placed in consumers' hands. But we live in politically populist times, and the experience with solar suggests a further shift in this direction would be widely welcomed.

9. First Dog on the Moon, 11 October 2024



Ross Rutherford, ESR Newsletter Editor, 3 November 2024