## Clean energy progress hinges on policy, science and action



It is tough to be optimistic about the climate these days. While the costs of extreme weather events like the Los Angeles wildfires pile up, the US federal policy pendulum is swinging away from facts, reason, and basic human decency. Nonetheless, even as the US government moves in the wrong direction, trends in science, economics, and increasingly local politics indicate that the pendulum will swing back in due course. After all, no-one can argue with the physics of today's clean energy technologies. Heat pumps, induction stoves, and electric vehicles (EVs) - to name just three - are fundamentally better technologies than what came before. The best gas furnaces might reach 95% efficiency, meaning they are converting 95% of the energy they use into heat; but most heat pumps easily top 200%, with some reaching 400% or more. Similar comparisons can be made between induction and gas stoves, and between EVs and gasoline- or diesel-powered

vehicles. By and large, we know what technologies we should be using to eliminate greenhouse-gas emissions; and in cases where we don't, we know what kinds of things to try.

This knowledge extends well beyond EVs and heat pumps to entire industrial sectors like cement or iron and steel. Here, outgoing US President Joe Biden's administration has made an important contribution with the Department of Energy's Liftoff Reports, which chart pathways to commercialisation for a broad selection of low-carbon technologies.

Consider cement, which accounts for some 8% of annual global greenhouse-gas emissions. Ordinary Portland cement, patented 200 years ago, has dominated the sector for decades. While measures like clinker substitution and efficiency improvements can abate up to 40% of emissions, getting to zero will require additional steps. These generally fall into two categories: cutting emissions from producing Portland cement or switching away from it altogether. Promising US start-ups like Brimstone and Sublime Systems are racing to demonstrate that either path is commercially viable.

One key ingredient is public subsidies to help firms climb the learning curve and slide down the cost curve toward faster commercialisation. Both Brimstone and Sublime Systems received early research and development funding from the US Advanced Research Projects Agency-Energy (ARPA-E) and have now advanced to the deployment stage, receiving up to \$190mn and \$90mn, respectively, to build their first commercial plants. All told, the Bipartisan Infrastructure Law and the Inflation Reduction Act allocated around \$100bn for such purposes, with public funding contingent on matching private investments.

Moreover, these sums are dwarfed by the Department of Energy's loan programme. With just \$17bn in taxpayer funds, the IRA authorises the department's Loan Programs Office to lend \$350bn for investments in clean energy and domestic EV manufacturing. And those public funds then catalyse multiples more in private investments. While some Republicans and members of Donald Trump's incoming administration want to cut this programme, doing so would only hurt US competitiveness.

Can we restore sanity to our national policies? It might be trite to say that change begins at home, but what is trite is often true. A good place to look is New York. While the city has many problems, its climate policies are not among them. Around 70% of New York's direct emissions come from heating and cooling buildings, while the other 30% comes from cars and trucks. Fortunately, Local Law 97 is already addressing the former. The law is one of the most ambitious decarbonisation measures for buildings anywhere, requiring most to reduce their emissions by 40% this decade, and by 100% by 2050. And while New York can do only so much about vehicle emissions, its long-delayed congestion pricing programme is finally being implemented. That is a good start.

Given that New York used to be the world's most congested city, the quality-of-life improvement from less traffic can already be felt. The same goes for another measure that took an absurdly long time to address: the lack of trash bins. Over the past year, the city has finally issued official trash, recycling, and compost bins, with enforcement for residential buildings beginning this month. Cleaning up our own act — including with mandatory composting and other policies — will not save the planet. But effective government just might.

Physics alone will not push the pendulum all the way back to where it was before. That will require policies based on sound economics. As long as Trump does not break the fulcrum and bring the entire pendulum crashing down, policies pioneered by his predecessor and by local communities will continue to be a force applying pressure in the right direction. — Project Syndicate

# Climate change forged a new reality in 2024: 'This is life now'



Intolerable heat. Unsurvivable storms. Inescapable floods.

In 2024, billions of people across the world faced climatic conditions that broke record after record: logging ever more highs for heat, floods, storms, fire and drought.

As the year drew to a close, the conclusion was both blatant and bleak: 2024 was the hottest year since records began, according to European climate scientists.

But it may not hold this dubious honor for long.

"This is life now and it's not going to get easier. It's only going to get harder. That's what climate change means," said Andrew Pershing, chief programs officer at Climate Central, a US-based non-profit climate advocacy group.

"Because we continue to pollute the atmosphere, we're going to

get, year after year, warmer and warmer oceans, warmer and warmer lands, bigger and badder storms."

Others use still bolder language.

"We are on the brink of an irreversible climate disaster," said the 2024 State of the Climate report.

Here's how that looked this year, what 2025 holds, and why there are still reasons to be hopeful.

### **S0S**

This was the first year when the planet was more than 1.5 degrees Celsius hotter than it was in the 1850-1900 pre-industrial period, a time when humans did not burn fossil fuels on a mass scale, according to the European Union's Copernicus Climate Change Service.

The sheer number of days of extreme heat endured by billions of people — from the desert town of Phoenix, Arizona to the desert town of Phalodi in India's Rajasthan — was startling.

Sunday, July 21, was the hottest day ever.

Until Monday, July 22.

The day after dipped a smidgen cooler.

These consecutive records came during Earth's hottest season on record — June to August — according to Climate Central.

Those three months exposed billions of people to extreme heat, heavy rain, deadly floods, storms and wildfires.

Friederike Otto of World Weather Attribution, a global team that examines the role of climate change in extreme weather, said heatwaves were a "game changer."

The world has not caught up: many deaths go unrecorded while some African countries lack an official definition for a

heatwave, meaning heat action plans don't kick in, she said.

"There is a huge amount of awareness that needs to be had to even adapt to today's heat extremes but, of course, we will see worse," Otto told the Thomson Reuters Foundation.

Between June 16-24, more than 60 percent of the world's population suffered from climate change-driven extreme heat.

This included 619 million in India, where more than 40,000 people suffered heatstroke and 100+ died over the summer.

Birds fell from the sky as temperatures neared 50 C (122 F).

Millions were affected: from China to Nigeria, Bangladesh to Brazil, Ethiopia to Egypt, Americans and Europeans, too.

Climate Central said one in four people had no break from exceptional heat from June to August, the highs made at least three times more likely by climate change.

During those months, 180 cities in the Northern Hemisphere had at least one dangerous extreme heatwave — a phenomenon made 21 times more likely by human action, Climate Central said.

### TOO HOT TO WORK

"The number of days where you are starting to push the physiological limits of human survival (are rising)," said Pershing, citing Pakistan and the Arabian Gulf as two areas that neared breaking point this year.

Hundreds died during the Hajj pilgrimage to Makkah as Saudi Arabia topped 50 C (122 F).

In the US Midwest and Northeast, Americans broiled under a heat dome when high pressure trapped hot air overhead.

NASA's Earth Observatory said extreme heat was often exacerbated by hot nights, a dearth of green space or air con, or a surfeit of concrete, which absorbs heat.

Heat and drought fueled wildfires this year, with blazes in the Mediterranean, United States and Latin America. Fires burned from the Siberian Arctic to Brazil's Pantanal wetlands.

"(The Pantanal) is a wet area that is not supposed to burn for months on end so that is probably something I would look out for next year where we see wildfires in ecosystems that are not traditionally burning ecosystems," said Otto.

### THE MOST VULNERABLE

The "new normal" hits the vulnerable hardest.

"The people who are succumbing to heat-related deaths are not the millionaires and billionaires," said Pershing.

"If you are a reasonably well-to-do person you can afford air conditioning, you have a vehicle that can get you where you need to go, you have ways to keep yourself cool. If you don't have access to these things or you lose them because of a power outage or another storm, that creates these additional vulnerabilities."

In Africa, nearly 93 percent of the workforce faces extreme heat.

On the Arabian Peninsula, it is more than 83 percent of workers.

European and Central Asian workers could be next in line.

For Otto, the answer to this fast-spreading risk lies in empathy, putting the poor and vulnerable — "the vast majority of the global population" — at the center of climate action.

"In Bangladesh, when you put the survival of the poorest in the center of the action, you actually have a society that is really well-equipped to deal with tropical cyclones," she said. "People know what to do and there are drills and practices."

Silver linings, though, are rare.

"Empathy is in short supply," said Otto.

#### **BOILING SEAS**

Ocean temperatures also hit alarming levels in 2024, wreaking havoc on land and sea.

Hurricane Milton came barely two weeks after Hurricane Helene, with abnormally warm waters in the Gulf of Mexico turbo-charging the twin storms that lashed the US Southeast.

"In that some places in the Gulf of Mexico ... temperatures were 400 times more likely because of climate change," Pershing said.

Climate Central found a similar link between October's floods in Spain and unusually warm waters in the Tropical Atlantic.

Human-driven climate change made these elevated sea surface temperatures up to 300 times more likely, Climate Central said.

### "WE NEED DRILLS"

Otto said this year's extremes, notably Europe's floods, illustrated a "failure of imagination" and a refusal to adapt.

"We don't just need the weather forecast or warnings. We need drills. We have to practice survival wherever heavy floods can happen and they can happen everywhere," she said.

Infrastructure also failed.

"The way that we have canalized rivers and sealed all the surfaces ... will mean disastrous damages every time there is a flood ... There is always this short-termism that it's expensive to fix it now but of course it will save lots of money and

livelihoods later," she said.

For Pershing, adaptation is "an exercise in imagination because we haven't seen these kinds of events before ... That is the challenge of climate change: we're going to be confronted year after year with conditions we've never experienced."

### SO WHAT NEXT?

Nobody expects a quick end to extreme weather but Otto is hopeful that humans may change their polluting ways.

"That is a reason for optimism ...clinging to fossil fuels (is) increasing inequality and destroying livelihoods but it increasingly makes less sense ...for national economies."

In another upbeat note, Otto said better preparations in Europe meant fewer deaths in this year's floods than previously.

But ocean temperatures are a key concern for 2025.

"The amount of heat stored in the ocean ... really has my attention because we are not quite sure if there is something different going on in the climate system," said Pershing.

Another risk — complacency.

"People do have a way of getting used to conditions and you can kinda get numb to it," Pershing said.

And complacency can breed paralysis.

"This was the hottest year, last year was the hottest year — probably next year will be the hottest year again," said Otto.

### Brazil's Climate Push Must Start at Home



As the current G20 president and host of next year's United Nations Climate Change Conference, Brazil has sought to establish itself as a global climate leader. But to have the biggest impact, Luiz Inácio Lula da Silva's government must lead by example, which means committing to ambitious emissions targets and energy policies.

AMSTERDAM — Ever since Brazilian President Luiz Inácio Lula da Silva returned to office in 2023 and told the world that Brazil is "back on the world stage," the government has endeavored to establish itself as a global climate leader. As the current G20 president, Brazil is pushing for a sustainable bioeconomy and scaled-up climate finance — goals that it will surely continue to pursue as the host of next year's United Nations Climate Change Conference (COP30). Moreover, the country recently formed a troika with the hosts of COP28 (the United Arab Emirates) and COP29 (Azerbaijan) to preserve the Paris climate agreement's goal of limiting global warming to 1.5º Celsius.

The Brazilian government has not been afraid to challenge

rich countries and individuals as part of its efforts to halt the rise in global temperatures. But to have the biggest impact, Brazil must lead by example. As the saying goes, charity begins at home. The timing could not be better: countries must submit more ambitious 2035 emissions-reduction targets, known as nationally determined contributions (NDCs), by February 2025.

The need to cut greenhouse-gas (GHG) emissions has never been more urgent for Brazil, which was recently hit by record flooding and has been fighting devastating forest fires for weeks. To be sure, investing in adaptation and resilience requires increased financial flows from the wealthy countries responsible for the bulk of historic pollution to vulnerable countries suffering the worst effects of global warming. But reducing fossil-fuel emissions and extraction, which has harmed traditional and indigenous communities' health, destroyed their land, and diminished their capacity to provide for their families, is also a matter of economic and social development. Brazil must devise an energy policy that works for these communities.

The share of electricity generated from wind and solar power is expanding rapidly, and these renewable-energy sources are becoming cheaper by the day. Brazil has abundant sun and wind and the tools to operate these technologies successfully. But, equally important, local communities are already expanding clean-energy infrastructure and have created innovative and effective solutions to participate in the decarbonization decision-making process.

Various community-led and decentralized clean-energy projects, often developed in partnership with NGOs, are being launched across Brazil, from isolated villages in the Amazon to densely populated *favelas* (informal settlements) in Rio de Janeiro. At the same time, the country's indigenous peoples have developed robust consultation protocols for the design and implementation of public and private renewable-energy projects

on their land.

Last year, COP28 closed with an agreement to "transition away from fossil fuels" — the first time such a call has been made at the climate summit — and to triple renewable energy and double energy efficiency by 2030. To honor that agreement, Lula's government must challenge the false notion that fossil fuels are necessary for development and can complement efforts to scale up and provide equitable access to community-centered renewable energy.

To show the world that Brazil can lead the global renewable-energy transition by example, its updated NDC must commit to bold action, such as stopping new fossil-fuel projects and shutting down existing ones, and deploying the resources required to meet the global goal of tripling renewable-energy generation. Moreover, to advance the goal of energy justice, the government should implement policies aimed at ensuring that solar and wind power reaches vulnerable communities.

If the Brazilian government creates a national platform that provides operational support to these clean-energy solutions, the country can show the world that it is possible to decarbonize while putting people first. In fact, this is not only possible but essential.

A few years ago, the world came together to combat the COVID-19 pandemic. Governments quickly poured resources into vaccine development and production, successfully creating the tools to solve a novel problem in record time. In this case, the world has everything it needs to accelerate the energy transition and limit global warming; all that it is missing is the political will to commit to — and follow through on — ambitious targets and policies. Brazil can and should be one of the first countries to demonstrate it.

## This is how we know when the world has its hottest day



On Sunday, the world had its hottest day on record. Just 24 hours later, that record was broken again, making Monday very likely the hottest day in thousands of years.

It may seem improbable for scientists to gauge the world's hottest day given that they don't have temperature monitors in every corner of the world and less than a century of relatively widespread observations. But they've developed a technique that's increasingly useful as the planet heats up.

This month's shocking heat findings, announced by the EU's Copernicus Climate Change Service, are based on "reanalysis," a technique that mixes temperature data and models to provide a global view of the climate. The center creates a nearly

real-time picture of the Earth's climate, including temperature, wind and precipitation, for roughly every 30-square-kilometer chunk of the planet's surface.

This reanalysis goes back to 1940, and it allows researchers to say with confidence when a record is broken, whether for a day, month or year. Beyond the new daily heat record, the data also shows that 2023 was the hottest year ever recorded and that every calendar month for the past 13 months has been the hottest on record.

Though there aren't thermometers in every corner of the world, Copernicus receives a large amount of weather data that it uses to underpin its reanalysis.

"We have this constant flow of information coming into the center," says Carlo Buontempo, director of the Climate Change Service, which is part of the European Center for Medium-Range Weather Forecasts (ECMWF).

Scientists at the center receive 100 million readings per day about weather conditions from around the world. Observations come from airplanes, satellites, ships, radar and surface-level weather stations — all feeding real-time information about temperature, wind, rain and snow information, as well as other factors like air pollution. This information is fed into a model, known as ERA5, which is already equipped with historic information about the global climate.

There are gaps in these observations, because the data sources don't cover every part of the world. Weather conditions like cloudy skies may also reduce the amount of data coming from sources like satellites. To fill these gaps, the scientists take the predictions they have already made, based on the long-term ERA5 model, and test them against the observations. That means a forecast that predicts a particular temperature in a particular place will be tested against all the data researchers receive about the weather in that place and

nearby, as well as broader forces like ocean currents and air circulation.

This is done repeatedly while assessing how compatible the prediction is with what's actually been recorded. The model also accounts for any errors in the recorded data, and relies on the laws of physics, including the weather patterns, currents and airflow that govern how the global climate works.

In this way, it's possible to create a complete picture that is as accurate as possible. That's what allows scientists to confidently declare a record like when the world experiences the hottest day in human history.

Globally, five weather services — the U.S.'s National Oceanic and Atmospheric Administration and NASA, the ECMWF, the China Meteorological Administration and the Japan Meteorological Agency — carry out continuous appraisals of global temperature using this technique. While their models differ slightly, the five groups have come to similar conclusions about record heat in recent months and years.

Historical data is trickier to come by. The longest-running temperature series, the Central England Temperature in the U.K., started in the 17th century. Data from before humans were systematically monitoring temperatures comes from sources like bubbles of gas trapped in glacial ice, or tree rings. These sources aren't as specific as a thermometer reading, but it's possible to say with confidence that recent temperatures are likely the highest in around 100,000 years, Copernicus says.

Meteorologists also have a good idea when a particularly significant day, like the hottest day on record, is on its way. This is partly because global mean temperatures usually peak between early July and early August. Last year's hottest day — which was the previous record for the hottest ever — occurred in early July amid a historic oceanic heat wave. An

intensifying El Nino — a natural global climate phenomenon that usually means hotter temperatures globally — provided yet another clue that record heat was brewing.

Until this July, it looked for a while like the world wouldn't set a new daily record, says Buontempo.

"The global mean temperature for the oceans started rising again," he says. "Some of the people who systematically monitor our predictions started to sound alarm bells."

By the start of last week, they were paying extra attention to the reanalysis and getting ready to make an announcement.

This technique isn't just useful for making "hottest day ever" announcements: It's being used to train artificial intelligence forecasting models, especially for "ensemble" weather forecasts, which represent multiple possible future scenarios. It's also used by solar energy companies to help homeowners work out how much energy their panels might generate, and by wind energy companies to plan where to put wind farms.

Copernicus is currently working on a new model, known as ERA6, which will be more precise — dividing the world into 14-km squares — and incorporate many more historic data sources, including early satellite readings from the 1970s.

For Buontempo, more important than any one day is the recent extraordinary streak of record-breaking months, given that's a better indicator of how rapidly the world is warming. But pinpointing a specific day does make a changing climate feel much more immediate.

"I think we have to make it more tangible, more direct, more visible," he says. "It is important that people are informed."

'Prerequisites for peace':
Expert applauds Skylakakis
for endorsing energy
transition policies that
'open the way to dialogue and
cooperation'



ATHENS, July 7, 2024 Greece: Energy and Environment Minister Theodoros Skylakakis is on the right track with his approach to Greece's energy transition plans, a noted regional expert says.

"He's got the right perspective," industry veteran and author Roudi Baroudi said after Skylakakis spoke at this week's

Athens Energy Summit. "He understands that although the responsibility to reduce carbon emissions is universal, the best policy decisions don't come in 'one-size-fits-all'."

Baroudi, who has more than four decades in the field and currently serves as CEO of Doha independent consultancy Energy and Environment Holding, made his comments on the sidelines of the forum, where he also was a speaker.

In his remarks, Skylakakis expressed confidence that Greece's increasing need to store electricity — as intermittent renewables generate a growing share of electricity — would drive sufficient investment in battery capacity, without the need for subsidies. Among other comments, he also stressed the need for European Union policymakers to account for the fact that member-states currently face the cost s of both limiting future climate change AND mitigating the impacts that are already under way.

"Every country is different in terms of how it can best fight climate change. Each one has its own set of natural resources, industrial capacity, financial wherewithal, and other variables. What works in one situation might be a terrible idea elsewhere. That's crucial and Skylakakis gets it," Baroudi said. "He also understands that an effective transition depends on carefully considered policies, policies that attract investment to where it can not only have the greatest impact today, but also maximizes the impact of tomorrow's technologies and tomorrow's partnerships."



"What Skylakakis is saying and doing fits in nicely with many of the same ideas I spoke about," Baroudi added. "When he talks about heavier reliance on wind farms, the added storage capacity is a foundation that will help derive a fuller return from each and every turbine. When he highlights the utility — pun intended — of power and gas interconnections with other countries and regions, these are the prerequisites for peace, the building blocks for cooperation and dialogue."

In his own speech shortly after Skylakakis', Baroudi told the audience at the capital's Hotel Grande Bretagne that countries

in the Eastern Mediterranean should work together to increase cleaner energy production and reduce regional tensions.

"Surely there is a method by which we can re-establish the same common ground enshrined in the wake of World Wars I and II, recall the same common interests and identify new ones, and work together to achieve common goals, just as the UN Charter implores us to," he said.

Baroudi advises companies, governments, and international institutions on energy policy and is an award-winning advocate for efforts to promote peace through dialogue and diplomacy. He told his audience that with both climate change and mounting geopolitical tensions posing threats to people around the world, policymakers needed to think outside the usual boxes.

In this way, he argued, "we might develop the mutual trust which alone can create a safer, happier, and better world for our children and grandchildren."

"Consider the possibilities if Greece, Türkiye, and Cyprus became de facto — or de jure — partners in a pipeline carrying East Med gas to consumers in Bulgaria, Romania, and Italy," he said. "Imagine a future in which Israeli and Lebanese gas companies were similarly — but independently — reliant on the same Cypriot LNG plant for 10-20%, or even more, of their respective countries' GDPs."

He also envisioned bilateral cooperation scenarios between Greece and Turkey and Syria and Turkey, as well as a regional interconnection that would provide backup energy for multiple coastal states.

"Instead of accepting certain ideas as permanently impossible, we ought to be thinking ahead and laying the groundwork," Baroudi said. "For Greece and Türkiye — as for other pairs of coastal states in the region — a good starting point would be to emulate the Maritime Boundary Agreement agreed to by

Lebanon and Israel in 2022."

Stressing the potential for cooperation to address both energy requirements and the stability required for stronger growth and development, Baroudi — whose books include a 2023 volume about the Lebanon-Israel deal and a forthcoming one urging other East Med countries to do the same — called on the EU to take up the challenge.



"Using dialogue and diplomacy to expand energy cooperation would benefit not just the countries of the East Med but also the entire European Union and much of its surrounding 'neighborhood'," he told an audience of energy professionals and key government officials. "That level of promise more than merits the attention of Brussels, the allocation of support resources, and even the designation of a dedicated point-person tasked with facilitating the necessary contacts and negotiations."

"This is how we need to be thinking if we want to get where we need to go," Baroudi said. "Instead of allowing ourselves to be discouraged by the presence of obstacles, we need to be investigating new routes that go around them, strengthen the

rule of law — especially human rights law — as a basis for the international system, and promote lasting peace among all nations. Only then can we declare victory over what the  $18^{\text{th}}$ -century Scottish poet Robert Burns called 'man's inhumanity to man'."

### How Europe can get the Green Deal done



Since the European Green Deal was introduced in 2019, European Commission President Ursula von der Leyen has touted it as the European Union's new economic-growth agenda. After all, while the strategy's core objective is climate-related — to reduce the EU's greenhouse-gas emissions to net-zero by 2050 — it aims to achieve that by modernising the economy and fostering

innovation. But not everyone is convinced.

In recent months, European drivers have complained about the EU's looming ban on the production and sale of cars with internal combustion engines, households have resisted plans to phase out gas boilers, and farmers have revolted against environmental regulations they view as overbearing. With the approach of next month's European Parliament elections, farright parties are jostling to establish themselves as the official standard-bearers of this growing discontent and preparing to use any power they win to sabotage the green agenda.

The protesters make some legitimate points. The radical transformation that the European Green Deal entails raises difficult questions about who should bear the costs of climate action, both within and among countries. If those costs end up falling disproportionately on ordinary workers — let alone the poorest and most vulnerable communities — the transformation will exacerbate inequality, with potentially serious social and political knock-on effects. Fortunately, properly designed climate policies can avert that outcome and actually lead to greater social equality.

The European Green Deal has accounted for climate-justice considerations since the beginning. Advocates always knew that they would need to secure the political support of coalintensive Poland, and they had not forgotten the "yellow vest" revolt that erupted in France in 2018, after President Emmanuel Macron attempted to introduce a carbon tax in road transport.

It is no coincidence that the first flagship initiative under the European Green Deal was the Just Transition Fund, which will dedicate €20bn (\$21.6bn) in 2021-27 to support the "economic diversification and reconversion" of the territories expected to be the most negatively affected by the green transition. Nor is it a coincidence that, while creating the first-ever carbon market for buildings and road transport, the European Commission established the Social Climate Fund, which is expected to mobilize at least €86.7bn between 2026 and 2032

to compensate the most vulnerable groups for higher energy prices.

These policy initiatives reflect the advice one would find in the economic literature on carbon dividends. But they will prove insufficient to offset the profound distributional effects of climate policy, particularly as decarbonisation accelerates and includes sectors that directly affect ordinary people's daily lives, such as buildings and transport. That is why Europe also needs a new green social contract, which focuses primarily on these sectors.

To this end, the EU should streamline and simplify existing funding instruments to deliver even more decisive support for the transformation of coal and carbon-intensive regions. It should also take steps to ensure that EU countries make better, more targeted use of carbon-market revenues to support the uptake of green alternatives, from electric vehicles to home heating systems. And it should push for a "Rural Green Deal" that supports small farmers while requiring the agrifood industry to transform its systems. While such EU-level action would not eliminate the distributional consequences of climate policy, it would help significantly.

The EU must also turn decarbonisation into a real economic opportunity by developing a solid green industrial policy. This will require, first and foremost, revitalising the "boring" EU single-market agenda, in order to leverage the bloc's greatest asset — a huge shared market for goods, financial services, energy, workers, and ideas — to incentivise new investments in clean tech.

Interventions in specific technology areas will also be needed. Rather than mimic the broad-based US Inflation Reduction Act, the EU should make the most of its limited resources by delivering targeted support in areas where it already has a solid comparative advantage on which to build. While some incumbent industries might need support as they decarbonise, supporting breakthrough innovations should be the primary goal.

The European Green Deal has come a long way since it was

conceived five years ago. But if the EU is to achieve its 2030 climate goals and achieve net-zero emissions by 2050, it must act now to ensure that it can weather the inevitable political headwinds. A new green social contract and industrial policy can make all the difference. — Project Syndicate

Simone Tagliapietra, a senior fellow at the Brusselsbased think-tank Bruegel, is an adjunct professor at the Johns Hopkins University School of Advanced International Studies, Bologna.

## 1.5°C target for globalwarming must prevail



The world is burning, and our political leaders are failing us. With temperatures rising at an alarming rate, it seems that anyone who believes it is still possible to limit global warming to 1.5° Celsius is in a rapidly shrinking minority.

As governments around the world fail to meet their responsibilities under the Paris climate agreement, the window for keeping global temperatures below the 1.5°C limit has all but closed due to insufficient action. But while some eminent commentators have declared the 1.5°C target "deader than a doornail," I have come to the opposite conclusion: 1.5°C will never die.

To be sure, the world is in a dire state. Greenhouse-gas (GHG) emissions dumped in the atmosphere since the start of the Industrial Revolution have already warmed the planet by roughly 1.3°C, according to this year's annual report on Indicators of Global Climate Change. And studies, including mine, unequivocally show that crucial climate goals are not being met. Under current policies, global temperatures are projected to increase by 2.5-3°C by the end of this century. Even if governments meet all their existing climate pledges, the odds against global warming staying below 1.5°C are seven to one. Combine this with the fossil-fuel industry's delaying tactics, including the greenwashing of their polluting business practices and recent roll-back on self-imposed emissions targets, and it becomes abundantly clear that our chances of staying below 1.5°C are indeed slim. Consequently, climate scientists expect global warming to "blast past" the 1.5°C limit.

But just as risks do not vanish when safety limits are exceeded, the Paris agreement's climate commitments do not disappear once we cross 1.5°C. While 1.5°C is a political target, it was not pulled out of thin air. It is a scientifically informed limit, first championed by small island states and later supported by a broad coalition of ambitious countries.

By now, it is clear to many governments that allowing global warming to exceed 1.5°C involves unacceptable societal risks, undermines development, and poses an existential threat to vulnerable communities and their cultures. Moreover, the line between "safe" and "dangerous" warming is becoming increasingly blurred. As the devastating effects of climate

change worldwide show, even 1.5°C is dangerous and our societies are ill-equipped to handle it.

Over the past 20 years, we have experienced what a world that has warmed by about 1°C is like. No region has been spared the impact, with a growing number of countries facing fires, floods, and storms, resulting in devastating human and financial costs that extend well beyond national borders. Between 2000 and 2019, climate-related disasters claimed over half a million lives, caused over \$2tn in estimated damage, and affected almost four billion people worldwide. Even at 1.5°C warming, up to one in seven species face extinction, critical ecosystems like tropical coral reefs face destruction, and extreme heat waves that our greatgrandparents experienced once in a lifetime will occur on average every six years. Centuries of ice melt will cause sea levels to rise, flooding major cities like London, New York, Shanghai, and Kolkata. Vulnerable and marginalised communities' efforts to escape poverty will be undermined, and every country's economic development will be impeded.

Limiting global warming is thus a matter of social justice, human rights, and long-term development, and this imperative remains even if we cross the 1.5°C threshold. Moreover, while exceeding 1.5°C will have unpredictable political consequences as compensation claims for avoidable climate-related damage increase, the political implications of reducing GHG emissions remain consistent with what the Paris agreement already outlines.

To halt global warming, the Paris agreement expects countries to implement emission-reduction plans that represent their "highest possible ambition." While governments are failing to meet this goal, exceeding 1.5°C does not change their responsibilities; in fact, fulfilling these commitments will become more important as temperatures continue to rise. The only way to improve our chances of keeping warming close to 1.5°C is by pledging and implementing more ambitious near-term emission cuts every year until 2035.

Even if we cannot avoid overshooting 1.5°C, the 1.5°C target

remains relevant. Every fraction of a degree counts, and global climate efforts must therefore focus on limiting the exceedance of 1.5°C and returning to safe levels as quickly as possible. The Paris agreement's target of achieving global net-zero GHG emissions, in particular, could help reverse some of the excess warming. To maintain a safe, liveable, and just planet, we must keep our eyes on the 1.5°C limit and ensure that pursuing it remains our top priority.

# Economic development in an age of great-power competition



Now that the United States has introduced a new set of import tariffs on Chinese goods, the world's two largest economies appear to be on the brink of open economic warfare — and developing countries are in danger of getting caught in the crossfire. Beyond the risk that they could face sanctions or other trade restrictions if one superpower perceives them to

be helping the other, Sino-American trade tensions are eroding the value of many of these economies' comparative advantages, such as cheap labour and land. Coping with these challenges will require skillful economic statecraft.

Comparative and competitive advantages are dynamic by nature; they can be acquired or lost over time. As Harvard's Michael Porter put it in 1990, "National prosperity is created, not inherited. It does not grow out of a country's natural endowments, its labour pool, its interest rates, or its currency's value, as classical economics insists." Rather, an economy's competitiveness "depends on the capacity of its industry to innovate and upgrade."

As a growing number of governments pursue industrial policies — from short-term protective measures, like tariffs, to more forward-looking initiatives, such as targeted subsidies and deep structural reforms — the capacity to innovate and upgrade depends significantly on the state's ability to work with the market to boost competitiveness. This poses a challenge for advanced economies no less than it does for developing countries.

Consider Europe, which was forced to rethink its prevailing business model — selling high-quality engineering products — after Russia's full-scale invasion of Ukraine in 2022. As supply chains were disrupted, and energy costs and inflation soared, Europe's reliance on others for critical goods, including inputs for its own manufacturing, became an enormous economic liability. Add to that China's growing dominance in electric vehicles, and Europe finds itself increasingly anxious about its future competitiveness.

To be sure, many European economies remain highly competitive: Europe dominates the top 20 of the International Institute for Management Development's 2023 World Competitiveness Rankings, with Denmark, Ireland, and Switzerland leading the pack. But Europe's larger economies have been sliding in the rankings.

Germany dropped seven spots between 2022 and 2023, to 22nd place, and France fell five spots, to 33rd.

One problem, pointed out in a report from the McKinsey Global Institute, is that while Europe leads in sustainability and inclusivity, per capita GDP (at purchasing power parity) is lagging. In 2022, it was 27% lower than in the United States, with about half that difference attributable to cultural norms — Europeans work fewer hours per capita over their lifetimes — and the other half resulting from differences in productivity levels. Boosting productivity is now a central concern of European policymakers and will have to be addressed partly through the development of high-tech industries.

This approach has certainly worked for the US, which spends 3.5% of its GDP on research and development — a smaller share than South Korea (4.9%) and Israel (5.6%), but significantly larger than China (2.4%) and the European Union (2.2%). All of these economies are devoting considerable attention to dualuse R&D in strategic areas like artificial intelligence, green tech, and quantum computing. What stands out about the US is that, while the government is providing funding and incentives, not least through the 2022 Inflation Reduction Act, it is the private sector that is driving plans to invest \$400-500 billion in R&D over the next decade.

As a report by the Boston Consulting Group notes, R&D is part of a "virtuous cycle of innovation" that sustains America's technological leadership. For example, the US claims 46% of the global market for semiconductor design. Thanks to its advanced technologies, the US semiconductor industry has a gross profit margin of 59%, which is 11 percentage points higher than competitors. In 2020, US semiconductor revenues reached \$208 billion — twice the revenues of the second-leading country.

But not just anyone can emulate America's high-tech success, which is partly a function of its large and dynamic capital market. In 2022, the total market capitalization of the US stock market was 2.5 times higher than that of Europe. As a share of GDP, total market value in the US exceeded 158% in 2022, lower than Taiwan (195% of GDP), but higher than every other economy, including China (65.4%), Japan (126%), Germany (45.5%), and India (103.7%).

With its deep capital markets, the US is well-positioned to generate funding for high-risk R&D and, more importantly, reward and retain talent. Other economies — including China, the EU, Japan, and most developing countries — cannot compete on this front, not least because their banking systems remain far more risk-averse.

Recognizing America's comparative advantages in high-tech sectors, China focused on building prowess in mid-tech areas of engineering and operational production and distribution, which opened the way to comprehensive competition at scale. Since 2014, China has led the world in exports of high-technology goods, accounting for more than 30% of the global market share. Since 2000, it has tripled its share of gross value added.

For developing countries, this means that it will be very difficult to compete in mid-tech industries, not just the high-tech sectors that the advanced economies (and, increasingly, China) dominate. Add to that their limited capacity to finance investment and their dependence on access to global or regional markets to achieve economies of scale, and economic statecraft becomes all the more challenging.

Some priorities are clear. To achieve technological upgrading, countries must invest as much as possible in digital infrastructure and education, as well as projects related to the United Nations Sustainable Development Goals. To cope with rising protectionism among major economies, they will most

likely also increase support for domestic "champions," even if it means perpetuating market fragmentation.

Overall, however, we will probably see a lot more experimentation in development strategies in the coming years. Developing countries will just have to hope that the US and China come to some sort of grand bargain before their competition escalates into conflict.

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### Only public-private cooperation can accelerate decarbonisation



As countries around the world experienced record temperatures last year, UN Secretary-General Antonio Guterres declared: "We must turn a year of burning heat into a year of burning ambition." But to move away from fossil fuels and unlock the green transition's economic benefits, such as job creation and universal access to clean energy, industry leaders and policymakers must work together to translate the commitments made at the UN Climate Change Conference in Dubai (COP28) into actual renewable gigawatts.

COP28 marked a historic turning point in the battle against climate change. Rallying around the UAE Consensus, world leaders pledged to move away from fossil fuels, agreeing to triple renewable power capacity to at least 11,000 gigawatts and double energy efficiency by 2030.

But ambition alone is not enough to achieve these targets and limit global warming to 1.5C. Governments must invest in mature, cost-competitive renewable technologies that can be rapidly deployed at scale. When integrated with long-duration energy storage, green hydrogen, and system optimisation, these

technologies represent the most reliable and flexible way to accelerate the energy transition.

Renewables will undoubtedly shape the global energy landscape in the coming years. Both solar and wind power are expected to grow significantly, with hydropower serving as the backbone of grid flexibility. Consequently, renewables are poised to become the twenty-first century's dominant source of global electricity.

But as a joint report released by the International Renewable Energy Agency (IRENA) and the Global Renewables Alliance (GRA) ahead of COP28 noted, tripling renewable capacity will require cooperation between the private and public sectors. Partnerships should focus on initiatives that deliver immediate results, such as mobilising low-cost financing, accelerating permitting processes, clearing grid connection backlogs, reforming government auction mechanisms for renewable-energy projects, and diversifying global supply chains. A strong commitment to inclusivity and the active participation of developing economies must be at the heart of these efforts. IRENA and GRA are demonstrating this commitment by collaborating on the annual reports commissioned by the COP28 Presidency to monitor progress toward the global tripling target and facilitate the energy transition.

We must, however, move faster, especially if we aim to ensure that progress is equitably distributed around the world. While renewable power capacity rose by 473 gigawatts in 2023, the economic benefits of the energy transition did not reach every country. Remarkably, 83% of these increases were concentrated in China, the European Union, and the US, leaving many countries in the Global South behind.

In fact, the shift to renewables is alarmingly slow in many parts of the world. Opportunities to address development and access challenges in Sub-Saharan Africa, where more than 500mn people still lack access to electricity, are being squandered. This sluggish transition can be attributed largely to the lack of affordable financing, adequate planning, and the policy and market frameworks needed to support the adoption of renewable

energy. Tellingly, public fossil-fuel subsidies reached \$1.3tn in 2022 — roughly the annual investment needed to triple renewable capacity by 2030.

A critical first step toward fostering greater public-private co-operation in pursuit of COP28's ambitious targets is to reform the global financial architecture. Africa, for example, accounts for 17% of the world's population but has received less than 2% of global investments in renewable energy over the past two decades, underscoring the need to reduce capital costs and attract private investors. Developing industrial clusters and initiating grant programs could also help foster environments conducive to innovation and private-public partnerships.

Recent commitments by world leaders offer glimmers of hope. African leaders at the September 2023 Africa Climate Summit in Nairobi, for example, pledged to increase the continent's renewable capacity to at least 300 gigawatts by 2030. This effort aims to reduce energy poverty and boost the global supply of cost-effective clean energy suitable for industrial use.

Kenyan President William Ruto, a key advocate of the Nairobi agreement, established the Accelerated Partnership for Renewables in Africa, an African-led international alliance of governments and stakeholders that aims to accelerate renewable-energy deployment, increase access, promote green industrialisation, and strengthen economic and societal resilience.

Governments and business leaders should harness the current political momentum to foster co-operation between policymakers and private investors. As governments develop appropriate policy and market frameworks to facilitate the transition to renewables, the private sector — historically responsible for 86% of global investments in renewable energy — is poised to lead the charge. Together, we can achieve a clean, secure, and just energy future. But to realise this vision, we must act fast. — Project Syndicate

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### Greece Spearheads a Dynamic Energy Transition



Countries have different energy priorities due to factors like the availability of energy resources, geopolitics, the population size, environmental considerations and excessive use of energy, the needs of industry, and the availability of technology.

The most representative energy priorities among countries, including Greece, revolve around energy security, reduction of greenhouse gas emissions, affordability, and avoidance of

deforestation. Construction of additional energy infrastructure and charging energy consumers with more taxes for excessive energy use constitute additional energy priorities. According to a market survey conducted by IPSOS in late 2022 that engaged 24 thousand people in 28 countries, the top energy priority was that of energy security followed by the development of cleaner energy sources, like wind and solar, and the affordability of energy.

The war on Ukraine brought energy security to the forefront of concerns for many regions, particularly Europe. Directly impacted countries, like Germany, have had to reactivate coal production and extend the operational lives of nuclear power plants to ensure efficient supply of energy to consumers.

### **Electricity Generation from Renewables**

Despite challenges associated with the war on Ukraine, Greece has emerged more resilient by enhancing reform of its energy market and accelerating deployment of renewables in accordance with the National Climate Law of 2022. The Climate Law signals concrete milestones for Greece's energy transition with most prevalent the reduction of greenhouse gas emissions by 55 percent by 2030 and, achievement of net zero emissions by 2050.

The Climate Law also foresees a total phase-out of lignite generated electricity by 2028. Notably, Greece ranks 2<sup>nd</sup> out of the 27 EU member states in the reduction of electricity generation from certain solid fossil fuels; lignite generated electricity decreased by 57,7 percent in the first 8 months of 2023 compared to the same period of 2019 according to the Greek Independent Power Transmission Operator (IPTO).

The reduction of the use of solid fossil fuels has been offset by the accelerated development of renewable sources of energy, construction of critical energy infrastructure, and promotion of plans for Greece to position itself as key hydrogen hub in Europe. It is only in four years that Greece enhanced the installed capacity of renewable energy plants, accounting for 50 percent of electricity generation, with a clear target for electricity generation from renewables to reach 80 percent by 2030. The Greek solar photovoltaic market has gained most traction with 1.4 GW of new photovoltaic projects connected to the grid in 2022 and with anticipation of 10.9 GW to be added during the period of 2024-2027 according to the latest report by industry association Solar Power Europe.

### The Offshore Wind Challenge

Wind energy in Greece has been surpassed by photovoltaics in new and total installations primarily due to delays in the licensing process. The largest onshore wind power plants include the 336 MW onshore Evia Wind Farm of Ellaktor located in Evia, Central Greece; the 330 MW Kafireas wind farm of Terna Energy on the island of Evia; and the 153MW Imathia Kozani Wind Farm under development by 547 Energy LLC, located in West Macedonia. Greece's revised National Energy and Climate Plan (NECP) sets a clear target of 2 GW for onshore wind capacity and 2.7 GW for offshore wind capacity by 2030.

Greece swiftly moves forward to tap for the first time ever its offshore wind potential in pursuance of the national offshore wind farms development program that incorporates 25 eligible development areas in the Ionian, Aegean, and the East Mediterranean Seas.

An environmental impact assessment that has been completed by the Hellenic Hydrocarbons and Energy Resources Management Company includes maritime zones of over 2,712 square km where floating technology will be employed for the offshore wind farms in full compliance with environmental safeguards striking a balance between offshore wind energy, national security, and tourism.

Offshore wind energy falls under the creation and development

of new markets along with carbon dioxide CO2 capture and green hydrogen production.

### Unlocking the CO2 Storage Potential

Clean hydrogen can prove to be commercially viable due to the use of CO2. CO2 can be transported from where it is produced, via ship, truck or in a pipeline, and be used in commercial applications such as food and beverage production, metal fabrication, and cooling.

The majority of commercial applications center on the direct use of CO2 by turning it into chemicals and construction materials. Liquid CO2 can also be transported to an underground site where it can be permanently stored under strict environmental standards. The capture and storage of CO2 contribute to the decarbonization of heavy industries and the development of clean hydrogen.

It is in this context that Greece swiftly moves to identify potential areas for CO2 storage, with the most mature option being that of Prinos basin. Specifically, under Greek and European legal contexts, an exploration permit has been awarded to medium-sized Energean Oil & Gas for CO2 storage in the depleted Prinos field evaluated as the best option because of its depth and structure.

Prinos is scheduled to be operational from the fourth Quarter of 2025 as small-scale project with capacity of up to 1 million tons (MT) of CO2 annually and with plans to increase capacity from the fourth Quarter of 2027 up to 3 MT of CO2 annually. Areas with saline aquifers, mafic rocks and oil and gas fields throughout Greek territory are evaluated as potential storage sites.

### Prospects of a Hydrogen Hub for Europe

Green hydrogen production and transportation falls within the priorities of the Greek National Energy and Climate Plan. It

is estimated that little investment is required, primarily in the form of developing compression stations, for the conversion of the existing national network to transport hydrogen. Extensive cross-border pipelines like Interconnector Greece-Bulgaria (IGB) and Trans Adriatic Pipeline (TAP) have the potential to transport hydrogen.

Proper energy infrastructure can guarantee that massive imports of hydrogen from the Middle East and North Africa are directed to Europe via Greece. The European Union has declared that as the Ukraine war goes on it will have to import 10 MT of renewable hydrogen annually until 2030.

The first major hydrogen project that meets demands of industrial production has been launched in the north-west of Saudi Arabia, in a region called NEOM, that has been declared an exclusive renewable and hydrogen zone. The Neom Green Hydrogen Company project constitutes an 8.4-billion-dollar green hydrogen and green ammonia production facility that will integrate 4 GW of wind and solar energy to produce 600 tons of carbon-free hydrogen per day. Large-scale production of renewable hydrogen from the NEOM region is expected to begin in 2026, and green hydrogen will be exported in the form of green ammonia.

Overall, Greece fosters an effective energy transition with a blend of renewable energy pathways and a match of CO2 storage and hydrogen transportation. It is with no doubt that important targets and deliverables are on the horizon.

### Antonia Dimou

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